Food safety practices and dietary intake of female students in self-catering residences at the Cape Technikon

by

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ABSTRACT

Concerns have been voiced regarding the food practices and dietary intake of students since residences changed from a catered to a self-catering food provision system. In this study, the purchasing, storage, food preparation practices and dietary intake of female students living in self-catering residences at the Cape Technikon in Cape Town, South Africa, were investigated.

A sample of 60 students, representative of the female students living in self-catering residences, participated. A structured interview, together with direct observation, using an observational checklist, was used to determine whether food practices complied with food safety guidelines. As self-reported and actual behaviour may differ, the reported food safety behaviour was compared with the observed behaviour. The mean food and beverage intakes were determined using two 24-hour dietary recalls covering a week and weekend day. Intakes were compared with the recommendations of the Daily Food Guide and the South African Food-Based Dietary Guidelines. Nutrient intakes were analysed using dietary analysis software. Nutrient intakes were compared with the Dietary Reference Intakes for their gender and age grouping. Intakes of $\leq$ 67% of the Recommended Dietary Allowance/Adequate Intakes or below were deemed as inadequate. The weight status of the students was also determined and compared to the health maintenance Body Mass Index range of 20 to 25 kg/m^2.

Results indicated that some, but not all food safety guidelines were followed. Both positive and negative practices were reported and observed. Students reported following safe food purchasing guidelines, and in many cases stored ingredients and leftover food items safely. However, personal hygiene practices, e.g., washing of hands with soap and water, and general hygiene practices, e.g., avoidance of cross-contamination between raw and cooked food items, were neglected. Although students also cooked food items thoroughly, leftover food items were not reheated sufficiently. Observed behaviour was less positive than reported behaviour. Significant differences ($p < 0.05$) were found between the observed and self-reported behaviour regarding washing of hands, the manner in which hands were washed prior to food preparation and the drying of hands following washing prior to food preparation. Significant differences ($p < 0.05$) were also found between the observed and self-reported behaviour regarding the washing and drying of hands after handling raw chicken (or meat), the use of the same knife for slicing raw and ready-to-eat food and the use of the same plate/chopping board for raw and ready-to-eat food items. Students also showed a lack of awareness regarding the causes of food-borne disease, high-risk food items, and the need to avoid cross-contamination.

Their mean food and beverage intakes complied only in part to set standards. Failure to meet the recommended number of food group servings was in part due to the large percentage of students who skipped meals. The nutrient intakes met or exceeded the recommendations for some nutrients, but were below the recommendations for others. The low intakes of calcium, iron and folic acid were a concern. More than half of the students had an optimal body weight, while 22% were either overweight or obese.

As the majority of the students indicated interest in food safety and nutritional information, it is recommended that intervention be introduced to enable female students to improve their food practices.

STATEMENT

I, Linda Dorothea du Toit, hereby declare that the contents of this thesis represent my own unaided work, and that the thesis has not previously been submitted for academic examination towards any qualification. Furthermore, it represents my own opinions and not necessarily those of the Cape Technikon.

Signed ...LDdu Toit...
at ...Cape Town......
on the ....3...day of .December.2004

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CHAPTER 1
INTRODUCTION

1.1 Background

Since 2002, all the Cape Technikon student residences, except those situated in Mowbray and at Wellington, have had self-catering food provision systems. Students living in these residences are responsible for the preparation of their own meals, usually breakfast and supper, during the week and, in addition, lunch over weekends. In the student centre on the main campus, a student dining room and cafeteria provide for the purchase of food items during the week (Cape Technikon, 2003a:1). Furthermore, smaller cafeterias and kiosks are located in the various buildings housing the respective faculties.

During the Nineties a contracted catering company supplied the meals to the then existing Cape Technikon residences. In these residences, students were provided with breakfast and supper during the week and all three meals during weekends. During the week, the students could also obtain vouchers to purchase lunch items at the Cape Technikon cafeteria. In the residences the purchasing, storage and preparation of foods were done according to safety guidelines and nutritionally planned menus, as set out by the specific contracted catering company. Balanced meals were prepared in a central kitchen and served to students in a communal dining area. Students were generally not involved in the planning, purchasing, storage or preparation of the food items for meals.

With the acquisition of several additional residences by the Cape Technikon, a system of self-catering was implemented for the newly acquired as well as existing residences. The main reason for this change in the food provision system was financial. For the year 2003, the residence fees were as follows:
R7 020 per annum for self-catering residences and R14 040 per annum for the catering residences of Mowbray and Wellington (Cape Technikon, 2003b:1).

Considering the available literature, the self-catering responsibility that had been relegated to the students highlights two areas of concern, namely, their application of food safety guidelines in the purchasing, storage and preparation of food items and the nutritional adequacy of their dietary intake.

The formal food safety infrastructure is not sufficient in preventing the occurrence of food-borne disease. Consumers can, by using poor food safety practices, reverse much of the effort made by food producers, both primary and secondary, to produce safe food (Simpson, 1993:4; Jay et al., 1999a:921). With the food chain becoming more complicated, the consumer has a greater responsibility regarding the safety of food (Hudson & Hartwell, 2002:165). However, studies investigating the food practices of consumers have concluded that many consumers are unlikely to have been trained in food safety and may have limited knowledge and skills related to food preparation (Beard, 1991:123; Griffith & Worsfold, 1994:201; Knabel, 1995:121). Good food safety practices can reduce or even prevent the occurrence of food-borne illness in the home (Bennion & Scheule, 2004:57).

Although most studies have examined the food safety practices of the population as a whole (Gettings & Kiernan, 2001:148), it seems that unsafe food practices are conducted more often by young adults (aged 18 – 29) and occasional food preparers (Klontz et al., 1995:972; Altekruse et al.,1996:287). The student population fits this risk group description.

While research on consumer food safety practices have been done in the United States of America (USA) (Williamson et al., 1992:94; Fein et al., 1995:1405; Altekruse et al., 1996:287; Yang et al., 1998:S33; Shiferaw et al., 2000:1538; Meer & Misner, 2000:1725; Li-Cohen & Bruhn, 2002:1287; Anderson et al., 2004:186), the United Kingdom (UK) and Ireland (Worsfold & Griffith, 1997a:399; Gorman et al., 2002:143; Hudson & Hartwell, 2002:165; Clayton et al., 2003a:434), Canada (Canadian Food Inspection Agency, 1998:1), Australia (Jay et al., 1999a:921; Jay et al., 1999b:1285) and Jamaica (Knight et al., 2003:309), little is known about the food safety practices of South African consumers. Only two studies (Unklesbay et al., 1998:1175; Sharp & Walker, 2003:11) could be obtained in which the food safety practices of tertiary institution students, residing in the USA and the UK respectively, were investigated. Information on the food safety practices of tertiary students therefore seems to be limited, although this age group has been indicated in conducting unsafe food practices (Williamson et al., 1992:94; Deakin, 1999:1; Shiferaw et al., 2000:1538).

Young adult women have high nutritional needs, but their lifestyles may compromise their food intake and place them at risk for poor nutritional health (Hampl & Betts, 1995:893; Dinger & Waigandt, 1997:360; Gillis & Williams, 2002:1). In addition, students are at risk of developing serious health problems in later life, as young adulthood is the time when the precursors of nutritionally related adult diseases are established (Guyton et al., 1989:11; Horwath, 1991:395; Beerman, 1991:343). The risk for developing chronic conditions, such as coronary heart disease, certain types of cancer, non-insulin dependent diabetes mellitus and osteoporosis, might thus be lessened if healthy lifestyle practices were followed during the earlier years (Klemmer, 2002:97; Hizza & Gerrior, 2002:3). Furthermore, food safety and nutrition are intertwined as food-borne pathogens can affect nutritional status by reducing appetite and the absorption of nutrients (Woteki et al., 2001:S502).

Since the beginning of the Nineties numerous studies (Beerman et al., 1990:215; Horwath, 1991:395; Georgiou & Arquitt, 1992:358; Eves et al., 1994:363; Cotunga & Vickery, 1994:417; Mitchell et al., 1994:A52; Hertzler et al., 1995:49; Fennell, 1997:109; Meilman et al., 1997:201; Rangan et al., 1997:110; Haberman & Luffey, 1998:189; Chapman et al., 1998:176; Lowry et al., 2000:18; Anding et al., 2001:167; DeBate et al., 2001:819; Edwards & Meiselman, 2003:21) have investigated the dietary habits of students at tertiary institutions. However, only a few studies could be obtained in which the effect of residence and the subsequent catering arrangements on the dietary intake of students have been explored (Stordy & Cowhig, 1972:A81; Beerman et al., 1990:215; Brevard & Ricketts, 1996:35). The general conclusion drawn from these studies is that the dietary habits of students can be considered poor and that they require improvement.

In the South African context, Senekal (1988:1) investigated the dietary intake of female first year students at the University of Stellenbosch and Steyn et al. (2000a:53) examined the dietary intake of female first-year students at the University of the North. In the first study it was mentioned that the students resided in residences where catering was supplied. The latter study, however, focused on the dietary habits of students for the period before they entered the university.

The lifestyles of students are a matter of concern. Lifestyle affects not only their present health and wellbeing, but habits established during early adulthood can continue into later life (Haberman & Luffey, 1998:189). In addition, students at tertiary institutions are likely to develop into an influential sector of society as they mature (Wardle et al., 1997:450). Determining the food practices of students in self-catering residences can provide a basis for the formulation of health promotion programmes. According to Foster and Käferstein (1985:1273) the planning of effective strategies to encourage and strengthen desirable behaviours and to discourage undesirable behaviour should be based on existing practices.

1.2 Aim and objectives of study

The aim of this study was to determine the food safety practices and dietary intake of female Cape Technikon students living in self-catering residences.

The first objective was to determine whether female students living in the self-catering residences of the Cape Technikon followed food safety guidelines in the purchasing, storage and preparation of food items for their own consumption.

The second objective was to compare the self-reported food safety behaviour of female students living in the self-catering residences of the Cape Technikon with their observed food safety behaviour.

The third objective was to determine whether the food and beverage intake of female students, living in the self-catering residences of the Cape Technikon, complied with the recommendations of the Daily Food Guide and the South African Food-Based Dietary Guidelines.

The fourth objective was to determine whether the mean nutritional intakes of female students in the self-catering residences of the Cape Technikon, as supplied by their recorded week- and weekend day food and beverage intakes, met the energy and nutrient Recommended Dietary Allowances/Adequate Intakes (RDA/AI) for their gender and age grouping. Intakes of 67% of the RDA/AI and less were deemed as inadequate.

The fifth objective was to determine whether the weight status of the female students in the self-catering residences of the Cape Technikon was in line with the health maintenance Body Mass Index (BMI) range of 20 to 25 kg/m^2.

The last objective was to compare the mean energy and nutrient contents of the menus utilized by one of the catered residences at the Cape Technikon to the mean nutritional intakes of female students in the self-catering residences of the Cape Technikon.

It was hypothesised that the food purchasing, storage and preparation practices and food choices of female Cape Technikon students, living in self-catering residences, would not meet safety standards and would not provide in their nutritional needs.

1.3 Operational definitions

- Food safety practices: Includes the purchasing, storage, preparation and cooking of food items.

- Self-catering residences: Residences where students prepare their own meals, usually breakfast and supper during the week, along with lunch over weekends.

- Food-borne illness: Symptoms, often gastro-intestinal, following the ingestion of food or drink containing preformed pathogenic bacteria, viruses, fungi, parasitic protozoa, other parasites, marine phytoplankton or chemical substances (Lacey, 1993:25; Knabel, 1995:123).

- Food-Based Dietary Guidelines (FBDG): Guidelines compiled by the South African Food-Based Dietary Guidelines Work Group in association with the Nutrition Society of South Africa and the Association for Dietetics in South Africa to help South Africans over the age of five years to choose an adequate, but prudent diet (Vorster et al., 2001:S3; South African Department of Health, 2003:1).

- Daily Food Guide: Foods of similar origin and nutrient content are grouped together and recommendations for the consumption of a specific number of servings from each group provided (Sizer & Whitney, 2003:35).

- Dietary Reference Intakes (DRI): Comprises a set of four lists of values for the dietary nutrient intakes of healthy people in the USA and Canada. The values include Estimated Average Requirements (EAR), Recommended

Dietary Allowances (RDA), Adequate Intakes (AI) and Tolerable Upper Levels (UL) (Sizer & Whitney, 2003:33).

CHAPTER 2
LITERATURE REVIEW

2.1 Food-borne disease

2.1.1 Incidence

Although reports differ with regard to the number of cases of food-borne disease reported annually in the USA, the numbers are continually high. Buzby and Roberts (1997:57) reported figures of 3.3 to 12.3 million cases a year, whereas Altekruse et al. (1999:216) and Mead et al. (1999:607) indicated figures of between 6.5 and 76 million cases annually. The Department of Health and Human Services' Centers for Disease Control (CDC) estimate that food-borne illness are responsible for 325 000 hospitalisations and 5 200 deaths in the USA each year (Rippel, 2002:1).

Ninety-seven percent of food-borne illness cases between 1987 and 1992 were of microbial origin, making it the most serious food safety problem in the USA (Collins, 1997:471). One of the most common causes of food-borne illness is *Salmonella* (Doyle, 1993:346; Sharp & Reilly, 1994:25), and an average of 6 249 cases of *Salmonella* related food-bome illness cases are reported to the CDC on a yearly basis. On average the CDC also annually receives reports of 1 994 cases of *Shingella*, 636 cases of *Stapphylococcus aureus*, 549 cases of *Clostridium perfringens*, 200 cases of *Streptococcus Group A*, 145 cases of *Campylobacter* and 128 cases of *Escherichia coli*-linked food-borne disease (Robens, 1996:2).

Although it is not possible to make direct comparisons between the incidence data, due to the differences in national surveillance systems (Motarjemi & Käferstein, 1997:5), it has been suggested by Redmond and Griffith (2003a:130, citing the Communicable Diseases Network, 1997) that the USA, the UK and

Australia have similar incidences of food-borne disease. Motarjemi and Käferstein (1997:5) reviewed the results of a national survey, conducted in 1995 in the UK, where 7% of health problems were due to food-borne disease. The corresponding incidences reported by them for New Zealand were 9% in 1993 and for Sweden 7% in 1995, while a much higher incidence of 15% was reported by them from a sentinel study conducted in the Netherlands. Motarjemi and Käferstein (1997:6) thus indicated that the occurrence of food-borne disease is a widespread public health problem.

Food-borne disease is also a major problem in developing countries, such as Malaysia, Egypt, India and the Latin American countries. Arrifin (1993:2) quotes the following statistics: In 1991, 91 cases and 18 deaths due to botulism were recorded in the city of Cairo and in the same year ten Latin American countries recorded 300 000 cases and 3 170 deaths due to cholera.

Cholera has been endemic to the Southern African regions since the early 1970s (City of Cape Town Health Services, 2003:1), and its high incidence is reflected in the following figures (Table 2.1) released by the South African Department of Health (2002:1) for the period January 1991 to August 2002.

Table 2.1 Incidence of food poisoning and cholera in South Africa

Date	**Deaths**		**Number of cases**	
	Food poisoning	**Cholera**	**Food Poisoning**	**Cholera**
2002: January to August	0	104	115	15 737
2001: January to August	42	157	492	96 482
2000: January to December	9	80	60	10 161
1999: January to December	5	*	439	*

* Data incomplete, as provinces such as the Eastern Cape, did not submit any figures for the specific year

* Source: Health Systems Research, Research Co-ordination and Epidemiology, Department of Health, South Africa (South African Department of Health, 2002).

Worldwide the figures mentioned may, however, not be a true indication of the extent of food-borne illness as different procedures are used by the various agencies responsible for the collation of statistics on the incidence of food-borne disease (Lacey, 1993:25). In South Africa, food-borne disease cases must be reported to the provincial health departments, which in turn notify the National Department of Health. The Health Act, Act 63 of 1977, section 47 (South African Department of Health, 1977) mandates this procedure. However, food prepared for private consumption lies outside the scope and beyond the control of the Environmental Health section of city councils (City of Cape Town Health Services, 2003:1) and may not be included in the statistics on the occurrence of food-borne disease.

According to the World Health Organization (WHO), only 10% of food-borne disease incidents occurring in most European countries are reported (Scott, 1996:5). In the USA the CDC estimates that only 1 to 10 % of *Salmonellosis* cases are actually reported (Robens, 1996:2).

This considerable variance between formal notification and the true incidence of food-borne illness may be caused by the fact that many consumers do not seek medical attention on experiencing symptoms of food-borne disease (Miles et al., 1999:745; Mead et al., 1999:607). A reason for this is that many consumers do not consider an episode of food-borne illness as serious enough to visit a medical practitioner (Jones, 1992:107; Simpson, 1993:4; Ackerley, 1994:69; Deakin, 1999:1; Miles et al., 1999:745). Symptoms of food-borne disease vary from mild to severe, but most consumers tend to think of the consequences as being mild (Fein et al., 1995:1405).

In a pilot study conducted by Hudson and Hartwell (2002:168) to determine the food safety awareness of older people at home, it was found that 64% of the participants had suffered illness, which they attributed to "something they had eaten", but none had reported this to either a doctor or to their local

Environmental Health Department. Reported cases are most likely of those persons who had sought medical attention and probably represent those who were most seriously ill or those most at risk, such as young children, the elderly and those with pre-existing illnesses or compromised immune systems. Mead et al. (1999:607) ascribe this under-reporting of food-borne disease to the fact that diagnostic testing may not be done to determine the cause of the illness or test results are not forwarded for tabulation.

Outbreaks of food-borne illness occur sporadically in private homes and typically only a few people are involved. As a result food-borne illness caused by food prepared in the home is reported much less frequently than institutional outbreaks (Knabel, 1995:126; Scott, 1996:6). Large outbreaks of food-borne disease are more likely to receive media coverage, strengthening the belief of many consumers that food-borne disease is most likely to be caused by food items consumed outside of the home (Scott, 1996:5; Worsfold & Griffith, 1997a:97; Medeiros et al., 2001a:110).

2.1.2 Factors leading to an increase in incidence

In the UK, the incidence of food-borne disease cases has increased substantially (Sharp & Reilly, 1994:25; Perry, 1994:188; Miles et al., 1999:744; Meredith et al., 2001:23) and in the USA public health officials have predicted a similar trend in the coming years (Medeiros et al., 2001b:1326). According to Vorster et al. (2001:S3), food safety in South Africa may also become a progressive problem in the future, mainly because of an increase in street vendors.

Various factors contribute to the increase in the incidence of food-borne disease. These include:

- Changes in the food supply system, such as the mass production of food and intensive agriculture and animal husbandry practices (Sharp & Reilly, 1994:25; Miles et al., 1999:745; Motarjemi, 2002:3).

- The consolidation of smaller food processing companies into larger ones (Jones, 1992:108). Although larger companies are often more likely to be aware of sanitation than smaller companies, a single food handling problem could reach large numbers of consumers and result in a massive outbreak of food-borne disease. The concentration of animals into larger production units and the slaughtering of animals at fewer and larger abattoirs increase the possibility of cross-contamination among meat carcasses (Jones, 1992:108; Ackerman, 2002:3).
- The increase in the international trade in food items (Sharp & Reilly, 1994:25; Käferstein et al., 1997:503; Miles et al., 1999:745; Ackerman, 2002:4).
- Environmental factors such as the lack of safe drinking water, and proper sanitation, the increase in pollution and the changing climatic conditions, i.e., global warming (Motarjemi, 2002:3).

A further factor is a possible increase in the occurrence of food-borne pathogens and emerging "new" pathogens (Doyle, 1993:346; Käferstein et al., 1997:503). Several micro-organisms were only recognised as important food-borne pathogens during the last two decades. These include *Escherichia coli* 0157:H7, *Listeria monocytogenes*, *Campylobacter jejuni* and *Vibrio cholera* (Doyle, 1994:219). In addition, micro-organisms can evolve rapidly and adapt to their environment (Knabel, 1995:119; Beumer & Kusumaningrum, 2003:299). Examples of these changes include the growth of *Listeria monocytogenes* in refrigerated food products and the presence of *Legionella pneumophila* in systems containing stagnant water (Beumer & Kusumaningrum, 2003:299).

Further reasons for the increase in the incidence in food-borne disease include the lack of food safety training of retail employees (USA Dept of Health and Human Services, 2001:31). Although the food processing industries are implementing Hazard Analysis and Critical Control Point (HACCP), structured food safety systems may not be implemented in food service and retail establishments (Collins, 1997:472). According to Linton (1995:1), most food-borne illnesses linked to food service and food retail operations are due to poor personal hygiene, cross-contamination and/or temperature abuse.

There has also been an increase in the number of people who are at risk because of compromised capacities to fight food-borne illness (Knabel, 1995:119; Käferstein et al., 1997:503; Motarjemi, 2002:4). Robens (1996:2) identifies high risk individuals as the very young, the elderly, patients undergoing chemotherapy, recent recipients of organ transplants and people whose immune systems are depressed, such as by Acquired Immunodeficiency Syndrome (Aids). Added to this list are pregnant women and people with chronic illness, including diabetes and kidney disease (Anon, 2002a:1).

In the USA, food safety and public health officials attribute the rise in the incidence of food-borne disease to changes in demographics and consumer lifestyles. A study by the American Meat Institute in 1996 noted that there are a greater number of single-head households and an increasing number of women in the workforce. In the USA, 70% of women between the ages of 25 to 44 years work fulltime outside the family home (Williamson et al., 1992:94; Collins, 1997:473; Maciorowski et al., 1999:833).

These changes have led to families having less time for shopping and food preparation. Consumers also have limited commitment to food preparation and appear to be more interested in convenience and saving time than in proper food handling and preparation (Knabel, 1995:119; Hunter, 1996:14). According to Collins (1997:475), more than 85% of employed women shop and cook, but most spend less than 30 minutes preparing a meal and 20% spend less than 15 minutes.

A further contributing factor to the rise in food-borne illness is the lack of concern over personal hygiene, which is illustrated in the forsaking of cutlery, for example, where fingers are used in the sharing of food items (Lacey, 1993:29). In addition, the habit of several people eating simultaneously from a communal food container should be discouraged, especially in areas under threat of cholera (City of Cape Town Health Services, 2003:1).

Consumers are also becoming more interested in "healthy" foods; this includes eating foods of animal origin that are under-processed or under-cooked (Doyle, 1993:346), and food items that contain no preservatives and that are marketed as being "natural" (Knabel, 1995:119; Zink, 1997:467; Deakin, 1999:1). Consumers are travelling more and becoming more "adventurous" in their food choices, choosing potential high-risk food items, such as sushi, more frequently than in the past (Miles et al., 1999:745; Jones, 1992:108).

2.1.3 Effects

In the past, experts used to think that food-borne disease was limited to an episode of acute illness (Woteki et al., 2001:S502), with symptoms varying from mild to severe episodes of nausea, vomiting, diarrhoea and fever (Sizer & Whitney, 2003:512). Today, it is known that infections can also cause chronic complications (Miles et al., 1999:746). According to Lindsay (1997:2), chronic sequelae may occur in 2 to 3% of food-borne disease cases and the long-term consequences may be more detrimental to health than the acute disease.

Altekruse et al. (1998:31) reported that approximately four million cases of human *Campylobacteriosis* occur in the USA each year and that although the majority of cases only display limited diarrhea, a small portion of patients develop severe sequelae, such as reactive arthritis and Guillain-Barré Syndrome. Other long-term consequences of episodes of food-borne disease include ailments such as ankylosing spondylitis, artropathies, renal disease, cardiac and neurological disorders, and nutritional and other malabsorptive disorders. For example, bacteria such as *Salmonellae* can cause medical complications such as aortitis, cholecystitis, endocarditis, osteomyelitis and pancreatitis (Sharp & Reilly, 1994:26; Mead et al., 1999:607; Miles et al., 1999:746).

Further effects of food-borne disease include medical costs and productivity losses because the affected person is not able to be at work (Ralston et al., 2000:44). Medeiros et al. (2001b:1326) points out that the estimated annual costs from food-bome disease are related to the severity of the illness. Illness caused by *Escherichia coli* 0157:h7 can be very severe and this will escalate the cost.

2.2 Food safety practices

2.2.1 Potential for inappropriate food practices in the home

Epidemiological data from Europe, North America, Australia and New Zealand indicate that a substantial proportion of food-borne disease cases are caused by food prepared in the home (Bryan, 1978:816; Borneff et al., 1988:1; Williamson et al., 1992:94; Simpson, 1993:4; Meredith et al., 2001:23; Crawford & Murano, 2002:6; Redmond & Griffith, 2003a:130). Similar findings supporting the home as a source of food-borne disease in the UK and Ireland were reported by Worsfold and Griffith (1997a:97), Miles et al. (1999:744) and Gorman et al. (2002:148).

Bryan (1988:816) identified and classified the factors that contributed to outbreaks of food-borne disease in the USA from 1961 to 1982. Contaminated raw products, inadequate heating and improper cooling mostly caused *Samonellosis*. Staphylococcal food-borne disease was mainly caused by infected food handlers handling cooked foods, a lapse of 12 hours or more between cooking and eating, and improper cooling, while botulism was caused by inadequate heat processing, improper fermentations, and an incorrect holding temperature, incorrect cooling, a lapse of 12 or more hours between preparation and eating, inadequate reheating, and incorrect hot holding led to *Clostridium* *perfringens* enteritis.

The domestic kitchen is a potential source of food-borne illness as contaminated raw foods, poor personal hygiene and improper preparation, cooking and cooling of food can act as breeding grounds for pathogenic micro-organisms (Bryan 1988:663; Gorman et al., 2002:144). Further factors that have been shown to be frequently implicated in outbreaks of food-borne illness in the home include the practice of cooking food items far in advance of consumption, together with the storage of food items at room temperature for extended periods of time (Bryan, 1988:663; Worsfold & Griffith, 1997b:401).

Bacterial contamination in the kitchen often occurs during processing of raw foods (Enriquez et al., 1997:20). Pathogenic micro-organisms were spread from raw chickens to hand and contact surfaces in domestic kitchens during the preparation of a meal in studies conducted by De Wit et al. (1978:208), Cogan et al. (1999:354), Gorman et al. (2002:143) and Mattick et al. (2003:842). In the study conducted by Gorman et al. (2002:143), 80% of the raw chickens brought into homes naturally contained one or more of the following micro-organisms: *Salmonella, Campylobacter, Escherichia coli* and *Staphylococcus aureus*. These micro-organisms were found to cause cross-contamination in 32% of the draining boards and 24% of the counter-tops in the participating homes. In addition, all of the food preparers' hands were free from the test micro-organisms before preparation started. However, following the preparation of the roast chicken, *Campylobacter* and *Staphylococcus aureus* were found on the hands of the food preparers. Similarly, Borneff et al. (1988:1) found in a study that working surfaces and equipment in a domestic kitchen were contaminated with *Sarcinae* after the preparation of a meal containing artificially contaminated minced meat.

Organisms may be transferred to food items by the food handler both directly or by cross-contamination through the use of hands, surfaces, utensils, and equipment (such as a blender and can opener) which have been inadequately cleaned and disinfected between the preparation of different types of food (Roberts, 1990:861; Scott & Bloomfield, 1990:271; Jones, 1992:109). Kusumaningrum et al. (2003:227) found that *Salmonella enteritidis*, *Staphylococcus aureus* and *Campylobacter jejuni* were readily transmitted from wet sponges to stainless steel kitchen surfaces and from these surfaces to the cucumber and chicken fillet slices used in their study.

Rusin et al. (2002:585) investigated the transfer of bacteria (*Micrococcus luteus, Serratia rubidea* and phage PRD-1) from the fingertips to the lips and found that these transfers were similar to those observed from hard surfaces to hands. These researchers concluded that infectious doses of pathogens may be transferred to the mouth after handling everyday contaminated household objects such as dishcloths, sponges, turning a kitchen tap on or off, or preparing hamburger patties.

Various studies have investigated microbial contamination in domestic kitchens. In a study conducted by Sharp and Walker (2003:13), total viable counts (TVC) and colony-forming units (cfu/ml) of coliforms were recovered from sites in the communal student kitchens that were investigated. Although the microbial levels varied from site to site, high levels of TVC and coliforms were found in two out of the six kitchens. The highest counts were found on chopping boards (TVC 6.6 x 10^4 and coliforms 5.9 x 10^4 cfu/ml), refrigerator door handles (TVC 5.5 x 10^3 and coliforms 2.9 x 10^3 cfu/ml), and cloths (TVC 5.6 x 10^7 and coliforms 4.3 x 10^7 cfu/ml).

Results from a study conducted by Scott et al. (1982:279), involving more than 200 homes, indicated that 10 to 24% of kitchen surfaces, chopping boards, refrigerator and cooking hob surfaces were contaminated with over 200 organisms per 20 cm^2. In addition, moist kitchen areas such as sinks, waste traps and surroundings, acted as reservoirs, which sheltered and encouraged the proliferation of entero-bacteria. Josephson et al. (1997:737) corroborated these results and found that household kitchens showed significant contamination with bacteria such as *Escherichia coli, Campylobacter* and *Salmonella.*

Beard (1991:123) rated cutting boards as a major source of microbiological cross-contamination and various researchers (Enriquez et al., 1997:20; Hilton & Austin, 2003:257) concluded that used household sponges and dishcloths contribute to the bacterial contamination of food preparation surfaces, hands, and foods in the home kitchen. In the study by Enriquez et al. (1997:20), used sponges and dishcloths were collected from households in four cities in the USA. The geometric mean from the liquid samples wrung from the sponges was 1.15×10^5 cfu/ml for total bacteria and 4.46×10^2 cfu/ml for faecal coliform bacteria. Dishcloths also showed a high count of faecal coliform bacteria, being 2.03×10^3 cfu/ml and a total bacterial count of 1.31×10^5 cfu/ml. A total of 23 different bacterial species were identified from the sponges and 13 from the dishcloths. Species identified included *Enterobacteriaceae*, *Pseudonomas* spp, *Salmonella* spp and *Staphylococcus aureus.*

In a study conducted by Gorman et al. (2002:148) to investigate cross-contamination in the preparation of a domestic roast chicken dish, each of the participants was supplied with a sterile dishcloth. However, after the preparation of the naturally contaminated chickens, the aerobic plate counts of dishcloths showed that more than 70% of these cloths had counts of more than 100,000 cfu/ml. According to Gorman et al. (2002:148), these results are supported by previous studies in the UK which found that dishcloths may become heavily contaminated by micro-organisms such as *Salmonella* and *Staphylococcus Aureus* after only a short period of use. In a study by Meredith et al. (2001:30), chicken breasts that were artificially contaminated with *Escherichia coli* DH5a (pLITE 27) were used in the preparation of a casserole dish in a model kitchen. The results of the study showed that the most frequently contaminated objects and sites included those associated with personal hygiene and cleaning, namely tea towels, dish cloths and the sink area. Eighty percent of the tea towels and

71% of the dishcloths were contaminated with *Escherichia coli.* In addition, the damp conditions, which often occur in dishcloths from one meal to the next, may result in the contaminated dishcloths being a source of contamination in the preparation of the next meal (Bennion & Scheule, 2004:62).

Hilton and Austin (2003:257) collected samples of 100 "in-use" kitchen dishcloths from domestic kitchens and isolated *Staphylococcus aureus* from 4% of the sponge-type cloths. In addition, the results of laboratory experiments showed that various species of bacteria can survive on soiled (but clean looking) kitchen surfaces and on both clean and soiled dishcloths for up to four hours and in some cases up to 24 hours (Scott & Bloomfield, 1990:271).

Food products such as poultry and eggs may be contaminated with *Salmonella*, but most strains are heat sensitive and are killed by thorough cooking of these products (Jones, 1992:113). Similarly foods such as ground beef may be contaminated with *Escherichia coli* 0157:H7 and could cause illness if not heated sufficiently (Borch & Arinder, 2003:381; Ackerman, 2002:4). Phillips and Roscoe (1996:23) investigated the survival of *Escherichia coli* 0157:H7 in ground beef burgers after using the cooking procedures recommended by the manufacturer. These researchers found that in the extra thick ground beef burgers these bacteria remained viable, and therefore maintained the potential for causing food-borne disease.

Consumers use refrigerators to delay food spoilage and slow down the multiplication of pathogens (Simpson, 1993:6). However, this is effective only if the temperature of the refrigerator is between 1 and 4 ^{0}C. Choma <u>et al</u>. (2000:617) found low initial numbers of *Bacillus cereus* in samples of cook-chill and pasteurised vegetable products, but 10% of the strains isolated from these products were able to grow at 5 ^{0}C. In addition, poor use of domestic refrigerators and breaking of the cold chain can lead to the proliferation of *Listeria monocytogenes*, psychotropic bacteria that can easily grow between 0 and 10 ^{0}C

(Rosset, 2001:287).

According to Scott (1996:5), a number of food-borne infections associated with the modern home may be reduced or even prevented by the use of simple hygiene techniques. The major control factors to prevent food-borne disease in the domestic kitchen are as follows: using safe purchasing practices, storing ingredients safely, practising good personal and general hygiene, cooking food items thoroughly and handling leftovers safely (Bryan, 1988:663; Knabel, 1995:128; Medeiros et al., 2001b:108; Food Safety and Inspection Service, 2002:1).

2.2.2 Areas of unsafe food practices

2.2.2.1 Purchasing

(i) Street vendors

Consumers purchase food products from various suppliers, which include supermarkets, fast food outlets and street vendors (Opare-Obisaw, 1998:139; Azanza, 2001:515; Nel & Steyn, 2001:118). Studies in developing countries show that some street vendors do not follow the basic practices for the prevention of food-borne disease. In a study conducted by Mensah et al. (2002:546) in Accra, Ghana, food items were prepared at ground level, cooked well in advance of consumption and exposed to flies and dust. Despite these conditions, this survey showed that the microbial levels of most of the street foods investigated were within acceptable limits. However, food items such as salad, macaroni fufu (pasta with pounded cassava, plantain, cocoyam or yam) and fried fish had unacceptable levels of *Shigella sonnei*, *Salmonella arizonae* and enteroaggregative *Escherichia coli*.

In South Africa there is limited information available regarding the incidence of diseases related to the consumption of street food. In a Department of Health survey conducted in 1995, samples were taken from street food vendors in tourist areas, flea markets and transport terminals in the Western Cape. In more than 90% of the samples taken the microbial levels were acceptable; the exception was the food items, which were sold at tourist areas. The Department of Health concluded that although tourist site vendors had better facilities, i.e., availability of clean water and refuse containers compared to vendors at flea markets and transport terminals, poor personal hygiene and poor handling led to the higher bacterial counts in food items sold by tourist site vendors. These food items carried high concentrations of *Escherichia Coli* and *Staphylococcus Aureus* (Sidley, 1995:1).

Studies conducted in the Johannesburg area showed similar results. Mosupye and Von Holy (2000:145) found that the quality and safety of the food items analysed were considered acceptable as samples had relatively low bacterial counts and comparatively low levels of food-borne pathogens. They identified ready-to-eat food items sold by vendors at public transport centres as a possible microbiological hazard. Kubheka et al. (2001:127) investigated the safety of salad and gravy items sold by street vendors over a four-month period in the Johannesburg area. This study confirmed the conclusion of the previous studies that the quality and safety of street food items were acceptable despite vendors working under conditions perceived as unsuitable for the preparation and selling of ready-to-eat foods. These included environmental shortcomings such as no shelter, no running water, discarding wastewater and garbage in the street, poor personal hygiene and food preparation practices. Mosupye and Von Holy (2000:145) and Kubheka et al. (2001:130) concluded that adequate cooking and/or short holding times were instrumental in reducing the growth of bacterial populations.

(ii) Raw food items

The sale of contaminated raw food items to the public is an important contributing factor to outbreaks of food-borne diseases in homes (Bryan, 1988:663). Pathogens such as *Salmonella typhimurium DT105, Campylobacter, Listeria monocytogenes* and *Escherichia coli* 0157:H7 are associated with a range of raw foods items that are regularly prepared in the home kitchen (Ralston et al., 2000:44; Zhao et al., 2001:5431; Borch & Arinder, 2003:381).

Not all raw food items are contaminated, but some foods, such as poultry and poultry products, are more likely to be contaminated than other foods (Roberts, 1990:859; Griffith & Worsfold, 1994:200; Sharp & Reilly, 1994:27; Zhao et al., 2001:5431). Moore et al. (2002:1326), for example, found in their survey on raw chickens that 94% of the fresh birds and 77% of the frozen birds were contaminated with *Campylobacter* spp. In addition, Harrison et al. (2001:450) found that 34% of whole-chicken packaging was contaminated with *Campylobacter* and 11% with *Salmonella*. Raw meat products, such as sausages and burger patties, are another potential source of pathogenic bacteria as ground meat products are generally more prone than larger pieces of meat to microbiological contamination (Roberts, 1990:859; Jay et al., 1999a:922; Ackerman, 2002:4).

Other high-risk foods include raw (unpasteurised) milk and raw shellfish. The consumption of raw milk, or products such as cheese made from raw milk, increases the risk of brucellosis, a systemic bacterial disease. *Staphylococcus aureus, Bacillus cereus* and *Listeria monocytogenes* may also be found in raw milk (Roberts, 1990:860). Fish and shellfish may become contaminated either from the environment from which they are harvested, such as water polluted with sewage, or from the environment during further processing (Roberts, 1990:860). Raw shellfish from polluted water may be contaminated with *Vibrio cholerae* (City of Cape Town Health Services, 2003:2) or *Escherichia coli* (Roberts, 1990:860).

Shiferaw et al. (2000:1538) found in a survey of 7 439 adults in five states in the USA between 1996 and 1997 that 1.5% of the respondents drank raw milk and 1.9% ate raw shellfish. Yang et al. (1998:S33) reported similar findings from a multi-state surveillance study in the USA. In this study, 8% of the respondents reported eating raw oysters and 1.4% reported drinking raw milk. However, when Timbo et al. (1995:214) conducted a similar survey in the coastal state, California, 23% of the respondents reported that they ate raw shellfish, and one-third of these respondents reported eating raw shellfish as often as once a month.

In the USA, media reports and campaigns, such as the Partnership for Food Safety Education's "Fight BAC!™" and the "Farm to Table" initiatives, have emphasised the risks of the aforementioned foods (Food Safety and Inspection Service, 2002:1). However, a survey conducted by the USA Food and Drug Administration on a nationally representative sample of American consumers indicated that although no change was seen in the consumption of potentially risky foods, such as undercooked meat products, from 1998 to 2001, there has been an increase in the consumption of raw fish, clams and oysters (Fein et al., 2002:1). In addition, Redmond and Griffith (2003a:145) point out that similar to other self-reported practices, the consumption of unsafe foods may possibly be higher than that which is actually reported.

In the purchasing of food products the potential for temperature abuse also exists. This occurs if, for example, the temperature of raw meat rises above 10 °C. At these temperatures food-borne pathogenic micro-organisms flourish (Hudson & Hartwell, 2002:165). In an Australian food safety survey conducted by Jay et al. (1999a:922), consumers were asked a number of questions to ascertain the length of time a high-risk product, such as raw meat, may have been out of refrigeration after purchasing. About one-third (33%) of the respondents indicated that they bought their meat either at the beginning or in the middle of their shopping trip, thus exposing these products to temperature abuse. To ensure that perishable foods stay at a safe temperature after shopping and during transport home, it is recommended to use an insulated bag or similar container. Thirty-five percent of respondents reported that they do use such a device to keep food cool after shopping and during transport home.

(iii) Convenience foods

In the USA, consumer preference for convenience foods has increased (Knabel, 1995:119; Zink, 1997:467; Ackerman, 2002:4). This demand has led to an increase in the quantity and variety of products available to the consumer (Francis et al., 1999:1; Francis, 2003:2). Convenience foods vary from fully prepared products designed to replace home-cooked meals to pre-washed and pre-cut fresh vegetable and salad ingredients.

According to Williamson et al. (1992:94), these food products are becoming more important to working mothers with limited time for food preparation. On average the working mother spends no more than 15 to 30 minutes assembling an evening meal (Kinsey, 1990:22; Griffith & Redmond, 2001:70). The emphasis on convenience may focus consumer attention away from safe methods of food preparation and storage and, in addition, partially prepared foods may have different, less familiar handling requirements (Williamson et al., 1992:94; Dumagan & Hackett, 1995:37).

Prepared chilled products such as pre-washed and pre-cut fresh fruits and vegetables provide substrates and environmental conditions conducive to the survival and growth of micro-organisms. Preparation operations disrupt surface tissues and provide a potentially rich source of nutrients for micro-organisms. In addition, the high water activity and the neutral or low acid tissue pH of produce encourage microbial growth in prepared chilled produce (Francis, 2003:2). These products receive more handling, which makes them more susceptible to food-borne disease organisms (Hunter, 1996:15). To prolong the storage life of these products, modified atmospheric packaging, in combination with refrigeration, is increasingly being used. The fresh nature of these products, together with the mild processing techniques used and the chilled storage conditions has offered micro-organisms such as *Listeria monocytogenes, Aeromonas hydrophilia* and *Clostridium botulinum* new ecosystems and potential infection vehicles (Francis et al., 1999:1).

Sagoo et al. (2003:403) investigated the microbiological quality of bagged, prepared salad vegetables available from retail stores in the UK. These researchers found that although the majority of the samples were of satisfactory microbiological quality, 0.5% of the samples were unacceptable. The unsatisfactory quality was due to *Escherichia coli* and *Listeria* spp. levels in excess of 10^2 cfu/g. In addition, 0.2% of the samples showed the presence of *Salmonella* or *Listeria monocytogenes* at levels of 660 cfu/g, which is indicative of a health risk. According to Francis (2003:2), the presence of pathogens in prepared chilled foods is caused by contamination during agricultural production, harvesting, preparation and packaging. However, cross-contamination by consumers after opening the pack can also occur.

In 1996, nearly 40% of the 2 000 shoppers surveyed by Collins (1997:473) purchased fresh delicatessen items from their primary supermarket at least once a week, and more than 10% reported a weekly purchase of ready-to-eat take-out foods from the supermarket. Many convenience food labels give no directions for the handling of any uneaten food portions and in-store delicatessen products, such as packaged sandwiches and salads, often lack handling directions (Hunter, 1994:15).

Food items purchased from restaurants and delicatessens are handled by more people, distributed in stages, and held before being sold. These are factors that increase the chance of food becoming contaminated or being held at unsuitable temperatures (Jones, 1992:108). In addition, food items at salad bars have a potential for contamination as a direct result of consumer access. Diaz-Knauf et al. (1992:12) observed customers at a self-service salad bar and found that although a high level of staff maintenance was present, problems were encountered with the spillage of food items and the touching of the food items by consumers.

Hunter (1996:15) reported on the results of a study conducted at the University of Nebraska. In this study, all of the lettuce, tomato, broccoli and cauliflower samples collected from three supermarket salad bars showed unacceptable levels of coliform bacteria, yeasts and moulds. However, in a study to determine the presence of *Listeria monocytogenes* in ready-to-eat foods such as luncheon meats, salads, soft cheeses and smoked seafood bought from retail markets in the USA, Gombas et al. (2003:559) found that only a small percentage (0.17% to 4.7%) of these foods was contaminated. *Listeria monocytogenes* levels in the positive samples varied from less than 0.3 mpn (most probable number) per g to 1.5×10^5 cfu/g.

(iv) Minimally processed foods

There has also been an increase in consumer preference for minimally processed foods (Eley, 1992:12; Knabel, 1995:119). Minimally processed foods are designed for a "fresh-like" state and extended shelf life, but this presents concerns regarding the maintenance of safety. These food items may be pasteurised and stored under controlled conditions in refrigerated cases before being sold to consumers. If at some stage these food items are contaminated or held at temperatures that are too high, heat-resistant spores that survived pasteurisation may proliferate. Organisms that would normally indicate spoilage are destroyed during pasteurising, leading to the consumer having no indication that the product is not safe for consumption (Jones, 1992:108). In addition, some bacteria, e.g., *Listeria monocytogenes,* implicated in food-borne disease, are able to multiply at refrigerator temperatures (Eley, 1992:12; Ackerman, 2002:2).

(v) Food labels

Many food labels do not give directions for maintaining the safety and the quality of products (Bruhn, 1997:513). Consumers who read food labels may in some cases not understand the directions, which may be confusing, vague, or contradictory, or the directions may be read and not followed (Hunter, 1994:8). However, in the USA, safe-handling instructions on meat products appear to have had an effect. According to the Food Marketing Institute (1996 as cited in Bruhn, 1997:513), 60% of survey respondents indicated that they were aware of the labels. Sixty-five percent of these respondents reported that the label instructions increased their awareness of safety and 43% indicated that they changed their behaviour as a result of the information. The most common self-reported behavioural change was washing the counter and utensils after contact with meat, followed by washing hands more frequently and cooking to the proper temperature.

Although Hunter (1994:9) estimated that only 45% of American consumers read food labels, results from a survey carried out by the Research Triangle Institute indicated that most consumers in the USA check expiry dates when purchasing food products (Rippel, 2002:1). Checking "sell by date" or "best before date" reduces the odds of buying contaminated food (Anon, 1999a:8).

2.2.2.2 Storage

Food products, especially raw foods from animal origin sold to the consumer, may be contaminated with pathogenic micro-organisms (Bryan, 1978:817). Once purchased, the consumer has the responsibility to store and handle food products correctly in order to minimise the risk of further contamination and to decrease the growth of the micro-organisms already present (Griffith & Worsfold, 1994:200; Gorman et al., 2002:144).

Many consumers do not follow safety guidelines, such as prompt refrigeration after purchasing perishable food products, separation of raw and ready-to-eat food products during storage, keeping perishable food products at or below 4 °C and following the correct procedures when thawing frozen food items (Worsfold & Griffith, 1997a:97; Li-Cohen & Bruhn, 2002:1287; Jay et al. 1999a:921).

In a Canadian consumer survey it was found that 34% of the respondents indicated that food products should be promptly refrigerated and that only 16% indicated that different food products should be kept separate from one another to avoid cross-contamination (Canadian Food Inspection Agency, 1998:2). In a national survey conducted among 2 000 randomly selected households in the USA only 23% of the respondents indicated that they stored meat, poultry and fish on the refrigerator shelf above other foods (Li-Cohen & Bruhn, 2002:1287).

In a survey conducted by Jay et al. (1999a:922) in Australia, 21.4% of the respondents indicated that they stored raw meat on the top shelf in the refrigerator and 19.1% of the respondents indicated that they used the middle shelf. This practice increases the risk of cross-contamination owing to the potential dripping of raw meat juices down onto other foods stored beneath. The risk is especially high if the foods stored below the meat are ready-to-eat items that will not be heated to high enough temperatures to destroy pathogenic bacteria (Anon, 2000:4).

Consumers store chilled food items in refrigerators for periods varying from a few hours to many days (James & Evans, 1992:313). In general, consumers are aware that a refrigerator extends the shelf life of food items and keeps food safe. However, in order to realise these beneficial effects, the appliance must be operated correctly (Jay et al., 1999a:932). According to Hudson and Hartwell (2002:168), temperatures within a refrigerator can vary significantly. Flynn et al. (1992:307) reported that the top shelf was the warmest part inside the refrigerator while James and Evans (1992:313) found that temperatures varied over the whole refrigerator and ranged from 4.5 ^{0}C to 30.5 ^{0}C, with the vegetable compartment being the warmest part of the refrigerator. In addition, on average only 29.0% of the refrigerators in their study operated below 5 ^{0}C. Temperature variations can be affected by the placement of the refrigerator as high temperatures in the surrounding kitchen and warm air from nearby cooking equipment can lead to inefficient temperature control (Auckland Healthcare, 2000:2).

Further factors that decrease the efficiency of a refrigerator are overloading and an open door. Overloading impairs the air circulation that keeps the food cold. Frequent opening or leaving the door open for extended periods of time causes a rise in temperature, especially in domestic units that take longer to recover from temperature fluctuations (Auckland Healthcare, 2000:2; Hudson & Hartwell, 2002:168). In a study conducted by Audits International in the USA, direct observations of consumers' kitchens revealed that 23% of the refrigerators in these kitchens had temperatures above 4.4 ^{0}C (Partnership for Food Safety Education, 1998:2). *Staphylococcus aureus, Clostridium perfringens,* and *Bacillus cereus* are the pathogens primarily associated with inadequate refrigeration (Medeiros et al., 2001a:111).

In the UK, a report on consumer attitudes compiled by the Food Standards Agency (2002a:64) indicates that 40% of the sample surveyed in 2000 and 37% of the sample surveyed in 2001 claimed to have a refrigerator thermometer at home. A similar proportion of respondents in 2000 and 2001, 39% and 35% respectively, claimed to know what the temperature of their refrigerator should be. However, in the 2000 survey only 24% of those who claimed to know the right temperature were accurate and in the 2001 survey the percentage was even lower with only 18% of the respondents being correct. These results are reflected in the survey by Jay et al. (1999a:923), where only 26.3% of the respondents knew that the temperature of their refrigerator should be between 1 ^{0}C and 5 ^{0}C.

Being in possession of a refrigerator thermometer does not guarantee its use as only 24.7% of the respondents in a study conducted by Jay et al. (1999a:924) indicated that they checked the temperature of their refrigerator. Even if consumers check refrigerator dials regularly, it may not be an indication that the refrigerator is at a sufficiently low temperature. Refrigerator dials are not always reliable and most temperature dials are not calibrated according to the internal temperature of the refrigerator (Hudson & Hartwell, 2002:168).

Frozen meat and poultry should be thawed by placing it in the refrigerator, under cold running water or in a microwave oven (Anon, 2000a:2; Food Safety and Inspection Service, 2003:1). In the Food Standards Agency consumer research into Christmas habits, it was reported that only 20% of the respondents who bought frozen turkeys thawed the birds in the refrigerator. Sixty-nine percent thawed their turkeys by leaving them standing in the kitchen or another room in the house, in the garage or even in the garden shed (Food Standards Agency, 2002b:3). In an Australian survey 40.1% of the respondents reported that they thawed meat by leaving it at room temperature (Jay et al., 1999a:924). In a survey conducted with householders in an urban Jamaican community, the majority of the respondents reported a fairly high knowledge of safe food handling practices, yet more than one-half were unfamiliar with the correct procedure for freezing and thawing foods (Knight et al., 2003:309).

In determining the frequency of shopping for food products, Eley (1992:12) and Perry (1994:188) found that many households shop only once a week and that perishable food products are often kept for several days before being eaten. In a Canadian study, most of the respondents believed that raw, minced meat can be stored in the refrigerator for up to five days before it becomes a food-borne illness hazard. The majority of respondents also believed that they could tell if food might cause food-borne illness by looking at it and smelling it (Canadian Food Inspection Agency, 1998:3).

The handling of leftover food items, that is, storage and reheating, also has the potential for temperature abuse. The potential abuse increases if the consumer is ignorant of the basic requirements for temperature control within the home (Hudson & Hartwell, 2002:165).

2.2.2.3 Preparation and cooking

Studies indicate that unsafe food handling and preparation practices by consumers are common in the USA (Daniels, 1998:54) and the UK (Worsfold & Griffith, 1997a:97). In studies where observational methods were used to investigate domestic food preparation, the vast majority of consumers (76% to 99%) failed to implement one or more basic food safety practices (Worsfold & Griffith, 1997a:97; Griffith et al., 1998:225; Daniels, 1998:56; Anderson et al., 2004:186).

(i) Hand washing

The transmission of pathogens via contaminated hands occurs often and is considered a major cause of food-borne illness (Hunter, 2000:24; Medeiros et al. 2001a:108). If hands are not washed correctly and at appropriate times, pathogens such as *Escherichia coli* O157: H7can be transmitted to prepared or ready-to-eat food items (Collins 1997:475; Medeiros et al., 2001a:108), directly to the mouth, or to other household members (Jay et al., 1999b:1294). Hand washing has been shown to be one of the most important factors in controlling the spread of pathogenic micro-organisms (Hunter, 2000:24; Rippel, 2002:1; Kohl et al., 2002:267; Clayton et al., 2003b:223).

Unfortunately, this simple way to cut down on cross-contamination is very often not carried out. According to data provided by the American Society of Microbiology/Bayer Hand Washing Survey done in 1996 in the USA, people do not wash their hands as often as they think they do. In telephone surveys, 94% of the respondents claimed they always washed their hands after using a rest room, but observations indicated that only about 68% actually washed their hands (Collins, 1997:475). Lack of hand washing is a problem even in the health care profession, where, despite regular educational efforts and the application of prescriptive rules, there has been a consistent failure to achieve long-term adherence to appropriate hand hygiene practices (Elliot, 2003:88).

Redmond and Griffith (2003a:137) have reviewed all published and unpublished studies on consumer food safety conducted from 1975 to 2002 in the UK, Northern Ireland, Europe, the USA, Australia and New Zealand. They found that the majority of respondents (75 to 100%) in these studies were aware of the fact that hand washing before and during food preparation was important for safe food preparation.

In studies conducted by Altekruse et al. (1996:290), Yang et al. (1998:S33) and Shiferaw et al. (2000:1538), nearly all the respondents (62 to 100%) reported that they always or usually washed their hands after handling raw meat or poultry, and 87% to 92% reported that they always or usually washed their hands before handling food. In addition, the Food Safety and Inspection Service (2002:2) stated in their report on consumer food safety in the USA that the 66% of respondents who reported washing their hands with soap after handling raw meat or poultry in 1993, increased to 76% in 1998 and 82% in 2001.

However, from observational studies where actual hand-washing practices during food preparation were observed, it was concluded that hand-washing practices are in need of improvement as the majority of consumers did not wash their hands at all the appropriate times or use an appropriate method (Worsfold & Griffith, 1997a:97; Daniels, 1998:55; Clayton et al., 2003b:223).

Redmond and Griffith (2003a:147) cite a study by Griffith et al. (1999) who compiled a hand-washing checklist for use in an observational study which involved the preparation of a specific meal. The observed participants in the study only attempted to decontaminate their hands (or remove residue from hands) in 50% of the check-listed occasions, with 44% of these attempts consisting of rinses only. Adequate hand washing was only implemented on 6% of the occasions after handling raw meat and poultry. In an observational food safety study involving 121 households in 82 cities in the USA and Canada, 99% of the observed households failed to meet all of the food safety standards that are required for restaurants. In addition to neglected hand washing and an absence of hand-drying towels, the misuse of common cloths, sponges and towels was observed (Hunter, 2000:26).

Most of the observational studies have been based on the preparation of single meals. However, in a study carried out in the UK to determine the consistency of consumer food safety practices, the results indicated that there were no significant differences between mean risk scores for repeated food preparation sessions involving the same meal (Griffith & Redmond, 2001:70).

It is considered safe hand washing when hands are washed with hot water and soap or a detergent for lathering and rinsing, followed by the use of a clean, unused hand towel or disposable paper towel for drying (Patric et al., 1997; Bennion & Scheule, 2004:62). According to the US Department of Agriculture (USDA), people may think that they have washed their hands, whereas in reality they were only rinsing them (Hunter, 2000:24). In a study conducted by Jay et al. (1999a:924) in Australia, 82.3% of the respondents reported that they used soap when washing their hands during food preparation. However, 39.5% of the respondents indicated that they did not have soap available in the kitchen. Effective hand washing was therefore not practised by a significant number of respondents during food preparation.

According to Hunter (2000:25), it is important to dry hands after washing them as residual moisture remaining on the hands is an important factor in the number of micro-organisms that may be transferred from hands to food items and surfaces. However, in the study conducted by Jay et al. (1999a:925), 18% of the respondents indicated that they dried their hands on the same towel that was used for drying dishes. This practice is not recommended as pathogens from the hands, especially if washed inadequately, may be transferred to the towel and then to the dishes or utensils (Jay et al., 1999a:925).

(ii) Washing of produce

In the raw state, foods such as fruits and vegetables may be contaminated with organisms, such as *Listeria monocytogenes, Clostridium botulinium* and *Bacillus cereus*, which are present in the soil in which they are grown (Roberts, 1990:860; Adams & Moss,1995:176; Kubheka et al., 2001:130). Contamination with organisms, such as *Salmonella, Escherichia coli* 0157:h7, *Campylobacter jejuni* and *Vibrio cholerae* can also occur owing to the use of improperly composted manure, irrigation water containing untreated sewage, or contaminated wash water (Adams & Moss, 1995:186; Beuchat & Ryu, 1997:459). The Food Safety and Inspection Service (1999:1) recommends that all fresh produce should be washed under cold running tap water before preparation or consumption to reduce and remove any micro-organisms present.

In a national USA mail survey conducted by Li-Cohen and Bruhn (2002:1291), respondents indicated that the most common reason for washing fresh produce was to remove dirt (91%). This was followed by the removal of pesticides (93%) and the removal of bacteria or germs (60%). However, in this survey, 6% of the respondents indicated that they seldom or never wash fresh produce and more than 35% of the respondents indicated that they do not wash melons before preparation (Li-Cohen & Bruhn, 2002:1287). In a survey conducted by the Food Marketing Institute in 1998, only 23% of the respondents indicated that washing fruits and vegetables was an important procedure to keep food safe from germs

(Partnership for Food Safety Education, 1998:1).

Many consumers believe that washing raw meat and poultry before cooking is necessary to "clean" these foods (Anon, 1999a:2). According to the Food Safety and Inspection Service (1999:1), there is no benefit in the washing of raw meat and poultry as it will not remove bacteria and make these foods safer. Washing raw meat and poultry may contaminate the sink, and if fresh produce is washed afterwards, cross-contamination will occur. Furthermore, if wiping cleans the sink, the sponge or cloth used will be contaminated with bacteria, which could lead to further contamination. In a UK study investigating Christmas food preparation habits, more than 86% of the respondents reported that they washed the turkey before cooking it for dinner (Food Standards Agency, 2002b:1). Meat and poultry will only be rendered safe by cooking it to an internal temperature of 74 °C, as disease-causing bacteria will be eliminated at this temperature (Anon, 1999a:2; Food Standards Agency, 2002a:1; Bennion & Scheule, 2004:64).

(iii) Cross-contamination

According to Jay et al. (1999b:1285), many opportunities for cross-contamination exist in the domestic kitchen. During preparation, ready-to-eat food items can become contaminated with pathogenic micro-organisms which are transferred from contaminated hands, produce and equipment, such as cutting boards and knives used during food preparation. According to Sharp and Walker (2003:11), kitchens that are shared have an increased risk of cross-contamination owing to the number of individuals using the kitchen, lack of feelings of responsibility regarding the cleaning of the communal kitchen, and differing standards of hygiene. Medeiros et al. (2001a:109) concluded that many cases of *Campylobacteriosis* are the result of cross-contamination from kitchen equipment that was used to prepare raw poultry and then was inadequately cleaned before used for the preparation of ready-to-eat foods.

The results from an experimental study indicated that bacteria with attachment properties similar to *Salmonella spp.* could be readily transferred to cutting boards during food preparation. If boards are not adequately cleaned after use, fresh vegetables cut on the contaminated boards will show signs of cross-contamination (Zhao et al., 1998:960). Wachtel et al. (2003:1176) inoculated ground beef with *Escherichia coli* O157:h7. The beef was then shaped into patties, which transferred some of the bacteria to the hands and cutting board surfaces. Subsequently these pathogens were transferred to the lettuce leaves that were handled afterwards.

Consumers may not be familiar with the word "cross-contamination" as illustrated by the study of Jay et al. (1999a:925), where 50.5% of the respondents did not know the meaning of the term. A large majority of the respondents (92.1%), however, gave the correct answer when possible responses to the question on cross-contamination were supplied.

Self-reported behaviours relating to the cross-contamination of ready-to-eat food by raw meat and/or poultry have been reported by a number of researchers. Klontz et al. (1995:927) found that one-quarter of the respondents indicated that they would use the same cutting board, without cleaning it, for other food after using it for cutting raw meat or chicken. Yang et al. (1998:S33) found that 18.6% of respondents, in a multi-state surveillance study in the USA, indicated not washing their hands with soap and water after handling raw meat and chicken, and that 19.5% of the respondents indicated that they did not wash their cutting board with soap or bleach after using it for raw chicken or meat. In an Australian survey conducted by Jay et al. (1999a:925), 28.9% of the respondents indicated that they would use the same utensil for the cutting of raw and cooked produce, using the utensil as is or simply wiping it with a cloth.

Results of a nationwide telephone survey in the USA indicated an improvement in the food-handling practices of consumers from 1993 to 2001, as most of the respondents reported using practices that would reduce cross-contamination. Shiferaw et al. (2000:1538) reported similar results as 93% of the respondents in a USA multi-state telephone survey indicated that they almost always washed their cutting boards after cutting raw chicken. The same percentage of the respondents also said that they almost always washed their hands after handling raw meat or poultry.

In contrast, the results of a study by Daniels (1998:56) where direct observation techniques were used, found that 76% of the respondents were guilty of cross-contamination when preparing raw and cooked food. In a visually recorded study conducted by Anderson et al. (2004:186), 84% of the participants cross-contaminated ready-to-eat foods with raw meat or raw egg during preparation. Furthermore, Daniels (1998:56) found that an overwhelming majority (92%) of the participants misused kitchen cloths/ sponges by not using separate cloths/sponges for washing dishes, wiping counters, wiping hands and drying clean dishes. Griffith and Redmond (2001:71) concluded that the biggest threat regarding the incidence of food-borne disease in the home lies in cross-contamination.

(iv) Temperature control

The consumption of raw or under-cooked food items from animal origin can be considered as a risk factor for food-borne disease. Pathogenic micro-organisms frequently contaminate foods such as meat, poultry and eggs. These organisms can be transmitted to humans and cause serious illness (Roberts, 1990:859). For example, under-cooked ground meat products such as meat patties have been a source of *Escherichia coli* 0157:H7 (Bryan, 1988:663; Doyle, 1993:346; Adams & Moss, 1995:186; Jay et al., 1999a:923). The consumption of raw or undercooked eggs has frequently led to cases of the food-borne illness caused by *Salmonella Enteritidis* (Roberts, 1990:859).

If contaminated products are heated to an internal temperature of 70 °C, most pathogenic micro-organisms are eliminated (Roberts, 1990:859). However, studies show that many consumers consume raw or undercooked food items. Shiferaw et al. (2000:1538) reported that in an interstate telephone survey in the USA, 18% of the respondents indicated that they ate runny eggs and 30% of the respondents indicated that they preferred "pink" burger patties. Yang et al. (1998:S33) conducted a similar study and reported that approximately 50% of the respondents reported eating undercooked eggs and 19.7% of the respondents indicated eating "pink" burger patties. In the age group 18 to 29 years the number of respondents who ate "pink" meat patties increased to 21.8%. In the study conducted by Jay et al. (1999a:923) in Australia, about 20% of the respondents stated that they consumed ground meat products that were raw or cooked to rare or medium.

A further incorrect practice is to cook frozen meat and poultry without thawing it first. Jay et al. (1999a:923) found that 1.2% of respondents reported that they cooked meat from the frozen state. This method of preparation increases the risk of food-borne disease as pathogens in the interior of minced meat products, whole poultry and rolled joints of meat may survive the cooking process (Anon, 2000:4).

Most consumers use visual cues to determine whether meat and eggs are adequately cooked (Medeiros et al., 2001a:109). Mattick et al. (2002:541) investigated the prevalence of *Salmonella* in sausages and their destruction by frying and barbecuing, and found that in some cases *Salmonella* cells survived the cooking process although the sausages appeared to be well cooked.

This subjective assessment of doneness is not considered a good practice, as colour may not be an indication of doneness. Researchers in the USA have found that more than a quarter of fresh meat patties and two-thirds of frozen meat patties turn brown before being cooked to a safe temperature. Some meat patties may be predisposed to early browning because they have been exposed excessively to air, kept for too long before they are cooked, or not chilled sufficiently during storage (Anon, 1999a:8). The use of a thermometer is thus recommended when cooking meat, poultry and eggs (Anon, 1999a:8; Medeiros et al., 2001a:109).

Worsfold and Griffith (1997a:97) used direct observations and temperature measurements and found that more than half of the respondents cooked food well in advance of consumption. The majority of respondents held the cooked food items at ambient temperatures for prolonged periods. At these temperatures bacteria multiply rapidly and consumption of such items could lead to episodes of food-borne illness (Knabel, 1995:119).

Worsfold and Griffith (1997a:97) further reported that the majority of respondents did not use any method to increase the cooling of cooked food items. In addition, cooked and left-over food was inadequately re-heated before consumption. Jay et al. (1999a:923) reported similar findings in that most of the respondents (84.5%) would cool leftover food, such as casseroles, or other food with meat, chicken or fish, to room temperature before putting it in the refrigerator or freezer. Leaving food to cool at room temperature before refrigeration indicates an uncontrolled time period where food is left in the temperature danger zone of 5 to 60 °C (Bennion & Scheule, 2004:65).

Jay et al. (1999a:923) reported that 69% of the respondents thought it was very important not to reheat food more than once. Reheating food items more than once is not necessarily a dangerous microbiological practice. However, if it is linked to leaving food at room temperature before refrigeration, it may mean that many consumers allow their left-over food items to be at unsafe temperatures for time periods that are cumulatively dangerous.

2.3 Factors that contribute to unsafe food practices

2.3.1 Environment

Worsfold and Griffith (1997b:405) concluded that the opportunities for cross-contamination might be greater in a domestic kitchen than in a commercial kitchen. In a domestic kitchen a wide variety of food items are prepared, food preparation may be undertaken at irregular intervals by different family members and the layout, facilities and materials used in the construction of the kitchen may not be conducive to good hygiene practices. In a Food Marketing Institute study, consumers participating in focus group discussions also indicated that planning, timing and space affected their food handling behaviour (Collins, 1997:475). The lack of facilities in a domestic kitchen for the separation of raw and cooked foods is seen as one of the causes of cross-contamination in these kitchens (Jay et al., 1999b:1285). In addition, kitchens are used for non-food-related activities, cleaning may take place on an ad hoc basis, and the food handler may not be trained in food preparation (Worsfold & Griffith, 1997b:405).

The possibility of poor food safety practices increases in communal kitchens owing to the number of individuals using the kitchen (Sharp & Walker, 2003:11). Sharp and Walker (2003:11) conducted a food safety survey of the kitchens shared by undergraduate students and found that the users of such kitchens commonly made food safety errors. The researchers surmised that possible reasons for the many errors that occurred might lie in the lack of food safety knowledge and/or a lack of responsibility for the cleaning of these kitchens by the students.

2.3.2 Culture

To understand the food safety practices of consumers, their existing cultural and social preconceptions must be acknowledged. Collins (1997:475) points out that barriers to safe food handling behaviour include historical and cultural practices. While some cultural beliefs can promote food safety, others may be harmful. Examples of harmful beliefs include a preference for undercooked meat and fish, precooking of large quantities of food and taboos against hand washing (Ariffin 1993:1).

2.3.3 Knowledge and misconceptions regarding food safety

Many consumers think that their own food safety practices are acceptable and that there is little risk associated with the food that they have prepared (Griffith & Redmond, 2001:71). In a Research Triangle Institute study, 86% of the participants were mostly or completely confident that the meat and poultry that they prepared at home was safe to eat (Research Triangle Institute, 2000:4). Many consumers are thus ignorant of the fact that at least 60% of food-borne illness originates in the home, believing that the problem lies with food manufacturers and restaurants (Bruhn, 1997:512; Worsfold & Griffith, 1997a:97; Fein et al.,1995:1405).

Several surveys report that the majority of respondents indicate that they are aware of the importance of hand washing, cooking food to proper temperatures, keeping raw food separate from cooked food, keeping surfaces clean and refrigerating leftover food (Spriegel, 1991:14; Canadian Food Inspection Agency, 1998:2; Griffith & Redmond, 2001:71).

However, data from surveys carried out in the UK reveal that major gaps exist in the knowledge that consumers have of food safety (Simpson, 1993:4; Scott, 1996:7; Miles et al., 1999:744; Research Triangle Institute, 2000:4). In a study conducted in the USA by the Food Marketing Institute (1990 as cited in Bruhn, 1997:513), consumers indicated refrigeration, proper storage, checking expiry dates, washing and cleaning food items, proper cooking and proper wrapping of food items as steps that they would undertake to ensure safe food. However, none of the respondents mentioned the washing of hands or avoiding cross-contamination as preventative measures against the occurrence of food-borne disease. This was comparable to the findings of a USA Department of Agriculture study where results indicated that many consumers were aware of *Salmonella* and *Escherichia coli*, but that many other pathogenic bacteria implicated in food-borne disease, such as *Campylobacter* and *Listeria,* were not known (Rippel, 2002:1). As a result, many consumers may not be aware that both raw food and the human body can be a cause of bacterial contamination in the domestic kitchen (Scott, 1996:7; Bruhn, 1997:511).

Many consumers also have misconceptions regarding food safety. According to Henneman (1999:23), many consumers believe myths such as the following: "If it tastes okay, it's safe to eat" and "We've always handled our food this way and nothing has ever happened." Respondents in the 1996 Food Marketing Institute Study also tended to think that cooked food was "safer" than raw food and that recontamination of un-refrigerated food was less of a problem with cooked than with raw food (Collins, 1997:475). Some consumers believe that foods should be cooled to room temperature before being placed in the refrigerator. According to Jones (1992:109), this myth originated when food was cooled in iceboxes. The hot food items would melt the ice and thus cause all the food in the icebox to spoil.

As a result of the lack of knowledge and the prevalence of misconceptions, the importance of many of the basic instructions regarding personal hygiene, correct storage, temperature control, adequate cooking and the prevention of cross-contamination may not be fully understood (Scott, 1996:9; Redmond & Griffith 2003a:145). In addition, many consumers consider their homes to be the least likely place for food safety problems to occur and are therefore unlikely to be receptive to the food safety messages aimed at their home environment (Deakin, 1999:2). Scott (1996:9) ascribes the lack of attention that has been given to the promotion of home hygiene practices in recent times to consumer assumptions that the modern home is not an environment where hygiene needs be a matter for concern.

Many factors contribute to the poor knowledge regarding food safety. Owing to demographic and lifestyle changes, such as more women entering the workforce, many children and young adults grow up without learning the basic principles of safe home food preparation (Williamson et al., 1992:94; Deakin, 1999:2). It is estimated that in 70% of households in the USA there is no adult at home during the day. As a result children are preparing food for themselves without adult supervision (Collins, 1997:475).

Working parents consider time a precious commodity and spend as little time as possible on meal preparation and cleanup (Williamson et al., 1992:94; Collins, 1997:471). The majority of these parents rely on prepared or ready-to-eat or ready-to-heat meals and takeaways (Deakin, 1999:3). As a result, children's first-hand observation of food preparation has been reduced or eliminated (Beard, 1991:123; Williamson et al., 1992:94; Dumagan & Hackett, 1995:37). Many children therefore grow up with almost no experience of foods in a raw state and with only a limited exposure to a variety of food types (Worsfold, 1995:22). In addition, few schools offer or require food preparation classes (Knabel, 1995:121; Worsfold, 1995:22; Deakin, 1999:2).

Changing lifestyles have thus not only led to a lack of food preparation knowledge but also to a lack of food preparation skills (Beard, 1991:123; Griffith & Worsfold, 1994: 201; Knabel, 1995:121; Kastner, 1995:2742). Williamson et al. (1992:94) found that survey participants aged 35 and younger had a lower level of knowledge about food safety terms and concepts, compared with participants older than 35. In terms of food preparation practices, Deakin (1999:3) reported that young adults indicated lower confidence levels in their cooking skills than older age groups. Jay et al. (1999a:925) found that the highest occurrence of cross-contamination practices were in the age group 17 to 35 years and Shiferaw et al. (2000:1538) found that young adults were less likely to wash their hands after handling raw chicken when compared with older adults (88% versus 95% respectively). Li-Cohen and Bruhn (2002:1294) pointed out that studies completed in the last decade showed that people in their thirties and younger are more likely than older people to use unsafe practices when preparing food. Furthermore, a preference for undercooked meat patties was more common among young adults in the 19 to 25-year age group (Shiferaw et al. 2000:1538). According to Rippel (2002:1) better knowledge of proper cooking techniques on the part of senior citizens may be the reason for their safer food handling practices.

Respondents with no formal food training learn about food preparation through family and friends or teach themselves through reading, watching television and/or listening to the radio (Canadian Food Inspection Agency, 1998:4; Jay et al. 1999a:927). In health education, the mass media can be used as an important source of information (Tate & Cade, 1990:32), but in studies investigating the role of the general mass media it was found that it was a poor source of factual food safety advice and that celebrity chefs often projected the wrong image regarding food safety (Griffith & Redmond, 2001:72). In addition, recipes in cookbooks and in women's magazines seldom contain adequate information on food safety. Recipe directions on cooking are also often imprecise. As most consumers do not have thermometers to monitor the temperature of food items during cooking, accurate instructions for cooking hazardous ingredients, such as chicken, are needed to ensure food that is safe for consumption (Worsfold, 1995:23).

The knowledge of consumers is associated with their current practices and this in turn affects their willingness to change these practices if they learn that their current practices are unsafe (McIntosh et al., 1994:83). In many countries national consumer campaigns have therefore been promulgated to educate consumers on food safety. In the USA the Partnership for Food Safety Education launched the "Fight BAC! ™" campaign in 1997 (Bennion & Scheule, 2004:58) and the Food Safety and Inspection Service (FSIS) the Food Thermometer Education Campaign" in 2000 (Food Safety and Inspection Service, 2002:1). In addition, the US Department of Agriculture, the Department of Health and Human Services and the Environmental Protection Agency initiated the national food safety campaign "From Farm to Table". Concern about food-borne disease is also reflected in the new guideline, "Keeping food safe to eat", which was added to the 2000 edition of the Dietary Guidelines for Americans (Woteki et al., 2001:S502; Whitney et al., 2002:35). Similar campaigns also exist in the UK, where the "Farm to Fork" initiative and in Australia, where the "Paddock to Plate" approach have been launched (Redmond & Griffith, 2003a:132).

According to Lacroix et al. (2003:59), conflicting recommendations are evident when reviewing consumer publications and scientific literature. Inconsistent food safety messages confuse consumers and do not promote proper food safety behaviour. According to a promotional communication by the South African Department of Water Affairs and Forestry (2003:50), hands can also be shaken to dry after being washed with soap and water. However, residual dampness, which may remain on the hands, increases the possibility of micro-organisms being transferred from hands to food surfaces (Hunter, 2000:27).

In addition, the message conveyed in consumer food safety campaigns may not be clear to all consumers. In a focus group study conducted by the Research Triangle Institute (2000:2), participants discussed the promotional material used as part of the "Fight Bac! ™" campaign. All the participants were familiar with the message "Wash hands and surfaces often" and understood the importance of washing hands and surfaces to prevent the spread of bacteria. Some of the participants correctly defined "Cook to proper temperatures" as cooking food to a certain internal temperature to kill bacteria. However, some participants thought it meant to cook to the temperature specified in the cooking instructions or recipe and a few participants confused the internal temperature of the food with the oven temperature.

2.3.4 Attitude, intentions and behaviour

Various researchers have investigated the attitude, intentions and behaviour of consumers with regard to food safety practices. The relationship between these factors has also been explored (Redmond & Griffith, 2003a:133).

2.3.4.1 Attitude

Determining the food safety attitude of consumers can contribute to an understanding of their actual food safety behaviour (Redmond & Griffith, 2003a:140) as attitudes can have a direct influence on behaviour (Saba & Di Natale, 1999:69). Kraus (1995:58) analysed 88 attitude behaviour studies and concluded that attitude can significantly predict future behaviour.

Many related definitions have been compiled to define attitude. Ribeaux and Poppleton (1978:138) define an attitude in simple terms as "*a learned predisposition to think, feel and act in a particular way towards a given object or class of objects*". Learning can be a conscious or unconscious process where the conscious part will involve understanding. The cognitive component of the definition relates to the person's beliefs. Beliefs are based on both objective evidence and personal estimations, and may be accurate or inaccurate. The affective component includes likes, dislikes, feelings and emotions. It influences and is influenced by personal estimations. The conative or behavioural component includes both conscious and unconscious actions. In addition, actions take place within a specific situation that will, on its part, influence behaviour (Downie et al., 1996:122). According to Ribeaux and Poppleton (1978:138) the three components comprising attitudes do not need to coincide and the cognitive and affective aspects are only slightly related to overt behaviour.

Sapp et al. (1994:31), however, found that attitudes can influence behaviour directly. Ralston et al. (2000:47) reported on the results of a study conducted by the Economic Research Service of the USA Department of Agriculture in which the effect of attitude on consumer food safety behaviour was investigated. In this study, the relationship between consumers' motivation to avoid the risk of food-borne disease and the cooking and ordering of burger patties was determined. The relationship between consumers' burger patty choice and their preference for undercooked burgers due to palatability reasons was also examined. They found that consumers with a high-risk motivation and low palatability motivation were less likely to eat burger patties lightly cooked. Consumers who had experienced food-borne disease were also more motivated to avoid the risk of food-borne disease (Ralston et al., 2000:47). In a survey conducted by Jay et al. (1999a:921), 75% of the respondents recognised that there was a likelihood of food-borne disease occurring in the home, and 25% of the respondents actually changed their eating habits because of publicity surrounding food poisoning outbreaks.

In contrast, other researchers (Wicker, 1969:41) found no positive correlation between attitude and behaviour. In a study to determine the attitudes of college students towards food safety, Unklesbay et al. (1998:1175) found that all the respondents had positive attitudes towards food safety as they either agreed or agreed strongly with statements on food safety. However, the data on their self-reported food safety practices indicated positive and negative actions. The majority of the students indicated that they usually discarded food that had passed the expiry date, refrigerated leftovers immediately after eating a meal, and served food immediately after it had been cooked. On the other hand, most of the students also indicated that they usually used dishes with cracks and chips and consumed fruits and vegetables without washing them.

Clayton et al. (2003a:451) reported that all the participants in a study had positive attitudes towards the importance of washing their hands. Ninety-five percent of the respondents believed it was very likely that washing and drying their hands would help to prevent food poisoning. All the respondents believed that washing and drying hands after handling raw food items and between the preparation of raw and ready-to-eat food items were extremely important actions. Nonetheless, during observations, none of the participants adequately washed their hands on all the necessary occasions.

2.3.4.2 Intentions

Knowledge and attitude influence beliefs and may interact to produce behavioural intentions (Tones, 1979 as cited in Rennie, 1995:77). An intention is influenced by the person's attitude towards the behaviour and the perceived social pressure to carry out or refrain from that particular behaviour (Rutter & Quine, 2002:11). According to Ajzen and Fishbein (1980:51) behavioural intention is the immediate determinant of behaviour.

In a study undertaken by Mullen (1997 as cited in Redmond & Griffith, 2003a:144), a significant relationship between the behavioural intentions and actual observed food safety behaviours of children and young adults was determined. In contrast, in a study conducted by Clayton et al. (2003a:453), the intended behaviour of the respondents was contradicted by their actual behaviour. Eighty-five percent of the respondents reported that they were very likely to wash their hands after handling raw food, and 80% of the respondents indicated that they were very likely to wash utensils in between, or use different utensils for the preparation of raw and ready-to-eat food items. However, none and 48% of the respondents respectively carried out the intended behaviours adequately in these two situations.

The positive intentions voiced by consumers may not be reflected in their behaviour due to a variety of factors. Redmond and Griffith (2003a:144) cited a study by Griffith et al. (2001) where all the respondents intended to wash and dry their hands after handling raw food. However, these intentions might not have been realised because of a lack of soap, the belief that soap is not necessary for washing hands adequately or external events that interrupted the specific behaviour.

2.3.4.3 Behaviour

(i) Relationship between knowledge and self-reported behaviour

In a study by Meer and Misner (2000:1725), it was established that the food safety knowledge score of the respondents had a small, positive effect on their food safety practice score. Altekruse et al. (1996:293) found that respondents who were able to specify a food item associated with the *Salmonella spp.* were more likely to report washing their hands and cutting boards after handling raw meat or poultry, than those respondents who were unaware of this association. This led these researchers to conclude that a basic knowledge of microbiology may motivate consumers to use safe food practices.

However, in other studies where respondents reported their own home food preparation practices, food safety knowledge did not always correlate with safe food preparation practices. Williamson et al. (1992:100) reported that 51% of respondents correctly identified *Salmonella* as a term associated with poultry and eggs and indicated that they would use the correct procedure of immediately refrigerating a chicken after cooking. In contrast, 15% of the respondents did not know the term, but would use the correct storage procedure and 23% of the respondents, although they correctly identified the term, did not indicate following proper storage procedures for cooked chicken. Clayton et al. (2003b:223) found that all the participants in a study on hand-washing behaviour were knowledgeable about hand-washing techniques, but during observations none of the participants washed their hands adequately during the preparation of food.

Lack of knowledge may thus contribute to unsafe food handling practices, but ignorance may not be the major cause why consumers may fail to apply principles already known to them (Worsfold & Griffith, 1997a:103). Williamson et al. (1992:94) concluded that knowledge in itself did not guarantee that safe food preparation practices would be implemented.

In a study conducted by McIntosh et al. (1994:83), respondents' awareness of the dangers of undercooked meat patties, their knowledge of specific food-borne pathogens and their knowledge of food safety practices did not affect their willingness to change the degree to which they would cook hamburger patties. These researchers, however, found an indirect link between knowledge and the willingness to change cooking practices. Knowledge of food-borne disease increased the respondents' awareness of the dangers associated with the consumption of undercooked hamburger patties, which then in turn affected the cooking practices of the respondents. The researchers thus concluded that knowledge affects willingness to change, but only indirectly by working through variables linked to this willingness.

(ii) Relationship between self-reported and observed behaviour

Consumers self-reported food safety practices do not appear to be good predictors of their actual behaviour. When findings from observational food safety studies are compared to self-reported behaviour, it is evident that consumers report that they follow safety guidelines even when they don't (Worsfold & Griffith, 1997a:97; Jay et al., 1999b:1285; Medeiros et al., 2001a:110; Clayton et al., 2003a:434; Redmond & Griffith, 2003a:130).

Jay et al. (1999b:1285) found a significant variance between the stated answers in response to a questionnaire on food safety and the actual video recording of the food safety behaviour of the participants. In 70% of the cases the kitchen surfaces were not cleaned as frequently as was stated in the questionnaire.

Furthermore, in 50% of the cases, soap was not used when washing hands and in 45% of the cases, hands were not washed after handling raw meat although it was stated in the questionnaire that these habits were usually followed. Clayton et al. (2003a:453) reported similar findings. In their study on the factors that underlie the implementation of specific food safety practices by consumers, all the participants answered the knowledge questions on the washing of hands and utensils accurately. However, none of the participants always washed their hands adequately after handling raw foods and before handling ready-to-eat foods and only 48% of the participants washed the utensils in between or used different utensils for the preparation of raw and ready-to-eat food items.

Redmond and Griffith (2003a:145) state: *"Self-reported practices are personal accounts of one's actions and may or may not reflect actual behaviors. Data from self-reported questions may provide valid information on awareness or indirect knowledge about 'correct' behaviors rather than precise information on actual behaviors and thus may not provide an accurate representation of what actually constitutes a respondent's true behavior."*

A respondent may thus claim to carry out the perceived "correct" behaviours in order to convey a positive image (Bowling, 1997:229). Social desirability bias (the tendency to over-report desirable behaviour) has been demonstrated in various studies. Manun'Ebo et al. (1997:1015) found in a study in rural Zaire, that 44% of the respondents indicated that they washed their hands before food preparation, but that only 33% of the respondents actually washed their hands. The majority of respondents (76%) also indicated that they washed their hands before eating, but only 60% of the respondents washed their hands in the observational study.

In addition, certain behaviours may be automatic; not resulting from learnt responses but may rather reflect habits learnt in early socialisation (Ronis et al., 1989:213). Habits that may have developed at an earlier age could have resulted from cultural and social influences and not from a rational consideration of health and safety knowledge (Rozin & Fallon, 1986 as cited in McIntosh et al., 1994:84). Verplanken et al. (1998:111) indicated that the concept of habit should be investigated when trying to predict and change acts that had become automatic responses to situations. In a study conducted by Audits International (1999 as cited in Li-Cohen & Bruhn, 2002:1293) 65% of the respondents who had committed cross-contamination hazards on camera were unaware of these actions.

2.3.5 Relationship between knowledge, attitude, intentions and behaviour

Researchers such as Griffith et al. (2000) and Mullen (1997) have used psychological theories or models to try to describe the relationship between knowledge, attitude, intentions and/ or behaviour regarding food safety (cited in Redmond & Griffith, 2003a:133). In addition, health professionals may use models to understand and predict behavioural changes. Behavioural change is a complex process and is often difficult to achieve and to maintain. Theoretical models can be used as a conceptual framework for health promotional activities and can suggest methods by which programme aims may be met (Anon, 1998:1).

2.3.5.1 KAP model

The KAP model of health education (Figure 2.1) is relatively simple and suggests that an individual's behaviour or practice (P) is dependent on their knowledge (K) and attitudes (A). This model is used frequently in health behaviour research (Hausmann-Muela et al., 2003:3). Rennie (1995:77) applied the KAP model to food hygiene education as indicated in the following figure (Figure 2.1).

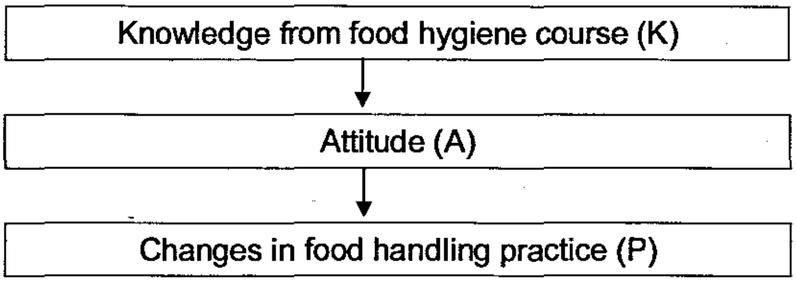

Figure 2.1 KAP model of health education (as indicated in Rennie, 1995:77)

The underlying assumption of this model is that by changing knowledge, behaviour is automatically changed as well. The validity of this relationship between these factors has been tested in many situations and has often been found to be absent. Hausmann-Muela et al. (2003:3) regard this model as over-simplistic as it does not take into account the many factors, which influence behaviour. Factors such as cultural, social and environmental influences (Rennie, 1995:77) and individual factors such as motivation (Ingle, 2003:1) are not taken into account.

However, this model has been successful in cases where the target group has little knowledge. If the target group already has a certain level of knowledge about the subject concerned, then it is more difficult to bring about behavioural change simply by providing information. In addition, it may be even more difficult to counteract misconceptions which have been available for a considerable period of time and reinforced by poor hygiene practices in the home (Rennie, 1995:78). The provision of information is not sufficient for behavioural change to occur. The consumer must desire the benefits of these changes and the changes must be perceived to be attainable (Anon, 1998:2).

2.3.5.2 Social cognition approaches

There are various definitions of social cognition, but according to Rutter and Quine (2002:1), *"the central tenet is that people's social behaviour is best understood by examining their beliefs about their behaviour in a social context".* Social cognition models assume that an individual's behaviour is determined by their beliefs, attitudes and norms within social and environmental conditions (Clayton et al., 2003a:435). The use of social cognition models and theories for health-related issues has enabled researchers to clarify the relationship between attitudes, beliefs, behaviour and behavioural change (Redmond & Griffith, 2003a:144). Social scientists have found that a social cognition model, such as the Health Belief Model, and a theory, such as the Theory of Reasoned Action, can be used to predict certain types of preventative health behaviour (McIntosh et al., 1994:83; Clayton et al., 2003a:435).

(i) Health Belief Model

The Health Belief Model (HBM) was one of the first behavioural change theories developed (Brown, 1999). According to Rosenstock (1990:42) consumers will be motivated to carry out preventative health behaviours in response to a perceived threat to their health (Figure 2.2). This perceived threat is itself influenced by general health values, which include interest and concern about health, specific health beliefs about vulnerability to a particular health threat, and beliefs about the consequences of the health problem (Brown, 1999:2). Changes in behaviour are dependent on the belief that the threat is serious and that a change in behaviour will reduce the threat. In addition, the person must recognize that barriers to behavioural change exist; he/she must believe that he/she is capable of changing his/her behaviour and must also be exposed to a cue for the specific health action to be realised (Rosenstock, 1990:43; Brown, 1999:3; Elder et al., 1999:275).

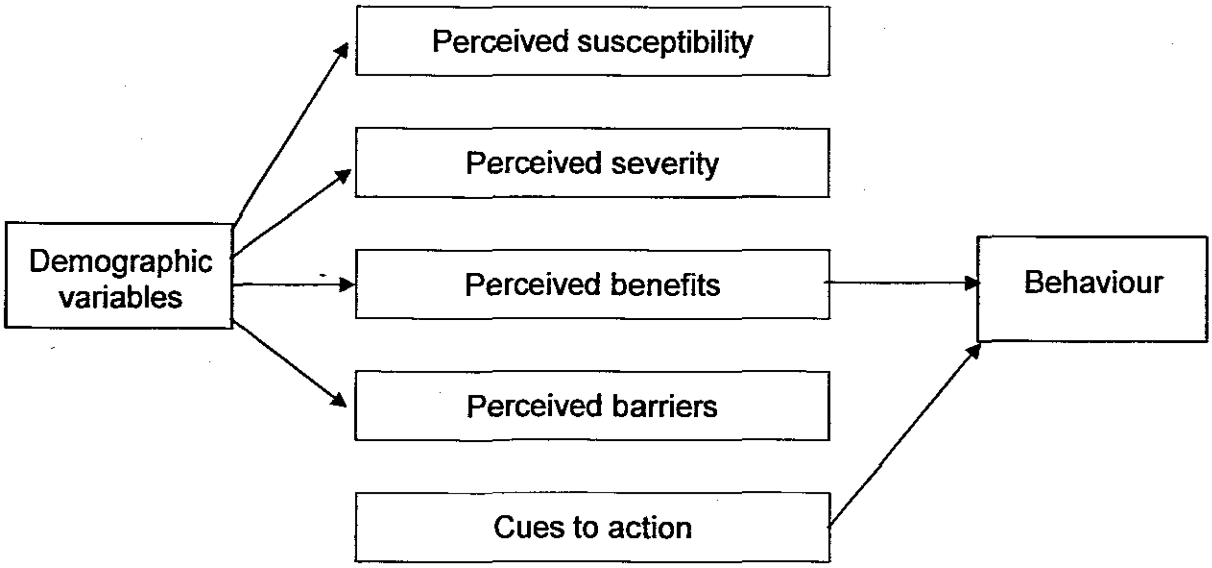

Figure 2.2 Health Belief Model (as indicated in Rutter & Quine, 2002:9)

According to this model, people's willingness to change their behaviour is determined by perceptions and beliefs (McIntosh et al., 1994:84). Limitations of this model include the absence of cultural, socio-economic and emotional factors such as fear or denial (Brown, 1999:3). In addition, the interaction between beliefs is not indicated and variables are not operationally defined (Rutter & Quine, 2002:10). Despite these limitations, the Health Belief Model has received support from health professionals and is still widely used to predict health behaviours (Rutter & Quine, 2002:11).

Frewer et al. (1994:19) and Schafer et al. (1993:17) conducted studies using the Health Belief Model to establish the food safety attitudes of consumers. Schafer et al., (1993:17) found that factors that could predict food safety actions were derived from the Health Belief Model. In this study, these factors included the perception that unsafe food is a personal health threat, that something could be done by the respondents about this threat, and the motivation to preserve good health. Ackerley (1994:69) utilised the Health Belief Model to determine whether consumers were likely to accept information on food safety. She found that by using this model, an assessment could be made of how consumers can be brought to a point of action. Hanson and Benedict (2002:S25) used this model to examine older adults' food-handling behaviours. They measured the perceived threat of food borne illness (perceived severity and susceptibility), cues to action (media and education cues) and safe food-handling behaviour (cross-contamination and sanitation). They found that cues to action were positively related to the perceived threat of food-borne illness and safe-food handling behaviours. In addition, they also found a positive relationship between sanitation and the perceived severity of food-borne illness.

In the Health Belief Model the importance of perceived barriers that prevent health behaviour is emphasised. These barriers can be internal, similar to the concept of self-efficacy, or external. In a study by Clayton et al. (2003a:452), 28% of the respondents indicated a lack of time as the most important barrier preventing consumers from carrying out specific food safety actions. In addition, 14% of the respondents indicated laziness and 11% of the respondents indicated low risk perception as internal barriers that affected food safety behaviour. These researchers concluded that there was a need for more detailed research to further investigate the nature of internal and external barriers to carrying out food safety actions.

(ii) Theory of Reasoned Action / Theory of Planned Behaviour

The Theory of Reasoned Action (Ajzen & Fishbein, 1980:8) and the extended Theory of Planned Behaviour (as cited in Rutter & Quine, 2002:11) (Figure 2.3) provide a theoretical account of the way in which attitude, subjective norm, and behavioural intentions combine to predict behaviour (Rutter & Quine, 2002:11). Ajzen and Fishbein (1980:77) assumed that individuals are usually quite rational and make systematic use of information available to them. As a rule, individuals consider the implications of their actions before they decide to engage or not engage in a given behaviour (Brown, 1999:2). According to Ajzen and Fishbein (1980:91) measures of personality and attitudes towards targets do not correspond with a single behaviour, but rather correspond to wider behavioural categories. The best predictor of a specific behaviour is the person's intention to behave in that manner. Intention is formed by attitudes and norms and, added to the Theory of Planned Behaviour, the concept of perceived behavioural control (Rutter & Quine, 2002:11).

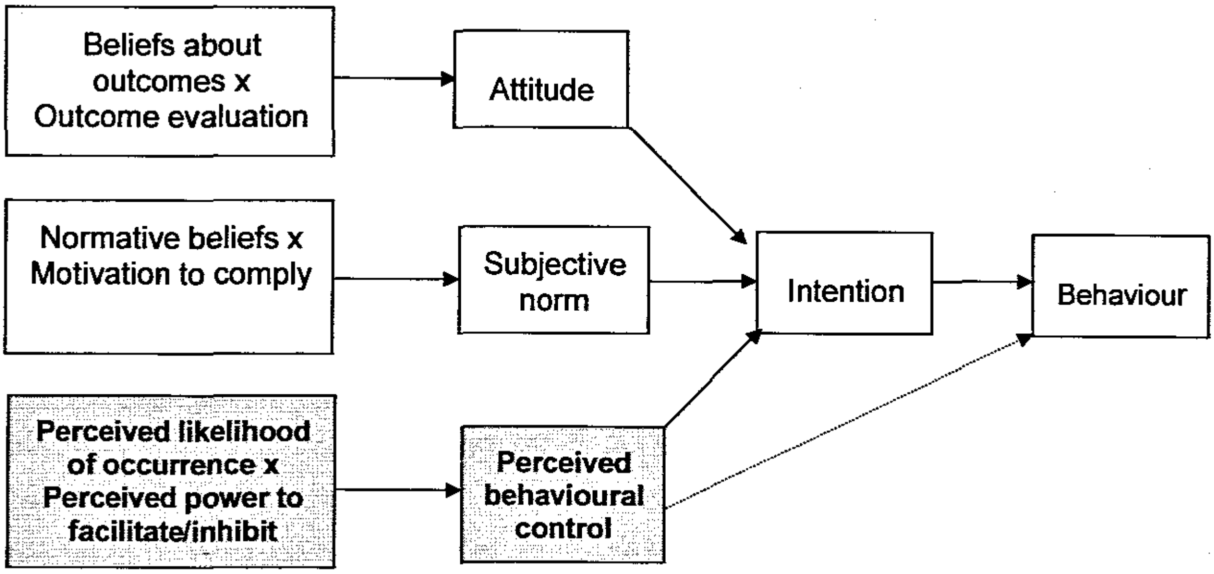

Figure 2.3 Theories of Reasoned Action and **Planned Behaviour** (as indicated in Rutter & Quine, 2002:12)

Attitudes are influenced by the beliefs that the person has regarding the outcome of the specific behaviour, whereas norms are influenced by the social pressure to perform (or not to perform) the behaviour. Perceived behavioural control is influenced by perceptions of impediments or opportunities that may inhibit or facilitate certain behaviour (Elder et al., 1999:275; Rutter & Quine, 2002:12).

According to McIntosh et al. (1994:83) both the Theory of Planned Behaviour and the Health Belief Model indicate that individuals make rational decisions about health behaviour when they are aware of related health problems, have some knowledge concerning these problems, as well as some judgement as to the level of risk involved in not changing their behaviour. In order to change, individuals have to perceive that their current behaviour endangers their health and that by taking action there is a strong likelihood that the risk will be lower (Wilcock et al., 2004:60). In addition, both these approaches acknowledge the effect of the social environment on awareness, knowledge, and judgement (McIntosh et al., 1994:83).

Redmond and Griffith (2003a:144) cite a study by Griffith et al. (2001) in which results indicated that although the Theory of Planned Behaviour did not significantly predict the food safety behaviour of consumers, there were significant correlations between cognitive elements of the model and behavioural intentions.

Clayton et al. (2003a:434) used the Theory of Planned Behaviour to investigate the underlying causes of food safety behaviour in consumer homes. In Stage 1 of their study, the salient beliefs of consumers, concerning preventative food poisoning actions, were determined. In the following stages the knowledge and attitudes towards the identified food safety actions were determined and their observed implementation of these food safety practices evaluated. The results of the study indicated discrepancies between the knowledge and intentions of the respondents on the identified food safety practices, and their implementation of these practices. The researchers concluded that measures of perceived behavioural control, perceived barriers and perceived risk may provide more useful information for the development of food safety intervention materials than measures of knowledge and intention.

The Theory of Reasoned Action and the Theory of Planned Behaviour have received extensive support by social psychologists interested in identifying health beliefs that may be changeable. However, the prediction of behaviour using these models is less successful (Rutter & Quine, 2002:13), as these theories also have limitations, which are as follows: Factors such as personality and demographic variables are not taken into account. An assumption is also made that perceived behaviour control predicts actual behaviour control. This may not always be the case. In addition, these theories are based on the assumption that consumers are rational and make systematic decisions based on available information, and are thus not considering unconscious motives (Brown, 1999:6).

2.4 Collection of data on food safety practices

Survey data is usually obtained by interviews and/or self-completed questionnaires (Babbie, 1992:269; Singleton et al., 1993:248; Bowling, 2002:196). In the majority of consumer food safety surveys, interviews were used. The second most common method was self-completed questionnaires, followed by direct observations and focus group studies (Redmond & Griffith, 2003a:133). Each of these methods has its own particular strengths and weaknesses (Compton & Hall, 1972:140; Bowling, 2002:259).

2.4.1 Interviews

In an interview data is collected by an interviewer putting questions, pertinent to the purposes of the research study, to a respondent and recording the answers (Compton & Hall, 1972:240; Bowling, 2002:260). Interviews can be unstructured, with no questions compiled in advance or they can be structured, with an interview schedule or questionnaire consisting of closed- and/or open-ended questions (Baily, 1978:197; Babbie, 1992:147; Bowling, 2002:311). The main reason for using a structured interview is to increase reliability. Conducting interviews using questions with the same wording, sequence and manner increases the quality of the data as measurement error is minimised. Using a structured interview may, however, decrease validity, as questions cannot be adapted for each respondent. This may be a problem if the same questionnaire is used for respondents from different cultural and socio-economic backgrounds (Singleton et al., 1993:259).

An interview conducted face-to-face with the respondent is described as a personal interview. Personal interviews can also be conducted by telephone (Babbie, 1992:262; Bowling, 2002:260). Personal interviews have an advantage in that the interviewer controls the interviewing situation. The interviewer can notice and clear up any misunderstandings and misinterpretation of words and questions and follow up vague and incomplete responses (Compton & Hall, 1972:241; Babbie, 1992:269; Bless & Higson-Smith, 1995:111; Bowling, 2002:261). The interviewer can ensure that all questions are answered, that the first response as well as subsequent responses to each question is recorded, and that someone other than the designated respondent does not provide any of the answers to the questions (Huysamen, 1994:146).

Personal interviews decrease the number of "don't know" and "no answer" responses as the interviewer can observe as well as ask questions. Furthermore, when comparing questionnaires administered by an interviewer to self-completed questionnaires, the response rate is higher, especially when compared with mail surveys (Babbie, 1992:269; Bowling, 2002:261).

One of the drawbacks of personal interviews is the fact that respondents cannot be completely anonymous. This can lead to respondents basing responses on what they think the interviewer expects of them, rather than those that actually apply to them (Bless & Higson-Smith, 1995:116). Responses may also not be accurate, if respondents' answers are not interpreted correctly and verified (Worsfold & Griffith, 1997a:98).

Interviewers should be trained properly so as not to affect a respondent's perception of a question or an answer given. They should be a neutral medium through which questions and answers are transmitted (Babbie, 1992:270). Questions must be presented in the same way to minimise the role and influence of the interviewer and to enable a more objective comparison of results (Bless &

Higson-Smith,1995:107). Interviewers should thus be aware of their own influence on the respondents. In order to control it they should not say anything, which may be construed as a hint about what is regarded as the desired response (Bless & Higson-Smith, 1995:116). Interviewers should also be familiar with the questions so that they can read them fluently or even ask them from memory without deviating from the formulated questions (Huysamen, 1994:144).

The high cost of personal interviews is a further limitation. Personal interviews are time consuming; not only is time spent on the interview itself, but also in the arrangement of appointments (Compton & Hall, 1972:241; Bowling, 2002:261). Apart from the time required to conduct interviews, there are costs associated with the training of interviewers (Huysamen, 1994:146). Interviewers also have to be paid for conducting the interviews and their travelling costs have to be reimbursed (Huysamen, 1994:146).

Telephone interviewing shares some of the advantages and limitations of personal interviews. The main advantage, however, when comparing telephone interviews with personal interviews is the substantial saving in time and money. Response rates are also as high as or even higher than with personal interviews (Singleton et al., 1993:264). In addition, data collection can be better controlled if all the interviewers are calling respondents from a single room, as an interviewing supervisor can clarify any problems immediately. Telephone interviewing is also safer, especially if respondents cannot be contacted during the day and live in areas with a high crime rate (Babbie, 1992:275). Limitations of telephone interviews, when compared with personal interviews, are that it is more difficult for interviewers to establish a feeling of trust with the respondents (Singleton et al., 1993:264), that it is only suitable for use with short questionnaires containing straight forward questions and that the topic should be of a non-sensitive nature (Bowling, 2002:261).

2.4.2 Self-administered questionnaires

Survey data can also be collected by means of a self-administered questionnaire. Self-administered questionnaires may be handed out and completed by respondents in an institutional setting, such as a school, but mostly these questionnaires are handed out or mailed to respondents to be filled in at home (Baily, 1978:111; Babbie, 1990:176; Singleton et al., 1993:264).

Questionnaires that are self-completed by respondents are usually structured, containing previously compiled questions with fixed wording, a specific sequence of presentation and indications of how to answer each question (Huysamen, 1994:144; Bless & Higson-Smith, 1995:107). Questions can be open and/or close-ended (Babbie, 1992:147).

Using self-administered questionnaires to collect survey data is less expensive than using either a personal or telephonic interview, as trained interviewers to conduct the interviews are not needed. In addition, there are no travel or telephone expenses (Babbie, 1992:277; Singleton et al., 1993:264). A further advantage includes the possibility that respondents may feel more at ease if they can answer sensitive or controversial questions anonymously and in the privacy of their own home, rather than being faced by an interviewer (Babbie, 1992:277). Respondents may also feel less of a desire to try to impress an interviewer, minimizing social desirability and interviewer bias (Compton & Hall, 1972:240; Bowling, 2002:259).

The biggest limitation of self-administered questionnaires is the low response rate. Even though a variety of techniques, such as offering monetary incentives and following up on respondents, has been used with varying degrees of success to increase the response rate, it is still much lower than the response rates of interviews (Babbie, 1990:187; Singleton et al., 1993:265; Bowling, 2002:264). In addition, more questions are left unanswered when respondents complete questionnaires themselves, as compared with interviews, which further lowers the amount of useable data (Babbie, 1992:277; Singleton et al., 1993:265). Stated response categories may not be sufficiently comprehensive and not all possible answers accommodated, thus some respondents may be "forced" to choose a response category that might not fully represent their view (Bowling, 2002:279). Although the influence of interviewers is eliminated, the opportunity to clarify questions or answers or to control the sequence of completion is also removed (Singleton et al., 1993:265).

2.4.3 Direct observations

In an interview situation or when completing a self-administered questionnaire respondents report their own behaviour pattern. Self-reported and actual behaviour is, however, not always positively correlated (Bryan, 1988:663; Redmond & Griffith, 2003b:25). According to Compton and Hall (1972:209), direct, structured observation often bridges the gap between what people say or believe they would do in a specific situation and what they actually do. Sven and Ary (1989 as cited in Redmond & Griffith, 2003b:25) described structured observation as *"systematic, quantitative and limited to defined, measurable and observable behavior variables, which are determined before the actual observation is carried out".*

The main advantage of structured observation as a means of gathering data on food safety is its directness, as data can be collected first hand in a natural setting (Worsfold & Griffith, 1997a:98: Redmond & Griffith, 2003b:25). Interviewers do not have to depend on respondents' possible misleading reports about the relevant behaviour, as in interviews or on questionnaires, but instead, are able to observe the behaviour directly (Huysamen, 1994:139: Bowling, 2002:358).

Structured observational studies as a method of data collection have limitations. These studies can be time-consuming and costly (Compton & Hall, 1972:216; Huysamen, 1994:140). The presence of observers and the respondents' awareness that they are under observation may influence their behaviour leading to reactive measurements instead of the observation of natural behaviour (Huysamen, 1994:140; Bowling, 2002:358). According to Redmond and Griffith (2003b:26), the "Hawthorne effect" could lead to respondents consciously changing their usual behaviour to create a more positive image of themselves.

Observer bias is considered by Saunders et al. (2000, as cited in Redmond and Griffith, 2003b:26) to be the greatest threat of reliability when observational techniques are used. The prejudices of the observers may affect their observation and consequently the validity of their ratings (Huysamen, 1994:140). Furthermore, the potential for observational bias exists, as outside variables are, to some extent, unpredictable (Worsfold & Griffith, 1997a:98).

2.4.4 Focus groups

Focus groups are unstructured interviews with small groups of people who interact with each other and a group facilitator (Bowling, 2002:394). This method of data collection is a good choice if various perspectives about the same topic are required (Gibbs, 1997:1), as the group dynamics can stimulate discussion and generate ideas. Focus groups can be used to examine not only what people think, but how and why they think in a particular way (Bowling, 2002:394). Focus groups can be used in various stages of a study, assisting in planning and/or evaluation of activities (Gibbs, 1997:1).

An advantage of this method includes the insight that is gained by the researcher into the way consumers understand the world around them and the way that they are influenced by others in a group situation (Gibbs, 1997:1). In a group situation participants could reveal different understandings and meanings of the same topic, which will enable the researcher to obtain possible explanations of attitudes and behaviour patterns more easily (Gibbs, 1997:2).

The fact that the researcher has less control over the data produced than in an interviewing situation can be indicated as a limitation of this type of research (Gibbs, 1997:4, citing Morgan, 1988). In addition, individuals might express views influenced by the group situation, which may differ from those expressed in an individual situation (Gibbs, 1997:4). Some individuals might feel inhibited by the presence of others in a group and might thus not contribute fully to group discussions (Bowling, 2002:395).

2.5 Dietary intake of students

2.5.1 Adequacy of food and dietary intake

2.5.1.1 Food intake in accordance with the Daily Food Guide and Dietary Guidelines

The Daily Food Guide (USA Department of Agriculture (USDA), revised edition of former Basic Four Food Group Guide, 1985) was compiled to provide a practical interpretation of nutrient standards, such as the Recommended Dietary Allowance (Williams, 1993:8). In this guide related food items, providing specific nutrients, are grouped together and recommended numbers of servings, to meet nutritional needs, are given for each group (Sizer & Whitney, 2003:35). The food groups, recommended servings for teenage girls and active women and serving sizes are indicated in Addendum A.

A revised third edition of the Dietary Guidelines for Americans was issued by the USDA and Health and Human Services in 1990 (Williams, 1993:12). These guidelines emphasise health promotion through the reduction of disease risk. The guidelines are as follows:

- *" Eat a variety of food;*
- *Maintain a healthy weight;*
- *Choose a diet low in fat, saturated fat and cholesterol;*
- *Choose a diet with plenty of vegetables, fruits and grain products;*
- *Use sugars in moderation;*
- *Use salt and sodium in moderation; and*
- *Drink alcoholic beverages in moderation"* (USDA and Health and Human Services, 1990 as cited in Williams, 1993:A-103).

Food consumption surveys as indicated below determined that young adult females have marginal or below recommended intakes for all five of the major food groups of the Daily Food Guide. In addition, the preliminary findings of the seven-year Tufts Longitudinal Health Study, which started in 1998, and is investigating the lifestyles of college students, are similar to those of the 1995 CDC study. In both studies the conclusions were that young adults in the USA had low levels of physical activity and consumed diets not in line with the Dietary Guidelines for Americans (Klemmer, 2002:97).

In a Canadian study conducted by Jacobs-Starkey et al. (2001:61) a mean daily intake of 1.6 servings of milk and milk products was indicated by females between the ages of 18 and 34 years. The mean intake 1.6 servings was below the minimum of 2 daily servings as recommended by Canada's Food Guide to Healthy Living. Haberman and Luffey (1998:189) reported that more than 80% of the respondents in their study of college students in the USA indicated that they consumed quantities of milk and milk products below the recommendation of the Daily Food Guide. Other studies in the USA conducted by Hizza and Gerrior (2002:6) and Lawrence and Schank (1993:533) reported similar findings on the low intake of milk and milk products. Van Eeden and Gericke (1996:90) found in a study, conducted in South Africa, that both the rural and urban female student groups exhibited a low score (1.4 and 1.92 respectively out of a maximum dietary score of 4) for the milk and milk products group. Similar low intakes were reported by Langenhoven et al. (1995:524) who found that only 13% of respondents over the age of 18 years, in a study involving 2000 households in South Africa, indicated an adequate intake of 400 ml or more of milk per day.

Cotunga and Vickery (1994:417) reported that only 40% of the respondents, in a study which investigated USA college students' compliance with the Food Guide Pyramid recommendations, consumed the recommended number of 2 to 3 daily servings from the meat, poultry, fish, dry beans, eggs and nuts group. This finding is consistent with the data collected by Lawrence and Schank (1993:533) and Hizza and Gerrior (2002:3). In addition, the respondents in the latter study also included meat and fish in their list of least favourite foods. In South Africa Van Eeden and Gericke (1996:90) found that a rural and an urban female student group reported low intakes of protein rich foods. These two groups respectively obtained scores of 3.4 and 3.62 out of a maximum dietary score of 4 for protein rich foods.

Research has confirmed that fruit and vegetables have a key role in a healthy diet, but various studies reveal that young adults do not consume the recommended number of servings. In a UK study investigating the fruit and vegetable consumption of first-year undergraduate students, Williams (2000:370) found that fewer than 20% of the respondents achieved the WHO (World Health Organization, 1990:31) recommendation of eating five portions (400 g) of fruit and vegetables per day.

Studies conducted among college student populations in the USA by Mitchell et al. (1994:A52), Haberman and Luffey (1998:190), Anding et al. (2001:168) and Hizza and Gerrior (2002:3), also reported inadequate intakes of fruit and vegetables. Furthermore, the 1995 USA National College Health Risk Behavior Survey found that 74% of college students did not eat five or more servings of fruit and vegetables per day (DeBate et al. 2001:820). Wardle et al. (1997:446) reported that only 62% of the female respondents, in a study, which involved more than 16 000 students from 21 European countries, indicated that they consumed fruit daily. Van Eeden and Gericke (1996:90) found in a study conducted in South Africa, that both the rural and urban female student groups, exhibited low scores (2.5 and 3.02 respectively out of a maximum dietary score of 4) for the fruit and vegetables group. Similar low intakes was reported by Langenhoven et al. (1995:524) who found that only 28% of the respondents, aged 18 and older, in a study conducted in South Africa, indicated an intake of 4 portions of fruit and vegetables per day.

In a number of studies, the bread, cereal, rice and/or pasta intake of female college students fell below the 6 to 11 servings per day as recommended in the Food Guide Pyramid. Cotunga and Vickery (1994:418), Haberman and Luffey (1998:190), Anding et al. (2001:168) and Hizza and Gerrior (2002:3) all reported that female college students in the USA consumed grain quantities below the recommended minimum of 6 servings as indicated in the USDA Food Guide Pyramid. In the South African study by Van Eeden and Gericke (1996:90) found that both the rural and urban female student groups obtained scores below the maximum dietary score of 5 portions for the cereal group. The rural group obtained a score of 3.95, while the urban group had a score of 3.89.

The Dietary Guidelines for Americans recommend the intake of fibre-rich foods such as whole grains, fruits and vegetables (Sizer & Whitney, 2003:12). Horwath (1991:400), in a study conducted in New Zealand, and Glore et al. (1993:517), in a study conducted in the USA, reported low intakes of dietary fibre amongst students. However, Wardle et al. (1997:446) reported that about half of the students involved in a European study indicated that they were trying to increase their dietary fibre intakes.

According to the Dietary Guidelines for Americans, all adults and healthy children aged 2 and older should choose beverages and foods that limit their intake of sugars (Sizer & Whitney, 2003:12). Free sugars should not contribute more than

10% of the total energy intake (World Health Organization, 2003:56). According to the World Health Organization (WHO) free sugars refer to all mono- and disaccharides added to food during the manufacturing process, during preparation or consumption as well as all sugars naturally present in honey, syrups and fruit juices (World Health Organization, 2003:56). Senekal (1988:163) reported that the total sugar intake (sugar added to food which excludes the sugar naturally present in food) of female first-year university students residing in residences of the University of Stellenbosch comprised approximately 13, 5% of their total energy intake.

Furthermore the Dietary Guidelines for Americans recommend that foods should be chosen and prepared with less salt (Sizer & Whitney, 2003:12). Wardle et al. (1997:446) commented on the results of a European study involving students from 21 countries. An average of 68% of the female students who participated in the study indicated that they tried to limit their salt intake. These percentages varied from 39% to 91%, with the higher numbers representing students residing in Sweden and Finland.

According to the Dietary Guidelines for Americans, all adults and healthy children aged 2 and older should be physically active each day (Sizer & Whitney, 2003:12). Both diet and exercise play an important role in decreasing the prevalence of chronic diseases such as coronary heart disease, non-insulin-dependent diabetes mellitus, and some types of cancers, stroke and osteoporosis (Brevard & Ricketts 1996:35).

Beerman et al. (1990:217) found, in a study conducted in the USA, that the majority (75%) of female university students reported that they exercised regularly (1 – 3 times/week), while 6% of the respondents indicated that they exercised occasionally (1 – 4 times/month) and 19% indicated that they exercised rarely (less than or equal to 6 times/year). In contrast, in a study investigating whether college women in the USA are following the Dietary

Guidelines for Americans, Anding et al. (2001:167) found that 66% of the respondents indicated a sedentary lifestyle. The preliminary results of the Tufts Longitudinal Study further indicate that there is a continual decline in exercise time as students enter and progress through university (Klemmer, 2002:98).

Cole and Ogungbe (1987:309) reported similar results as they found that female Nigerian students were physically not very active. The female students who participated in the study indicated that they spent the greater proportion of their time in activities that involved either sitting down or lying in bed. Fennell (1997:109) indicated that more than one-third of a student sample (male and female) at eight historically black colleges and universities in the USA had not exercised or participated in sports activities for more than 20 minutes during the previous week.

Physical activity, diet and overall health are interrelated. Students who exercised regularly (at least three times a week) were more likely to meet the USDA recommended fruit and vegetable intake. Furthermore, students who exercised regularly reported that they used their time more productively, had greater confidence in their intellectual capabilities and were feeling more positive about themselves (Anon, 2000b:1). In addition, regular exercise promotes cardiovascular fitness, enhances muscle tone and bone density and helps maintain optimal body weight (Haberman & Luffey, 1998:189).

According to the Dietary Guidelines for Americans, all adults and healthy children aged 2 and older should aim for a healthy body weight (Sizer & Whitney, 2003:12). The increase in overweight and obesity in young women is a cause for concern (Gillis & Williams, 200:1). Haberman and Luffey (1998:189) calculated the body mass index (BMI) of a sample of college students at a large urban university in the USA and found that 8% of the students were categorised as being overweight. This percentage is far higher in the USA study by Lowry et al. (2000:18), who reported that 35% of their student sample was overweight or obese (BMI ≥ 25 kg/m^2). In both these studies the data was based on the self-reported heights and weights of the respondents.

In the adult health questionnaire of the South African Demographic and Health Survey 1998, data were collected from men and women aged 15 years and older. Based on their BMIs, only 37 % of the women surveyed were at an optimal body weight. Approximately 55 % of the women surveyed were overweight (BMI 25 to 29.9 kg/m^2) or obese (BMI 30+ kg/m^2). Overweight patterns did not differ much between urban and non-urban women, although urban women tended to be more obese (South African Department of Health, 1999:244). In the age group 15 to 24 years 9.5% of women were underweight (BMI < 18.5 kg/m^2), 60.7% were of a normal weight (BMI 18.5 to 24.9 kg/m^2), 20.0% were overweight (BMI 25 to 29.9 kg/m^2) and 9.6% were obese (BMI 30+ kg/m^2) (South African Department of Health, 1999:274). Steyn et al. (2000b:146) investigated the lifestyle risks that might contribute to chronic disease in black, female students at the University of the North. In the South African study by Steyn et al. (2000b:146) 18% of the respondents were found to be overweight (BMI 25 to 29.9 kg/m^2), 6.5% obese (BMI ≥ 30 kg/m^2) and 26.8% underweight.

2.5.1.2 Energy and nutrient intakes in accordance to the Dietary Reference Intakes

The 2000 Dietary Reference Intakes (DRI) have replaced the 1989 Recommended Dietary Allowance (RDA) of the USA Food and Nutrition Board with an expanded set of standards for nutrient intakes (Sizer & Whitney, 2003:30). The DRI estimates are quantitative measurements used for the planning and evaluation of diets of healthy people living in the USA and Canada (Anon, 2001b:1). The set of standards of the DRI include the RDA, Adequate Intake (AI), Tolerable Upper Intake Level (UL) and the Estimated Average Requirement (EAR). These can be defined as follows:

- *" RDA: The average daily intake sufficient to meet the needs of 97% - 98%*

of all healthy individuals in a life-stage and gender group.

- *AI: The recommended intake based on observed or experimentally determined approximations. Used when scientific evidence is insufficient to calculate an EAR.*
- *UL: The highest level of daily intake likely to produce no risk or adverse effects to almost all individuals in the general population.*
- *EAR: The daily amount of nutrient that will maintain a defined level of nutriture in half the healthy individuals in a life-stage and gender group"*

(USA Food and Nutrition Board, 2000 as cited in Anon, 2001b:1).

The DRI values for most nutrients have not changed significantly from the 1989 RDA values. However, the values for some nutrients, e.g. vitamin C, vitamin E and folate, are higher than the previous values, while values for nutrients, such as selenium and zinc, are lower (Anon, 2001c:2). The studies reported on in this literature review used the 1989 RDA values as criteria for determining the dietary intake adequacy of female students unless stated otherwise.

Iron deficiency is the most common nutrient deficiency found among young adult women (Gillis & Williams, 2002:2). In a UK study investigating the changes that took place in the diets of university students from 1986 to 1991, a large proportion of female students (62.5%) were not consuming the RDA for iron in all of these years (Eves et al., 1994:363). In the USA, Hoffman (1989:836) found in a study, involving college students, that nearly half of the female respondents had iron intakes below the 75% level of the RDA. Low intakes of iron by female college students in the USA were also reported by Jakobovits et al. (1977:405) and Herzler and Frary (1992:867). In studies conducted respectively in Australia, New Zealand and South Africa by Rangan et al.(1997:110), Horwath (1991:400) and Steyn et al. (2000:53) similar low intakes of iron was reported.

Calcium deficiencies during early adulthood are of particular concern because of their association with bone health in later years (Gillis & Williams, 2002:2).

Findings from studies conducted in the USA by Hoffman (1989:836), Ostrom and Labuza (1977:70) and Glore et al. (1993:517) indicated that the calcium intakes of college women were below the AI. Similar findings were reported by Horwath (1991:395) in New Zealand, Rangan et al. (1997:110) in Australia and Steyn et al. (2000:53) in South Africa. Other minerals that are a cause for concern include copper, zinc and magnesium as Horwath (1991:400) and Glore et al. (1993:517) respectively reported low intakes of these minerals by college students.

Low intakes of specific vitamins were also reported. In the study by Eves et al. (1994:363), where these researchers investigated the changes in the diets of university students from 1986 to 1991 in the UK, they found the intake of vitamin A to be below the RDA in the latter years. The overall intake of riboflavin also tended to be continuously low in their study. Horwath (1991:395) investigated the nutritional status of undergraduates at a New Zealand university and reported that mean intakes of vitamins B6 and B12 were below the 1989 USA RDA levels.

Hoffman (1989:836) evaluated the nutrient intake of college students in the USA and found that folic acid intake was low for most respondents. Hilton (2002:172) corroborated this finding and found that all the respondents in a study of college students in the USA had intakes of folic acid, which were below the 400 μg level of folic acid recommended by the USA Centers for Disease Control and Prevention (cited in Hilton, 2002:176).

Herzler and Frary (1992:867) and Johnston et al. (1998:209) reported low intakes of vitamin C by female college students in the USA. In the latter study the prevalence of vitamin C deficiency ranged from 1 to 2%. Marginal vitamin C status was observed in 12% of their autumn student sample and in 16% of their winter student sample.

Hilton (2002:172) found that 33.3% of female college students in the US reported taking daily multivitamins. Horwath (1991:395) reported that only 16% of the female university undergraduate students in the study conducted in New Zealand indicated taking a supplement regularly, which was indicated to be at least once a week. In contrast, Eves et al. (1994:363) found that only a very small proportion of the UK university population (three to four students) in each year group, from 1986 to 1991, consumed dietary supplements, such as vitamin pills.

Anding et al. (2001:167) found that even if college students in the USA followed diets that were nutritionally adequate, they exceeded recommendations for fat, sodium and sugar. The Dietary Guidelines for Americans recommend that a diet low in saturated fat and cholesterol and moderate in total fat should be chosen (Sizer & Whitney, 2003:12). Anding et al. (2001:167) reported that 20% of the college student respondents exceeded the recommended level for cholesterol intake (more than 300 mg per day) and two-thirds of the respondents exceeded the recommended level of saturated fat intake (more than 10% of energy from saturated fat).

In a study conducted in the USA by Hampl and Betts (1995:893), 75% of a sample of 18- to 24 year-olds consumed more than 30% of their energy intake from fat and in a study conducted in South Africa, first year female university students consumed a mean of 36.6% of their energy intake from fat (Senekal, 1988:163). In both studies the current recommendation for dietary fat intake was thus exceeded. However, according to the National College Health Risk Behavior Survey conducted in the USA in 1995, 84.6% (± 1.8) of female students, aged 18 to 24 years, reported eating two or less foods typically high in fat content on the day prior to the survey (Center for Disease Control, 1997:40). Haberman and Luffey (1998:190) reported that 52% of the respondents in their study involving female college students in the USA indicated that they limited fat intake and 53.6% of the respondents indicated that they avoided fried foods. In addition, female students were more likely than male students (61.3% versus 41.7%) to limit fat intake. Wardle et al. (1997:446) reported that an average of 49% of the female students in the study comprising students in 21 European countries indicated that they tried to avoid the consumption of fat.

Many female students are dissatisfied with their body weight and shape. This dissatisfaction may lead to restrictive eating habits to limit energy intake. Miller et al. (1980:564), Hernon et al. (1986:217), Herzler and Frary (1989:349), Glore et al. (1993:517) in the USA and Eves et al. (1994:363) in the UK reported low energy intakes among female students. In contrast, Senekal (1988:163) indicated that the average energy intake of first-year female students in residences at the University of Stellenbosch at the beginning of the academic year was 8% higher than the 1985 RDA for their age group. However, after being at the university for three months, students who gained no or a moderate amount of body weight showed a decrease in total energy intake, but those students who gained in excess of 5 kg showed an increase in total energy intake.

2.5.2 Factors contributing to poor dietary intake

2.5.2.1 Knowledge of food and nutrition

According to Hizza and Gerrior (2002:4), the present generation of young adults in the USA is the first generation to have grown up with the benefit of dietary recommendations. However, the recommendations to increase complex carbohydrate and dietary fibre intakes and to reduce fat and cholesterol intakes are not reflected in the diets of this population group.

In addition, a discrepancy exists between people's perceived and actual behaviour (Klemmer, 2002:99). This is reflected by the following studies. Cotunga and Vickery (1994:417) reported that none of the students, in a study conducted in the USA, who rated their diets as good or excellent, when completing a questionnaire, indicated eating the minimum recommended number of servings from each of the food groups. In addition, Williams (2000:370) found that although 90% of undergraduate first-year students in the UK were aware of the health benefits of consuming fruit and vegetables, fewer than 20% of the students studied actually consumed the recommended five portions a day. Troyer et al. (1990:303) investigated the lifestyle of second-year medical students in the USA. These students were chosen because the assumption was that they were knowledgeable about exercise and an appropriate diet. The results, however, indicated that many of these students did not eat a prudent diet, were inactive, had hypertension, abnormal blood lipid levels, and were overweight and stressed.

In a study conducted in the USA by Lawrence and Schank (1993:527), young adult women reported their health as good or excellent; they viewed health as very important and generally used positive health practices. Data, however, revealed that the lifestyles of many of the respondents included negative health practices, such as poor dietary and exercise habits. A similar trend is reflected in the data of the Tufts Longitudinal Study where despite low dietary fibre and high fat intakes and numerous nutrient deficiencies, over 80% of the respondents indicated that they were not confused about dietary advice. According to Klemmer (2002:99), this contradiction signifies "*a false sense of confidence in nutritional knowledge, a lack of interest in following dietary guidelines, or strong barriers to pursuing healthy lifestyles*".

2.5.2.2 Living conditions and finance

For many people leaving home to commence their studies, young adulthood is a period of major change. Various researchers (Beerman, 1991:343; Brevard & Ricketts, 1996:35) have concluded that where students live has an influence on their food choices and nutrient intakes. In residences where all meals are provided, food availability is assured and depending on what is offered, individuals can, it is hoped, make an informed choice. However, in other situations, individuals may have to provide their own food and are often poorly equipped for this task (Edwards & Meiselman, 2003:22). For many students their college years will then also be their first experience of living away from home, and thus catering for themselves (Eves et al., 1994:364).

In a survey of university students in the UK, the nutrient intakes of students living in self-catering accommodation compared poorly with the nutrient intakes of students living at home or in a residence where breakfast and supper were supplied either by a parent or a catering company (Stordy & Cowhig, 1972:A81). These findings are corroborated by Hagger (1975:A119), who reported that students living in self-catering flatlets in the UK had lower intakes of energy, nicotinic acid, thiamin and iron, when compared with students living in residences where meals were supplied. Beerman (1991:343) compared the effect of type of residence on the dietary intake of students in the USA. Students residing in Greek housing (a fraternity or sorority where meals were provided and students ate their meals together, in family-style) were compared with off-campus housing (where students prepared their own meals) and on-campus housing (where students used a credit card system at the cafeterias or dining halls on the campus). Students living in Greek housing had higher intakes of calcium, iron, magnesium, and phosphorus when compared with the other types of housing that may indicate that Greek-housing seems to offer a good food choice in terms of nutrient provision.

In addition, Beerman et al. (1990:219) found that students living on campus tended to eat more fresh fruits, vegetables and fish than students living elsewhere. They were also less likely to select white bread. Their dietary practices were consistent with the USA Dietary Guidelines, reflecting the fact that full-time dieticians coordinated the on-campus food provision. Other factors may influence the differences between the dietary intakes of on- and off-campus students. The dining facilities on-campus offer students a variety of choices, including fresh fruit and vegetables from salad bars. Students living off-campus may be discouraged from purchasing and consuming fresh fruit and vegetables owing to the cost and work associated with preparing these food items.

Another reason for the poor dietary intake exhibited by students may be financial difficulties (Melby et al., 1986:799; Edwards & Meiselman, 2003:22). Eves et al. (1994:364) indicated that for many college students this might be the first time that they have control over their own finances. Students with limited funds have to be selective in how they spend their money. Entertainment and alcohol may assume a higher importance to some of these students than food and academic necessities (Edwards & Meiselman, 2003:22). Stewart-Brown et al. (2000:492) also found that the main sources of emotional distress affecting students comprised study, work and financial problems. In research conducted by Chapman et al. (1998:181) in the USA involving college and university students, students' breakfast patterns and food costs affected what the students consumed at breakfast.

2.5.2.3 Dietary variety

A lack of variety in the diet may contribute to low micronutrient and energy intakes and add to chronic lifestyle diseases (Maunder et al., 2001:S8). Haberman and Luffey (1998:189) found that 76% of the respondents in a study investigating the eating habits of college students in the USA indicated that they ate the same foods day after day. Possible reasons for the limited food choices were a lack of cooking experience and time constraints. In addition, the introduction of the "food court" concept, which offered a greater number of choices per meal, but a limited variety of food items, could have contributed to the lack of variety in the diets of students (Haberman & Luffey, 1998:191).

Cole and Ogungbe (1987:316) reported a similar lack of variety. They investigated the food intake of female Nigerian students and found that during the seven-day study period the food intake pattern did not show much difference in terms of the food types consumed or the frequency of intake. However, in a survey to determine the eating patterns of first-year female students at the University of the North, South Africa, it was concluded that the group consumed a large variety of food items (Nel & Steyn, 2001:118).

2.5.2.4 Meal skipping

According to Hizza and Gerrior (2002:4), poor eating habits of college students may result from skipping meals. In studies investigating meal patterns it was determined that many college/university students and young adults in the USA do not consume breakfast regularly. Beerman et al. (1990:218) reported that 64% of female university students indicated that they regularly skipped meals and Nicklas et al. (1998:1432) that 37% of the young adult respondents skipped breakfast. DeBate et al. (2001:824) reported similar results where 44.2% of the sample of college students never or rarely consumed breakfast and only 36.6% of the students consumed breakfast always or often. This pattern was echoed in the studies of Hertzler and Frary (1989:351), where 43% of the sample of university students reported skipping breakfast more than half the time, and Lawrence and Schank (1993:527), where 70% of the respondents reported that the meal skipped most often was breakfast.

According to Chapman et al. (1998:176), various studies have shown positive effects of consuming breakfast. Students who eat breakfast are more likely to have adequate micronutrient intakes, higher intakes of dietary fibre and a lower percentage of kilojoules provided by fat (Hammond & Chapman, 1994:69).

Senekal (1988:194) reported that 70% of the female first-year students at the University of Stellenbosch living in catered residences indicated eating breakfast, while 86% of the respondents indicated eating lunch. In the first survey at the beginning of the academic year, 85% of the respondents indicated that they ate supper, but in the second survey in May of the same year only 67% of the respondents indicated eating supper on a regular basis.

2.5.2.5 Consumption of snacks and fast foods

The eating patterns of young adults are becoming less structured and food consumption has shifted from meals to snacks (Lawton et al., 1998:149). The availability of these foods has increased as more colleges and university food malls are now providing a large number of affordable and convenient fast-food alternatives to students (Azanza, 2001:515).

Beerman et al. (1990:215) and Zizza et al. (2001:303) reported that young adults in the USA have a preference for snack, fast or take-away foods. Zizza et al. (2001:303) found that the number of snacks that young adults consumed per day increased by 14% over a three-year period. In addition, the energy contribution of snacks to the total daily energy intake increased from 20% to 23%. In a study conducted on female university students, 43% of the respondents indicated that they consumed too much "junk" food, with their favourite snacks being potato chips, pretzels, Nachos and sweets (Lawrence & Schank, 1993:527). In a South African study, Mokotsi (1998:37) investigated the buying behaviour of students at the Vaal Triangle Technikon and found that 50% of the respondents indicated usually buying fast foods, while 40% indicated usually buying other types of food. Mokotsi (1998:37) concluded that the large expenditure on food compared with other commodities was due to the fact that the Vaal Triangle Technikon Hostel Services did not provide meals to students staying at the hostels. These students were responsible for their own meal provision.

The consumption of snacks and fast foods is associated with an increased total energy intake. These foods are often high in fat and sodium and low in other nutrients and contribute to the dietary excesses of total fat, saturated fat, cholesterol, and sodium that are common in the diets of young adults (Niklas et al., 1995:316; Hizza & Gerrior, 2002:7).

2.5.2.6 Alcohol consumption

According to Wechsler et al. (1997:273), the alcohol consumption of students is a serious problem at institutions of higher education in the USA. In South Africa, similar concerns have been voiced (Peltzer, 2003:1097). Alcohol use by students, especially binge drinking, is associated with academic and emotional problems, as well as violence and physical injuries. Furthermore, there is evidence that more young people are drinking alcohol, that the amounts and frequency of alcohol consumption are increasing and that people are starting to drink alcohol at a younger age (World Health Organization, 2001:2).

Wechsler and Isaac (1992:2929) reported that binge drinking statistics at 14 Massachusetts colleges in the USA remained fairly constant between 1977 and 1989 with 13% to 14% of female respondents indicating "frequent-heavy" alcohol consumption. Although the high level of alcohol intake is a cause for concern, a further cause for concern was the fact that alcohol consumption did not show the same decline as was observed in the use of other drugs on the campuses studied (Wechsler & Isaac, 1992:2931). On a more positive note, Meilman et al. (1997:201) reported that the majority of students participating in the Core Alcohol and Drug Survey, conducted at 105 USA college campuses between October 1995 and June 1996, indicated that they consumed little or no alcohol on a weekly basis. However, the number of respondents, being approximately 10%, who reported that they consumed an average of 15 or more drinks weekly, was alarmingly high.

2.6 Dietary intake methodology

According to Biro et al. (2002:S28), there is no ideal method to determine dietary intake. The method chosen should be based on the purpose of the study, the precision needed, the particular population, the available resources and whether the period of interest is the past or the present (Hankin, 1992:173; Grosvenor & Smolin, 2002:52).

Food records, dietary recalls, such as the 24-hour dietary recall, food frequency questionnaires and dietary histories are methods that could be used to collect information on dietary intake. In all dietary recall methods there are certain limitations as these methods rely on the memory and reliability of the respondent (Grosvenor & Smolin, 2002:52). Krantzler et al. (1982:1234) concluded that those foods eaten regularly showed the highest recall accuracy, while foods consumed less frequently were often omitted from the recall. The findings of various researchers (Carter et al., 1981:542; Linussen et al., 1974:277) indicate that respondents demonstrate a tendency to overestimate their dietary intake when they have a low consumption of food and underestimate their intake when consumption is high. This tendency is called the "flat slope syndrome". Respondents may also report what they perceive they should have been eating instead of what they actually ate (Rohan & Potter, 1984:876).

2.6.1 Food/dietary records

The food/dietary record method requires respondents to record their food and beverage intake over a number of days (Hankin, 1992:176). This method is seen as the most accurate with respect to the foods and quantities consumed (Biro et al., 2002:S27; Grosvenor & Smolin, 2002:52). Another advantage is the fact that respondents do not have to rely on memory (Hankin, 1992:177). However, to be successful, dedicated and highly motivated respondents are needed (Hankin, 1992:176), as reporting must be done at the time of consumption and amounts consumed must be weighed (then referred to as weighed food records) or estimated using household measures or food models (Thompson & Byers, 1994:S2245; Biro et al., 2002:S27; Grosvenor & Smolin, 2002:52). Further disadvantages include that the intake may be atypical for the particular period (Thompson & Byers, 1994:S2246) and that it is difficult for respondents to report accurately and in detail if most meals are not consumed at home (Hankin, 1992:177). Although respondents are asked to follow their usual dietary habits they may modify their eating practices to reduce their workload in this regard (Hankin, 1992:177; Grosvenor & Smolin, 2002:52). Thompson and Byers (1994:S2246) concluded that the records of the initial days were more complete than the record keeping of the latter days in studies utilising food records.

2.6.2 Dietary recall

2.6.2.1 24-hour dietary recall

The 24-hour dietary recall is a data collection method in which a trained dietary interviewer conducts a personal or telephonic interview to determine the foods and amounts actually consumed by an individual on one or more specific days (Willett, 1998:2; Thompson & Byers, 1994:S2246).

Advantages of the 24-hour dietary recall method include the relatively low respondent and interviewer burden (Thompson & Byers, 1994:S2246; Grosvenor & Smolin, 2002:52). This method is also unlikely to alter the dietary behaviour of respondents and the personal contact between the interviewer and respondent contributes to the reliability of the collected data (Biro et al., 2002:S26). Karvetti and Knuts (1985:1437) investigated the validity of the 24-hour recall method by comparing recalled food intake to observed intake and came to the conclusion that validity is unsatisfactory on an individual level, but satisfactory on group level. Thompson and Byers (1994:S2246) concluded that the principal use of the 24-hour recall is to describe the average dietary intake of a group of respondents.

Limitations of this method include that it does not account for the day-to-day variability of individuals' intake (Hankin, 1992:176) and that the respondents' recall depends on memory (Biro et al., 2002:S26). An incomplete recall may be caused by the fact that most people eat without devoting full attention to the type and amount of food that they are eating (Dwyer et al., 1987:1509). Eating behaviour can be considered an automatic process, which is habitual and requires little attention (Dwyer et al., 1987:1510, citing Anderson, 1980). Furthermore, the 24-hour recall method is depended on well-trained interviewers who are skilled in the identification of available foods and meals and in the preparation practices used by the target group (Biro et al., 2002:S26).

2.6.2.2 Food frequency questionnaire

When using food frequency questionnaires, respondents are asked to indicate their usual consumption of food items from a list of foods for a specific period (Biro et al., 2002:S27). To estimate nutrient intakes, food frequency questionnaires may incorporate portion sizes (Thompson & Byers, 1994:S2247). This method is designed to estimate selected food items usually eaten, and can be used to rank individuals by food or nutrient intakes so that characteristics of those with high and low intakes may be compared (Thompson & Byers, 1994:S2248). It has limitations in that quantification may be inaccurate owing to poor estimation of recall portion sizes. Respondents' memory of past food intake patterns is required and the present intake pattern may influence the recall of a past pattern (Biro et al., 2002:S27).

A dietary score, or simplified food frequency questionnaire, is compiled using previously established dietary intake data (Venter, 1990:195). As only the food items that were mostly consumed are included the dietary score, questionnaires are usually brief (Thompson & Byers, 1994:S2248). Examples of dietary scores include a self-scoring food frequency questionnaire developed by Block et al. (1990:58), based on the analyses of the USA Second National Health and Nutrition Examination Survey (NHANES II) data. In this questionnaire, the 13 food items selected, accounted for most of the intake of fat by American women. Patterson et al. (1994:57) developed an index using the dietary recommendations of the USA National Research Council on Diet and Health to measure overall dietary risk for chronic disease.

According to Thompson and Byers (1994:S2249), brief dietary assessment methods can be useful in situations that do not require either an assessment of the total diet or quantitative accuracy in dietary estimates. Dietary scores are useful in determining dietary intake trends (Venter, 1990:196). As these methods are often designed to capture information on a limited number of nutrients, estimates of the dietary intake for a specific population cannot be made. In addition, the specific food behaviours correlating with dietary intake in a particular study may not correlate similarly in another population or even in the same population at another time (Thompson & Byers, 1994:S2249).

2.6.2.3 Dietary history

A dietary history is a general term used to describe the collection of information on overall dietary patterns (Grosvenor & Smolin, 2002:53). It is used for example in research on the etiology of diseases, such as heart disease and cancer. The first dietary history methodology, developed by Burke (1947:1041) used a combination of methods. It started with the 24-hour dietary recall method to determine the usual meal pattern. This was followed by the completion of a food frequency questionnaire covering the previous three to six months. Lastly respondents completed a three-day dietary record. From these data the average daily dietary intake could be calculated. This method initially required skilled staff and has a high labour, time and respondent burden (Biro et al., 2002:S27). As more than one method was used the data gained from dietary histories may be more accurate than other dietary intake methods (Grosvenor & Smolin, 2002:53).

However, due to the time and effort used to obtain the data in the past, most dietary histories are at present based on lists of foods or groups of food items with similar nutritional values. The selected food items are based on the eating habits of the population being studied (Hankin, 1992:178). According to Hankin (1992:184) this method can be adapted and used for various ethnic groups and it is suitable for cross-cultural comparisons.

2.7 Weight status determination

A variety of measurements, norms and tables are used to interpret the weight status of respondents. These norms and tables provide a framework to determine whether a respondent would be classified as under- or overweight (Venter, 1990:168). Weight status, and in particular body fat, can be determined by various methods. Although methods such as densitometry and visual imaging scans are the most accurate in determining body fat, these methods are expensive and limited to laboratory use. Anthropometric measurements are comparatively simple, inexpensive methods for determining relative nutritional status by measuring body weight, height and contours (Williams, 1993:145).

Body weight on its own is not a good indication of body fat, since it does not indicate whether the weight is partly or mostly composed of muscle, water or fat (Fidanza, 1991:7). It is thus advisable to use body weight in combination with height or skin fold measurements (Williams, 1993:145).

In order to compare the body mass of different individuals and to express the degree of overweight numerically, various indices have been developed. The most commonly used today is the Quetelet Index or Body Mass Index (Gurr, 1990:98). Body Mass Index (BMI) values are calculated by dividing the weight (in kg) of a person by the square of the person's height (in m). Overweight may be defined by a BMI of between 25 and 30 kg/m^2 and obesity may be defined by a BMI above 30 kg/m^2 (Whitney et al., 1996:216, citing the Committee on Diet and Health, 1989).

The limitations of BMI values include that it is most accurate in assessing degrees of obesity and less useful for evaluating non-obese person's body fatness. In addition, these values also fail to indicate how much of the weight is fat and where that fat is located (Sizer & Whitney, 2003:318)

The advantages of BMI values are that these measurements are inexpensive, easy to take and accurate (Whitney et al., 1996:217). As it shows a correlation with body fatness, it can be used as an indicator of obesity and to help evaluate a person's health risks associated with underweight or overweight (Sizer & Whitney, 2003:315).

This chapter gave an overview of the available literature on food-borne disease. The incidence and effects of food-borne disease, the potential for food practices in the home that could culminate in food-borne disease, the factors that contribute to food-borne disease and the methods used to collect data on food safety practices were examined. In addition the dietary intake of students at tertiary institutions and the methods used to determine dietary intake were reviewed. Chapter 3 will outline the research design and methodology used in this study.

CHAPTER 3
RESEARCH DESIGN AND METHODOLOGY

3.1 Permission to conduct study

The Research Committee of the Faculty of Applied Sciences at the Cape Technikon recommended the research proposal for submission to the Senate of the Cape Technikon for final approval. The Senate approved the proposal in 2003. The Ethical Committee of the Cape Technikon had their first meeting in 2004 and was thus not in place to grant approval for the execution of this study. Permission to undertake the study was granted by the Head of the Department of Residences at the Cape Technikon. All the wardens of the Cape Technikon self-catering residences included in the study were thereafter contacted to obtain permission for individual participation of the residences. Written permission to undertake the study was granted by the wardens of the Groote Schuur and the Elizabeth Women's Residence (EWR). Telephonic conversations were held with the wardens of the other residences and their permission to conduct the study in the Waterside, Down Town Lodge and J&B Residences was obtained. All the students taking part in the study were informed of the objectives and the methodology to be used prior to their participation in the study. All the students who participated did so voluntarily, however, written consent from the respondents was not obtained.

3.2 Type of study

A cross-sectional survey was conducted to determine the food practices of female students living in self-catering residences. Cross-sectional surveys collect data at a specific point in time from a sample representing the larger population (Babbie, 1990:56). The principal contribution of a survey lie in its description of current practices or beliefs with the intent of making plans for improving conditions or processes in a particular situation (Compton and Hall, 1972:139;

Babbie, 1990:51). The survey conducted was both descriptive, in that it described the present food practices of the students, and analytical, in that relationships between variables were investigated (Compton & Hall, 1972:140; Singleton et al., 1993:250; Bowling, 2002:196).

3.3 Method used for collection of food safety data

The method chosen should be appropriate to the specific social research situation. Surveys should be designed around the purpose of the enquiry, the population on which it focuses and the resources available (Hoinville and Jowell, 1978:2; Babbie, 1990:34; Bowling, 2002:261). The choice of measuring instruments should be based on the validity and reliability of the data that can be obtained within the limits of time and other available resources (Compton and Hall, 1972:139; Bowling, 2002:144 & 261).

In this study at the Cape Technikon, the food practices of female students residing in self-catering residences were determined using personal structured interviews and direct, structured observations. Using a self-administered questionnaire to collect data would have been less expensive than the methods chosen. However, the data from self-administered questionnaires would not that easily have allowed for the inclusion of observations of food preparation conditions as these would have necessitated separate occasions. Whereas with the interview, one occasion was made possible, i.e., the interview was initiated during the cooking of the provided food items.

Interviews using structured questionnaires can, if carefully compiled for the specific topic, yield highly accurate data (Bowling, 2002:261). Personal interviews are also a good choice when long interviews are necessary and when visual aids are used (Singleton et al., 1993:261). In this study, questions on the purchasing, storage, preparation and consumption of food items were included, making the questionnaire relatively lengthy. Visual aids were also used in the determination of the dietary intake.

The food practices of consumers do not always reflect either their food safety knowledge or self-reported behaviour (Redmond & Griffith, 2003b:25). Griffith and Redmond (2001:71) found in their study on food safety that all of the respondents could answer the knowledge questions on hand washing and the hygienic use of utensils correctly. When self-reporting food safety practices, 47% and 80 % of the respondents respectively indicated that they carried out the correct behaviour, but when they were observed none and 47% of the respondents respectively demonstrated the correct behaviour. Similar results were reported by Jay et al. (1999b:1285) in the findings of a video study of domestic food-handling practices in Australia. Redmond and Griffith (2003b:17) came to the conclusion that observational data provided the most reliable information regarding the actual food safety behaviour of consumers.

In this study, the structured personal interviews were thus supplemented by direct, structured observations of food preparation. Respondents were provided with a limited number of ingredients and were observed while they prepared a meal utilising these ingredients in a residential kitchen. Redmond and Griffith (2003b:26) reported that observations carried out in the natural environment are more true-to-life than in a laboratory. However, it is more difficult to control outside variables in a domestic kitchen. Outside variables may influence the observation of actions, which could result in an increased potential for observer and reactivity bias. According to Coolican (1999:114) this also increases the difficulty of replicating data. To limit the effect of outside variables, interviewers with knowledge and experience of food preparation in self-catering residences were used in this study.

Data obtained from a single survey is less reliable than data that has been derived from two or more surveys by means of the same methods (Compton and

Hall, 1972; 140; Monsen & Cheney, 1992:13). In this study, a once-off observation of the food safety handling practices was carried out. It therefore cannot be concluded that this is typical of the normal behaviour pattern. However, Griffith and Redmond (2001:72) point out that observational studies of food safety practices indicated that food practices of individuals tend to be very repeatable and conclude that once people get into a particular pattern of food preparation, they tend to keep to it. This once-off observation could therefore be seen as a good indication of the normal behaviour pattern of the respondents.

3.4 Method used for collection of dietary intake data

The 24-hour recall method was chosen to collect the data on dietary intake for this study. Only one weekday recall was selected to collect the data on dietary intake as the preliminary study (see Section 3.6.1), on the food provision practices of students residing in self-catering residences, indicated that dietary intake during the week showed little variety with the same food and beverage items being consumed daily. As food intakes during the weekend differed considerably from meals consumed on weekdays (Hankin, 1992:177; Van Eeden & Gericke, 1996:87), it was decided to supplement the weekday recall with a recall of a weekend day, either a Saturday or a Sunday. The results from the preliminary study (see Section 3.6.1) then also indicated that the respondents who usually ate lunch did not prepare their own lunches during the week, but that they prepared their own lunches at weekends.

Reasons for the choice are based on the fact that the 24-hour recall can be completed in a relatively short time (Hankin, 1992:176). It is an inexpensive but effective method for assessing mean intakes for groups of individuals (Morgan et al. 1987:888). Posner et al. (1992:171) found in comparing estimates of nutrient intake by three diet assessment methods (24-hour recall, 3-day food record and food frequency questionnaire) that estimates of group mean intakes from the 24-hour recall and 3-day records were similar in both men and women with a difference of less than 10% for most nutrients. Time and cost effectiveness are especially important when the dietary recall forms part of a longer questionnaire (Morgan et al., 1987:888), which was the case in this study.

3.5 Method used for weight status determination

According to Fidanza (1991:1), the selection of the specific measurements depends on the purpose of the study and the size of the sample to be examined. Each technique has strengths and weaknesses, but in all cases, the accuracy of the results depends on the skill of the person using the technique and the interpretation of the results (Sizer & Whitney, 2003:315).

In this study the body weight status determination was based on the weight and height measurements of the students and the calculation and interpretation of their Body Mass Index (BMI) values. The BMI values were calculated by dividing the weight (in kg) of each respondent by the square of the respondent's height (in m). The desired health maintenance BMI range for adults is 20 to 25 kg/m^2 (Williams, 1993:146).

3.6 Questionnaire and observational checklist construction

3.6.1 Preliminary study

During October 2002, a preliminary study was undertaken to obtain information on the food provision practices and eating habits of students residing in the self-catering residences. The aim of the preliminary study was to collect information in order to construct the final research questionnaire. A structured questionnaire with close-ended questions was compiled to fulfil this purpose (see Addendum B). The questions included in this self-administered questionnaire covered aspects such as whether the students prepared their own breakfast, lunch and/or supper, the food items they prepared and/or consumed, the equipment/utensils they had available for food preparation, and the cleaning practices at the residences (see Addendum B).

Copies of the self-administered questionnaire (Addendum A) were provided to all the female National Diploma (ND): Consumer Science: Food and Nutrition students living in self-catering residences. These students were familiar with food provision, because of their study course, and could therefore provide additional commentary to clarify/add to the data collection as deemed necessary. Nineteen out of the thirty students (63.0%) returned completed questionnaires.

Eleven of the nineteen students who returned completed questionnaires resided in the Groote Schuur residence (the largest residence), two in the Down Town Lodge and six in EWR. None of the first- or second-year ND: Consumer Science: Food and Nutrition students resided in either the J&B or Waterside residences.

Eighteen of the respondents usually ate breakfast, which they prepared for themselves during the week and at weekends. They indicated that they mostly consumed breakfast cereals (78%), bread (61%) and eggs (44%) during the week. Other food items for breakfast included milk, tea, coffee, fruit juices, fruit, cheese, peanut butter and yoghurt. Only two respondents indicated that they additionally prepared bacon over the weekends, and one respondent indicated the preparation of cooked porridge, fish fingers, liver and Vienna sausage. It was clear from the returned questionnaires that the same breakfast food items were prepared daily and that the breakfast pattern of the respondents did not differ much.

Nine of the respondents indicated that they usually ate lunch during the week, but none of them prepared their own lunch. As none of the respondents indicated preparing their own lunch during the week, the lunch items consumed were not indicated in the preliminary questionnaire. On enquiry by the researcher, these nine respondents reported daily purchasing the following food items from the student cafeteria or kiosk for lunch: a toasted sandwich, pie or potato chips or a packet of crisps and a carbonated beverage. Respondents did, however, indicate that they prepared their own lunch at weekends. Food items prepared mostly included bread, eggs, pasta and salad.

All nineteen respondents reported that they usually ate supper. They prepared their supper items themselves during the week and at weekends. These supper meals, whether they were weekday or weekend day suppers, usually consisted of a protein-containing main dish, a food item high in starch, cooked vegetables and/or salad. Specific food items prepared were as follows: chicken (84%), pasta (68%), vegetables (68%), rice (63%), maize porridge (58%), red meat, e.g., beef, pork or lamb (47%), potatoes (37%), samp and beans (32%) and salad (32%). Other food items mentioned by one or two respondents included African salad (maize porridge and sour milk), sausage, liver, gravy and dumplings.

In terms of equipment, all the respondents indicated that they had the following items available: a stove, plates, cups or mugs, cutlery, pots and/or frying pan, refuse bin and a basin for washing dishes. Other available equipment indicated was as follows: microwave oven (89%), refrigerator (84%), electric kettle (79%), freezer (58%), toaster (53%), storage cupboard for cooking utensils (47%), mixing bowl (42%), egg lifter or other utensils (32%) and measuring equipment (21%). One respondent each indicated that she had a blender and an electric mixer available for food preparation. Respondents indicated the availability of the following cleaning agents: a cloth or sponge for washing up (86%), washing-up liquid for washing dishes (84%), cloth for drying (58%), and soap for washing hands (11%).

All nineteen respondents indicated that they themselves were responsible for the cleaning of utensils, such as pots, pans, plates, knives and forks that were used in food preparation. The majority of the respondents (58%) indicated that they were responsible for cleaning the surfaces in the kitchen. Forty-two percent of the respondents indicated that it was the task of the cleaning company personnel, while two of the respondents indicated that both they and the cleaning company personnel were responsible for this job. The same percentage (42%) of respondents indicated that it was the duty of the cleaning company personnel to clean the inside of the refrigerator and oven. However, 37% of the respondents indicated that they were responsible, but 21% of the respondents were not sure who was responsible for this task. The majority of students (89%) indicated that the cleaning company personnel were responsible for sweeping and washing the kitchen floor.

Based on the data from this preliminary study, it was decided to observe the preparation of an evening meal in the final study as the majority of students prepared food for themselves at this time. The utensil and equipment list filled in by the respondents indicated that almost all the students had the necessary items for food preparation. The majority of students also indicated the availability of a refrigerator; this led to the inclusion of questions regarding the storage of perishable foods in the final questionnaire compiled (see Addendum C, Section A). As the findings regarding the responsibility of the overall cleaning were not clear, these practices were not investigated in this study.

3.6.2 Questionnaire content

As there is no standard for measuring safe food handling in the home (Worsfold & Griffith, 1997b:401; Lewis, 1998:20), the data gathered from the preliminary study, together with the following sources, were used for the compilation of five food safety control points that were applicable to the objectives of this study. These sources were as follows:

- The South African regulations relating to food premises and the transport of food (South African Department of Health, 1977).
- The control factors identified by Medeiros et al. (2001b: 1326), based on the food items mostly associated with pathogens causing food-borne

illness and the unsafe food handling behaviours most often practised by food handlers.

- The questions used in a national Australian food safety survey, compiled by Colmar Brunton Research, a market research company and the staff of Microtech Laboratories to determine food buying and transportation practices, food hygiene practices, knowledge of food-borne illness and food safety of consumers (Jay et al., 1999a:921).
- The critical control points identified by Griffith & Worsfold (1994:203) in applying HACCP principles to domestic food preparation.

Based on the references mentioned above the following five control points were compiled: "*Follow safe purchasing practices*", "*Store ingredients safely*", "*Practice good personal and general hygiene*", "*Cook food items thoroughly*" and "*Handle leftovers safely*". These control points were used as the starting point for formulating the individual items in the food safety questionnaire and observational checklist (Addendum C, Sections A, B & C).

As observers would find it difficult to record all food safety behaviours, a food safety check list with specific behavioural categories was compiled so that only behaviours that were regarded as indicators of the dependent variable in question could be recorded. According to Huysamen (1994:141), behavioural categories should be mutually exclusive, with a particular behaviour falling into only one category. Furthermore, behavioural categories should be exhaustive, where together the categories would provide for all forms of behaviour, which qualify as indicators of the particular dependent variable. Inter-rater reliability may thus be improved by carefully defining the dependent variable and by properly training observers in advance. According to Redmond and Griffith (2003b: 26), to test for reliability of recorded observations, an assessment of intra- and inter-observer reliability needs to be determined. To address this aspect in the study, a pre-test of the study was conducted (see 3.7).

In this study respondents were supplied with chicken portions, bread rolls, butter portions and tomatoes. The choice of the chicken was based on the following criteria: it is a food item that is potentially hazardous unless it is handled correctly and it is commonly implicated in food-borne illness (Roberts, 1990:859). Furthermore, it requires correct storage and the judgement of the consumer in determining whether it is cooked (Worsfold & Griffith, 1997a:97). In addition chicken was the food item mostly indicated by the respondents in the preliminary study (see Section 3.6.1). The bread rolls, butter portions and tomatoes were supplied for a side dish. These ingredients were supplied to observe whether cross-contamination between raw and ready-to-eat food items occurred during the food preparation session. The food items supplied are available all year round from major supermarkets, are not too expensive, and are commonly consumed by the group under study.

Tabled lists of the food items usually consumed, as indicated by the preliminary study (see Section 3.6.1), were compiled to record the dietary intakes of respondents for the week and the weekend day recalls (Addendum C, Sections E & G). The Food-Based Dietary Guidelines (Vorster et al., 2001:S3) were used as the basis for the compilation of additional questions on dietary intake. Questions regarding meal skipping, activity level, legume, water, alcohol and salt consumption and the use of dietary supplements were amongst others included (Addendum C, Section D).

3.6.3 Questionnaire item wording and format

The following criteria were applied in the wording of each question: questions should not be too long, not contain ambiguous or vague wording or be double-barrelled. The level of wording must be suited to the educational level and background of the respondents. All the questions must refer to specific matters and have specific answers, while leading questions must be avoided (Baily, 1990:128; Oppenheim, 1992:128; Babbie, 1992:148; Huysamen, 1994:130;

Bowling, 2002:308). In addition, each question was checked to determine if it related to the research problems being studied, as recommended by Babbie (1990:129) and Compton and Hall (1972:242).

Furthermore, questions were arranged in a logical structure, starting with simple, non-threatening questions (Babbie, 1992:157: Huysamen, 1994:132) and finalising one topic before continuing to the next. Questions were formulated in such a way as to minimise the tendency of respondents to answer all questions in a specific direction regardless of the content (Oppenheim, 1992:121; Bless & Higson-Smith, 1995:117).

Response categories to questions can either be open-ended or close-ended, with both forms having advantages and disadvantages (Baily, 1978:123; Oppenheim, 1992:115). Close-ended questions provide a greater uniformity of responses and are more easily processed (Baily, 1978:123; Babbie, 1992:147; Oppenheim, 1992:115). Other advantages of close-ended questions include the assurance that responses are usually relevant to the questions and that respondents may be able to ascertain question intent more easily if they are aware of response categories (Bailey, 1978:123; Bowling, 2002:281).

Disadvantages of close-ended questions include omitting answers that respondents might have found helpful (Babbie, 1992:147; Babbie, 1990:128). Respondents may also feel that they are forced to choose one of the options provided and the potential true level of response variation in the respondent population may thus not be seen (Baily, 1978:1; Bowling, 2002:279).

Open-ended questions are particularly useful when all the possible answer categories are not known, when there are too many possible answers to a specific question and if detailed answers of respondents are required (Baily, 1978:125: Bowling, 2002:278). Disadvantages of open-ended questions include, amongst others, that some respondents may give answers irrelevant to the study

(Babbie, 1990:127) and that answers must be coded before they can be processed for computer analysis providing an opportunity for misunderstanding and researcher bias (Babbie, 1992:147).

The closed-ended option was chosen for this study to gather information on food safety behaviour and dietary intake. To overcome the problem of excluding a response category, a category labelled "other" was added to answer categories. A "don't know" option was included as a potential response to factual questions. Babbie (1990:128) and Bowling (2002:279) recommend the inclusion of such an option as it lowers the risk of obtaining incorrect information by forced choice. It was deemed not necessary to add an "unsure" option to the answer categories for questions A28, A31 and A33 (Addendum C) as the possible answers to these questions were not given to respondents. Responses interpreted by the interviewers as "unsure" would have been included in the "other" options.

3.6.4 Questionnaire format

Care was taken to spread out the questions over sufficient pages to provide an uncluttered look and to separate headings from questions (Babbie, 1990:135). The response format of boxes, as suggested by Babbie (1992:152), was used. Contingency questions and questions relevant only to some respondents were printed in bold to make it easier for interviewers to maintain a steady flow when conducting the interview (see Addendum C). Enough space was provided on the 24-hour recall forms to add other foods consumed by the students not indicated on the forms as identified in the preliminary study (see Addendum C, Sections E & G).

3.7 Pre-testing study

A pre-testing of the study was conducted by the researcher during April 2003. Nine first-year ND: Consumer Science: Food and Nutrition students residing in self-catering residences took part in the pre-test. These students were chosen as they are from the same population as that for which the eventual study was intended (Compton & Hall, 1972:245; Singleton et al., 1993:270). In addition, these students were familiar with basic food safety and food preparation practices. The purpose of the pre-test study was to eliminate any misunderstandings and ambiguities caused by improper wording of questions (Compton & Hall, 1972:242: Babbie, 1990:221), and to detect possible flaws in the methodology planned (Huysamen, 1994:197).

The actual procedure to be used during the interview and observational sessions was used. However, participants were asked their interpretation of each of the formulated questions, after giving an answer. It was noted whether participants found questions understandable and unambiguous and whether some questions were answered in an unexpected manner (Compton & Hall, 1972:245; Babbie, 1990:230).

The following changes were made to the questionnaire. In Section A on food practices, examples of perishable foods were added to Question A5, in Question A9, raw meat and chicken were indicated as uncooked, in Question A24 examples of foods that contain raw eggs were added. In Section C, the sequence of the questions was changed to be similar to the usual procedure that is followed when preparing food items. In Section D on dietary intake, the word "similar" in Question D1 was also indicated as "the same". In Question D4 the term "legumes" was substituted with "dry beans, peas or lentils". An additional question regarding soy mince products was added. No changes were made to the 24-hour dietary recall format or additional dietary intake questions (see Addendum C).

The answers of respondents were checked against the categories provided and where necessary additional categories added (Compton & Hall, 1972:243; Babbie, 1992:147). In Question A2, the Technikon cafeteria was added as a source of buying ready-to-eat-foods, and in Question A14, a label instruction was added as an option that can be followed for deciding how to handle frozen meat and chicken before cooking (see Addendum C).

In evaluating the observational checklist, the researcher noted whether the specific behaviour categories that were included in the list could be observed, whether categories were mutually exclusive and whether all relevant behaviours were included in each category. According to Huysamen (1994:142), all specific concrete behaviours, which qualify for inclusion in an observational checklist, should be identified in a pilot study.

Furthermore, the researcher ascertained if the instructions regarding the preparation of the food items were clear, whether the choice of food items was suitable for the preparation methods envisaged and whether the interviewers would be able to execute the observation checklist while the respondents prepared the specific food items. Adequate time frames and limits for the execution of the sessions were also determined. To determine inter-observer reliability of recorded observations, two of the interviewers used in this study observed the meal preparation of one of the participants and noted the results. The two observational checklists yielded identical results, possibly due to the structured response format used.

No changes were made to the items in the observational checklist, but the food items provided for food preparation were changed from chicken portions and salad ingredients to chicken portions, tomatoes, bread rolls and individually wrapped butter portions. The first five students who participated in the pre-testing indicated that they would not usually consume a salad with a cooked chicken dish for an evening meal. The last four students used the cooked chicken portions with the raw tomato slices as a filling for the buttered bread rolls.

3.8 Interviewers

3.8.1 Interviewer selection

According to Singleton et al. (1993:269), there are no commonly agreed-on standards for the selection of interviewers. They recommend that an interviewer should have a pleasant personality, a neat appearance and not be prejudiced towards the population being interviewed. Interviewers should be able to establish a good rapport with the subjects that they are interviewing (Bowling, 2002:311). In addition, an interest in the survey topic, a legible handwriting, and the ability to listen and record responses accurately are desirable characteristics (Singleton et al., 1993:269).

For this study, eight second- and two-third year students studying the ND: Consumer Science: Food and Nutrition were used as interviewers. These students are of the same gender and race and with similar backgrounds to the respondents. The similarity in background enabled the interviewers to be more knowledgeable of the cultural influences and food habits of the respondents. In addition, the interviewers all live in residences, making them familiar with the daily routine of residence occupants. According to Huysamen (1994:146) and Babbie (1990:189), using interviewers who are similar to the respondents will minimise the effect of the interviewer on the responses provided.

Furthermore, students studying the ND: Consumer Science: Food and Nutrition have knowledge of food items and preparation practices as these form part of their course content. Their background should make them familiar with the dietary habits of the respondents and also enable them to get detailed and complete answers from the respondents. The use of fellow students as interviewers may have a lesser effect, compared with interviewers formally qualified in food science and/or nutrition, on the expectations felt by the respondents towards the interviewers on following correct food practices.

3.8.2 Interviewer training

On the 16th and 23rd of April 2003, ten interviewers were trained to conduct the interviews and observations. Training of interviewers is essential as the reliability and validity of the measurements obtained depend *inter alia* on the experience and skills of the observers (Huysamen, 1994:140; Bowling, 2002:261). If an interviewer is unfamiliar with the questionnaire, the interview is likely to take more time, and an unfair burden is placed on the respondent. Interviewers should be able to read the questionnaire items without error or stumbling over words and phrases (Babbie, 1992:271).

Interviewers were trained as a group, to ensure that they all received the same information. Role-playing was used as the main training technique. The first training session started with a description of the study. Even though the interviewers were only involved in the data collection, it was important for them to understand what the aim and objectives of the study were. According to Babbie (1992:73), the motivation and morale of interviewers can be low if they are not aware of the importance of their contribution to the study.

Interviewers were then informed about the sampling procedure that was to be followed (see Section 3.9 & Addendum D, Section A). Each interviewer used a mock name list together with a table of one-, two-, and three-digit random numbers (Mason & Bramble, 1989:431) to complete an exercise in sampling. This was done to ensure that the sampling instructions were understood and that the interviewers would be able to execute the random sampling procedure correctly.

The researcher then handed out the questionnaires to the interviewers and read through each question, explaining the purpose of each one and allowing time for questions or comments from the interviewers. This was followed by a demonstration interview conducted by the researcher. The interviewers were then paired off to work through the questionnaire (Addendum C). One of the interviewers assumed the role of the interviewer while the other participated as the respondent. On completion, the roles were reversed. Babbie (1992:274) recommends this training procedure. As a conclusion to the training session, the interview procedure instructions were discussed (Addendum D, Section B).

The second training session focused on the sequence of the observational interview, the completion of the 24-hour dietary recalls and obtaining the weight and height measurements of the respondents. After discussing the observational procedure (Addendum D, Sections C & E), the researcher read through each item in the observational checklist and explained the intention of each item. As the interviewers were all trained in food preparation and were familiar with the food preparation facilities at the residences, it was not deemed necessary by the researcher to have an actual food preparation session.

The researcher explained the importance of accuracy in recording food items and quantities for the completion of the 24-hour dietary recall. Special attention was given to the determination of helpings, as the knowledge of consumers, regarding portion sizes, is generally inaccurate (Guthrie, 1984:1440; Food Standards Agency, 2002a:7). Interviewers were instructed to use the provided measuring spoons (graduating from 2.5 to 15 ml), cups (graduating from 60 ml to 240 ml), drinking glass (400 ml) and bowl (500 ml) to determine the volumetric content of the glasses, mugs, cups, bowls, serving spoons, teaspoons and tablespoons normally used by each respondent. Further visual aids included a large plate (25 cm diameter) and a side plate (12 cm diameter). These plates were used to determine the helping sizes of food items, such as meat. For example, a lamb chop of medium thickness that would cover a quarter of the larger plate would have a mass of approximately 110 g. In addition, interviewers were instructed to specify the specific cut, e.g., rib chop, whether it was a thick or medium-thick chop, if fat was trimmed from the meat and how it was cooked.

Instructions were also given on the need to record all brand names of food items consumed as well as all additions to foods (e.g., fats, sugars, sauces). If any of the food items consumed were not self-prepared, the place of purchase was to be indicated. This was done to ensure that helpings were reported as accurately as possible (Addendum D, Section D). After the explanation regarding the completion of the 24-hour dietary recall, the interviewers were paired off to work through the 24-hour recall. One of the interviewers assumed the role of the interviewer while the other participated as the respondent. On completion, the roles were reversed. The researcher then went through each of the 24-hour recalls with each pair of interviewers, checking for missing information, i.e., additions to food items and portion sizes.

The researcher lastly explained the instructions regarding the anthropometric determination of the body weight status of the respondents (Addendum E). Using these instructions, all the interviewers individually determined the weight and height of two first-year ND: Consumer Science: Food and Nutrition students, as well of one another. The researcher checked the height and weight anthropometric findings and found that all measurements were determined correctly. If the measurements had been found not to be accurate, the particular interviewer would have repeated the process with the interviewer paying attention to the technique followed and the accurateness with which the measurement readings were recorded.

Interviewers were instructed to collect all equipment and ingredients necessary for the observational part of the study from the researcher on each date scheduled. Completed questionnaires and equipment were to be returned as indicated in Addendum D, Section E.

3.9 Research study

3.9.1 Sampling procedure

In this study the population was limited to female students living in Cape Technikon self-catering residences. The study population consisted of black female students aged between 18 and 24 years. During June 2003, the total number of students studying at the Cape Technikon was 15 592, of which 7 991 were female and of which 812 were living in self-catering residences (Cape Technikon, 2003c: 3). Students studying the ND: Consumer Science: Food and Nutrition and living in self-catering residences were excluded from the study, as they were either involved in the preliminary study, the pre-testing of the questionnaire or participated as interviewers.

Stratified random sampling was used to determine a sample for the study. The population is divided into different groups called strata for this type of sampling, so that each element belongs only to one stratum (Huysamen, 1994:41; Bless & Higson-Smith, 1995:91). By stratifying the population into relative homogeneous strata before sampling, the sample is more representative of the population and the degree of sampling error decreased (Babbie, 1992:233). A further advantage is that a smaller sample compared with simple random sampling is required (Huysamen, 1994:41).

In this study, the kitchens in each residence were numbered and a list was compiled of all the students who used a particular kitchen. The use of kitchens is allocated by the residential management and is based on the location of a student's room. Students living in a specific section or floor of a residence would therefore use a particular kitchen. No cooking is permitted in the bedrooms of the residences (Cape Technikon, 2003a:1).

All kitchens are supplied with basic equipment such as a stove, microwave oven, toaster and kettle by the Cape Technikon (Cape Technikon, 2003a:1). The kitchens, however, differ in size and layout. Other equipment, either supplied by the Cape Technikon or the students using the specific kitchen, may also be found and could be different from one kitchen to the next. To decrease the effect of the kitchen environment on the food preparation practices of the respondents, it was decided to include students from each of the kitchens (Addendum D, Section A).

Simple random sampling, using a table of one-, two- and three-digit random numbers (Mason & Bramble, 1989:431) was used to determine the specific participants from each list of kitchen users (Addendum D, Section A). In simple random sampling there is an equal opportunity for each element to become part of the sample (Bless & Higson-Smith, 1995:88). The following table (Table 3.1) indicates the Cape Technikon self-catering residences, as well as the total number of female students in each residence, the number of kitchens per residence and the number of respondents from kitchens identified for participation in the study.

Table 3.1 Distribution of respondents per self-catering residence

Cape Technikon self-catering residences	**Number of female students per residence**	**Number of kitchens per residence**	**Number of female respondents per residence**
Groote Schuur	432	18	31
EWR	236	11	18
DownTown Lodge	78	7	6
Waterside	50	1	4
J&B	16	5	1
Total	**812**	**42**	**60**

3.9.2 Sample size

Sixty students were observed and interviewed. This number does not represent the population numerically. According to Compton & Hall (1972:190), large samples provide more accurate information, but a sample that is representative of the population is more important than the size of the sample. Stratified random sampling as used in this study also allows for a smaller sample compared with simple random sampling (Huysamen, 1994:41).

The main reason for the small sample is the nature of the study. Direct observational techniques and structured interviews are costly in both time and money. According to Bless and Higson-Smith (1995:111), these constraints normally result in a small sample. The size of samples used in observational food safety studies varies (Redmond & Griffith, 2003b:135). Hudson and Hartwell (2002:165) observed the behaviour of 14 respondents in a pilot study on the food safety awareness of older people, Jay et al. (1999b:1285) video-recorded food practices in 40 Australian domestic kitchens, Griffith et al. (2001) observed the behaviour of 40 respondents in a UK study on food safety (cited in Redmond & Griffith, 2003a:153), and Worsfold and Griffith (1997a:97) used direct observation and temperature measurements to investigate the food safety practices of 108 consumers.

In this study the population was relatively homogeneous, i.e., respondents were all female students, aged 18 to 24 years, studying at the Cape Technikon and residing in a residence. It was thus assumed that the small sample would, to a certain extent, cover the characteristics of the population. Owing to the small sample, the results cannot be generalised. Only certain tendencies as a result can be determined.

The evaluation of the dietary intake by means of the 24-hour recall necessitates 50 students to represent a typical group food intake (Young et al., 1952:218).

According to Singleton et al. (1993:169), 30 cases are generally regarded as minimally adequate for statistical data analysis.

3.9.3 Study design

Personal interviews, utilising a structured questionnaire (Addendum C, Sections A, B & C), were used together with direct, systematic observations to determine the food safety behaviour. Dietary intake was determined by means of personal interviews utilising the 24-hour dietary recall and additional questions on dietary intake (Addendum C, Sections D, E & G).

The data collection sessions took place during for the first three weeks of May 2003. At this time, it was assumed that respondents would have settled in, as they would have lived in the residence for approximately three months and should therefore have developed a routine regarding food practices. The first semester examinations usually commence at the beginning of June at the Cape Technikon, and food practices might change during this study period. The data collection therefore had to be completed before this period.

To overcome the limitation that respondents cannot be completely anonymous, respondents were assured that only their particular interviewer knew their names and that all information received was to be treated confidentially.

3.9.3.1 Collection of food safety data

Three data collection sessions were scheduled with each respondent. The first and main data collection session commenced with the interviewer conducting a face-to-face interview with a respondent on general food safety practices and demographic information (Addendum C, Section A). The possible answers to the questions were read to the respondents except for factual questions such as Question A6 on the correct temperature of the refrigerator, Questions A28 and

A31 on the causes of food poisoning, and Questions A33 to A36 on specific food poisoning causing bacteria. The answers to the question on purchasing criteria, Question A3, were also omitted allowing respondents to provide their own answers.

After the introductory interview on general food safety, the respondent's food preparation practices were observed (Addendum C, Section B). The respondents were asked to prepare a chicken dish of their choice using the chicken portions supplied by the interviewers for the observational session. No instructions regarding the preparation of the chicken dish were supplied and respondents were encouraged to use handling techniques with which they were familiar. To reduce the chance of reactive behaviour, respondents were informed that they would be observed during the preparation of the food and that a checklist would be completed. However, respondents were unaware of the specific activities that were checked. After the food preparation session, the personal interview was continued to gather data on specific food safety behaviour issues (Addendum C, Section C).

3.9.3.2 Collection of data on dietary intake

Interviewers continued with the questions on dietary intake (Addendum C, Section B) following the questions on food safety (Addendum C, Section D). The first session was concluded with the completion of 24-hour weekday dietary recalls by the respondents (Addendum C, Section E). Two further sessions followed for the completion of a 24-hour weekend day dietary recall (Addendum C, Section G). This session took place within two weeks following the first session.

3.9.3.3 Anthropometric data

Within the two weeks following the first session the respondent's anthropometric measurements (Addendum D, Section B) also had to be recorded in a further session. The anthropometric measurements included the height and weight measurements of the respondents. The height of each student was determined by using a rigid free- standing instrument. This measuring instrument has a moveable attachment, squared at a true right angle against the vertical flat built-in tape measure surface that can be moved down to the crown of the respondent's head. The height of each respondent was noted in centimetres. The body weight of each respondent was determined by using a beam scale (Detecto-Medic) with non-detachable weights. The scale has a total capacity of 140 kg, measured in 0.1 kilogram units. The scale was calibrated for accuracy during the training of the interviewers and before the first respondent was weighed. The height and body weight measurements of each respondent were used to calculate their Body Mass Indexes (BMI) as a measure of their body weight status. The instructions provided to the interviewers in determining the body weight status of the respondents is included in Addendum E.

3.9.4 Analysis of catered residential menus

To enable a comparison between the dietary intake of students in this study and the intake of students living in a residence where meals are supplied, menus from the Cape Technikon residence, Viljoenhof, were analysed theoretically for nutrient contents and food group servings provided. At Viljoenhof, the contracted catering company supplies meals based on a four-week seasonal cycle menu. Seven daily menus, Monday through to Sunday, were randomly chosen from the summer cycle. Additional information regarding cooking methods and ingredients used was supplied by the cook at the mentioned residence (Nel, 2003). The menus were analysed in terms of nutrient contents, using the FoodFinder™3 dietary analysis software package (2002) and according to the number of servings as recommended by the Daily Food Guide (Whitney et al., 2002:36). Medium-sized portions of menu items as indicated by the FoodFinder™3 (2002) were used for this analysis. The medium-sized portions of the menu items indicated in the FoodFinder™3 (2002) could in most instances, e.g. 1 bread slice, ½ cup cooked cereal, rice and pasta ½ cup cooked vegetables and canned fruit, etc. be compared directly to the Daily Food Guide. For other food items such as e.g. milk the medium-sized portions of the menu items made up a fraction of the serving sizes recommended by the Daily Food Guide. Table 3.2 compares the serving sizes of the Daily Food Guide with the medium-sized portions of the menu items as indicated by the FoodFinder™3 (2002). Where medium portion sizes were not indicated in the FoodFinder™3 (2002) portions sizes as indicated by Langenhoven et al. (1986) were used.

Table 3.2 Comparison of serving sizes of the Daily Food Guide with the medium-sized portions of menu items indicated by the FoodFinder™3 (2002)

Daily Food Guide *		FoodFinder™3
Food group items	Serving sizes	Medium-sized portions of selected menu items
Bread	1x30 g slice	Bread, sliced (30 g)
Bread roll	½ roll	Bread roll, round (50g)
Ready-to-eat cereal	125 ml (½ cup)	Cornflakes, ½ cup (20g)
Rice, cooked cereal, pasta	30 g (½ cup)	Rice, ½ cup (65 g) Maize porridge, stiff, ½ cup (125g) Macaroni, ½ cup (75g)
Vegetables: cooked or raw	125 ml (½ cup)	Carrots, ½ cup (80g) Potato chips, medium serving (80 g) Broccoli, ½ cup (75 g)
Vegetables: leafy raw	250 ml (1 cup)	Spinach, ½ cup (90 g)
Fruit	1 medium	** Apple, medium (150 g) Orange, medium (180 g) Guava, medium (95 g)
Melon	1 wedge	Melon, medium wedge (60 g)
Fruit juice	190 ml (½ - ¾ cup)	** 125 ml
Canned fruit	125 ml (½ cup)	Fruit cocktail, medium serving (110 g)
Dried fruit	65 ml (¼ cup)	Raisins, medium handful (27 g)

Table 3.2 (Continued).

Daily Food Guide *		FoodFinder™3
Food group items	Serving sizes	Medium-sized servings of selected menu items
Lean meat, fish, poultry	90 g	Beef stew, ½ cup (125 g) Fish, battered, fried, medium serving (120 g) Chicken thigh, medium (80 g)
Peanut butter	60 ml (4 tablespoons)	Medium thick spread on 1 slice bread (10 g)
Nuts	125 ml (½ cup)	Peanuts, medium handful (35 g)
Milk or yoghurt	250 ml (1 cup)	With breakfast cereal, medium (125 ml) In coffee, medium (40 ml) Fruit flavoured yoghurt, container (175 ml)
Cheese	45 g	On bread or roll (10 g)

* Adapted from the USA Department of Agriculture, revised edition of former *Basic Four Food Groups Guide*, 1985. (Williams, 1993:10)
** Langenhoven et al. (1986)

3.9.5 Analysis of data

3.9.5.1 Screening

Before starting to compile and code data from a survey, Bless & Higson-Smith (1995:123) recommend editing the data to ensure that each question has been answered and the answer properly recorded. In this study, the interviewers handed in the questionnaires from their first interview session, on food safety and dietary intake, before commencing the second interview, consisting of the second dietary interview covering the weekend day recall. This enabled the researcher to check each questionnaire and to clarify vague or inconsistent response information with the respondent via the interviewer.

3.9.5.2 Analysis

The SPSS (Statistical Package for Social Sciences) for Windows was used for the statistical analysis of the data. The respondent coding of the individual questionnaires were handled by the interviewers to increase respondent anonymity. The coding of the questionnaire responses and the computer loading of the data was handled by the statistician involved in the study after all the completed questionnaires were screened by the researcher (see 3.9.5.1) and the "other" response categories identified and collated. The distribution of participants was examined according to demographic factors, such as faculty, self-reported and observed food safety practices, as well as dietary intakes. The chi-square test (χ^2) was performed to determine whether self-reported food safety behaviour was related to actual observations of food safety behaviour. Odd ratios were used to determine the strength of association between self-reported and actual practice of food safety behaviour. The paired samples t-test was performed to determine whether the macro- and micronutrient weekday intake, as determined by the 24-hour dietary recall, was related to the weekend-day macro- and micronutrient intake of respondents (see Section 3.9.5.2, ii). The level of significance used was $p = 0.05$ or 0.01.

(i) Food safety behaviour

Self-reported and observed food safety behaviour (Addendum C, Sections A, B & C) was analysed based on the adherence to the compiled food safety guidelines, namely, to "*Follow safe purchasing practices*", "*Store ingredients safely*", "*Practice good personal and general hygiene*", "*Cook food items thoroughly*" and "*Handle leftovers safely*".

(ii) Dietary intake

Self-reported dietary intake, based on the information obtained from the average of a weekday and a weekend day 24-hour dietary recalls (Addendum C, Sections E & G), was analysed by assessing adherence to the South African Food-Based Dietary Guidelines (Vorster et al., 2001:S3; South African Department of Health, 2003:1) and the Daily Food Guide (Whitney et al., 2002:36). Although the 24-hour dietary recall method does not reflect the daily food intake pattern of individual respondents, it does indicate dietary intake of the group of respondents on the specific days selected. Through the use of the Daily Food Guide, it was determined whether respondents consumed the recommended number of servings of each of the food groups for their age group on the specific days selected for the collection of the data.

This was done by classifying all basic food items reported into one of the following groups: the bread, cereal, rice and pasta group, the vegetable group, the fruit group, the meat, poultry, fish, dry beans, eggs and nuts group, or the milk, yoghurt and cheese group. Addendum A indicates the food groups, the foods included per group, the recommended servings for teenage girls and active women per food group and the serving sizes for the foods included per food group.

Mixed dishes, such as cottage pie and spaghetti bolognaise, which contain ingredients classified under various groups, were broken up and the individual ingredients assigned to the relevant groups. An additional group, titled fats, oils and sweets have no serving suggestions, but should be used sparingly as they contribute few nutrients (Whitney et al., 2002:37). This group was divided into the following two sub-categories, and for each of these food items it was indicated "yes" if present and "no" if absent in the diet:

- Fast foods: included potato chips, pies, pizza, sausage rolls and vetkoek.

- Snacks: included carbonated drinks, cool drinks e.g. orange squash, sweets, chocolates, potato crisps, cakes, tarts, cookies, muffins and ice cream.

The following parameters were used to determine whether respondents followed the Food-Based Dietary Guidelines (Vorster et al., 2001:S3, South African Department of Health, 2003:1):

- *Enjoy a variety of foods.* Students' consumption of food items, as indicated by the 24-hour dietary recalls, was compared with the food group provision of the Daily Food Guide and the variety within each food group noted.
- *Be active.* The participants' physical activity (Addendum C, Section D, Questions D18 & D19) was compared with the recommendations of the American College of Sports Medicine (ACSM), who recommends that individuals accumulate 30 minutes of moderate to vigorous activity on most, preferably all, days of the week (Pate et al., 1995:402).
- *Make starchy foods the basis of most meals.* The participants' consumption from the bread, cereals, and other grains group, as indicated by the 24-hour dietary recalls, were calculated and the presence of these food items within most of the meals noted. It was also noted if these items were in a refined or unrefined state.
- *Eat plenty of fruit and vegetables every day.* The participants' intakes of fruit and vegetables, as indicated by the 24-hour dietary recalls, were compared with the Daily Food Guide's recommended 5 to 9 servings per day (Whitney et al., 2002:36).
- *Eat dry beans, peas, lentils and soya regularly.* The participants' consumption of these food items, as indicated by the 24-hour dietary recalls, was determined. Additional questions regarding the intake of dry beans, peas, lentils and soya products were included in the questionnaire (Addendum C, Section D, Questions D3, D4, D5, D6). According to Venter and Van Eyssen (2001:S37), numerous studies have shown the beneficial effects of an intake

of 100 – 200 g of cooked dry beans per day on the risk markers for chronic lifestyle diseases, but that smaller amounts may also have health benefits.

- *Meat fish, chicken, milk or eggs could be eaten daily.* The participants' consumption of these items, as indicated by the 24-hour dietary recalls, was calculated and compared with the Daily Food Guide's recommendation of two to three servings for the meat, poultry, fish, dry beans, eggs and nuts group and the three servings of the milk, yoghurt and cheese group as the participants were all younger than 25 years (Whitney et al., 2002:36).
- *Eat fats sparingly.* The participants' fat intake, as indicated by the 24-hour dietary recalls, was compared with the recommendation that fat intake should be limited to 30% of the energy intake (Wolmarans & Oosthuizen, 2001:S48). According to Healthy People 2010, no more than 10% of the energy intake should be from saturated fat, and according to The American Heart Association, cholesterol should be limited to 300 mg per day (Whitney et al., 2002:149).
- *Use salt sparingly.* Adherence to this guideline was based on the answers to the following questions in the interview questionnaire: whether participants preferred salty foods, if salt was added to prepared food items, and whether food was tasted before the salt was added (Addendum C, Section D, Questions D7, D8, D9).
- *Eat foods and drinks containing sugar sparingly and not between meals.* The participants' intake, as indicated by the 24-hour dietary recalls, of added sugar was compared with the 12 teaspoons (60 ml) of the USA Department of Agriculture for teenage girls and active women (Whitney et al., 2002:42). Whether sugar was consumed at or between meals were not indicated.
- *Drink lots of clean, safe water.* The participants' water consumption was based on the questions regarding water intake (Addendum C, Section D, Questions D10 & D11) and compared with the 2.2l per day recommended by the USA National Research Council for women under average conditions (Bourne & Seager, 2001:S64).

- *If you drink alcohol, drink sensibly.* The participants' alcohol intake was based on the questions on alcohol consumption (Addendum C, Section D, Questions D13 & D14) and compared with the recommendations of the Australian National Health and Medical Research Council. It is recommend that women consume no more than two standard drinks (1 drink = 340 ml cooler/cider, 120 ml wine or 25 ml spirits) of alcohol per day and that at least two days per week are alcohol-free (Van Heerden & Parry, 2001:S71).

The FoodFinder™3 dietary analysis software package (2002) was used to determine the following nutrient intakes of the respondents:

- Macronutrients: energy, total protein, plant protein, carbohydrates, starch, added sugar, total dietary fibre, total fat, saturated, mono-unsaturated and polyunsaturated fats and cholesterol.
- Minerals: calcium, iron, magnesium, phosphorus, potassium, sodium, chloride, zinc, copper, chromium.
- Vitamins: vitamin A, thiamin, riboflavin, niacin, vitamin B_6, folic acid, vitamin B_{12}, pantothenic acid, biotin, vitamin C and vitamin E.

The nutrient intakes of the respondents were compared with the Dietary Reference Intakes (DRI) for females, aged 19 to 30 years, and the percentage intake of the Recommended Dietary Allowance (RDA) and Adequate Intakes (AI) calculated. DRI values are recommendations for optimal intakes and include a generous safety margin to meet the needs of almost all healthy people in a specific age and gender group (Whitney et al., 2002:32).

(iii) Weight status

Interviewers made appointments with the students participating in the study to be measured and weighed. The instructions for the interviewers on determining the weight and height measurements of the students and the calculation and interpretation of their Body Mass Index (BMI) values are described in Addendum

E. The BMI values were calculated by dividing the weight (in kg) of each respondent by the square of the respondent's height (in m). The desired health maintenance BMI range for adults of 20 to 25 kg/m^2 (Williams, 1993:146) was used as a guideline.

The research design and methodology described in this chapter was applied in the execution of the study. The results obtained regarding the food practices of the female students, residing in the self-catering residences of the Cape Technikon, are provided in the next chapter.

CHAPTER 4
RESULTS AND DISCUSSION

4.1 Sample

All the randomly selected female students (n = 60) representing the self-catering residences of the Cape Technikon participated in the study. All 60 the selected students participated voluntarily. About 38% (38.3%) of the respondents indicated that they were studying a course that resorted under the Faculty of Management, 23.3% were studying in the Faculty of Applied Sciences, 18.3% in the Faculty of Business Informatics, 11.7% in the Faculty of the Built Environment and Design and 8.3% in the Faculty of Engineering. None of the respondents indicated that they were studying a course that resorted under the Faculty of Education. The campuses of the Faculty of Education are situated at Wellington and Mowbray. At present the residences situated in these areas still have meal provision facilities and were thus not included in the study.

4.2 Food safety practices

Consumers need to master numerous food safety skills, starting from the purchasing and receiving of food products to the processing and provision of foods for themselves and for others (Bennion & Scheule, 2004:62). Food safety therefore starts with safe purchasing practices.

4.2.1 Purchasing of food items

In response to the question on purchasing practices (Addendum C, Section A, Question A1) all of the respondents (n = 60) reported that they usually bought ingredients to prepare food at the residences at supermarkets. Two respondents (3.3%) additionally reported that they purchased food items from small stores. Similarly, in a study conducted in Pretoria, the majority (73.2%) of urban female students reported regularly shopping at a supermarket.

However, 45.6% of the urban students also reported shopping at small stores (Van Eeden & Gericke, 1996:87). Regarding the purchasing of ready-to-eat food items, such as pies, pizza, cooked sausage and chips, (Addendum C, Section A, Question A2) 66.7% of the respondents (n = 40) reported that they bought these food items from fast food outlets, 35% (n = 21) also indicated the Cape Technikon cafeteria and 33.3% (n = 20) indicated supermarkets. Only a small number of respondents reported that they usually purchased food items from street vendors. Seven respondents (11.7%) indicated that they purchased ingredients to prepare food at the residences from street vendors and 4 respondents (6.7%) reported purchasing ready-to-eat food items from street sellers. Similarly, in the study conducted in Pretoria, only 6.3% of the urban female students reported purchasing food items from street vendors (Van Eeden & Gericke, 1996:87).

In comparison, a study conducted by Opare-Obisaw (1998:139) at the University of Ghana, found that 86% of the respondents regularly purchased cooked meals and snacks from street vendors. Reasons given by the students at the University of Ghana for purchasing food items from vendors, rather than eating in the dining halls and cafeterias of the university, included that the vendors always had food available (62%), that the food was cheaper (62%), and that the vendors offered more variety (42%). In the USA Meer and Misner (2000:1725) found that 17% of the adult respondents attending an Expanded Food and Nutrition Education Program in Arizona reported that they purchased food items from vendors.

The safety of food purchased from street vendors is a cause for concern, owing to the inherent potential health hazards caused by poor safety practices (Opare-Obisaw, 1998:143). In South Africa, contrasting evidence exists. In two studies conducted in Johannesburg (Mosupye & Von Holy, 2000:145; Kubheka et al., 2001:130) the microbial levels of street foods were found to be within acceptable standards. However, in a study conducted in Cape Town, food items sold in tourist areas had unacceptable levels of *Escherichia Coli* and *Staphylococcus Aureus* (Sidley, 1995:1).

In response to the question on purchasing characteristics (Addendum C, Section A, Question A3) 73.3% of the respondents reported that they looked at price when purchasing food items. A possible reason may be the funds available to students. Stewart and Tinsley (1995:229) reported that young working adults would choose food items that they liked, but that their choice would be within their budget constraints. Similarly, Glanz et al. (1998:1118), found that respondents reported cost as the second most important influence on their food choice, the most important being taste.

Other characteristics reported by about half of the respondents included brand (53.3%), freshness (50%) and sell-by-date (48.3%). A lower percentage of respondents, 16.7% and 11.7% respectively, indicated taste and packaging as purchasing criteria. The percentage of respondents who indicated each of the characteristics mentioned above is illustrated in the following table (Table 4.1).

Table 4.1 Characteristics taken into account when purchasing food products

Food purchasing characteristics	**Yes**		**No**	
	N	**%**	**N**	**%**
Price	44	73,3	16	26,7
Brand	32	53,3	28	46,7
Freshness	30	50,0	30	50,0
Sell-by-date	29	48,3	31	51,7
Taste	10	16,7	50	83,3
Packaging	7	11,7	53	88,3
Other responses	6	10,0	54	90,0

Product characteristics such as freshness and sell-by-date are important food safety guidelines, especially when purchasing perishable food products. According to a study conducted by the Research Triangle Institute (2000:7) in the USA, many participants indicated that they referred to the sell-by-date, best-if-used-by/before, or use-by-date when purchasing food items. In addition, the majority of these participants knew the meaning and understood the differences between these terms.

In addition, 6 respondents in this study added additional information to the answer categories provided. Four respondents (6.7%) reported looking at quantity and 2 respondents (3.3%) indicated looking at the fat content of the food items. In a study conducted in South Africa by Badham (2003:25), 34.5% of the respondents claimed to always look for health information on the labels of food products. Badham (2003:25) also found that the more educated the person, the less likely he/she was to read labels. The majority of respondents who read labels and looked for health information in the South African study were between the ages of 25 and 34 years, thus older than the respondents in this study.

Marietta et al. (1999:445) found that 70% of the college student respondents in a study conducted in the USA looked at nutritional information on the label, specifically when purchasing a product for the first time. However, these students indicated that nutritional label information played only a minor role in their daily dietary planning. Shepherd (1990:3) concluded that nutritional concerns played a role in the choice of certain food products, e.g., low-fat milk, but that in other products, such as snack and high fat foods, sensory attributes were of more importance.

4.2.2 Food storage

Where applicable, the self-reported food storage behaviour of the respondents (as indicated in Sections A and C of Addendum C) was compared with the observed behaviour of the respondents (as indicated in Section B of Addendum C). In some cases this was not possible, as, for example, certain equipment such as the refrigerators was shared by students which meant that the stored items were not only those of the respondents.

4.2.2.1 Time lapse before storing

In response to the question on the storage of ingredients (Addendum C, Section A, Question A4) 88.3% of respondents (n = 53) reported that they immediately packed their ingredients away on arrival at the residence after shopping, while 11.7% of the respondents (n = 7) reported that they only packed their shopping away after some time had passed. Similar results were obtained in a survey conducted among Sainsbury customers in the UK, where 84% of the shoppers questioned said that they quickly unpacked and stored bought food items on returning home. A further 6% of the shoppers indicated that they would only put fresh food items bought away immediately (Spriegel, 1991:14). Packing chilled, perishable food items into the refrigerator on reaching home after shopping contributes to the maintenance of the cold chain. Breaking of the cold chain, and especially if coupled with poor use of the domestic refrigerator, can lead to the growth of *Listeria monocytogenes* (Eley, 1992:12; Rosset, 2001:287).

4.2.2.2 Chilled storage

The safety of perishable food products depends on temperature control throughout all stages of the cold chain. These stages include the production, transport and storage of food items both in retail displays and in the domestic kitchen (Laguerre et al., 2002:653). In this study, all the respondents indicated the availability of refrigeration facilities (Addendum C, Section A, Question A5). Approximately 48% (48.3%) of the respondents (n = 29) reported that they had their own refrigerator, while 51.7% of the respondents (n = 31) reported that they shared a refrigerator (Addendum C, Section A, Question A5). All the respondents (n = 60) in this study reported that they stored perishable ingredients such as fresh milk, cheese and polony in a refrigerator. In a survey of Sainsbury customers, the majority of the participants were aware that food items such as milk, cheese, fresh uncooked meats and cooked meats should be stored in the refrigerator (Spriegel, 1991:14).

Results from the observation (Addendum C, Section B, Question B17) indicated that the majority (86.7%) of the respondents (n = 52) did store perishable items in the refrigerator. However, two respondents (3.3%) did not store perishable ingredients in the refrigerator and five respondents (8.3%) stored only some, but not all of the perishable ingredients in the refrigerator and in one refrigerator no perishable food items were present. However, no significant difference ($p > 0.05$; $p = 0.769$) was found between the observed and self-reported behaviour of respondents regarding the storage of perishable food items.

In terms of available space (Addendum C, Section A, Question A8), 56.7% of the respondents (n = 34) reported that there was usually sufficient space in the refrigerator to store their ingredients, while 13.3% of the respondents (n = 8) reported that there was sometimes sufficient space in the refrigerator to store their ingredients. The other 30% of the respondents (n = 18) indicated that sufficient refrigerator storage space was a problem they experienced. The observation of refrigerator space availability confirmed the self-reported behaviour, as 76.7% of the refrigerators did not appear overloaded, although it was apparent in 23.3% of the cases (Addendum C, Section B, Question B18). However, no significant difference ($p > 0.05$; $p = 0.167$) was found between the observed and self-reported behaviour of respondents regarding the availability of refrigerator space.

An overloaded refrigerator impairs the air circulation that keeps food cold and it can also result in poor stock rotation (Eley, 1992:12). *Listeria monocytogenes* thrive at refrigerator temperatures and can grow to unsafe levels in food items kept for too long in the refrigerator. Food-borne disease will result if contaminated food items are consumed without further heat treatment (Auckland Healthcare, 2000:2).

Respondents were asked for how long they usually kept food items such as fresh milk, cheese and polony in the refrigerator. Responses varied from less than a week, one to two weeks, until the expiry date or until the produce showed signs of decay (Addendum C, Section A, Question A9). In addition, three respondents (5%) did not choose any of the answer categories provided, but indicated that they stored these food items for three weeks to a month. Figure 4.1 indicates the responses to this question.

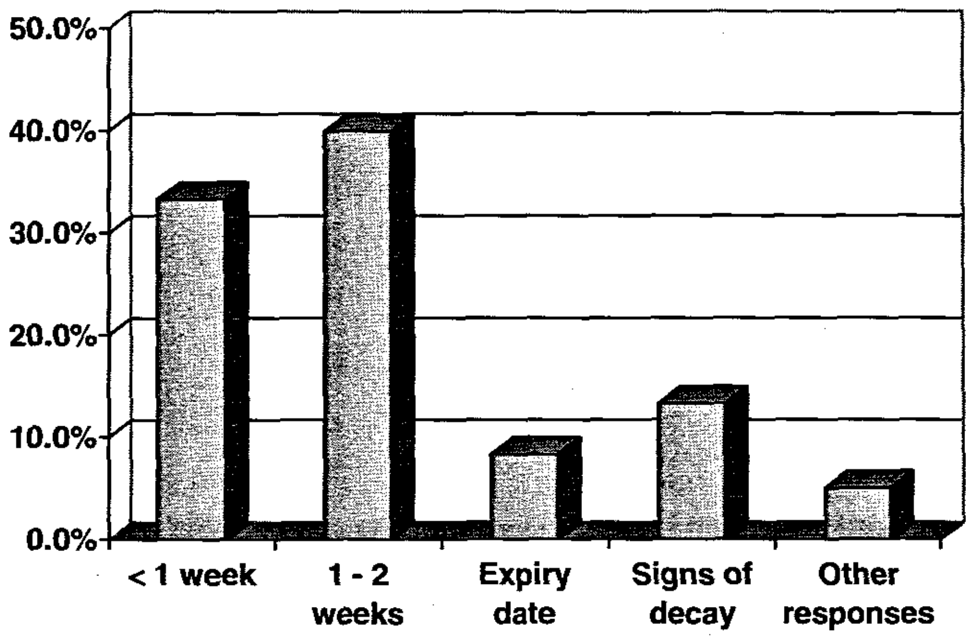

Figure 4.1 Storage periods of perishable food items in refrigerator

In this study, the majority (73.3%) of the respondents (n = 44) kept perishable food items for a limited time period, and only five respondents (8.3%) indicated using expiry dates as a guideline. Expiry dates are better indications of the freshness and safety of perishable food items compared with a specific storage period, as food products may no longer be fresh on purchasing if sufficient control regarding the discarding of stock past its sell-by date is not implemented in the retail store.

Eight respondents (13.3%) indicated keeping fresh produce such as milk, processed meats and cheese until it shows signs of decay. Processes such as pasteurisation may kill spoilage bacteria, but not affect heat resistant bacterial spores. If these foods items are mishandled, e.g., left at room temperature for extended periods of time, spores may proliferate. Food products may thus appear safe as no spoilage is visible, but if consumed may cause food-borne disease (Jones, 1992:108).

In a study conducted by Unklesbay et al. (1998:1175) among college students, the majority of respondents reported that they usually followed the instructions on the labels for storing frozen food items. In addition, these students reported that they would not keep food items after the expiry date. Similarly, in a study conducted in the UK, 64% of the respondents indicated that they would not keep food products after the use-by-date had expired (Spriegel, 1991:14).

As all the respondents (n = 60) indicated using a refrigerator to store perishable food products, respondents were asked how frequently they cleaned the refrigerator (Addendum C, Section A, Question A7). Even though Sharp and Walker (2003:13) found no clear correlation between visual hygiene score and microbial counts in their study of six communal student kitchens, the kitchen with the worst mean visual hygiene scores also had the most highly contaminated sites with a total viable count of 3.0×10^3 cfu/ml and a coliform count of 1.4×10^4 cfu/ml for the refrigerator door handle.

In response to the question on the frequency of cleaning the refrigerator, 40% of the respondents (n = 24) reported that they cleaned the inside of the refrigerator every time something spilled, and 10% of the respondents (n = 6) indicated that they cleaned the refrigerator when it appeared to be dirty. In addition, 10% of the respondents (n = 6) reported that they cleaned the refrigerator more often than once a month, while 30% of the respondents (n = 18) reported that they clean the refrigerator once a month. Six respondents (10%) did not indicate any of the stated answer categories, but reported that they did not clean the refrigerator. Figure 4.2 indicates the frequency the respondents indicated cleaning the refrigerator.

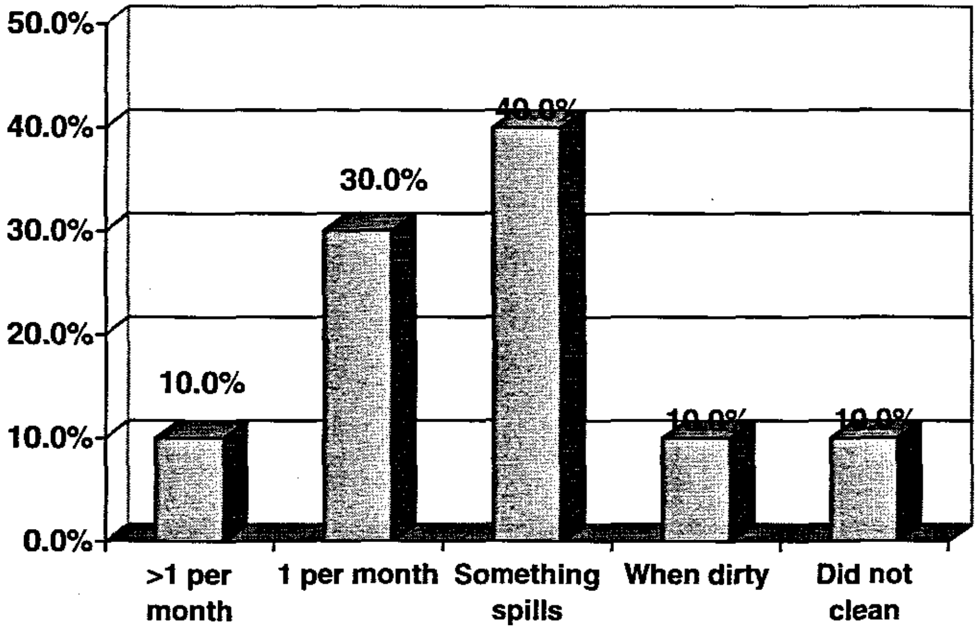

Figure 4.2 Frequency of cleaning refrigerator

These results indicated that refrigerators were cleaned more frequently than indicated by the results obtained in other studies. In the USA, Li-Cohen and Bruhn (2002:1289) conducted a mail survey and found that only 14% of the respondents reported cleaning their refrigerator weekly, while more than 40% of the respondents reported cleaning it once a month. However, 34% of the respondents reported that they cleaned their refrigerators two to three times a year, 7% of the respondents reported cleaning the refrigerator only once a year and 5% less than once a year.

Even though the majority (n = 48) of the respondents (80%) indicated cleaning the refrigerator regularly (every time something spilled, more often than once a month and once a month), results from the observation on the cleanliness of the refrigerator (Addendum C, Section B, Question B19) indicated that 36.7% of the refrigerators did not appear to be clean. No significant difference ($p > 0.05$; $p = 0.481$) was found between the observed and self-reported behaviour of respondents regarding the cleaning of the refrigerator.

A possible explanation for the contradiction between observed and self-reported behaviour may lie in the structure of the questionnaire. The question on the cleaning of the refrigerator may have been "loaded" (Oppenheim, 1992:137; Huysamen, 1994:132), as it was not preceded by a question to enquire whether the refrigerator was cleaned or not. This placed the onus on the respondents to deviate from the prompted response if the refrigerator was in fact not cleaned at all. In addition, by asking the respondents how often they cleaned the refrigerator, they could have been brought under the impression that the interviewer expected it to be cleaned.

4.2.2.3 Storage of raw meat and chicken

(i) Self-reported storing practices

Almost all the respondents (n = 59; 98.3%) reported that they purchased raw meat or chicken (Addendum C, Section A, Question A10). In response to the question on the storage of the raw meat or chicken (Addendum C, Section A, Question A11), 69.5% of the respondents (n = 41) reported storing it in the freezer or the freezer compartment of the refrigerator, while 22% (n = 13) reported using the freezer and refrigerator and 8.5% (n = 5) reported using only the refrigerator. These results show some similarity with the results of the study conducted by Jay et al. (1999a:922) who found that the majority (87%) of respondents in an Australian phone survey reported storing their meat in the freezer.

Those respondents (n = 18) who indicated that they stored raw meat or chicken in the refrigerator were asked the specific storage location for these food items (Addendum C, Section A, Question A12). Only 33.3% of the respondents (n = 6) reported using the correct area, namely the bottom shelf. The rest (n = 12) of the respondents (66.7%) reported using the top or middle shelf or no particular place in the refrigerator. In addition, only 16.7% of the respondents (n = 3) reported that they usually stored raw meat or chicken in a container with a lid (Addendum C, Section A, Question A13). A further 5.6% of the respondents (n = 1) reported that they sometimes stored these raw food items in a container with a lid. According to Stevens (2003:18), storing meat in a sealed container at the bottom of the refrigerator can be considered a basic home hygiene practice.

Similar results on the specific storage site of raw meat, fish and poultry in the refrigerator were reported in other studies. In a study conducted with the customers of Sainsbury in the UK, only 34% of the respondents indicated storing raw meat at the bottom of the refrigerator (Spriegel, 1991:14). Jay et al. (1999a:922) found in a phone survey conducted in Australia that 86.6% of the respondents reported storing raw meat on the top or middle shelf of the refrigerator. Li-Cohen & Bruhn (2002:1294) reported that 23% of the respondents in a mail survey indicated placing their meat and fish on a refrigerator shelf above other foods, while 9% of the respondents did not place their raw meat and fish at any specific location in the refrigerator.

(ii) Observed storing practices

Observations of the refrigerators containing raw meat or poultry (Addendum c, Section B, Question B21) indicated that in 15% of the cases all these products were stored on the bottom rack, while in a further 15% of the refrigerators, some, but not all of the raw meat or poultry products, were stored on the bottom shelf. However, in 41.7% of the refrigerators, no raw meat or chicken was present.

In an observational study conducted by Daniels (1998:54), 76% of the respondents were guilty of cross-contamination, e.g., storing raw food items above ready-to-eat foods in the refrigerator. Similarly, Anderson et al. (2004) found in a video surveillance study that 63% of the participants stored raw meat, poultry or seafood on the middle or top shelf of the refrigerator. Storing raw meat on the top or middle shelf, or in no particular place in the refrigerator, increases the risk of cross-contamination owing to the potential dripping of raw meat juices down onto other foods stored below. Especially at risk would be ready-to-eat foods that would not be heated to sufficiently high temperatures to kill the bacteria implicated in food-borne disease (Anon, 2001:2; Anon, 2000:3).

4.2.3 Preparation and cooking

Where applicable the self-reported food safety behaviour of the respondents (as indicated in Sections A and C of Addendum C) was compared with the observed behaviour of the respondents during the food preparation session (as indicated in Section B of Addendum C).

4.2.3.3 Handling frozen food items

Respondents (n = 54) who reported that they stored raw meat or chicken in the freezer were asked if they defrosted these food items before cooking (Addendum B, Section A, Question A14). The majority (70.3%) of the respondents (n = 38) reported that they usually defrosted frozen meat or chicken before cooking, while 20.3% of the respondents (n = 11) reported that they sometimes defrosted these frozen food items before cooking them. The cooking of meat and poultry from the frozen state as indicated by 9.2% of the respondents (n = 5) in this study is a hazardous practice as pathogens in the interior of these products may survive the cooking process (Jay et al.,1999a:922; Anon, 2000a:3; Stevens, 2003:17).

In response to the question on the method used for defrosting (Addendum C, Section A, Question A15), 74% of the respondents (n = 40) used a safe method, namely the microwave oven or the refrigerator. Only 25.8% of the respondents (n = 14) followed incorrect methods, namely defrosting frozen food items at room temperature or in warm water. Defrosting frozen food items at room temperature or in warm water is a hazardous practice as temperatures between 5 ^{0}C and 60 ^{0}C can lead to potential growth of food-borne pathogens (Brown, 2000:129; Food Safety and Inspection Service, 2003:1; Anon, 2000:4). One respondent did not choose any of the answer categories provided and indicated using cold water for defrosting. Figure 4.3 indicates the methods reported by the respondents for defrosting frozen meat or chicken.

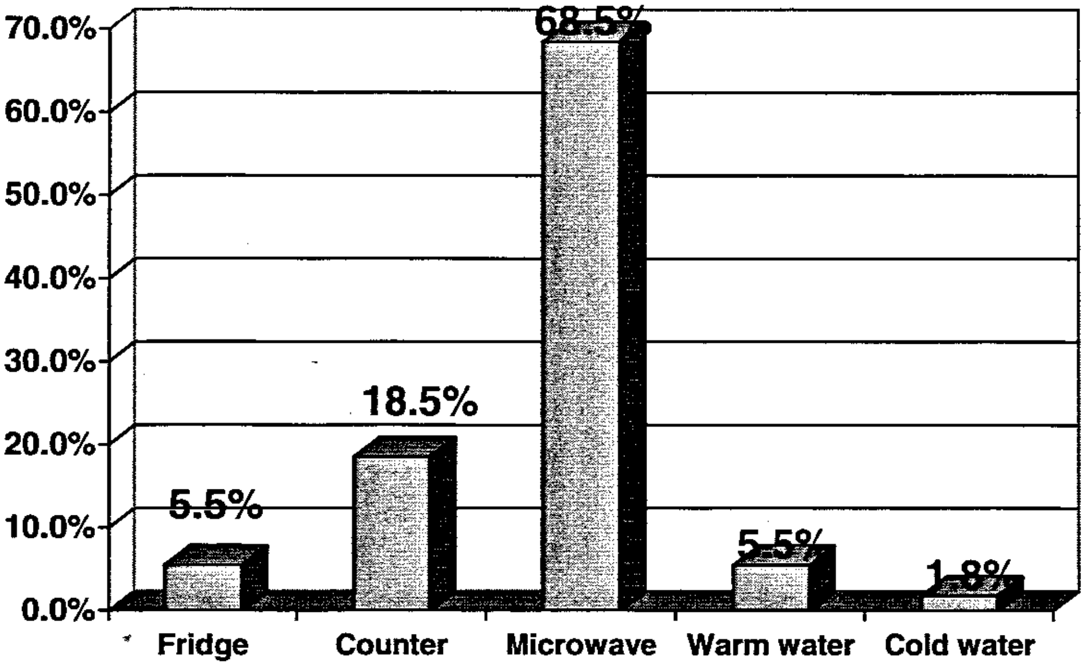

Figure 4.3 Method used for defrosting frozen meat or chicken

In this study, a larger percentage (71.5%) of respondents used a correct method for defrosting compared with other studies. Meer and Misner (2000:1725) reported that only 53% of the respondents reported using a correct method for defrosting raw animal food products in a study conducted in the USA. Twenty- one percent of these respondents reported placing food products on a counter to defrost, while 41% of the respondents reported that they used the refrigerator, and 12% of the respondents indicated that they used a microwave oven. Jay et al. (1999a:921) found in a telephone survey in Australia that 55.1% of the respondents reported using one of the following methods: placing the meat in the refrigerator (34.4%), using a microwave oven (18.5%), or using running water (2.2%).

The high percentage (66.1%) of respondents who reported using a microwave oven in this study could be contributed to the fact that all the kitchenettes in the self-catering residences are equipped with microwave ovens. Doubts have been raised about the safety of cooking raw meat in microwave ovens (Eley, 1992:10). However, the use of the microwave for the cooking of meat or poultry was not included in this study.

4.2.3.2 Handling advanced prepared and leftover food items

The proportion of the respondents (n = 24) who reported that they usually cooked foods in advance of eating was 40%. An additional 13.3% of the respondents (n = 8) reported that they sometimes cooked food in advance of consumption (Addendum B, Section A, Question A16). The majority of the respondents (n = 26) who indicated advance cooking of food items reported that they stored the food that they had prepared in advance in the refrigerator (81.3%), while 12.5% (n = 4) and 6.3% (n = 2) respectively stored the food in a cupboard or on the stove (Addendum c, Section A, Question A17). Figure 4.4 indicates the storage sites of food items prepared in advance.

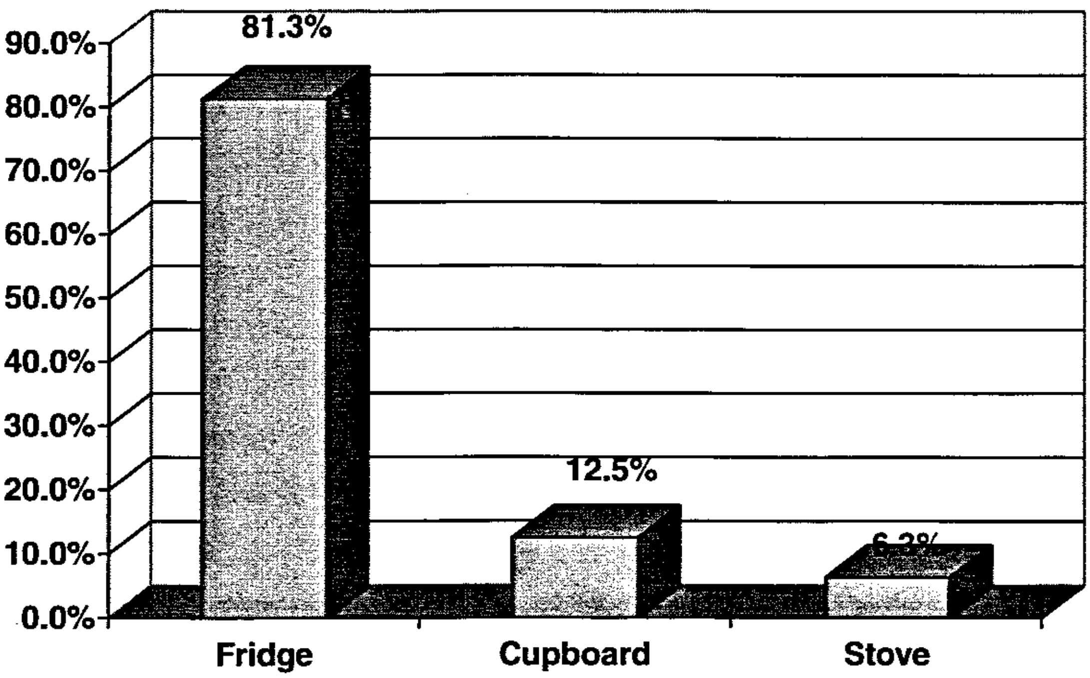

Figure 4.4 Storage sites of food items prepared in advance

In a study conducted in the UK, 58% of the respondents indicated that they prepared food in advance, either for eating it later on the same day or on another day. Less in line with guidelines, however, was the fact that of these respondents, 37% would sometimes store the cooked meals on the kitchen work surface and 24% would sometimes store the food in a saucepan on top of the stove (Simpson, 1993:4).

According to Bryan (1988:663) and Brown (2000:130), improper cooling frequently contributes to outbreaks of food-borne disease. Respondents in this study who indicated that they stored the food that they'd prepared in advance in the refrigerator (n = 26) were asked whether they cooled the food at room temperature first before putting it in the refrigerator (Addendum C, Section A18) About 80% (80.7%) of these respondents (n = 21) indicated that they usually followed this practice, while 15.3% of the respondents (n = 4) indicated that they sometimes cooled the food to room temperature before placing it in the refrigerator.

Similar results were found by Jay et al. (1999a: 921), who reported that 85% of the respondents in a telephone survey admitted that they allow cooked food to cool to room temperature before refrigerating it. Angelillo et al. (2001:161), however, reported that approximately half (49.9%) of the respondents in a study conducted in Italy put leftovers in the refrigerator soon after meals. Anderson et al. (2004:189) found that 57% of the participants in a video surveillance reported that they would cool leftover soup or stew to room temperature before placing it in the refrigerator. Pathogens that have survived cooking procedures may be given an opportunity to multiply if food items are not cooled quickly and then subsequently refrigerated (Worsfold, 1995:23). Leaving food to cool at room temperature before refrigeration indicates an uncontrolled time period when food is left in the temperature danger zone (5 ^{0}C to 60 ^{0}C) in which potential growth of micro-organisms and production of toxins may occur (Jay et al., 1999:922; Brown, 2000:130; Anon, 2001a:2).

In response to question A19 (Addendum c, Section A) 81.7% of the respondents (n = 49) indicated that they would store food that was left over after eating a meal that they had prepared or leftovers after eating take-away food items, in the refrigerator. The remaining 18.3% of the respondents (n = 11) stored leftover food on a kitchen counter or in a cupboard. According to

Worsfold and Griffith (1995; 359), leftover food should not be stored in the refrigerator in a covered container for longer than three days. In this study, leftover food was usually stored by 88.3% of the respondents (n = 53) in a container with a lid, while 10% of the respondents (n = 6) indicated that they used this practice sometimes and only 1.7% (n = 1) indicated that they did not store the leftover food items in a covered container (Addendum C, Section A, Question A20). While leftover food items were mostly stored in a container with a lid, this practice was not reported or observed in the storage of raw meat or chicken (see Section 4.2.2.3).

Observations (Addendum C, Section B, Question B20) indicated that in 51.7% of the cases where ready-to-eat food items were present in the refrigerator, they were covered. In a further 31.7 % of the cases some, but not all, of the ready-to-eat food items in the refrigerator were covered and in 10.0% of the cases ready-to-eat food items were left uncovered in the refrigerator.

As indicated in Figure 4.5, a large proportion (58.3%) of the respondents (n = 35) surveyed reported storing the leftover food for one day only. Approximately one-third (33.3%) of the respondents (n = 20) stored the leftover food for two to three days, and the remaining 8.3% of the respondents (n = 5) reported storing the leftover food for four or more days (Addendum C, Section A, Question A21).

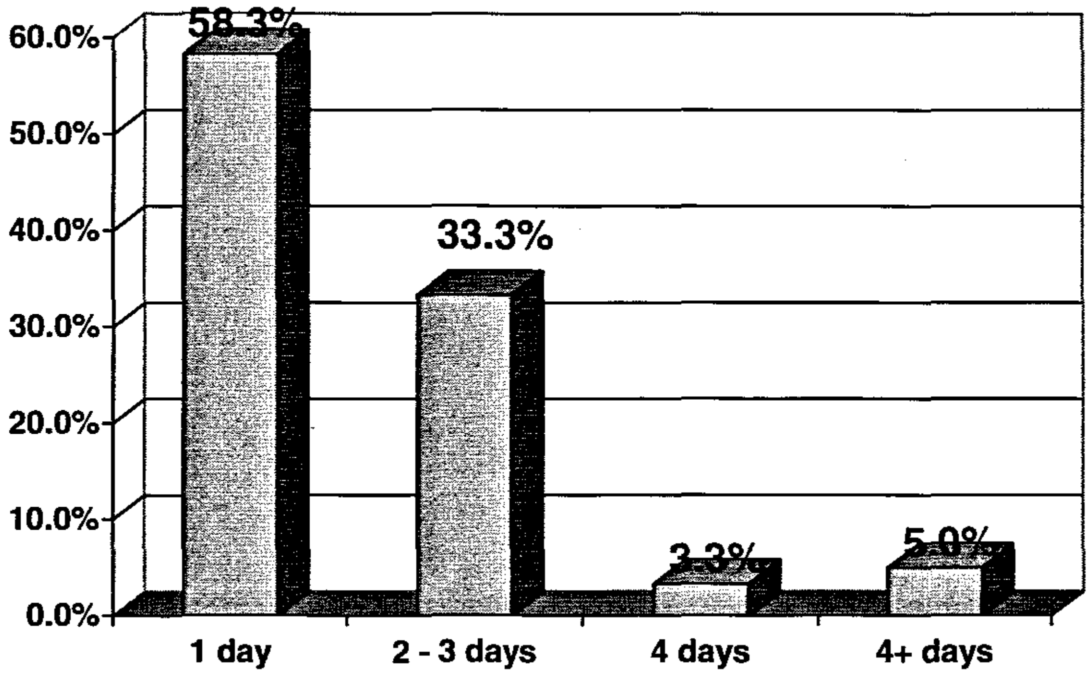

Figure 4.5 Storage times of leftover food items

According to Beumer and Kusumaningrum (2003) and Worsfold and Griffith (1995), the practice of cooking food far in advance of consumption together with the storage of leftover foods, especially if stored at room temperature, is one of the high-risk steps in a domestic kitchen and has been implicated frequently in outbreaks of food-borne disease. Beumer and Kusumaningrum (2003:301) cite a study conducted by Brinkman et al. (1999), who found that 7.3% of the leftover food samples collected from domestic kitchens showed high bacterial counts (log cfu/g > 6.0). Bacteria found in these samples included *Enterobacteriaceae* and *Bacillus cereus.* Beumer and Kusumaningrum (2003:301) concluded that leftovers should be handled hygienically, kept in clean containers, cooled as quickly as possible, covered and then stored in a refrigerator for no longer than three days.

4.2.3.3 Hand washing

(i) Hand washing before starting food preparation

According to Bennion and Scheule (2004:62), following simple hygiene rules, such as washing hands before handling food, can prevent the occurrence of food-borne disease. Table 4.2 illustrates the observed and self-reported behaviour of washing hands before starting food preparation. In this study, 70% of the respondents were observed attempting to wash their hands (Addendum C, Section B, Question B1), while 75% of the respondents reported that they usually washed their hands before starting to prepare food items (Addendum C, Section C, Question C1). In addition, 25% of the respondents indicated that they sometimes washed their hands before starting food preparation. A significant difference ($p > 0.05$; $p = 0.023$) was found between the observed and self-reported behaviour of respondents regarding the washing of hands before starting food preparation.

Table 4.2 Observed and self-reported behaviour of washing hands before commencing food preparation

Washing of hands prior to food preparation	**Observed behaviour ***		**Self-reported behaviour ***	
	N	**%**	**N**	**%**
Yes	42	70.0	45	75.0
Sometimes	N/a	N/a	15	25.0
No	18	30.0	0	0.0
Total	**60**	**100**	**60**	**100**

* Significant difference ($p < 0.05$; $p = 0.023$)

N/a: Not applicable to observed behaviour

These results show some similarity to other studies. Li-Cohen and Bruhn (2002:1290) reported that 53% of the respondents, involved in a national mail survey in the USA, indicated that they always washed their hands before handling fresh produce, while 34% of the respondents indicated that they performed this action most of the time, and 9% of the respondents indicated some of the time. However, Worsfold and Griffith (1997a:97), using direct observation techniques, found that only 34% of the respondents in a study conducted in the UK washed their hands prior to the preparation of food. Anderson et al. (2000), as cited in Redmond and Griffith (2003a:152), reported the results of an intra-study comparison between the self-reported practice and observed behaviour of respondents regarding hand washing. Although 87% of the participants reported washing their hands all or most of the time before food preparation, only 45% of the respondents were observed attempting to wash their hands before starting food preparation.

In this study, a large percentage of respondents (70%) were observed attempting to wash their hands. However, the number of respondents who followed the correct procedure for this action was very low (Addendum C, Sections B & C, Questions B2 & C2). Adequate hand-washing practices include the use of hot water and soap for lathering and rinsing (Bennion & Scheule, 2004:62). Table 4.3 illustrates the observed and self-reported manner in which hands were washed prior to starting food preparation. In this study, only 10% of the respondents were observed using soap and water for washing their hands before starting food preparation, while 30% of the respondents indicated that they usually followed this practice. Almost 60% (58.3%) of the respondents were observed rinsing their hands before starting food preparation, but a higher number (68.3%) of respondents reported that they usually rinsed their hands before starting food preparation. A significant difference ($p < 0.05$; $p = 0.031$) was found between the observed and self-reported behaviour of the respondents regarding the manner in which hands were washed prior to starting food preparation.

Table 4.3 Observed and self-reported manner of washing hands prior to food preparation

Manner of washing hands prior to food preparation	**Observed behaviour ***		**Self-reported behaviour ***	
	N	**%**	**N**	**%**
Used soap and water	6	10.0	18	30.0
Rinsed	35	58.3	41	68.3
Wiped with cloth	1	1.7	0	0.0
Not washed	**18**	**30.0**	**1**	**1.7**
Total	**60**	**100**	**60**	**100**

* Significant difference ($p < 0.05$; $p = 0.031$)

Various studies have investigated the manner in which hands were washed before starting food preparation. Redmond and Griffith (2003a:148) cite surveys conducted in the UK (Department of Health and Social Sciences and Northern Ireland Health and Social Services Board, 1998; Food and Drink Federation, 1996; Food Safety Authority of Ireland, 1998), in which 87% to 92% of the respondents indicated that they always or usually washed their hands with soap and water before handling food. However, in a video surveillance study conducted by Jay et al. (1999b:1294) in Australia, a significant deviation between the stated and actual behaviour of the respondents was also observed. Forty six percent of the respondents did not use soap for washing their hands although they indicated that they would in a questionnaire on food safety practices filled in prior to the video recordings. Similarly, Anderson et al. (2004:188) found in a video surveillance study conducted in the USA that although 45% of the respondents attempted to wash their hands before beginning food preparation, only 38% used soap when washing their hands.

Hands should be dried after washing using a clean, unused hand towel or paper towel (Bennion & Scheule, 2004:62). In this study (Addendum C, Sections B & C, Questions B3 & C3), only one respondent (1.7%) was observed using a paper towel for drying her hands and only one respondent also reported usually using a paper towel for drying her hands. Approximately 38% (38.3%) of the respondents were observed drying their hands on a kitchen cloth, while 10% were observed using a drying cloth to dry their hands. While 38.3% and 10% of the respondents respectively were observed using a kitchen or drying cloth, 65% of the respondents reported that they would usually use a kitchen cloth and 25% of the respondents reported that they would usually use a drying cloth for drying their hands after washing. A significant difference ($p < 0.001$; $p = 0.000$) was found between the observed and the self-reported procedure used for drying hands following washing prior to food preparation. Table 4.4 compares the observed drying of hands to the self-reported procedure indicated for drying hands.

Table 4.4 Observed and self-reported drying of hands prior to food preparation

Method of drying hands following washing prior to food preparation	Observed behaviour*		Self-reported behaviour*	
	N	%	N	%
Kitchen cloth	23	38.3	39	65.0
Drying cloth	6	10.0	15	25.0
Paper towel	1	1.7	1	1.7
Not dried	12	20.0	5	8.3
Not washed	18	30.0	0	0.0
Total	**60**	**100**	**60**	**100**

* Significant difference ($p < 0.001$; $p = 0.000$)

Patrick et al. (1997:319) found that the drying of hands after washing is critical as bacteria are frequently recovered from hands that have not been dried effectively. The residual moisture remaining on the hands, if not dried, also contributes to the number of micro-organisms transferred from hands to solid surfaces. However, using a kitchen cloth for the drying of washed hands may re-contaminate the hands as a kitchen cloth is normally used for actions such as wiping surfaces. In addition, it is possible that following hand washing, and even more likely if the hands are merely rinsed, bacteria will be transferred from the hands to the kitchen or drying cloth. The damp state of many kitchen and drying cloths creates suitable conditions for the survival of bacteria over a significant time period. If subsequently used for drying dishes or for drying hands, re-contamination would occur (Meredith et al., 2001:34; Bennion & Scheule, 2004:62).

(ii) Hand washing after handling raw meat or chicken

Table 4.5 illustrates the observed and self-reported behaviour of washing hands after handling raw poultry. A smaller percentage (63.3%) of respondents were observed attempting to wash their hands after handling the raw chicken (Addendum C, Section B, Questions B4), compared with the respondents (70%) who were observed attempting to wash their hands before starting to prepare food. Similarly, Anderson et al. (2004:188) found that the most common failure-to-wash hands behaviour occurred when respondents, in a video surveillance study, switched between raw meat/poultry/eggs and ready-to-eat food items. Seventy-five percent of the respondents in this study reported that they usually washed their hands after handling raw meat or chicken, and 13.3% reported that they sometimes attempted this action. Although none of the respondents indicated not washing their hands before starting food preparation, 11.7% of the respondents indicated that they did not attempt to wash their hands after handling raw meat or poultry (Addendum C, Section C, Question C4). A significant difference ($p < 0.05$; $p = 0.019$) was found between the observed and self-reported behaviour regarding the washing of hands after handling raw chicken (or meat).

Table 4.5 Observed and self-reported behaviour of washing hands after handling raw chicken (or meat)

Washing of hands after handling raw chicken (or meat)	**Observed behaviour ***		**Self-reported behaviour ***	
	N	**%**	**N**	**%**
Yes	38	63.3	45	75.0
Sometimes	N/a	N/a	8	13.3
No	22	36.7	7	11.7
Total	**60**	**100**	**60**	**100**

* Significant difference ($p < 0.05$; $p = 0.019$)
N/a: Not applicable to observed behaviour

Table 4.6 compares the observed and self-reported manner washing hands after handling raw chicken (or meat). Similar to the use of soap for washing hands prior to food preparation, only a small percentage of respondents (5%) were observed using soap and water for washing their hands after handling the raw chicken (Addendum C, Section B, Questions B5). A slighter higher number of respondents (18.3%) reported that they usually washed their hands with soap and water after handling raw meat or chicken. Seventy percent of the respondents reported that they usually rinsed their hands after handling raw meat or chicken, but this was observed in only 53.3% of the cases (Addendum C, Section C, Question C5). No significant difference ($p > 0.05$; $p = 0.498$) was found between the observed and self-reported behaviour regarding the manner in which hands were washed after handling the raw chicken (or meat).

Table 4.6 Observed and self-reported manner of washing hands after handling raw chicken (or meat)

Method of washing hands after handling raw chicken (or meat)	**Observed behaviour ***		**Self-reported behaviour***	
	N	**%**	**N**	**%**
Used soap and water	3	5.0	11	18.3
Rinsed	32	53.3	42	70.0
Wiped	3	5.0	0	0.0
Not washed	22	36.7	7	11.7
Total	**60**	**100**	**60**	**100**

* No significant difference ($p > 0.05$; $p = 0.498$)

Almost 60% (58.3%) of the respondents reported that they would usually use a kitchen cloth for drying their hands after washing, following the handling of the raw chicken. However, this action was observed in only 31.7% of the cases. Similarly a higher number of respondents (25%) indicated that they would usually use a drying cloth for drying their hands after washing, compared to the 8.3% of cases in which it was observed. Although none of the respondents reported that they would usually make use of a paper towel to dry their hands subsequent to washing them after handling raw meat or poultry, one respondent (1.7%) used a paper towel to dry her hands during the observation. Slightly more than 20% (21.6%) of the respondents who washed their hands after handling the raw chicken did not dry their hands during the observation, while 5% of the respondents reported that they would not usually dry their hands after washing them following the handling of raw meat and poultry (Addendum C, Sections B & C, Questions B6 & C6). A significant difference ($p < 0.05$; $p = 0.025$) was found between the observed and self-reported procedure used for drying of hands following washing after handling raw chicken (or meat). Table 4.7 compares the observed drying of hands with the self-reported procedure used for drying hands following washing after handling raw chicken (or meat).

Table 4.7 Observed and self-reported drying of hands following washing after handling raw chicken (or meat)

Method of drying hands following washing after handling raw chicken (or meat)	**Observed behaviour***		**Self-reported behaviour***	
	N	**%**	**N**	**%**
Kitchen cloth	19	31.7	35	58.3
Drying cloth	5	8.3	15	25.0
Paper towel	1	1.7	0	0.0
Not dried	13	21.6	3	5.0
Not washed	22	36.7	7	11.7
Total	**60**	**100**	**60**	**100**

* Significant difference ($p < 0.05$; $p = 0.025$)

Similar results were revealed by previous surveys. In studies conducted in the USA, (Altekruse et al., 1996:293), the Food and Drink Administration and the Food Safety and Inspection Service (2000) as cited in Redmond and Griffith (2003a:148), 66% to 76% of the respondents said that they washed their hands after handling raw meat or poultry. In agreement, 72% to 93% of the respondents in studies conducted by Nummery (1997), as cited in Redmond and Griffith (2003a:148), and Shiferaw et al. (2000:1538), indicated that they almost always washed their hands after handling raw meat or poultry. However, when using direct observation techniques, Worsfold and Griffith (1997a:97) found that 58% of the respondents in a study conducted in the UK did not wash their hands after handling raw animal ingredients. Similarly, in a video surveillance study conducted by Jay et al. (1999b:1293), 47% of the respondents did not wash their hands after handling raw meats.

Other researchers found similar variations as in this study between the stated and observed behaviour of respondents. Clayton et al. (2003a:452) found in a study conducted in the UK that 85% of the respondents indicated in response to a question that they were likely to wash their hands after handling raw food. However, none of the respondents observed in the study, by Clayton et al. (2003a:452) always carried out the indicated behaviour adequately while preparing a meal in a domestic kitchen set-up. Forty-five percent of the respondents attempted to wash their hands on some occasions, while 55% attempted this action at all the appropriate times. In addition, in a video surveillance study conducted by Jay et al. (1999b:1294) in Australia, 45% of the respondents did not wash their hands after handling raw meat although they indicated that they would in a questionnaire on food safety practices filled in prior to the video recordings.

Previous surveys also revealed that respondents who indicated that they washed their hands after handling raw meat or poultry did not always follow the correct procedure. In the FDA/USDA survey and in focus group studies conducted by the Research Triangle Institute (2000:5), 76% of the respondents reported that they washed their hands with soap after handling food such as raw meat or poultry. Altekruse et al. (1999:216) found in a study conducted in eight states in the USA, that only 19% of the respondents reported not washing their hands adequately after handling raw meat and chicken. Jay et al. (1999a:1294) found that although 56% of the respondents in an Australian telephone survey indicated washing their hands with soap and water after handling raw meat or poultry, 43% of the respondents indicated that they would only rinse their hands and 2% of the respondents indicated that they would wipe their hands.

4.2.3.4 Washing of produce

More than half (63.3%) of the respondents were observed washing the tomatoes supplied to them during the food preparation session (Addendum C, Section B, Question B7). A larger number of respondents indicated that they usually (71.7%) or sometimes (21.7%) washed fruit (such as apples) and vegetables (such as tomatoes) before eating them (Addendum C, Section C, Question C7). No significant difference ($p > 0.05$; $p = 0.57$) was found between the observed washing of tomatoes and the self-reported washing of fruit and vegetables prior to consumption. Table 4.8 illustrates the observed and self-reported washing of fresh produce.

Table 4.8 Observed and self-reported washing of fresh produce

Washing of tomatoes (fruit and vegetables)	**Observed behaviour***		**Self-reported behaviour***	
	N	**%**	**N**	**%**
Yes	38	63.3	43	71.7
Sometimes	N/a	N/a	13	21.7
No	22	36.7	4	6.7
Total	**60**	**100**	**60**	**100**

* No significant difference ($p > 0.05$; $p = 0.57$)

N/a: Not applicable to observed behaviour

Li-Cohen and Bruhn (2002:1294) reported similar results from a mail survey. In this study 6.7% of the respondents reported not washing fruit and vegetables, while in the USA study, 6% of the respondents indicated that they seldom or never washed fresh produce. In a video surveillance study conducted by Anderson et al. (2004:188), 6% of the participants also made no attempt to clean any of the salad ingredients used in preparing a salad, but approximately half (55%) of the participants rinsed the cucumber before slicing it. Similarly, in a study using direct observation techniques, Worsfold and Griffith (1997a:97) found that 41% of the respondents did not wash all of the vegetables before preparation.

4.2.3.5 Cross-contamination

In response to whether the same knife was or would be used (Addendum C, Section B, Question B8), 68.3% of the respondents were observed using the same knife for slicing the raw and cooked chicken (or the raw chicken and tomatoes and/or bread rolls), while 55% of the respondents indicated that they would usually make use of the same knife and 6.7% of the respondents indicated that they would sometimes make use of the same knife for slicing ready-to-eat food after using it on raw meat or chicken (Addendum C, Section C, Question C8). A significant difference ($p < 0.05$; $p = 0.018$) was found between the observed actions and the verbal responses regarding this behaviour. Table 4.9 illustrates the observed and self-reported use of the same knife for slicing raw and ready-to-eat food items.

Table 4.9 Observed and self-reported use of the same knife for slicing raw and ready-to-eat food items

Use of the same knife for slicing raw and cooked chicken, tomatoes or bread rolls (raw and ready-to-eat food items)	**Observed behaviour***		**Self-reported behaviour***	
	N	**%**	**N**	**%**
Yes	41	68.3	33	55.0
Sometimes	N/a	N/a	4	6.7
No	19	31.7	23	38.3
Total	**60**	**100**	**60**	**100**

* Significant difference ($p < 0.05$; $p = 0.018$)

N/a: Not applicable to observed behaviour

Cross-contamination can be avoided if a knife is washed with soap and water in between using it for raw and ready-to-eat food items. In this study, none of the respondents who used the same knife for the raw chicken and ready-to-eat food items was observed following this correct procedure (Addendum B, Section B, Question B9), although 8.3% of the respondents reported that they usually washed a knife with soap and water in between using it for raw and ready-to-eat food items (Addendum B, Section C, Question C9). A number of respondents did, however, attempt to clean the knife in between using it for the raw and ready-to-eat food items. Fifty percent of the respondents indicated that they usually rinsed a knife between using it for raw and ready-to-eat food items, while 48.3% percent of the respondents were observed rinsing the knife between using it on the raw and cooked chicken, tomatoes and/or bread rolls. About 13% (13.3%) of the respondents were observed wiping the knife with a cloth, while 6.7% of the respondents indicated usually following this action. No significant difference ($p > 0.05$; $p = 0.22$) was found between the actual and stated behaviours regarding the treatment (using soap and water, rinsing and wiping) of a knife in between using it for the raw and ready-to-eat food items. Table 4.10 illustrates the observed and self-reported cleaning of a knife in between using it for raw and ready-to-eat food items.

Table 4.10 Observed and self-reported treatment of knife in between using it for raw and ready-to-eat food items

Treatment of knife in between using it for raw and cooked chicken, tomatoes or bread rolls (raw and ready-to-eat food items)	**Observed behaviour***		**Self-reported behaviour***	
	N	**%**	**N**	**%**
Rinsed in water	29	48.3	30	50.0
Washed with soap and water	0	0.0	5	8.3
Wiped with cloth	8	13.3	4	6.7
No action taken	4	6.7	0	0.0
Same knife not used	19	31.7	21	35.3
Total	**60**	**100,0**	**60**	**100,0**

* No significant difference ($p > 0.05$; $p = 0.22$)

These results indicate a great degree of cross-contamination as none of the respondents were observed cleaning the knife correctly and only a small percentage of respondents (8.3%) indicated that they would usually clean it correctly. More in line with food safety practices are the results reported by Jay et al. (1999a:925) from a telephone survey conducted in Australia. Although 76% of these respondents indicated that they would use the same utensil for cutting raw meat and ready-to-eat food items, 46% of the respondents indicated that they would wash the utensil with detergent and hot water in between using it for the raw meat and ready-to-eat food items. However, 26% of the respondents indicated that they would wipe the utensil with a damp cloth in between using it for raw and ready-to-eat foods. In a another study by Jay et al. (1999b:1294) using video surveillance techniques, 35% of the respondents did not wash utensils between preparing raw and other foods, although they stated that they usually followed this practice in a food safety questionnaire completed prior to the video recordings.

In response to the question on the use of a chopping board or plate (Addendum C, Section B, Question B10), 40% of the respondents were observed using the same plate or chopping board for the raw chicken and the ready-to-eat food items. Thirty-five percent of the respondents reported that they usually followed this practice, while 8.3% of the respondents reported that they sometimes used the same plate or chopping board for raw and ready-to-eat food items (Addendum C, Section C, Question C10). A significant difference ($p < 0.05$; $p = 0.050$) was found between the observation and the response to usual behaviour in this regard. Table 4.11 illustrates the observed and self-reported use of the same plate or chopping board for raw and ready-to-eat food items.

Table 4.11 Observed and self-reported use of the same plate/chopping board for raw and ready-to-eat food items

Use of the same chopping board/plate for slicing raw and cooked chicken, tomatoes or bread rolls (raw and ready-to-eat food items)	**Observed behaviour***		**Self-reported behaviour***	
	N	**%**	**N**	**%**
Yes	24	40.0	21	35.0
Sometimes	N/a	N/a	5	8.3
No	36	60	34	56.7
Total	**60**	**100**	**60**	**100**

* Significant difference ($p < 0.05$; $p = 0.05$)

N/a: Not applicable to observed behaviour

Spriegel (1991:14) reported that when questioned, 51% of the respondents in a survey involving the customers of Sainsbury stated that they would cut cooked meat on a work surface used to cut raw meat and poultry. Altekruse et al. (1996:287) stated that 81% of the respondents in a study conducted in the

USA indicated that serving steak from the barbecue on the same plate that held the raw steak made food poisoning less likely to occur or made no difference to the occurrence of food poisoning.

Washing a plate or chopping board with soap and water in between using it for raw and ready-to-eat food items minimises the chances of cross-contamination (Anon, 2001:2). In this study, only one respondent (1.7%) was observed washing the plate with soap and water after using it for the raw chicken and before using it for the ready-to-eat food items (Addendum C, Section B, Question B11). In contrast, 21.7% of the respondents indicated that they would usually follow this practice (Addendum C, Section C, Question C11). Twenty percent of the respondents reported that they would usually rinse the plate or chopping board in between using it for raw meat and ready-to-eat food items, and 30% of the respondents were observed rinsing the plate in between using it for the raw chicken and ready-to-eat food items. One of the respondents (1.7%) indicated that she would wipe the chopping board or plate with a cloth while the same respondent was observed following this practice. No significant difference ($p > 0.05$; $p = 0.336$) was found between the actual and stated behaviour regarding the treatment of the plate or chopping board in between using it for the raw and ready-to-eat food items. Table 4.12 illustrates the observed and self-reported treatment of a plate/chopping board in between using it for raw and ready-to-eat food items.

Table 4.12 Observed and self-reported treatment of plate/chopping board in between using it for raw and ready-to-eat food items

Treatment of plate/chopping board in between using it for raw and cooked chicken, tomatoes or bread rolls (raw and ready-to-eat food items)	Observed behaviour*		Self-reported behaviour*	
	N	%	N	%
Rinsed in water	12	20.0	18	30.0
Washed with soap and water	13	21.7	1	1.7
Wiped with cloth	1	1.7	1	1.7
No action taken	0	0.0	4	6.7
Same plate/chopping board not used	34	56.7	36	60.0
Total	60	100,0	60	100,0

* No significant difference ($p > 0.05$; $p = 0.336$)

In contrast, in focus group studies conducted by the Research Triangle Institute (2000:4) in the USA, 83% of the participants indicated that they would wash cutting boards used for cutting raw meat or poultry with soap and/or bleach and water before using the cutting board again. Li-Cohen and Bruhn (2002:1290) obtained comparable results and found that 97% of the respondents reported that they always washed their cutting surfaces after contact with meat, poultry or fish. A high number of respondents (86%) also indicated that they always cleaned the cutting surface after cutting fruits and vegetables. However, only 65% of the respondents indicated always cleaning the cutting board before making ready-to-eat food items, such as sandwiches. In a telephone survey conducted by Klontz et al. (1995:927) 25% of the respondents in the USA said that they would use the same cutting board again without cleaning it with soap or bleach after cutting raw meat or chicken,

However, observed practices showed that 60% of the respondents in a study conducted by Worsfold and Griffith (1997a:97) cut all their ingredients on a single board and 25% of the respondents did not clean the cutting board using a recommended method. These results correspond with the video surveillance study conducted by Jay et al. (1999b:1294) in Australia who found that 34% of the respondents did not clean the preparation surface in between contact with raw and other foods although they indicated that they would.

Using the same spoon for tasting and stirring the food being prepared can lead to cross-contamination if the spoon is not cleaned correctly between these actions. More than half (68.3%) of the respondents were observed using the same spoon for tasting and stirring the food being prepared (Addendum C, Section B, Question B12). A similar number (61.7%) of the respondents reported that they would usually follow this practice and 13.3% of the respondents indicated that they would sometimes use the same spoon (Addendum C, Section C, Question C12). No significant difference ($p > 0.05$; $p = 0.272$) was found between the observed and self-reported behaviour regarding the use of the same spoon for tasting and stirring the food being prepared. Table 4.13 illustrates the observed and self-reported use of the same spoon for stirring and tasting food.

Table 4.13 Observed and self-reported use of the same spoon for stirring and tasting food

Use of the same spoon for stirring and tasting food	Observed behaviour*		Self-reported behaviour*	
	N	%	N	%
Yes	41	68.3	37	61.7
Sometimes	N/a	N/a	8	13.3
No	19	31.7	15	25.0
Total	**60**	**100**	**60**	**100**

N/a: Not applicable to observed behaviour

* No significant difference ($p > 0.05$; $p = 0.272$)

In this study, none of the respondents who used the same spoon for tasting and stirring the food being prepared was observed following the correct action, namely to wash the spoon with soap and water in between these actions (Addendum C, Section B, Question B13). Only 8.3% of the respondents indicated that they would usually wash a spoon with soap and water after using it for tasting (Addendum C, Section C, Question C13). Some of the respondents did attempt to clean the spoon, with 38.3% rinsing the spoon and 6.7% wiping it with a cloth. A larger number of respondents, 55% and 10%, respectively reported that they would usually rinse or wipe a spoon after using it for tasting. No significant difference ($p > 0.05$: $p = 0.454$) was found between the actual and stated behaviours regarding the treatment of the spoon. Table 4.14 illustrates the observed and self-reported cleaning of a spoon in between using it for stirring and tasting food items.

Table 4.14 Observed and self-reported treatment of spoon in between using it for stirring and tasting

Treatment of spoon in between using it for stirring and tasting	Observed behaviour*		Self-reported behaviour*	
	N	%	N	%
Rinsed in water	23	38.3	33	55.0
Washed with soap and water	0	0.0	5	8.3
Wiped with cloth	4	6.7	6	10.0
No action taken	14	23.3	0	0.0
Same spoon not used	19	31.7	16	26.7
Total	**60**	**100,0**	**60**	**100,0**

* No significant difference ($p > 0.05$; $p = 0.454$)

Using the same cloth to wipe raw food items and/or surfaces and to clean or dry dishes, leads to cross-contamination. In this study, 61.7% of the respondents ($n = 37$) were observed using the same cloth for these actions (Addendum B, Section B, Question B14). Almost 50% (48.3%) of the respondents ($n = 29$) reported that they would usually make use of the same cloth for these actions, and 10% of the respondents ($n = 6$) reported that they would sometimes use the same cloth (Addendum C, Section C, Question C14). No significant difference ($p > 0.05$: $p = 0.248$) was found between observed and self-reported behaviour regarding the use of the same cloth. During the observation, two respondents (3.3%) did not have a sponge or cloth available and four respondents (6.6%) did not wipe either the surface or any of the raw food items.

In an Australian telephone survey conducted by Jay et al. (1999a:925), 18% of the respondents indicated that they would use the same cloth for drying dishes and to dry hands. The findings reported by Daniels (1998:54) indicated that 92% of the participants in an observational study conducted in the USA misused a common cloth or towel.

Twenty percent of the respondents ($n = 12$) indicated that they would usually or sometimes use chipped or cracked glasses and crockery (Addendum C, Section C, Question C15). In 8.3% of the cases ($n = 5$), damaged utensils were observed to be present among the utensils belonging to the participants in this study (Addendum C, Section B, Question B15). No significant difference ($p > 0.05$; $p = 0.71$) was found between the observed and self-reported behaviour regarding the use of chipped or cracked glasses and crockery. These results are more in line with food safety guidelines than the results of Unklesbay et al. (1998:1175), who used a questionnaire to determine, *inter alia*, the self-reported food safety practices of a group of college students in the USA. In this USA study, the majority of the respondents indicated that they would use dishes that were chipped or cracked.

4.2.3.6 Temperature control

(i) Degree of doneness of chicken

Chicken should be cooked thoroughly. The flesh of the chicken should be white, it should not cling stingily to the bone and the juice should run clear (Anon, 2001:2). The majority (88.3%) of respondents were observed cooking the chicken to this stage (Addendum C, Section B, Question B16). Similarly, the majority (86.7%) of respondents indicated that they would cook chicken or liked it to be cooked to this stage (Addendum B, Section C, Question C16). A significant difference ($p < 0.05$; $p = 0.032$) was found between the number of respondents who were observed or reported cooking chicken to this stage and the number of respondents who were observed or indicated undercooking or liking undercooked chicken. Table 4.15 illustrates the observed action and self-reported preference of respondents with regard to the stage to which chicken is cooked.

Table 4.15 Observed action and self-reported preference of respondents with regard to stage to which chicken is cooked

Degree of doneness of chicken	**Observed behaviour**		**Self-reported behaviour**	
	N	**%**	**N**	**%**
Some pink in juice and/or meat *	7	11.6	2	3.3
Juice clear and white next to bone *	53	88.3	52	86.7
No preference	N/a	N/a	3	5.0
Total	**60**	**100,0**	**60**	**100,0**

N/a: Not applicable to observed behaviour
* Significant difference ($p < 0.05$; $p = 0.032$)

(ii) Degree of doneness of burger patties

Respondents were asked to what stage they cooked burger patties or liked them to be cooked (Addendum C, Section C, Question C17). The cooking of burger patties did not form part of the observational study. As seen in Table 4.16, the majority (76.7%) of the respondents indicated that they preferred burger patties to be cooked to the well-done stage (brown outside and inside).

Table 4.16 Preferred cooked stage of burger patties by respondents

Cooked stage of burger patties	**N**	**%**
Well done (brown outside and inside)	46	76,7
Half done (brown outside, pink inside)	7	11,7
No preference	4	6,7
Do not consume meat patties	3	5,0
Total	**60**	**100,0**

Redmond and Griffith (2003a:138) reviewed consumer food handling studies conducted in the USA, the UK, Canada, Australia and New Zealand from 1975 to 2002, and found that 85% to 92% of the respondents in studies using self-reported techniques (Food and Drink Federation, 1993; Food Safety Authority of Ireland, 1998) indicated that they always ensured that cooked or heated food was piping hot throughout. In contrast, 46% to 83% of the respondents in observational studies (Anderson et al., 2000, Griffith et al. 1999 and Redmond, 2002 as cited in Redmond & Griffith, 2003a:138) were observed to undercook hamburger patties and chicken.

The Research Triangle Institute used the data from previous surveys, including observational and consumer focus group studies, to measure the changes that occurred in consumer behaviour from 1993 to 1998 and to 2001 in the USA. In 1993, 74% of the participants indicated that they usually served hamburger patties medium or well done; in 1998 the number increased to 83%, although by 2001 a slight decrease to 82% was observed (Food Safety and Inspection Service, 2002:2). Using visual cues to ascertain the doneness of hazardous foods, such as chicken and burger patties, is not very accurate (Anon, 1999a:8). However, very few consumers have thermometers that can be used to monitor whether safe temperatures are reached during cooking (Worsfold, 1995:23). The researcher conducted an informal survey in the Cape Town area, and found that none of the four major food retail stores sold food thermometers. In this area, food thermometers were only available from specialist kitchen shops and suppliers to food service institutions. Owing to their unavailability and high prices, food thermometers are out of reach of most consumers.

(iii) Reheating left-over food items or food items prepared in advance

When reheating previously cooked foods, the same high temperatures should be reached as in the initial cooking as poor storage practices may have led to the proliferation of large numbers of bacteria in the cooked food (Worsfold, 1995:22). Respondents were asked to what stage leftover food items or food items that were prepared in advance were reheated (Addendum C, Section A, Question A22). None of the respondents indicated that they would heat the mentioned foods until they were boiling hot. Leftover food items or food items that were prepared in advance were indicated by 51.7% of the respondents (n = 31) to be reheated until they were hot, and by 48.3% (n = 29) until they were warm.

Eighty percent of the respondents (n = 48) reported that they would not reheat leftover food items more than once, while 16.7% of the respondents (n = 10) indicated that they reheated these foods more than once and 3.3% of the respondents (n = 2) indicated that they sometimes followed this practice (Addendum C, Section A, Question A23). Worsfold and Griffith (1997a:97) found in a study using direct observation techniques, that 11% of the participants did not reheat food products to an internal temperature of at least 74°C. In addition, 6% of the participants reheated the food product more than once, with intervening holding periods at room temperature.

(iv) Consumption of undercooked/ high risk foods

Only a small proportion of the respondents in this study reported eating or drinking foods that contain raw eggs (13.3%; n = 8) or raw fish (5%; n = 3) (Addendum C, Section A, Questions A24 & A25). These included food items such as homemade chocolate mousse, protein shakes or sushi. In contrast, results of previous studies conducted in the USA have revealed a far higher intake of these food items. In a study conducted by Altekruse et al. (1999:216) in eight states in the USA, 50% of the respondents indicated that they ate undercooked eggs and 8% of the respondents indicated consuming raw oysters. Klontz et al. (1995:927) reported that 53% of the respondents in a telephone survey conducted in the USA reported eating raw eggs and 8% reported eating raw sushi or ceviche.

4.2.3.7 Correspondence between self-reported and observed behaviour

In this study the number of respondents who reported that they usually made use of safe food practices was higher than the number of respondents who were observed executing these practices. Significant differences ($p < 0.05$) were found between the observed and self-reported behaviour regarding the manner in which hands were washed prior to food preparation (Table 4.3) and the drying of hands following washing prior to food preparation (Table 4.4). Significant differences ($p < 0.05$) were also found between the observed and self-reported behaviour regarding the washing (Table 4.5) and drying of hands after handling raw chicken (or meat)(Table 4.7), the use of the same knife for slicing raw and ready-to-eat food (Table 4.9) and the use of the same plate/chopping board for raw and ready-to-eat food items (Table 4.11).

Consistent with the results from other studies (Worsfold & Griffith, 1997a:97; Jay et al. 1999b:1285, Clayton et al., 2003a:434; Anderson et al., 2004:186), the self-reported food safety behaviour of the respondents was more positive than the observed behaviour. According to Medeiros et al (2001a:108), the relationship between self-reported and actual behaviour is not well understood. A reason for this discrepancy is, according to Redmond and Griffith (2003a:145), that data from self-reported questions may provide information on awareness or indirect knowledge about "correct" behaviour rather than information on actual behaviour. Bowling (1997:229) concluded that respondents may claim to carry out the "correct" behaviour, rather than behaviour which is perceived to be undesirable, in order to convey a positive image.

As the positive self-reported behaviours are not realised, barriers that may prevent respondents from actualising their behaviour should be investigated. According to Clayton et al. (2003a:450), internal barriers, such as self-efficacy and external barriers, such as a lack of time, could prevent consumers from carrying out specific food safety actions. Other barriers mentioned by Clayton et al. (2003a:450), include laziness and a positive optimistic bias regarding the home kitchen.

4.3 Food safety awareness

When asked whether food that was not safe could be identified by the way it looks and smells, 86.7% of the respondents (n = 52) answered affirmatively (Addendum C, Section A, Question A26). Approximately 80% (81.7%) of the respondents (n = 49) indicated that they thought that food that was not safe could be identified by the way it tastes (Addendum C, Section A, Question A27). The majority of the respondents thus indicated a belief in the myth that the safety of food products can be determined by using sensory attibrutes (Anon, 1999a:9). These findings suggest that the majority of respondents do not fully understand the origin of food-borne disease.

Simpson (1993:5) reported similar results. Seventy-five of the respondents in her study conducted in the UK smelled food items to decide whether they were fit to eat. Meer and Misner (2000:1725) found in a group of low-income adults attending an Extended Food and Nutrition Education Program that 30% of the respondents agreed with the statement that food that makes you sick can be identified by taste or smell. In addition, Williamson et al. (1992:96) found that only 6% of the respondents in a study conducted in the USA indicated that they would taste a suspected food to determine its safety.

According to Altekruse et al. (1996:293), a basic knowledge of microbiology may motivate consumers to use safe food handling practices. In this study, varied responses were found as answers to the question on the causes of food poisoning (Addendum C, Section A, Question A28). The majority of the respondents (46.7% & 45.0% respectively) indicated food that was stored for too long and bacteria as the causes of food poisoning. A small number of respondents (5%) indicated that they did not know the answer to this question. None of the respondents mentioned that they were unsure of possible causes of food poisoning (see Section 3.6.2) Table 4.17 indicates the responses of the question on the causes of food poisoning.

Table 4.17 Causes of food poisoning indicated by respondents

Causes of food poisoning	**N**	**Respondent %**
Food stored for too long	28	46.7
Bacteria	27	45.0
Contaminated food items	23	38.3
Dirty equipment and utensils	22	36.7
Food held at warm temperatures for too long	20	33.3
Poor hygiene practices	20	33.3
Hands not washed	17	28.3
Cross contamination between raw and cooked Foods	13	21.7
Other micro-organisms, e.g., mould	13	21.7
Viruses	13	21.7
Contact with animals and flies	11	18.3
Contaminated water	11	18.3
Food items not cooked to well done	9	15.0
Leftovers not reheated to boiling point	7	11.7
Food not cooled quickly after cooking	1	1.7
Don't know	3	5.0

A far higher awareness regarding the causes of food poisoning was encountered in other studies. In a telephone survey conducted by Jay et al. (1999a:921), 88% of the respondents contributed food-borne disease to the incorrect storage of food items, 80% to bacteria, 79% to consumption of food items past their use-by date and 74% to incorrect cooking. Similar to this study, a small percentage of respondents (2.1%) also indicated that they did not know the causes of food-borne disease. In focus group studies conducted by the Research Triangle Institute (2000:1), most of the participants indicated that they understood that bacteria and improper handling of food were the causes of food-borne disease.

Awareness of bacteria associated with food-borne disease was limited, as a large percentage (45%) of respondents (n = 27) could not name any bacteria associated with food poisoning (Addendum C, Section A, Question A33). The majority of respondents that indicated the name of a bacterium, mentioned *Salmonella*. Table 4.18 indicates the percentage of respondents that mentioned each type of bacteria.

Table 4.18 Food poisoning bacteria indicated by respondents

Bacteria	**N**	**Respondents %**
Salmonella	25	41.7
Staphylococcus aureus	7	11.7
Clostridium botulinium	6	10.0
Bacillus cereus	5	8.3
Clostridium perfringens	4	6.7
Escherichia coli	4	6.7
Shingella	3	5.0
Camplyobacter Jejuni	1	1.7
Listeria monocytogenes	0	0
Don't know	27	45.0
No response	3	5.0

Results from other studies indicated a higher level of consumer awareness regarding bacteria causing food-borne disease. In the study conducted by Jay et al. (1999a:921), 96% of the respondents indicated that they had heard of *Salmonella*. In the USA, data from the FDA/FSIS Food Safety Survey showed an increase in consumer knowledge of *Salmonella*. In 1993, 79% of the respondents were aware of this bacterium and in 2001 the number rose to 93% (Food Safety and Inspection Service, 2002:1). In a study conducted by Woodburn and Raab (1997:1105) in the USA, 99% of the respondents recognised *Salmonella* as a problem in food and 88% of the respondents could name appropriate foods as being at high risk for food-borne disease.

In this study, poor results were also obtained with regard to the questions on the meaning of cross-contamination, foods or food preparation practices associated with *Salmonella* food poisoning and foods or food preparation practices associated with *Escherichia coli* food poisoning (Addendum C, Section A, Questions, A34, A35, A36). Slightly more than half (56.7%) of the respondents (n = 34) reported that they were not aware of the term cross-contamination, while 34% (n = 20) indicated that they understand it to be when raw and cooked foods were in contact with each other. A further 7% (n = 4) and 2% (n = 1) of the respondents respectively indicated that cross-contamination referred to the preparation of food on a contaminated surface and using the same knife for raw and cooked foods.

Despite the low level of awareness the proportion of respondents who reported an awareness of specific food-safety practices was greater than the proportion of respondents who reported using the corresponding safe food practices. While 26 respondents explained the meaning of the term "cross-contamination" correctly:

- 13 respondents reported usually washing a plate/chopping board with soap and water in between using it for raw chicken and ready-to-eat foods;
- 11 respondents reported usually washing their hands with soap and water after handling raw chicken;
- 6 respondents reported storing raw meat or chicken on the bottom shelf of the refrigerator; and
- only 5 respondents reported usually washing a knife with soap and water in between using it for raw poultry and ready-to-eat foods.

Jay et al. (1999a:921) found in a telephone survey conducted in Australia that approximately half of the respondents did not know the meaning of the term cross-contamination. However, when given possible responses to this question, 91% of the respondents gave a correct answer. In this study possible responses were not given to the respondents in the section on food safety awareness (Addendum C, Section A, Questions A28, A31, A33, A34, A35 and A36).

In response to the question on the type of food or food preparation practice associated with *Salmonella* food poisoning (Addendum B, Section A, Question

A35), 70% of the respondents (n = 42) indicated that they did not know the association. Twenty-five percent of the respondents (n = 15) associated *Salmonella* with chicken and eggs, and 3% (n = 2) with cross-contamination. None of the respondents indicated that inadequate cooking could be associated with *Salmonella* food poisoning. Similarly to the findings on the awareness of cross-contamination the proportion of respondents who reported an awareness of specific food-safety practices was greater than the proportion of respondents who reported using the corresponding safe food practices. The correct association between food items, preparation and storage practices and *Salmonella* was indicated by 17 of the respondents, while:

- 13 respondents reported usually washing a plate/chopping board with soap and water in between using it for raw chicken and ready-to-eat foods;
- 11 respondents reported usually washing their hands with soap and water after handling raw chicken; and
- only 5 respondents reported usually washing a knife with soap and water in between using it for raw poultry and ready-to-eat foods.

Williamson et al. (1992:96) reported that 74% of the respondents in a mail survey associated *Salmonella* with raw poultry and eggs. Meer and Misner (2000:1725) found that 43% of the respondents in a study conducted in the USA did not know any foods associated with *Salmonella*. However, Jay et al. (1999a:926) found that between 20% and 53% of respondents could identify foods associated with *Salmonella* when they were read a list of foods.

In response to the question on the type of food or food preparation practice associated with *Escherichia coli* food poisoning (Addendum C, Section A, Question A36), 80% of the respondents (n = 48) indicated that they did not know the association. Approximately 13% of the respondents (n = 8) associated *Escherichia coli* with raw foods and approximately 2% (n = 2) associated *Escherichia coli* food poisoning with inadequate cooking and cross-contamination.

Results from previous studies vary. Although awareness *of Escherichia coli* increased from 85% of the respondents in 1998 to 88% of the respondents in 2001, in a FDA/FSIS Food Safety Survey (Food Safety and Inspection Service, 2002:1), Meer and Misner (2000:1725) found that 45% of the respondents did not know of any foods associated with *Escherichia coli* food-borne disease outbreaks. Jay et al. (1999a:926) reported that although 52% of the respondents in a telephone survey admitted that they had heard of *Escherichia coli*, only approximately 12% of the respondents could identify foods that were associated with these bacteria when they were read a list of foods. In contrast, Woodburn and Raab (1997:1105) found in a survey conducted in the USA that *Echerichia coli* was recognised as a problem in food by all the respondents.

In this study the low levels of respondent awareness regarding the causes of food poisoning were reflected in the low level of awareness of refrigerator temperatures. Although all the respondents (n = 60) indicated that they used a refrigerator for storing perishable food products, only 36.7% of the respondents (n = 22) indicated a temperature of between 1 and 5 ^{0} C when they were asked what they thought the temperature of the refrigerator should be (Addendum C, Section A, Question A6). About 32% (31.7%) of the respondents (n = 19) indicated that they did not know the refrigeration temperature, and 31.7% of the respondents (n = 19) gave an incorrect answer. Figure 4.6 indicates the results of the question on refrigeration temperature.

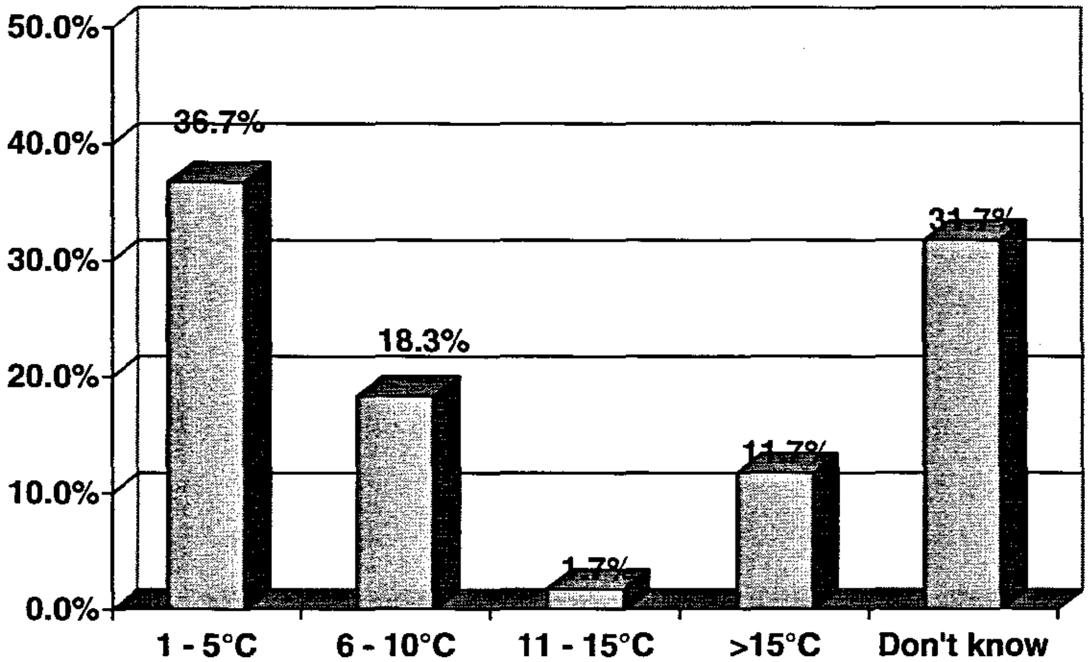

Figure 4.6 Refrigerator temperatures as indicated by the respondents

The results from this study are more in line with food safety guidelines than the results from other studies. In this study, the respondents who indicated 1 – 5 ^{0}C, may possibly have done so as it was the lowest range provided, and respondents linked this temperature to a refrigerator's being "cold". However, providing a lower temperature range would not be suitable, as it would have suggested a temperature at which freezing occurs.

In a study conducted in the UK, 84% of the respondents indicated that they did not know the temperature of their refrigerator and only 13% of the respondents stated a temperature in the range of 0 °C to 5 °C (Spriegel, 1991:14). Jay et al. (1999a:921) found in a telephone survey conducted in Australia that approximately 70% of the respondents were not aware of the correct refrigerator temperature for storing perishable foods, and O'Brien (1997:141) found in a study conducted in New Zealand, that 88% of the respondents did not know the temperature range that their refrigerators should be operating within. Simpson (1993:4) reported similar figures from a study conducted in the UK, where 61% of the respondents did not know the temperature range within which their refrigerators should be. Meer and Misner

(2000:1728) found that 69% of the respondents in a study conducted in the USA did not know the temperature of their refrigerator and 15% of the respondents gave an incorrect temperature. If the refrigerator temperature is not known, consumers cannot be sure that it is cold enough to prevent the multiplication of pathogenic bacteria. In addition, refrigerator temperatures above 5 ^{0}C will invalidate the "use by dates" of many perishable food items (Simpson, 1993:6).

The poor level of food safety awareness is a cause for concern. Bruhn (1997:511) concluded that if consumers misperceive the nature and origin of food-borne disease, they not only underestimate the seriousness of the consequences, but are also less motivated to change their food practices. Altekruse et al. (1996:293) found that respondents who could specify a food vehicle for the transmission of Salmonella were more likely to report safe food handling behaviour. However, in contrast, Altekruse et al. (1996:293) also found that some of the respondents reported unsafe food practices despite having a high awareness of food-borne illness. The conclusion that an awareness of food-borne illness does not necessarily lead to safe food practices is supported by studies conducted by Woodburn and Raab (1997:1109) and McIntosh et al. (1994:83).

The disparity between food safety knowledge and food safety practices can be partly attributed to optimistic bias effects (Miles et al., 1999:749). Weinstein (1980:409), described this bias as "*unrealistic optimism*" and indicated that it can be applied to trivial as well as life-threatening matters. Most people are biased in thinking that they are invulnerable and expect misfortunes to happen to others, not themselves. In addition most people will say that they are less likely than the average to experience bad things in life and more likely than the average to experience good things.

Respondents' risk perception may thus differ noticeably from their actual risk status (Frewer et al., 1994:19). Woodburn and Raab (1997:1107) found that 23% of respondents, in a study conducted following outbreaks of food-borne illness, believed that food eaten at home were a lower risk for causing food-borne disease than food eaten out. In addition, Altekruse et al. (1996) concluded that the knowledge of specific groups of consumers, such as young adults and occasional food preparers, was similar to that of the overall sample, but that they had lower rates of self-reported food safety practices. These researchers related this disparity between knowledge and self-reported practices to lack of food-handling experience or risk-taking behaviour.

4.4 Occurrence of food-borne disease

Thirteen respondents (21.7%) reported that they had been ill, possibly with food poisoning, since they had been living in the residence after being read the symptoms of food-borne disease (Addendum C, Section A, Question A29). Only 3 of the respondents (23%) who reported possibly experiencing food poisoning indicated that a medical doctor or clinic sister diagnosed the illness as food poisoning (Addendum C, Section A, Question A30). The most common cause indicated by the respondents (n = 5) for the food poisoning experienced was contaminated food items (38%). Fifteen percent of the respondents (n = 2) indicated each of the following reasons: bacteria, viruses, cross-contamination between raw and cooked foods and dirty equipment and utensils. An additional 15% of the respondents (n = 2) indicated that they did not know the cause of their illness (Addendum C, Section A, Question A31). Although only a small number of students (21.7%) reported that they had possibly experienced food poisoning, about half (51.7%) the respondents (n = 31) in the study thought it very likely (35% of the respondents) and likely (16.7% of the respondents) that in the future, while they were still living in the residence, they might experience food poisoning (Addendum C, Section A, Question A32).

In a study conducted by Fein et al. (1995:1405), 46% of the respondents indicated that they themselves or someone in their households had experienced an episode of food-borne disease in the previous three months, but only 14% of these respondents had reported the illness to a physician or the health department. Reasons for the illness were attributed to meat by 28% of the respondents, while 13% attributed the food-borne disease to poultry. In the study conducted by Fein et al. (1995:1405), respondents who believed that they had experienced food-borne disease had a greater awareness of micro-organisms associated with food-borne disease and were more concerned about food safety issues. With personal experience of a negative event, consumers are more likely to perceive the future probability of that event for them as greater than average (Weinstein, 1980:409). Conversely, in a study conducted by the Research Triangle Institute (2000:1), young adults, between 20 and 30 years old, were not concerned about food-borne disease because they had never experienced it. According to Bruhn (1997:512), this may lead to weak motivation to change to safer food practices. Schafer et al. (1993:17) concluded that motivation for proper food handling requires viewing the mishandling of food as a direct threat to one's health. The failure to associate mishandling of food in the home with food-borne disease interferes with education efforts aimed at improving food-handling practices.

4.5 Dietary intake

4.5.1 Adherence to the Food-Based Dietary Guidelines and Daily Food Guide

The self-reported dietary intakes, based on two 24-hour dietary recalls, of 60 black female students, aged between 18 and 24 years were analysed by assessing adherence to the Food-Based Dietary Guidelines for South Africa (Vorster et al., 2001:S3; South African Department of Health, 2003:1) and the Daily Food Guide (Williams, 1993:10; Whitney et al., 2002:36).

4.5.1.1 Dietary variety

The first recommendation indicated in the Food-Based Dietary Guidelines for South Africa is as follows: "*Enjoy a variety of foods*" (Vorster et al., 2001:S3). A lack of dietary variety may contribute to low micronutrient intakes. This is especially important in the case of nutrients, such as vitamin A, calcium, iron and vitamin C, which are found in high amounts only in a few foods. Chronic diseases of lifestyle such as hypertension, cardiovascular disease, non-insulin-dependent diabetes mellitus and cancer, are also linked to a lack of dietary variety (Maunder et al., 2001:S8).

More than half (60%) of the respondents (n = 36) indicated that they usually ate the same, or similar, foods daily during the term while living in the residence (Addendum C, Section D, Question D1). An additional 16.7% of the respondents (n = 10) reported that they sometimes followed this pattern. Although a variety of food items may be consumed within a single day, eating similar foods on a daily basis for the larger part of the year decreases the possibility of consuming a variety of foods.

An analysis of the two 24-hour dietary recalls, collected during the term time, indicated that only 17 respondents (28.3%) consumed food items from all five of the food groups listed in the Daily Food Guide (Williams, 1993:10). According to the data from the two 24-hour recalls a total of 156 different food items was consumed by the respondents on these two days. The number of food items was determined by totalling the different food commodities mentioned in the dietary recalls. Examples of how food commodities were classified is as follows: the commodity "milk, full cream" included fresh and Ultra High Temperature (UHT) milk, but excluding milk blends and non-dairy creamers; "cheese" included all hard, ripened cheeses such as Cheddar, Feta and Gouda, but excluded fresh cheeses such as cottage cheese; "chicken" included all portions such as a breast, thigh or leg, but excluded combined dishes such as chicken pie. This is a far smaller variety than the variety indicated in the results from other studies conducted in the Western Cape. However, in these studies, men and women of a wider age group, namely 15 to 64, were involved. In the Coronary Risk Factor Study (CORIS), white respondents consumed 669 different food items, compared with the 459 food items consumed by the coloured respondents in the Coronary Risk Factor Study on the Coloured population (CRISIC), and the 303 food items consumed by the black respondents in the Coronary Risk Factor Study on the Black population (BRISK) (Wolmarans, 1999:3). Table 4.19 based on the two 24-hour dietary recalls indicates the 30 food commodity most often indicated to be consumed by the respondents.

Table 4.19 "Top 30" food and drink items consumed by respondents

Ranking	Food item	Ranking	Food item	Ranking	Food item
1	Sugar; white	11	Rice; white	21	Green beans; fresh
2	Potatoes; boiled, mashed, fried	12	Milk blends/ Non dairy creamers	22	Biscuits; commercial, home baked
3	Chicken; all portions	13	Beef; all cuts	23	Maize porridge; stiff, crumbly
4	Breakfast cereal, instant; all varieties	14	Potato crisps	24	Jam; any fruit variety
5	Bread; white	15	Chocolate; slabs and bars	25	Sweets
6	Coffee; filter, instant	16	Eggs	26	Green pepper; fresh
7	Milk; fresh and UHT, full cream	17	Pasta; white	27	Tomatoes; fresh, canned
8	Fruit juice; concentrate	18	Bread; brown	28	Lettuce; fresh
9	Margarine	19	Carrots; fresh, frozen	29	Apples; fresh
10	Cool drinks; squash and carbonated beverages	20	Butternut squash; fresh	30	Fish; fresh, canned

Some variety in food intake was found within the food groups. In the bread, cereal, rice and pasta group, white bread was consumed by 43.3% of the respondents, white rice was consumed by 30% of the respondents and refined pasta and brown bread were respectively consumed by 18.3% of the respondents. In three studies conducted in the Western Cape, white bread was listed as one of the ten food items eaten by most of the respondents. In the CORIS study, 46% of the respondents indicated consuming white bread, while 52% of the respondents in the CRISIC study and 47% of the respondents in the BRISK study indicated consuming this food item. White rice was also popular, as 45% of the respondents in the CORIS study indicated the consumption of white rice, 61% in the CRISIC study and 40% in the BRISK study. The consumption of brown bread varied from 30% in the CRISIC study to 33% in the BRISK study and 42% in the CORIS study (Wolmarans, 1999:3).

In this study, about 13% (13.3%) of the respondents respectively indicated consuming each of the following food items: maize porridge, "Weetbix", "Cornflakes" and "All-bran flakes". Other food items in this group indicated by fewer than 10% of the respondents included oats porridge (8.3%), muesli (5%) and samp (3.3%). In the BRISK study, 38% of the respondents indicated eating porridge, but porridge was not included in the top ten food items eaten by the respondents in either the CORIS or CRISIC studies (Wolmarans, 1999:3).

Instant breakfast cereals were more popular than cooked porridge as 43.3% compared to 21.6% of the respondents indicated consuming these food items. The choice of instant cereals reflects a shift from a more traditional diet towards a Western diet. Similarly to the township dweller, however for different reasons, students living in self-catering residences may lack time for the preparation of food items such as maize porridge and samp (Bourne & Steyn, 2000:S25). The lack of time may be due to the shared kitchen/cooking equipment or students not being willing to spend lengthy time periods preparing food items. In addition, pre-cooked and instant porridge may not be available at the supermarkets frequented by the respondents, and if available, may be more expensive than the uncooked forms.

In the vegetable group the most popular food item was self-prepared potatoes (consumed by 40% of the respondents). Potatoes were boiled by the respondents and then served with margarine, or mashed with margarine and/or milk or sliced and then shallow fried in margarine or oil. The second most popular vegetable, consumed by 20% of the respondents, was purchased potato crisps. Crisps were purchased either at the Technikon cafeteria or a fast-food outlet. Similarly, 62% of the respondents in the CORIS study indicated the consumption of potatoes, while 51% of the respondents in the CRISIC study and 44% in the BRISK study reported consuming potatoes (Wolmarans, 1999:3).

Other popular vegetables in this study included carrots (consumed by 15% of the respondents), butternut squash, green beans (consumed by 13.3% of the respondents respectively), tomatoes, green pepper and mixed green salad (all three consumed by 11.6% of the respondents) and mixed frozen vegetables (consumed by 8% of the respondents). Almost 2% (1.7%) of the respondents respectively indicated consuming the following vegetables: spinach, broccoli, peas, cabbage, sweet potato, mushrooms, beetroot, sweet corn and gem squash. Vegetables were mostly boiled with added sugar and/or margarine. In a study conducted at the University of the North, involving first-year female students, 82.4% of the respondents consumed roots and tubers, such as potatoes, beetroot, carrots and sweet potatoes. Other vegetables, such as cabbage, tomatoes, green beans, spinach, marrow, pumpkin/butternut squash, mixed vegetables and peas were consumed by 98.5% of these respondents (Nel & Steyn, 2001:121).

In the fruit group, 40% of the respondents indicated drinking fruit juice. However, 36% of these respondents consumed fruit nectars (brands such as "Halls" or "Cedar"), while only 4% indicated consuming fruit juices (brands such as "Liquifruit" or "Ceres"). The most popular fruit was apples (consumed by 11.7% of the respondents). This was followed by naartjies, bananas and raisins (all three consumed by 3.3% of the respondents). Other types of fruit consumed which were mentioned by single respondents included guavas, pears and grapes. In the study conducted at the University of the North, fruit was far more popular than in this study, with 98.5% of the respondents indicating the consumption of fruits, such as bananas, mangoes, grapes, oranges, peaches, pears, apples, pineapple, paw-paw, naartjies and fruit juices (Nel & Steyn, 2001:121). The study conducted at the University of the North utilized a quantified food frequency questionnaire which indicated the usual consumption of food items compared to this study in which the dietary intake were determined by using two 24-hour dietary recalls. This study was conducted in May, which has a limiting effect on the variety of fresh fruit available at retail outlets.

In the meat, poultry, fish, dry beans, eggs and nuts group, the most popular item was chicken, which was consumed by 60% of the respondents. This was followed by beef mince (consumed by 16.6% of the respondents), beef patties (consumed by 11.7% of the respondents), eggs (consumed by 20% of the respondents), fish (consumed by 10% of the respondents), and mutton stew (consumed by 6.3% of the respondents). Five percent of the respondents respectively indicated consuming ham, bacon, sausage, dried beans and chicken livers. One respondent indicated consuming soya mince. Slightly more than half (53.3%) of the respondents used frying in oil or margarine for cooking these food items.

In the CORIS study, mutton, chicken, beef, fish and sausage appeared in the "top 20" list of food items consumed by the respondents, while fish, beef, chicken and mutton appeared in the list of the CRISIC respondents. In the BRISK study only chicken appeared from this food group in the "top 20" list (Wolmarans, 1999:3). Chicken therefore seems to be a generally popular food item among South Africans.

In the milk, yoghurt and cheese group, 40% of the respondents consumed full-cream milk, while 1.7% respectively consumed low-fat and skimmed milk. In this study 34 of the respondents (56.6%) did not consume milk. In the CORIS study, 78% of the respondents indicated consuming full cream milk, while 57% of the respondents in the CRISIC study and 45% of the respondents in the BRISK study indicated consuming this food item (Wolmarans, 1999:3). About 28% (28.3%) of the respondents in this study used a creamer and 5% used a milk blend. Hard cheeses, such as Cheddar and Gouda, were consumed on bread or pizzas by 8.3% of the respondents. About 7% (6.7%) of the respondents reported consuming fruit flavoured, sweetened yoghurt and two respondents (3.3%) drank a dairy and fruit juice blend.

Only 13.3% of the respondents (n = 8) indicated that they usually ate the same or similar food during the holidays compared with during the term (Addendum C, Section D, Question D2). An additional 13.3% (n = 8) indicated that they sometimes followed the same pattern. Although there was a large discrepancy between the number (76.7%) of respondents (n = 46) who indicated usually or sometimes eating the same food during the term, and the number (26.6%) of respondents (n = 16) who indicated usually or sometimes eating the same food during the holidays as during the term there was no significant difference ($p > 0.05$; $p = 0.553$) between the responses regarding eating habits during the term and eating habits during the holidays. During the official Technikon holidays, which are scheduled in June/July and mid-November to the end of January, the residences are closed and students have to return home or find alternative accommodation. Possible reasons for the difference in food intake are that students may have more time available for food preparation or may not be responsible for the preparation of their meals during the holidays. The person(s) preparing the food may be more skilled in food preparation, thus preparing different food items than the students themselves. If respondents come from a rural area, a more traditional diet may possibly be followed at home.

The results of studies conducted in the USA were disappointing with regard to dietary variety. Anding et al. (2001:169) found that none of the female college students filling in a three-day dietary record indicated eating a variety of food. In the study by Anding et al. (2001:168), variety was evaluated by comparing the students' intake with the suggested number of servings recommended by the United States Department of Agriculture Food Guide Pyramid. Similarly Haberman and Luffey (1998:191) reported that the majority (76%) of students, male and female, reported eating the same foods day after day. Both students living on- as well as off-campus reported a lack of dietary variety. These researchers speculated that possible reasons for this were the students' choice of "diet" or low-energy foods, the lack of cooking experience of many students, as well as time constraints. In contrast, in a study involving first-year female students at the University of the North, a variety of food items were consumed. The researchers hypothesised that the reason for this was the numerous traditional and fast food outlets in the specific area (Nel & Steyn, 2001:118).

In this study, the additional fats, oils and sweets group showed the most variety in food items consumed with a total of 45 different items. The most often indicated food items included sweets and chocolates as snack food items and potato fries as fast food items. However, dietary variety should be applied in conjunction with the other Food-Based Dietary Guidelines as more variety should not lead to an increase in processed foods, which may be high in fat, sugar and/or sodium and low in micronutrients (Maunder et al., 2001:S8).

4.5.1.2 Activity level

A further Food-based Dietary Guideline urges South Africans to *"be active"* (Vorster et al., 2001:S3). This guideline is based on the link between regular physical activity and the lowered risk of chronic lifestyle diseases, such as hypertension, cardiovascular disease, diabetes mellitus and cancer (Lambert et al., 2001:S12). According to the American College of Sports Medicine, and the United States Centers for Disease Control, individuals should attempt *"to accumulate 30 minutes or more of moderate-intensity physical activity on most, preferably all, days of the week"* (Pate et al., 1995:402).

More than half (65%) of the respondents (n = 39) in this study described their lifestyle as active, while 18.3% described it as very active (Addendum C, Section D, Question D18). However, only 50% of the respondents (n = 25) who indicated that they followed an active or very active lifestyle (n = 50) indicated that they accumulated 30 minutes or more of moderately intensive exercise on most days of the week (Addendum C, Section D, Question D19). Twenty-eight percent of the respondents (n = 14) thought that they achieved this goal sometimes. A possible reason for this discrepancy could be an overestimation of their activity level by some of the respondents. In addition, the respondents who indicated that they were very active may participate or additionally participate in more vigorous exercise activities and may as such not have indicated it as moderate intensive exercise. Only 16.7% of the respondents (n = 10) reported an inactive lifestyle.

Anding et al. (2001:168) found that only one-third of the female student respondents in a study conducted in the USA indicated exercising regularly. According to the National College Health Risk Behaviour Survey conducted in the USA in 1995, 35.3% (± 3.0) of female students, aged 18 to 24 years, reported engaging in vigorous physical activity (activities that caused sweating and hard breathing) for 20 minutes or more on three or more days of the seven days preceding the survey. A further 20.8% (± 2.6) of female students reported moderate physical activities (walking or bicycling) for 30 minutes or more on five or more days of the seven days preceding the survey (Center for Disease Control, 1997:18). However, Beerman et al. (1990:217) found that 75% of the student respondents reported exercising regularly (1 - 3 times per week), while 6% reported occasionally (1 – 4 times per month) and 19% reported that they rarely exercised (less or equal to 6 times per year). In contrast, Makrides et al. (1998:171) reported that fewer than half of the students participated in exercise three or more times per week.

Students who are inactive during their study years are likely to become sedentary adults (Anderssen et al., 1996:351), escalating the risk of lifestyle diseases. Regular physical activity has physical, emotional and mental advantages. It promotes cardiovascular fitness, enhances muscle tone, increases bone density and helps maintain optimal body weight (Haberman & Luffey, 1998:192), as it reduces body fatness and increases lean tissue (Sizer & Whitney, 2003:4). It lowers serum triglyceride concentrations, increases high-density lipoprotein concentrations and improves tissue sensitivity to insulin (Williams, 1993:426). Physical activity also improves mental functioning, bolsters self-confidence and lessens the likelihood of depression (Sizer & Whitney, 2003:4).

4.5.1.3 Food groups

The self-reported dietary intake, based on the information from two 24-hour dietary recalls (Addendum C, Sections E & G) was compared to the food groups as indicated in the Daily Food Guide (Williams, 1993:10) (Addendum A). Interviewers were instructed (see Section 3.82 and Addendum D, Section D) to record the food items and amounts consumed by the respondents as accurately as possible for comparison to the servings and serving sizes within each of the food groups as indicated by the Daily Food Guide (Williams, 1993:10; Whitney et al., 2002:36).

(i) Bread, cereal, rice and pasta group

According to the Daily Food Guide, 6 to 11 servings should be consumed daily from this group, with an intake of 9 servings recommended for teenage girls and active women (Whitney et al., 2002:42). In addition, the Food-Based Dietary Guidelines for South Africa recommend: "*Make starchy foods the basis of most meals*" (Vorster et al., 2001:S3). According to Vorster and Nel (2001:S17), this recommendation should be accompanied by advice to choose unrefined or minimally processed grains and cereals where possible.

High carbohydrate foods such as cereals, grains and some root vegetables are good sources of dietary energy. They are also a valuable source of micronutrients and dietary fibre when consumed in a minimally processed form. These foods also add protein to the diet. Foods high in starch, resistant starch and non-starch polysaccharides or dietary fibre influence health and prevent chronic diseases such as obesity, non-insulin-dependent diabetes mellitus, cardiovascular disease, cancer and other gastro-intestinal diseases. This is achieved by directly influencing the digestion, absorption, fermentation and metabolism of nutrients and indirectly by providing micronutrients and phytochemicals and by replacing fat and animal protein in the diet (Vorster & Nel, 2001:S17).

In this study, only 15 respondents (25%) indicated that they consumed 9 or more servings from this group. Intakes varied from 0 to 18 servings with a mean intake of 6.54 (± 3.75) servings meeting the recommended servings as indicated above. Table 4.20 indicates the respondent serving intakes from the bread, cereal, rice and pasta group. Fewer than half (44.9%) of the respondents (n = 27) reported consuming any of the foods from the breads, cereal, rice and pasta group in a wholegrain form. Wholegrain food items included brown bread (consumed by 18.3% of the respondents), "All-bran flakes" and "Weetbix" (both consumed by 13.3% of the respondents). In addition, low intakes from the fruits and vegetables groups were noted.

Table 4.20 Mean (SD) servings consumed from the bread, cereal, rice and pasta group

Daily Food Guide *			**Number of servings consumed by respondents (n = 60)**			
Food group	**Recom-mended serving intake ****	**Serving sizes**	**Mean**	**Median**	**Mini-mum**	**Maximum**
Bread, cereal, rice and pasta group	9	1x30 g slice bread 125 ml (½ cup) rice, cooked cereal, pasta 30 g (½ cup) ready-to-eat cereal ½ bread roll	6.54 (±3.75)	6.0	0	18

SD(±) = Standard deviation

* Adapted from the USA Department of Agriculture, revised edition of former *Basic Four Food Groups Guide*, 1985 (Williams, 1993:10).
** Whitney et al. (2002:42)

Anding et al. (2001:168) reported similar results from a study involving female college students in the USA where the majority of the respondents did not meet the minimum daily number of portions from the bread, cereal, rice or pasta group. Cotunga and Vickery (1994:418) used a food frequency questionnaire and found that only 16% of the participants in their study consumed the recommended 6 to 11 servings per day. In the study by Cotunga and Vickery (1994:418) 70% of the respondents were female and 18% male. Their ages ranged from 17 to 44 years with a mean of 21.1 years. The mean serving intake of bread, cereals, rice and pasta for this group was 4.1.

Considering the intake of whole grain food items, Beerman et al. (1990:217) reported that 57% of the respondents in a study conducted with female college students in the USA consumed about 1 serving of wholegrain bread per day and 25% of the respondents had between 1 and 6 servings of wholegrain bread per week. In contrast, 86% of the respondents involved in the First-Year Female Students Project conducted at the University of the North, indicated consuming brown bread or rolls, with fewer than half (48.5%) of the respondents indicating eating white bread or rolls (Nel & Steyn, 2001:118).

(ii) Vegetable and fruit groups

The Daily Food Guide recommends that 5 to 9 servings should be consumed per day with 4 servings from the vegetable group and 3 servings from the fruit group for teenagers and active women (Whitney et al., 2002:42). A minimum of 5 servings a day (2 servings of fruit and 3 servings of vegetables) is recommended by the 5-a-day for Better Health Campaign. In addition, the Food-Based Dietary Guidelines for South Africa state that all healthy persons aged two and older should "*eat plenty of vegetables and fruits every day*" (Vorster et al., 2001:S3).

According to Love and Sayed (2001:S24), there is sufficient evidence to support the increased consumption of fruits and vegetables as protection against cancers and cardiovascular disease. Fruits and vegetables, especially, have a protective effect against cancers of the oesophagus, stomach and lungs. In terms of cardiovascular disease, the intake of flavonoids, potassium, folic acid and dietary fibre is important. Although the evidence presently points to the role of specific vegetables (e.g. onions, carrots, broccoli and tomatoes) and fruits (e.g. citrus fruit) in disease prevention, the best overall advice according to Love and Sayed (2001:S24) is to encourage the intake of all fruits and vegetables as there may be many unidentified substances in these foods that may play a role.

In this study, only 6 respondents (10%) consumed 4 or more servings of vegetables. An additional 6 respondents (10%) consumed 3 to 3.5 servings, 17 respondents (28.3%) 2 to 2.5 servings and 10 respondents (16.7%) 1 to 1.5 servings. Five respondents (8.3%) did not consume any vegetables. The intake of fruit was as low with only 5 respondents (8.3%) consuming 3 or more servings of fruit. A further 5 respondents (8.3%) consumed 2 to 2.5 servings and 20 respondents (33.3%) 1 to 1.9 servings. Half (50.1%) of the respondents (n = 30) did not consume any fruit. Possible reasons for the low intake of vegetables and fruit may lie in the perceived cost and work associated with the preparation of fresh produce. Table 4.21 indicates the respondent intakes from the vegetable and fruit groups.

Table 4.21 Mean (SD) servings consumed from the vegetable and fruit groups

Daily Food Guide *			**Number of servings consumed by respondents (n = 60)**			
Food group	**Recom-mended serving intake ****	**Serving sizes**	**Mean**	**Median**	**Mini-mum**	**Maximum**
Vegeta-bles	4	125 ml (½ cup) cooked or raw vegetables 250 ml (½ cup) leafy raw vegetables	1.40 (±1.56)	1.0	0.0	6.5
Fruits	3	1 medium fruit 1 melon wedge 190 ml (½ - ¾ cup) fruit juice 125 ml (½ cup) canned fruit 65 ml (¼ cup) dried fruit	0.72 (±0.99)	0.0	0.0	4

SD(±) = Standard deviation

* Adapted from the USA Department of Agriculture, revised edition of former *Basic Four Food Groups Guide*, 1985 (Williams, 1993:10).
** Whitney et al. (2002:42)

Although studies conducted in the USA among female college students also indicate low intakes of fruit and vegetables, the results were more in line with the guidelines than in this study. According to the National College Health Risk Behavior Survey conducted in 1995, only 23.3% (± 2.5) of female students aged 18 to 24 years indicated eating 5 or more servings of fruit and vegetables during the day preceding the survey (Center for Disease Control, 1997:34). Cotunga and Vickery (1994:418) reported that 56% of the respondents consumed the recommended 2 to 4 servings of fruit, while 27% of the respondents consumed the recommended 3 to 5 servings of vegetables. Thus, fewer than half of the respondents (42%) consumed a combined total of 5 servings for fruit and vegetables per day. Anding et al. (2001:167) found that only 15% of the respondents consumed 5 or more servings of fruit and vegetables daily and Hizza and Gerrior (2002:7) reported a mean intake of 2.5 servings for vegetables and 1.4 servings for fruit for female college students.

In South Africa, the national survey conducted in 1991 showed that the black population group did not consume adequate amounts of vegetables and fruit. Only 22% of the respondents almost daily consumed 4 or more portions, while 29% of the respondents almost daily consumed between 1 and 3 portions. Twenty-three percent of the respondents consumed 4 or more portions daily, but on fewer than 4 days per week and 21% consumed fewer than 4 portions daily on fewer than 4 days per week. Two percent of these respondents indicated not consuming any vegetables or fruit (Langenhoven et al., 1995:523).

(iii) Meat, fish, poultry, dry beans, eggs and nuts group

Based on the Daily Food Guide (Williams, 1993:10), 2 to 3 servings should be consumed daily from the meat, fish, poultry, dry beans, eggs, and nuts group, with a recommended 2 servings for teenage girls and active women (Whitney et al., 2002:42). The South African Food-Based Dietary Guidelines recommend that "*meat, fish, chicken, milk or eggs could be eaten daily*" (Vorster et al., 2001:S3).

If foods from animals are eaten in moderation, they can contribute to an improvement in nutritional status, as these foods are the best sources of high quality protein as well as valuable sources of iron, zinc, thiamin, riboflavin and omega-3 fatty acids. However, over-consumption of these foods may increase the intake of saturated fats and increase the risk of chronic diseases, such as coronary heart disease and cancer (Scholtz et al., 2001:S39).

The number of servings eaten from the meat, fish, poultry, dry beans, eggs and nuts group in this study, although low, is more in line with the guidelines than the intake from the fruit and vegetable groups, as 27 respondents (45%) consumed 2 or more servings (Table 4.22).

Table 4.22 Mean (SD) servings consumed from the meat, fish, poultry, dry beans, eggs and nuts group

Daily Food Guide *			**Number of servings consumed by respondents (n = 60)**			
Food group	**Recom-mended serving intake** **	**Serving sizes**	**Mean**	**Median**	**Mini-mum**	**Maximum**
Meat, fish, poultry, dry beans, eggs and nuts	2	90 g lean meat, fish or poultry 60 ml (4 tablespoons) peanut butter 125 ml (½ cup) nuts	1.48 (±1.10)	1.5	0.0	5.0

SD(±) = Standard deviation

* Adapted from the USA Department of Agriculture, revised edition of former *Basic Four Food Groups Guide*, 1985 (Williams, 1993:10).
** Whitney et al. (2002:42)

Similar results regarding the intake from the meat, fish, poultry, dry beans, eggs and nuts group were found in studies conducted in the USA involving female college students. Cotunga and Vickery (1994:418) reported that 41%

of the respondents daily consumed the recommended 2 to 3 servings from this food group. However, DeBate et al. (2001:819) found that almost 60% of the respondents consumed 2 servings per day and Anding et al. (2001:168) reported that all the respondents met the minimum intake of 2 servings for this group.

Legumes, such as dry beans, may form part of this group as indicated by the Daily Food Guide. In addition, the South African Food-based Dietary Guidelines state "*eat dry beans, peas, lentils and soya regularly*" (Vorster et al., 2001:S3). Legumes are economical dietary sources of good quality protein, carbohydrates, soluble and insoluble dietary fibre components and a variety of minerals and vitamins, such as calcium, magnesium, potassium, thiamin, riboflavin and folic acid. In addition, these foods have a low energy, fat and sodium content. Soya foods may also contribute to polyunsaturated fatty acid intake. Although 25g of soy protein per day may be required to obtain a cholesterol lowering effect, the inclusion of some soy foods on a weekly basis may already provide health benefits (Venter & Van Eyssen, 2001:S32).

Respondents were asked whether they usually ate dry beans, peas or lentils, and 24 respondents (40%) answered affirmatively (Addendum C, Section D, Question D3). An additional 7 respondents (11.7%) indicated that they sometimes ate these food items. Although approximately half (51.7%) of the respondents (n = 31) in this study indicated eating these foods, none of the respondents indicated eating these foods on a daily basis (Addendum C, Section D, Question D4). Fewer than half of the respondents (41.9%; n = 25) reported eating them once or twice a week. Fifteen respondents (48.3%) reported eating these foods once or twice a month and 3 respondents (9.6%) indicated eating them only during the holidays.

Respondents were also asked about their intake of textured vegetable protein products (Addendum C, Section D, Question D5). These products are cheaper than red meat, poultry and fish and quick to prepare. However, only 18 respondents (30%) indicated that they consumed these products, with an additional 4 respondents (6.7%) indicating that they consumed these products sometimes. Six respondents (27.2%) indicated eating them 3 to 6 times a week, while 9 respondents (40.9%) indicated eating these products 2 times or less a week and 10 respondents (45.4%) indicated eating soy mince products only once or twice a month (Addendum C, Section D, Question D6).

In a study involving first-year female students at the University of the North, 21% of the respondents indicated eating dry beans, with an average intake of 40.2 g per day. Almost four percent (3.7%) of the respondents indicated eating split peas and 7.4% eating bean soup. About 15% (15.4%) of the students indicated eating soybean dishes, such as Imana or Toppers, with an average intake of 32.9g per day (Nel & Steyn, 2001:118).

(iv) Milk, yoghurt and cheese group

The Daily Food Guide recommends an intake of 3 servings a day for teenagers and young adults from the milk, yoghurt and cheese group (Whitney et al., 2002:42). Milk is also included as part of the South African Food-Based Dietary Guideline *"meat, fish, chicken, milk or eggs could be eaten daily"* (Vorster et al., 2001:S3). The intake from the milk, yoghurt and cheese group is particularly low, with no respondent consuming the recommended 3 servings (Table 4.23).

Table 4.23 Mean (SD) servings consumed from the milk, yoghurt and cheese group.

Daily Food Guide *			**Number of serving consumed by respondents (n = 60)**			
Food group	**Recom-mended serving intake ****	**Serving sizes**	**Mean**	**Median**	**Mini-mum**	**Maximum**
Milk, yoghurt and cheese	3	250 ml (1 cup) milk or yoghurt 45 g cheese 500 ml (2 cups) cottage cheese	0.62 (±0.65)	0.5	0.0	2.5

SD(±) = Standard deviation

* Adapted from the USA Department of Agriculture, revised edition of former *Basic Four Food Groups Guide*, 1985. (Williams, 1993:10)
** Whitney et al. (2002:42)

The low intake of milk is a cause for concern as milk, yoghurt and cheese are excellent sources of calcium, riboflavin and vitamin B_{12}. A low bone mineral density (BMD) is regarded as the most important risk for the development of osteoporosis. Although peak BMD is largely genetically determined, factors such as diet, particularly calcium intake, and physical activity may contribute significantly to the development of this disease (Anon, 1999b:22). Adequate calcium intakes are especially important for female students as 90% of total bone mass is achieved by the age of 16.9 years, 95% by the age of 19.8 years and 99% by the age of 26.9 years (Scholtz et al., 2001:S39). In the USA, a lower fracture rate exists in the African American population group, linked in part to their 10 – 15% higher peak BMD (Anon, 1999b:22). However, mean BMD values in the South African black population appear to be significantly lower than those of their American black counterparts (Hough, 2001:114), which may place them at a higher risk of osteoporosis.

French et al. (2003:1326) examined the dietary intake data from three national surveys conducted in the USA and found that the prevalence of soft drink consumption among the youth increased by 48% from 1977 to 1998. In addition, the average intake of soft drinks more than doubled. Harnack et al.

(1999:436) concluded that the substitution of milk by carbonated drinks and cool drinks is common among adolescents. This practice not only displaces the nutrients from milk, but also impairs the absorption of calcium due to the high phosphorus content of carbonated beverages (Miller & Maropis, 1998:193). A diet that does not include 2 to 3 servings of these foods a day also increases the risk of deficient intakes of magnesium, vitamin D and possibly zinc and iron (Weaver, 2000:S579).

A further reason for the poor intake of milk may lie in the perishable nature of fresh milk. This may lead to consumers buying fewer perishable "milk" products. However, most of the substitutes used in the place of fresh milk do not have the same nutritional value as milk. Seventeen respondents (28.3%) indicated that they made use of a non-dairy creamer to add to tea, coffee and/or with breakfast cereal. This percentage is higher than the approximate 10% indicated by Wolmarans (1999:4) based on the data from the CORIS, CRISIC and BRISK studies. However, in a study conducted by Steyn et al. (1990:23) involving adolescents in the Western Cape, 6 to 18% of urban and 4 to 25% of rural children consumed non-dairy creamers.

Studies conducted in the USA among college students found a correspondingly low intake from the milk, yoghurt and cheese group. Anding et al. (2001:168) reported that all the respondents failed to meet the minimum number of servings from this group. The mean intake was 1.3 (± 0.9) servings. Cotunga and Vickery (1994:418) reported that 44% of their respondents consumed the recommended 2 to 3 servings. In the study by Cotunga and Vickery (1994:418) 70% of the respondents were female and 18% male. Their ages ranged from 17 to 44 years with a mean of 21.1 years. The mean intake was 2.0 servings. DeBate et al. (2001:819) found that 48.3% of the respondents in their study met the minimum intake of 2 servings from this group per day.

In a study conducted at the University of the North a quantified food frequency questionnaire was used to collect dietary data from 413 black female first year students. Almost three quarters of these respondents (72.8%) reported drinking milk, but the average intake was only 129 g (equivalent to about ½ cup) per day. In addition, 39%, 10.3% and 13.2 % of the respondents respectively indicated drinking low fat yoghurt, skimmed milk yoghurt or buttermilk /maas. Quantities consumed were again small, with a combined average of 210.4 g (equivalent to almost 1 cup) per person. Half (51.5%) of the respondents indicated eating cheese with an average intake of 29.9g (slightly more than ½ of a serving) per day (Nel & Steyn, 2001:120). Low intakes of milk were also found in a national survey undertaken in 1991, where more than 50% of Black South Africans reported that they consumed less than 200 ml of milk per day (Langenhoven et al., 1995:523), which equals less than one serving per day.

(iv) Additional group

The additional group, titled fats, oils and sweets in the Daily Food Guide, have no serving suggestions, but should be used sparingly as they contribute few nutrients (Whitney et al., 2002:37). The South African Food-based Dietary Guidelines recommend the following in this regard: *"Eat fats sparingly"* (Vorster et al., 2001:S3) and *"Eat food and drinks containing sugar sparingly and not between meals"* (South African Department of Health, 2003:1).

The dietary intakes of the respondents in this study were scrutinised for the presence of fast foods and snacks. Fast foods included potato chips, pies, pizza, sausage rolls and vetkoek, and snacks included carbonated drinks, cool drinks, sweets, chocolates, potato crisps, cakes, tarts, cookies, muffins and ice cream. More than half (58.7%) of the respondents (n = 35) consumed snacks. The consumption of fast foods was lower with intakes indicated in only 21.7% of the diets. In addition, in this study slightly more than half (53.3%) of the respondents (n = 32) used frying in oil or margarine as a cooking method when preparing food.

Paeratakul et al. (2003:1332) found that adults and children who reported eating fast food in a study conducted in the USA had higher intakes of energy, fat, saturated fat, sodium and lower intakes of vitamins A and C. Studies have shown that an increased fat intake, especially of saturated fatty acids, is associated with cardiovascular disease, obesity, breast, colon and prostate cancers. To prevent these chronic lifestyle diseases, fat intakes from animal sources and non-dairy creamers should be lowered and unsaturated tub margarine and oils used rather than hydrogenated and animal fats. In addition, the use of fat in food preparation should be limited (Williams, 1993:76; Sizer & Whitney, 2003:142). Reducing fat in the diet has the potential to substantially decrease morbidity and mortality (Kuller, 1997:S9).

In this study, the majority (73.3%) of respondents (n = 44) reported adding sugar to coffee or tea or sprinkling it over breakfast cereal or porridge. Sugar was also first on the list of the "top thirty foods " listed in this study (see Section 4.5.1.1, Table 4.18), first in the "top ten" foods consumed in the CRISIC study (87% of the respondents reported consuming sugar) and well as in the BRISK study (reported by 75% of the respondents). It was second from the top, following coffee in the CORIS study, where 78% of the respondents reported consuming sugar (Wolmarans, 1999:3).

In this study, the respondents' intake of added sugar was measured against the 12 teaspoons (48 g) guideline of the USA Department of Agriculture for teenage girls and active women (Whitney et al., 2002:42). The added sugar intake of the respondents in this study averaged 45.9 g (± 28.5). This is lower than the sugar intakes reported by Steyn et al. (2000a:53), in which black female students with an urban background consumed a mean intake of 65.8 g of sugar and those with a rural background consumed 52.2 g of sugar.

In many developing countries, the incidence of obesity increases as sugar consumption rises. No evidence, however, links sugar consumption to obesity as food items that are high in sugar are often also high in fat and thus have a high energy value. Total sugar intake plays a role in dental health. Populations whose diets provide more than 10% of energy intakes from sugar, also have a high incidence of dental caries. However, the effect of sugar is linked to the time in which the teeth are exposed to the sugar-containing food item (Sizer & Whitney, 2003:130).

4.5.1.4 Salt usage and intake

The South African Food-based Dietary Guidelines recommend the following: *"Use salt sparingly"* (Vorster et al., 2001:S3). In this study, respondents were asked whether they liked salty foods (Addendum C, Section D, Question D7). In answer to this question, 21 respondents (35%) answered affirmatively, while an additional 12 respondents (20%) indicated that they sometimes liked salty food. Although 55% of the respondents (n = 33) indicated that they usually or sometimes liked salty food, only 28.3% (n = 17) usually sprinkled salt over food at the table or when eating snacks (Addendum B, Section D, Question D8). An additional 14% (n = 8) indicated that they followed this behaviour sometimes. Only 5 (19.2%) of the respondents who sprinkled salt over their food or snacks indicated not first tasting the food before adding salt (Addendum C, Section D, Question D9). An excessive intake of salt leads to an increase in blood pressure in genetically susceptible persons, and if the high intake continues over a long term it may result in hypertension. If salt is used sparingly in the preparation of meals and at the table, and the intake of processed foods high in salt is limited, the average intake of approximately 9g can be decreased to 6g sodium chloride per day. The latter amount is currently recommended by the USA dietary guidelines (Charlton & Jooste, 2001:S55).

In South Africa, it is estimated that approximately 3.3 million people are hypertensive (defined as blood pressure equal to or higher than 160/95 mm Hg and/or on antihypertensive medication). The South African Demographic and Health Survey conducted in 1998 indicated a higher prevalence in women (13% were diagnosed as hypertensive), compared with men (11% were diagnosed as hypertensive) (South African Department of Health, 1999:4). Studies conducted in South Africa have indicated a higher salt sensitivity among black patients with hypertension compared with white patients with hypertension (Touyz et al., 1993:693; Worthington et al., 1993:291).

4.5.1.5 Water intake

The South African Food-based Dietary Guidelines recommend the following regarding water intake: "*Drink lots of clean, safe water*" (Vorster et al., 2001:S3). In response to the question in the questionnaire on whether they routinely drank water, the majority (76.7%) of the respondents (n = 46) indicated affirmatively, while an additional 6.7% of the respondents (n = 4) indicated that they sometimes drank water (Addendum C, Section D, Question D10). Approximately 17% (16.7%) of the respondents (n = 10) indicated that they did not drink water. Based on the information from the two 24-hour dietary recalls it was determined that 43.3% of the respondents (n = 26) consumed tea and/or coffee, 40% consumed fruit juices (n = 24), and 33.3% cool drinks, either squashes or carbonated beverages (n = 20). Only two respondents (3.3%) indicated not consuming any form of beverage on the two days comprising the 24-hour dietary recalls.

Although the majority of respondents (83.4%; n = 50) indicated consuming water (Addendum B, Section D, Question D10), only 14% of the respondents (n = 7) reported drinking the 2.2 l per day recommended by the US National Research Council for women under average conditions (Bourne & Seager, 2001:S64) (Addendum C, Section D, Question D11). Figure 4.7 indicates the daily water consumption of the respondents.

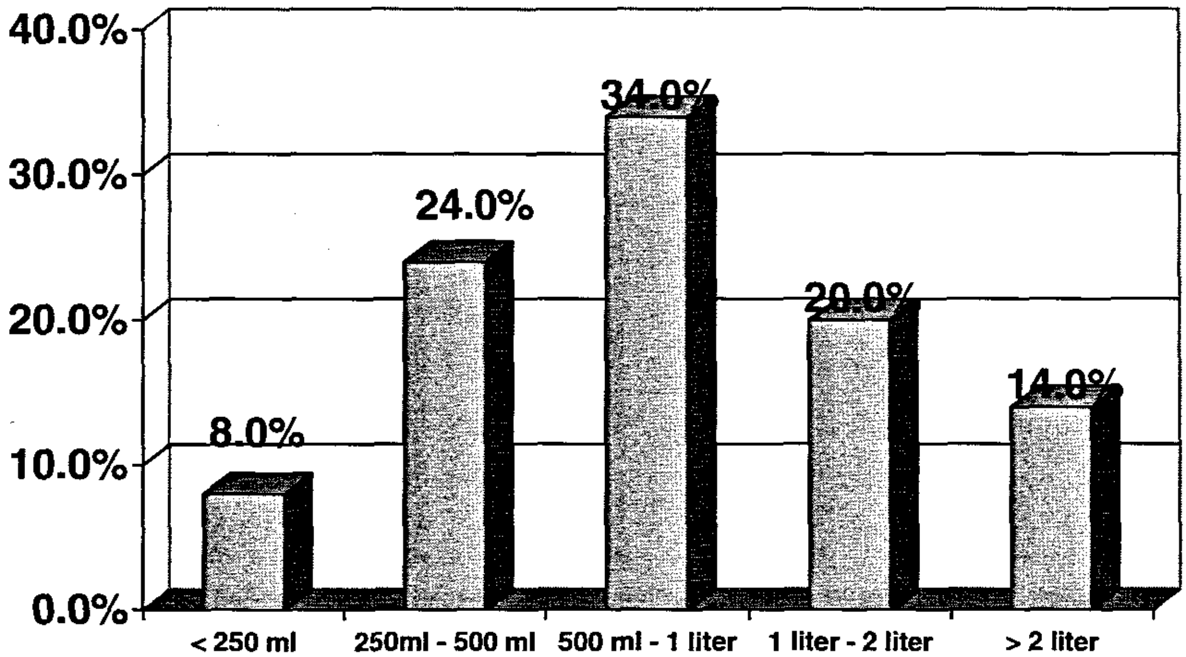

Figure 4.7 Daily water consumption of respondents (n = 50)

According to Williams (1993:270) and Sizer & Whitney (2003:267), water is an essential nutrient as well as a major component of the thermoregulatory process in the body. A daily intake of up to 2 litres of safe, clean water is desirable for optimum hydration and may be taken in the form of tap water, beverages such as tea and coffee, and other tap water-based drinks.

4.5.1.6 Alcohol consumption

The South African Food-based Dietary Guidelines indicate the following regarding the intake of alcohol: "*If you drink alcohol, drink sensibly*" (Vorster et al., 2001:S3). More than half (55%) of the respondents (n = 33) indicated that they usually (48.3%; n = 29) and sometimes (6.7%; n = 4) consumed alcoholic drinks (Addendum C, Section D, Question D12). The frequency of consumption was relatively low with 24.2% of the respondents (n = 8) consuming alcoholic drinks twice a week, 24.2% once a week (n = 8) and the rest (51.5%; n = 17) indicating that they consumed alcoholic drinks less than once a week (Addendum C, Section D, Question D13). This compares well with the recommendations of the Australian National Health and Medical

Research Council that at least two days per week should be alcohol-free (Van Heerden & Parry, 2001:S71).

However, the amounts consumed at a time were far in excess of the recommendation that women consume no more than two standard drinks (1 drink = 340 ml cooler/cider, 120 ml wine or 25 ml spirits) of alcohol per day as more than half (51.5%) of the respondents (n = 17) indicated drinking 4 to 6 drinks at a time (Addendum C, Section D, Question D14). Females consuming more than 4 drinks at a time are considered practicing binge drinking (Munro, 2002:9). Figure 4.8 indicates the alcohol consumption of the respondents.

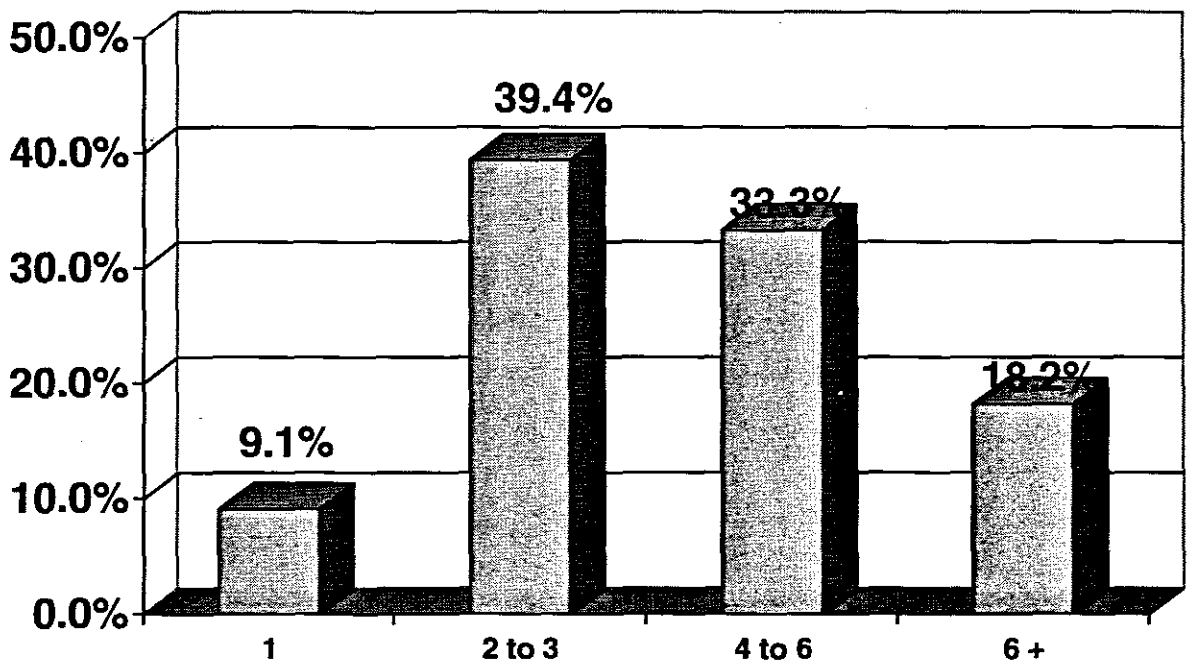

Figure 4.8 Number of alcoholic drinks usually consumed at a time (n = 33)

The findings of this study show some similarity to female college student alcohol consumption trends in the USA. According to the National College Health Risk Behavior Survey conducted in 1995, 67% of female college students had had at least one drink of alcohol during the 30 days preceding the survey. However, only a small percentage (1.6%) indicated that they had drunk alcohol on 20 or more of the 30 days preceding the survey (Center for Disease Control, 1997:7). Anding et al. (2001:169) found that only 13% of the respondents reported consuming alcohol during a three-day dietary record survey. Beerman et al. (1990:215) reported that 23% of female respondents consumed between 1 and 6 servings of beer per week and Cotunga and Vickery (1994:418) found that although 29% of respondents abstained from alcohol completely, 15% drank more than the dietary guideline limit of two servings per day. In addition, in a study conducted at the University of Iowa, 44% of the students (male and female) who consumed alcohol binged, and 19% of these students binged three or more times per week (Munro, 2002:9).

Misuse of alcohol, especially binge drinking, has detrimental effects on the health of adults and affects most of the organs in the body. Heavy drinking is also associated with a wide variety of negative social and economic effects, such as absenteeism from work/studies, road accidents and use of financial resources for drinking (Van Heerden & Parry, 2001:S71). Alcohol abuse among college students can lead to problems with academic achievement owing to lower class attendance and memory loss, violent behaviour, vandalism, theft, promiscuity and physical and emotional injuries (Wechsler & Isaac, 1992:2929; Munro, 2002:3; Peltzer, 2003:1097). In a study conducted at Rhodes University, all the students who consumed alcohol admitted that it influenced their health, and 68.8% indicated that they often experienced memory loss (Munro, 2002:9).

4.5.2 Supplement use

According to the Alternative Healthy Eating Index, the intake of multivitamins is recommended as a measure to reduce the risk of cardiovascular disease (McCullough et al., 2002:1261). In this study, only 16.7% of the respondents (n = 10) reported usually taking a vitamin and/or mineral supplement (Addendum C, Section D, Question D15). An additional 5% (n = 3) indicated taking a supplement sometimes. All the respondents (n = 13) that reported taking a supplement indicated following the dosage instructions on the label (Addendum C, Section D, Question D16). In a study conducted in the USA, a far larger percentage (34%) of female college student respondents indicated taking a nutritional supplement regularly. In the USA study, the intake of nutrient supplements increased the dietary adequacy score, especially in relation to iron (Jakobovits et al., 1977:407).

4.5.2 Meal patterns

In this study only 6 students (10%) indicated consuming all three meals either daily or 5 to 6 days per week (Addendum C, Section E, Questions E1, E2, E9, E10, E17, E18). Twenty three respondents (38.8%) indicated skipping one of the three meals daily or 5 to 6 days per week. Beerman et al. (1990:217) found in a study involving female college students in the USA that 64% of the respondents reported regularly skipping meals, while only 36% of the respondents reported rarely skipping meals. DeBate et al. (2001:819) in a study involving male and female college students, found that 36.6% of the students reported that they always ate breakfast, 81.0% reported always eating lunch and 90.2% reported always eating dinner. DeBate et al. (2001:819) hypothesised that the general failure of the respondents to meet the recommended number of servings from all the food groups, with the exception of the meat group, was due to the large percentage of students who skipped meals and consumed fast foods regularly.

4.5.3.1 Breakfast

Seventy percent of the respondents (n = 42) reported that they usually ate breakfast, while 18.3% of the respondents reported that they sometimes ate breakfast (Addendum C, Section E, Question E1). Almost 40% (39.6%) of these respondents (n = 21) indicated that they ate breakfast on a daily basis; while 15.1% of these respondents (n = 8) indicated that they ate breakfast 5 to 6 days a week (Addendum C, Section E, Question E2). The remainder of these respondents (n = 24) reported that they ate breakfast fewer than five days a week. This indicates that about 45% (45.2%) of these respondents regularly skipped breakfast as they ate breakfast on only 2 to about 4 days of the week. In addition, 7 respondents (11.7%) indicated that they did not usually eat breakfast. Figure 4.9 indicates the frequency of breakfast consumption in this study.

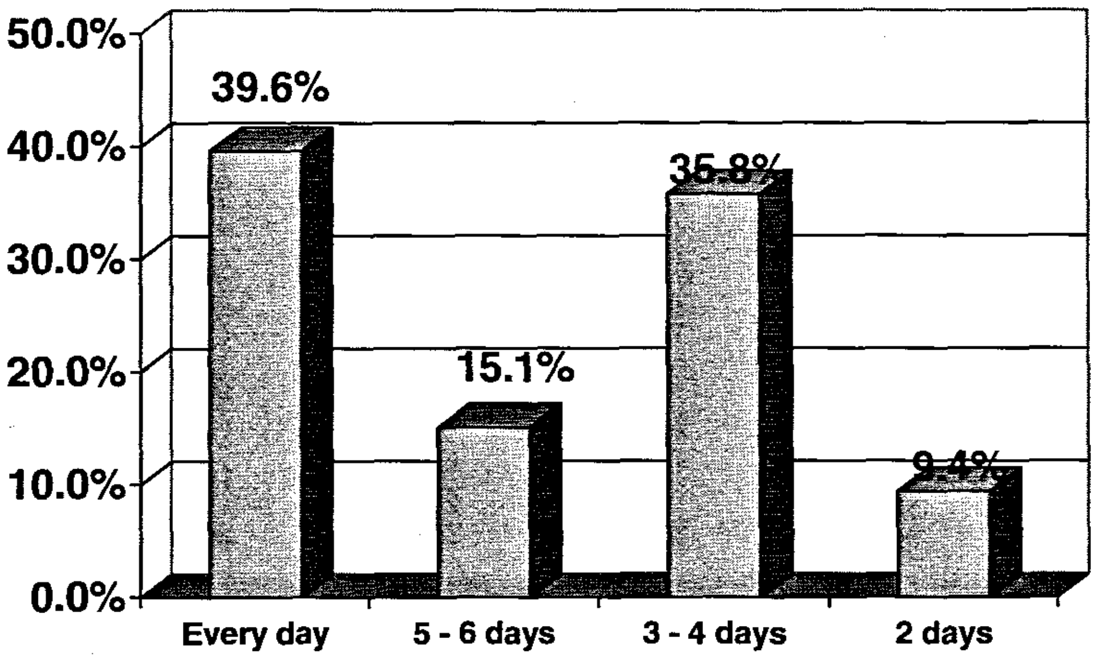

Figure 4.9 Frequency of eating breakfast per week (n = 53)

The findings of this study show some consistency with the study conducted by Hammond and Chapman (1994:69) in Canada, where 52% of the female college students consumed breakfast on all of the three mornings of a dietary survey. Thirty percent of the respondents ate breakfast on two out of the three mornings and 11% of the respondents ate breakfast on one of the three mornings only. Chapman et al. (1998:176) state that a number of studies have demonstrated positive effects, both nutritional and behavioural, of consuming breakfast. The nutritional advantages of consuming breakfast include a greater likelihood of consuming adequate quantities of micronutrients and fibre and a lower percentage of energy coming from fat, especially when the breakfast includes a breakfast cereal. Chapman et al. (1998:176) identified food preferences, time availability, food costs, cooking and storage facilities, and health concerns as factors that affect what is consumed at breakfast, but did not indicate if any of these factors influenced whether breakfast was consumed or not.

4.5.3.2 Lunch

Twenty-five respondents (41.7%) indicated that they ate lunch and 23 (38.3%) respondents indicated that they sometimes ate lunch (Addendum C, Section E, Question E9). Compared with breakfast, slightly fewer respondents indicated that they ate lunch (53 versus 48 respondents). More respondents therefore indicated not usually eating lunch compared with those who indicated not usually eating breakfast (12 versus 7 respondents). Only 14 (29.2%) of these respondents indicated that they ate lunch every day, while the majority (47.9%) of these respondents (n = 23) reported eating lunch only 3 to 4 times a week (Addendum B, Section E, Question E10). This is in line with the results of a study conducted in the USA, which found that adolescents skipped lunch more frequently than breakfast (Williams, 1993:385). Figure 4.10 indicates the frequency with which lunch was consumed in this study.

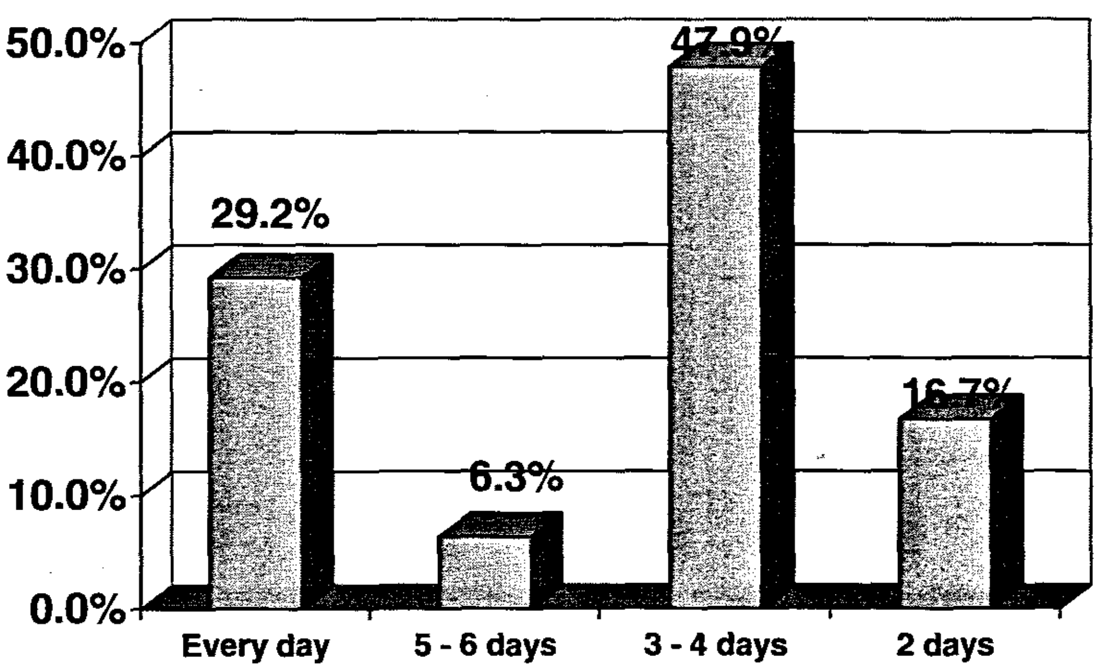

Figure 4.10 Frequency of eating lunch per week (n = 48)

4.5.3.3 Supper

Results of this study indicate a trend of skipping breakfast and/or lunch rather than supper as almost all of the respondents (93.3%; n = 56) indicated that they ate supper. Only 6.7% of the respondents 9n = 4) indicated that they sometimes ate supper (Addendum C, Section E, Question E17). Seventy percent of the respondents (n = 42) indicated that they ate supper every day and only 1.7% of the respondents (n = 1) indicated that supper was eaten 2 days or less per week (Addendum C, Section E, Question E18). These results imply that some students who indicated consuming supper 3 to 4 days per week indicated that they usually ate supper, while the others indicated that they sometimes ate supper when they indicated a supper intake of 3 to 4 days per week. The frequency with which supper was consumed in this study is indicated in Figure 4.11.

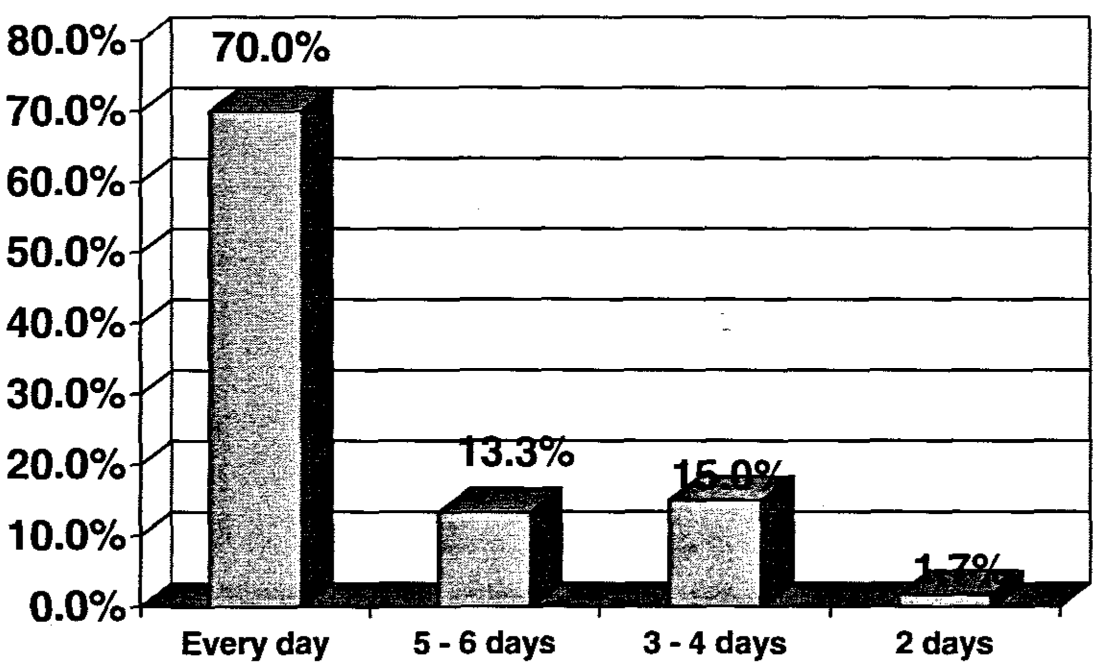

Figure 4.11 Frequency of eating supper per week (n = 60)

4.5.3.4 Snack patterns

(i) Snack consumption between breakfast and lunch

The majority (66.7%) of respondents (n = 40) reported consuming snacks in the morning between breakfast and lunch times (Addendum C, Section E, Question E5). Fifty percent of the respondents (n = 30) reported usually consuming snacks and 16.7% of the respondents indicated that they sometimes consumed snacks. About 23% (22.5%) of the respondents (n = 9) who reported consuming snacks (n = 40) reported consuming them every day and 42.5% (n = 17) reported consuming snacks 3 to 4 days a week (Addendum C, Section E, Question E6). Figure 4.12 indicates the consumption of snacks between breakfast and lunch times in this study.

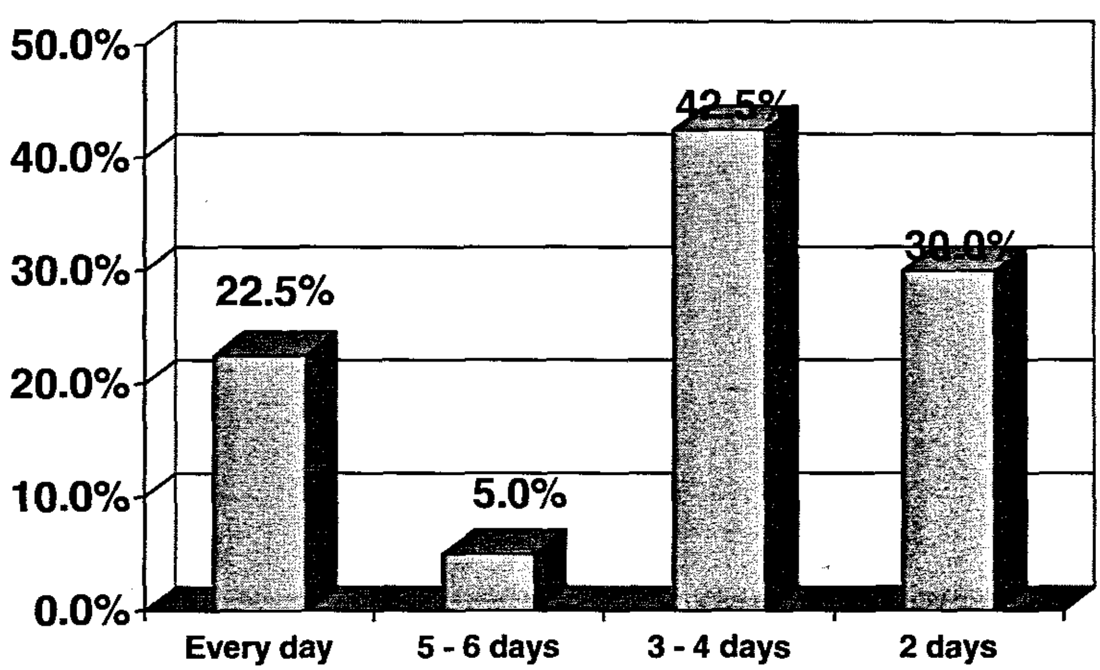

Figure 4.12 Snack consumption frequency per week between breakfast and lunch (n = 40)

(ii) Snack consumption between lunch and supper

Almost 50% of the respondents (48.3%; n = 29) reported that they consumed snacks in the afternoon between lunch and supper times, while 18.3% (n = 11) indicated consuming snacks sometimes (Addendum C, Section E, Question E13). Only a small percentage (12.5%) of the respondents (n = 5) reported that they consumed snacks every day (Addendum C, Section E, Question E14). The rest of the respondents (87.5%; n = 35) indicated consuming snacks from 6 days to fewer than two days a week. The snack consumption frequency of the respondents between lunch and supper times is indicated in Figure 4.13.

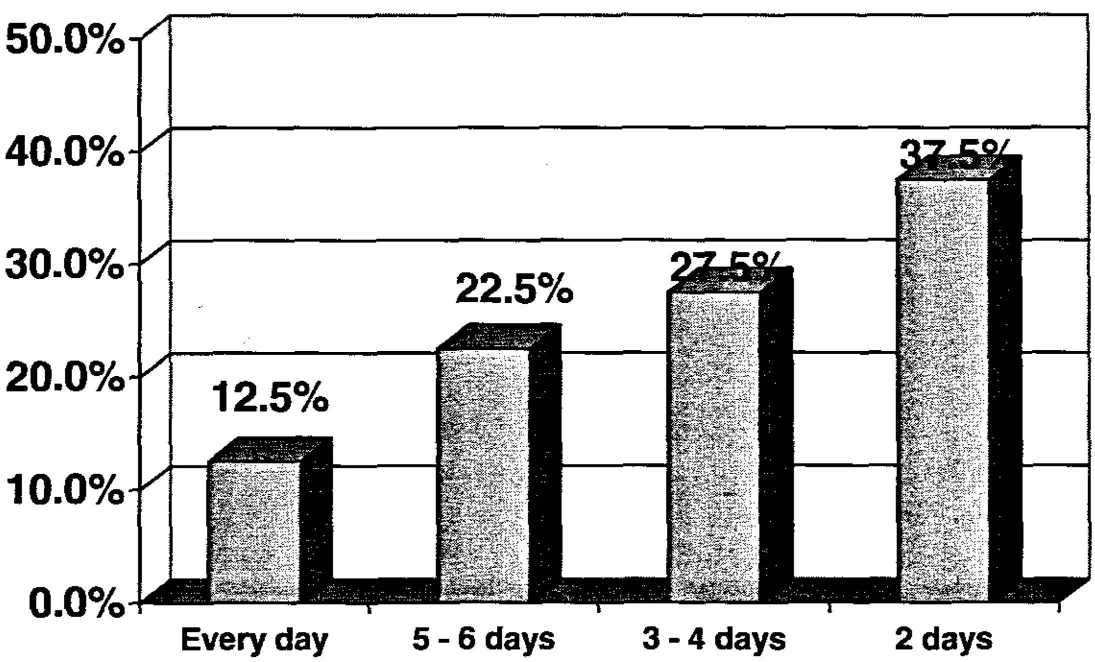

Figure 4.13 Snack consumption frequency per week between lunch and supper (n = 40)

(iii) Snack consumption after supper

Fewer than half (40%) of the respondents (n = 24) reported consuming snacks in the evening after supper and before going to bed (Addendum C, Section E, Question E21). About 22% (21.7%) of the respondents (n = 13) reported consuming snacks and 18.3% (n = 11) indicated that they sometimes consumed snacks. The remainder (60%) of the respondents (n = 36) indicated not eating snacks during this particular time. Fifty percent of the respondents (n = 12) who indicated consuming snacks (n = 24) reported consuming them two days or fewer per week, while only 8.3% of the respondents (n = 5) reported consuming snacks daily during this time (Addendum C, Section E, Question E22). Figure 4.14 indicates the consumption of snacks after supper in this study.

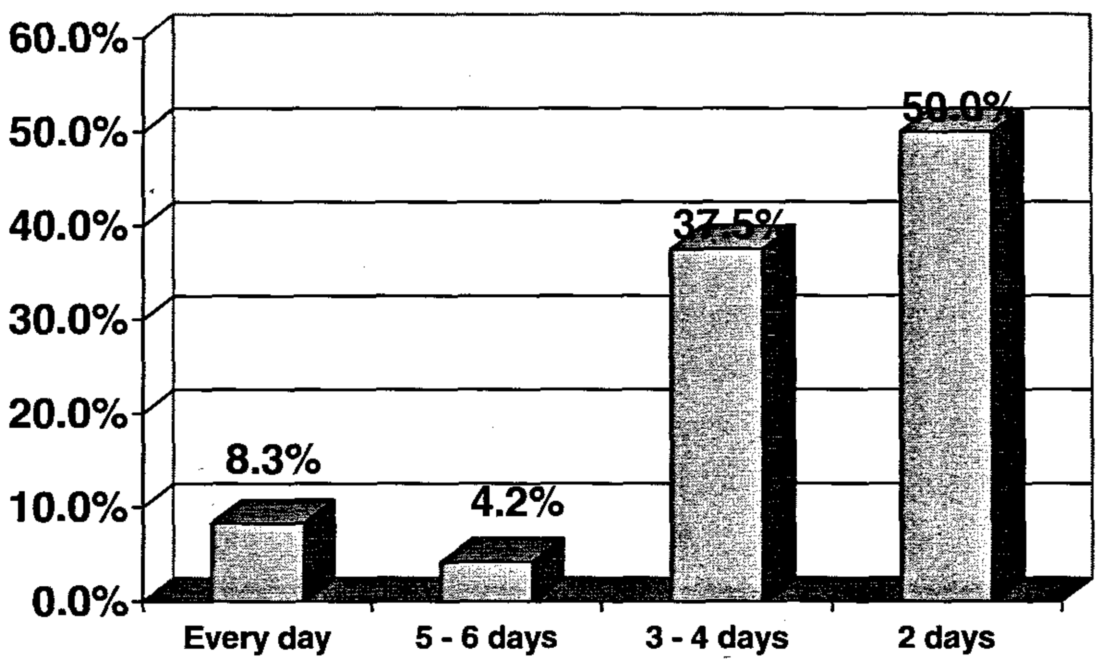

Figure 4.14 Snack consumption frequency per week after supper (n = 24)

These results are in contrast with the results of a study conducted in the USA that found that the majority of student respondents snacked in the evening after supper (Khan & Lipke, 1982:586). However, in the USA study, lunch and dinner were served at fixed times in dining facilities on the campus. Dinner was served between 17:00 and 19:00, leaving a 14-hour gap between dinner and breakfast the next morning. In comparison, the respondents in this study prepared their own evening meal at a time convenient to them. It could be that these students ate later at night, thus not requiring a snack before bedtime.

Jakobovits et al. (1977:411) found that on average the female college students in their study ate 5.14 times a day, meals and snacks included. They similarly found that although the evenings were the most usual time for snacking, most subjects had a snacking pattern, which was a complex mixture of morning, afternoon and evening snacks.

(iv) Food items consumed as snacks

The consumption of snacks can have a positive or negative effect on the nutritional status of the respondents depending on the choice of snack item. Khan and Lipke (1982:586) found that the snacks consumed by students in a study conducted in the USA contributed 3.5 to 34.8% to the RDAs for the different nutrients. Without the snack contribution, the energy, iron and calcium intakes would have been below the RDA level for the female students. This view is shared by Gatenby (1997:S17), who stated that foods consumed between meals could contribute significantly to the nutrient quality of the diet. However, high-energy snack foods and super-sizing portions of popular fast foods promote overeating and energy imbalance and can contribute to overweight and obesity (Gillis & Williams, 2002:3). Huang et al. (1994:1143), for example, found that the food items consumed most frequently by college students as snacks included popcorn, crackers, crisps and carbonated beverages. In this study, more than half of the respondents (58.7%; n = 35) consumed cool drinks, potato crisps, cool drinks, chocolates, biscuits and sweets as snack items. These, high-energy, low nutrient dense, foods are listed in the "top 30" food and drink items consumed by the respondents in this study (see Section 4.5.1.1, Table 4.18).

4.6 Comparison of menus supplied by catered residence with Daily Food Guide

The menus from the catered residence were analysed according to the number of servings as recommended by the Daily Food Guide (Williams, 1992:10; Whitney et al., 2002:36). Medium-sized portions of menu items as indicated by the FoodFinder™3 (2002) were used for this analysis. The medium-sized portions of the menu items indicated in the FoodFinder^{TM}3 (2002) could in most instances be compared directly to the serving sizes recommended by the Daily Food Guide. For other food items such as milk the medium-sized portions of the menu items made up a fraction of the serving sizes recommended by the Daily Food Guide (see Section 3.9.4, Table 3.2).

4.6.1 Bread, cereal, rice and pasta group

The analysis of the menus of the Cape Technikon catered residence, Viljoenhof, indicated a mean provision of 7 servings from the bread, cereal, rice and pasta group. This relatively low value may be due to the medium-sized portions that were used in the analysis and the exclusion of additional servings. For example, a variety of cereals as well as sliced bread are available for the daily breakfast. Students could consume more than the medium serving of cereal and the one slice of bread chosen for the daily breakfast analysis. However, the 7 servings are the minimum number of servings that will be provided and are slightly more than the minimum number of servings as indicated by the Daily Food Guide. This corresponds closely with the mean intake of 6.54 (± 3.75) servings of the students in the self-catering residences (see Table 4.20, Section 4.5.1.3, i).

4.6.2 Vegetable and fruit groups

The analysis of the menus of the Cape Technikon catered residence was more in line with the guidelines than the results of the intake of students in self-catering residences as it provided a daily mean of 3 servings of vegetables and 2 servings of fruit. Fruit and/or vegetables were present daily at all three meals. Again the minimum servings as indicated by the Daily Food Guide were provided for both these food groups. The mean vegetable intake of the students in the self-catering residences was 1.4 (± 1.56) servings and the mean fruit intake 0.72 (± 0.99) servings. (see Table 4.21, Section 4.5.1.3, ii).

4.6.3 Meat, poultry, fish, dry beans, eggs and nuts group

The analysis of the menus of the Cape Technikon catered residence was more in line with guidelines than the results of the intake of students in self-catering residences as it provided a mean of 2.5 servings from the meat, fish, poultry, dry beans, eggs and nuts group, thus meeting the recommendation of 2 to 3 servings per day. The mean intake of the students in the self-catering residences for this food group was only 1.48 (± 1.10) servings (see Table 4.22, Section 4.5.1.3, iii).

4.6.4 Milk, yoghurt and cheese group

The menu from the Cape Technikon catered residence indicated that only a mean of 1.5 servings from the milk, yoghurt and cheese group was served daily. This is not adequate, as a minimum of 2 servings from this group is recommended. Three daily servings would be more acceptable as the students are younger than 25 years and need to support the formation of a high BMD (Williams, 1993:228). The mean intake of the students in the self-catering residences was less in line with guidelines at 0.62 (± 0.65) servings (see Table 4.23, Section 4.5.1.3, iv).

4.6.5 Additional group

According to the Catering Manager of the residence (Büchner, 2004), sugar was available and could be sprinkled over the breakfast cereal or used in the tea or coffee that is available during meals. The quantity of sugar consumed would depend on the preferences of the students. In addition, jam was available on the breakfast table. Menu items served may also provide for the intake of fats, oils and sugar as they are used in the preparation of meal items. In addition, food items from this group are also often eaten as snacks in between meals and were not reflected in the daily menu of the contracted catering company.

4.7 Energy, macro- and micronutrient intakes

Two 24-hour dietary recalls were used to determine the food and beverage intakes of the respondents. The FoodFinder™3 dietary analysis software package (2002) was utilized for the nutrient analysis of the respondents' dietary intakes. The nutrient intakes of the respondents were compared with the Dietary Reference Intakes (DRI) for females, aged 19 to 30 years, and the percentage intake of the Recommended Dietary Allowance (RDA) and Adequate Intake (AI) calculated. The majority of the students (91.7%) indicated that they were between 19 and 24 years old, while only 8.3% of the respondents indicated that they were younger, being 18 years old. The dietary intake results of these 5 students were included with the results from the older age group. DRI values are recommendations for optimal intakes and include a generous safety margin to meet the needs of almost all healthy people in a specific age and gender group (Whitney et al., 2002:32).

4.7.1 Macronutrient intakes

4.7.1.1 Energy and protein intakes

The mean energy intake of the respondents was lower than the Estimated Energy Requirement (EER) recommendation (see Table 4.24). If compared with the weight status of the respondents, it should possibly have been higher, as 68.5% of the respondents were of an optimal body weight, 20.3% were overweight, and 1.9% obese (see Section 4.9.2). A possible reason for the low intake could be ascribed to underreporting the dietary intake. According to Biro et al. (2002:S28), and Kant (2002:315), this is a problem, which is frequently observed in food consumption surveys. Reported differences in mean energy intakes calculated from 24-hour recalls, compared with calculations from observed intakes, ranged from no significant difference to

19% less for recalled intakes. Overall, recalls tend to underestimate intake by 10% compared with observed intake (Willett, 1998:3).

The mean energy intake over weekend days was slightly higher than that over weekdays (see Table 4.24). A possible reason for this is that snacks were more popular over the weekend days compared with the weekdays. Forty-one respondents (68.3%) reported consuming snack foods such as sweets, biscuits, ice cream and carbonated beverages on the weekend day, compared with the 35 respondents (58.3%) who indicated consuming snacks on the weekday. The protein intake exceeded the recommendation (see Table 4.24).

Table 4.24 Comparison of weekday, weekend day and mean (SD) energy and protein intakes with the EER/RDA

		Weekday		**Weekend day**		**Mean intake**	
Nutrients	**EER*/ RDA***	**Amount consumed**	**% of EER/ RDA**	**Amount consumed**	**% of EER/ RDA**	**Amount consumed**	**% of EER/ RDA**
Energy (kJ)	9205	6995.2 (±3352.9)	**76.0**	7874.8 (±2778.4)	**85.6**	7435.0 (±2374.9)	**80.8**
Total protein (g)	46	56.1(±29.4)	**122.0**	64.6(±27.8)	**140.4**	60.3(±22.0)	**131.2**

(n = 60)

SD (±) = standard deviation

* FoodFinder™ 3 (2002)

** Sizer & Whitney (2003:C)

4.7.1.2 Carbohydrate and dietary fibre intakes

The mean carbohydrate intake of the respondents was 222.1g (± 9.7), which is below the Daily Value of 300 g of complex carbohydrates for a 2 000 calorie diet (Sizer & Whitney, 2003:105). The 1989 RDA for energy intake for females 19 to 24 years is 2 200 calories, thus slightly higher than the level of the Daily Value (Sizer & Whitney, 2003:C), indicating that the carbohydrate intake of the female students in this study should possibly have met or exceeded 300g. The mean dietary fibre intake was 16.3g (± 6.4), which is below the lower limit of 27g of dietary fibre per day as recommended, by the WHO (Sizer & Whitney, 2003:105). The low fibre intake is partly due to the fact that fewer than half of the respondents (44.9%; n = 27) reported consuming any of the foods from the breads, cereal, rice and pasta group in a wholegrain form. In addition, low intakes from the fruits and vegetables groups were noted.

4.7.1.3 Fat and cholesterol intakes

The mean fat intake in this study was 62.7g (± 25.1) with saturated fat, mono-unsaturated fat and polyunsaturated fat respectively contributing 19.6g (± 10.1), 20.0g (± 9.3) and 17.1g (± 8.1) to the total fat intake. The mean cholesterol intake of the respondents in this study was 248.9 mg (± 26.9). This is within the limits set by the American Heart Foundation that cholesterol intake should be limited to less than 300 mg per day (Sizer & Whitney, 2003:149).

4.7.2 Macronutrient contributions to energy intake

The participants' fat intake was compared with the recommendation that fat intake should be limited to 30% of energy intake (Williams, 1993:76). According to Healthy People 2010, no more than 10% of energy intake should be from saturated fat (Whitney et al., 2002:149). In this study, these goals were reached as the mean total fat contribution to energy intake was approximately 30% (30.3 ± 6.2) and the saturated fat contribution was just below 10% (9.4 ± 2.9). Mono-unsaturated and polyunsaturated fats accounted for 9.8% (± 3.1) and 8.3% (± 3.0) of the energy intake respectively. The 8.3% contribution of polyunsaturated fats to energy intake was within the recommended range of 6% to 10%. Carbohydrate intake, however, matches the lower limit of 55% as set by the WHO (Anon, 2001b:56). Table 4.25 indicates the contribution of each macronutrient to the total energy intake of the respondents for the weekday, weekend day and the mean intakes.

Table 4.25 Macronutrient contributions to energy intake for the weekday, weekend day and the mean intake

		Weekday		Weekend day		Mean intake	
Macro-nutrient	**Recom-mended % contribu-tion to energy intake ***	**Intake (g)**	**% contribu-tion to energy intake**	**Intake (g)**	**% contribu-tion to energy intake**	**Intake (g)**	**% contribu-tion to energy intake**
Protein	10 – 15	56.1	13.81	140.4	14.4	131.2	14.1
Total fat	15 – 30	57.8	29.51	67	31.24	44.25	30.3
Saturat-ed fat	< 10	17.6	8.91	21.6	9.82	13.71	9.4
Mono-unsat-urated fat	**	18.5	9.44	21.3	10.02	19.9	9.7
Poly-unsat-urated fat	6 – 10	16.1	8.03	18	8.5	17	8.3
Carbo-hydrate	55 – 75	231.6	56.58	233.6	53.704	465.2	55.14

(n = 60)

* World Health Organization (2003:56)

** No specific recommendation indicated

The higher intakes of proteins, fats and carbohydrates on the weekend day compared to the weekday could be due to the fact that more meals were eaten on the weekend day compared to the weekday. The weekday 24-hour dietary recall indicated that 40, 27 and 51 students (66.7%, 45% and 85 %) respectively indicated eating breakfast, lunch and supper on the preceding day. In comparison the weekend day 24-hour dietary recall indicated that 43, 39 and 53 students (71.7%, 65% & 88%) respectively consumed breakfast, lunch and supper on the preceding day. The intake of snacks on the weekend day was also more frequent compared to the weekday (see Section 4.7.1.1) Food items typically consumed while socializing such as chops, sausage, grilled and commercially fried chicken portions were also indicated more frequently on the weekend day compared to the weekday. No significant difference ($p > 0.05$) was found between the weekday 24-hour dietary recall and the weekend day 24-hour dietary recall.

4.7.3 Micronutrient intakes

4.7.3.1 Comparison of mineral intakes with the DRI

The mean intakes of calcium, iron, magnesium were less than 100% of the DRI. Low mean intakes of iron (61.2% of RDA) and calcium (42.7% of AI) were recorded (see Table 4.26). Intakes below two-thirds (67%) of the RDA are considered as risky as they fall close to the marginal intake of nutrients as recommended by the DRI (Sizer & Whitney, 2003:31). Reasons for the low intake of calcium can be ascribed to the fact that none of the respondents consumed the recommended number of 3 servings from the milk, yoghurt and cheese group (see Table 4.23, Section 4.5.1.3, iv). Vegetables also contribute to calcium intake, but in this study, intakes from the vegetable group were also low (see Table 4.21, Section 4.5.1.3, iii) The low intake of iron may also be ascribed to the low intake of vegetables, as well as a less than adequate intake from the meat, fish, poultry, dry beans, eggs and nuts group (see Table 4.22, Section 4.5.1.3, iii). Although beef was one of the more popular food items, placed 13th in the top 30 food and drink items consumed by the respondents (see Section 4.5.1.1, Table 4.19), the quantities consumed was small. Organ meats were also not a popular choice with only two respondents indicating the consumption of chicken livers. Poor dietary intake coupled with iron losses during menstruation and the increased need for iron during pregnancy place young adult women at risk of iron deficiency (Gizis, 1992:971). The consequences of iron deficiency include tiredness and apathy (Sizer and Whitney, 2003:287). In addition, Halterman et al. (2001:1318) concluded that an iron deficiency could lead to a decrease in intellectual performance. A significant difference ($p > 0.05$) was found between the weekday 24-hour dietary recall and the weekend day 24-hour dietary recall for the following minerals: calcium ($p < 0.05$; $p = 0.028$), zinc ($p < 0.05$; $p = 0.023$) and Chromium ($p < 0.05$; $p = 0.002$). Table 4.26 indicates the weekday, weekend day and mean intakes of minerals of the respondents in comparison with the DRI.

Table 4.26 Comparison of weekday, weekend day and mean (SD) intake of minerals with the Dietary Reference Intakes (DRI)

Nutrients	**DRI RDA/ AI***	**Weekdays**		**Weekend days**		**Mean intake**	
Minerals		**Amount consumed**	**% DRI**	**Amount consumed**	**% DRI**	**Amount consumed**	**% DRI**
Calcium (mg)	1000	410.4 (±294.3)	**41.0**	442.0 (±297.4)	**44.2**	426.2 (±237.0)	**42.7**
Iron (mg)	18	11.0 (±7.4)	**61.0**	11.1 (±6.2)	**61.4**	11.0 (±5.3)	**61.2**
Magnesium (mg)	310	216.1 (±129.6)	**69.7**	245.8 (±106.5)	**79.3**	231.0 (±93.4)	**74.5**
Phosphorus (mg)	700	883.3 (±460.3)	**126.2**	983.6 (±403.4)	**141.0**	933.4 (±330.0)	**133.3**
Zinc (mg)	8	7.62 (±4.3)	**95.1**	8.24 (±3.9)	**102.8**	7.93 (±3.2)	**99.1**
Copper (µg)	900	1053 (±562.0)	**128.9**	1267 (±583.4)	**128.9**	1160 (±498.7)	**128.9**
Chromium (µg)	25	50.9 (±6.2)	**203.7**	52.5 (±6.4)	**210.1**	51.7 (± 6.1)	**206.9**

(n = 60)

SD (±) = standard deviation

mg = milligrams; µg = micrograms

RDA = Recommended Dietary Allowance; AI = Adequate Intake

* Sizer & Whitney (2001:A)

The South African Food-based Dietary Guidelines recommend *"use salt sparingly"* (Vorster et al., 2001:S3). According to the National Research Council RDA (1989), the estimated potassium, sodium and chloride minimum requirements for healthy people older than 18 years are 2 000 mg, 500 mg, and 750 mg respectively (Williams, 1993:1). In this study, an adequate mean intake of 1 973.5 mg potassium per day was recorded. The mean sodium and chloride intakes were 1 491 mg and 1 184 mg per day respectively. Intakes of sodium and chloride are difficult to interpret, as salt usage was not determined. Considering these minimum requirements, the intakes of these minerals were considered adequate and possibly not of major concern in terms of high intakes, as only 55% of the respondents (n = 33) indicated a preference for salty food (Addendum C, Section D, Question D7), and only

28.3% of the respondents (n = 7) usually sprinkled salt over their food or snacks (Addendum C, Section D, Question D8). No results on the intake of the nutrients selenium, iodine, vitamin K and vitamin D are presented as the contents of these nutrients are not provided in all the food items included in the FoodFinder™ 3 dietary analysis software package (2002).

4.7.3.2 Comparison of vitamin intakes with the DRI

Low mean intakes were recorded for folic acid (59.2% of RDA) and vitamin E (59.3% of RDA) (see Table 4.27). In this study, the low intake of folic acid may be ascribed to the low intake of vegetables and fruit (see Table 4.21, Section 4.5.1.3, ii). In addition, a very small amount of milk (see Table 4.23, Section 4.5.1.3, iv) was consumed, which is a further concern as milk may enhance the absorption of folic acid (Sizer & Whitney, 2003:231). Similarly, the low intakes of vitamin E may be ascribed in part to the low intake of vegetables and fruit, as well as a low mean intake of unrefined grain products.

Despite the fact that 99% of the respondents (n = 59) failed to meet the recommended number of servings of fruits, and 96% (n = 58) the recommended number of servings of vegetables as indicated by the Daily Food Guide the average intakes of vitamins A and C exceeded 100 % of the RDA. A more apparent link between the mean intakes of nutrients such as vitamin A and vitamin C and food groups such as the fruits and vegetables was expected, as these are the food items rich in these nutrients. A possible reason for this discrepancy may lie in the choice of fruit juice (orange juice being a rich source of vitamin C) and vegetables (carrots, spinach and butternut being a rich source of pro-vitamin A) consumed by some of the respondents. A Significant difference ($p > 0.05$) was found between the weekday 24-hour dietary recall and the weekend day 24-hour dietary recall for the vitamin A ($p < 0.05$; $p = 0.047$), but not for any of the other vitamins. Table 4.27 indicates the weekday, weekend day and mean intakes of vitamins of the respondents in comparison with the DRI.

Table 4.27 Comparison of weekday, weekend day and mean (SD) intake of vitamins with the Dietary Reference Intakes (DRI)

Nutrients	DRI RDA/ AI*	Weekday		Weekend day		Mean intake	
Vitamins		**Amount consumed**	**% of DRI**	**Amount consumed**	**% of DRI**	**Amount consumed**	**% of DRI**
Vit A (µg)	700	636.8 (±1166.0)	**90.9**	1424.5 (±2882.3)	**203.5**	1030.6 (±1602.0)	**147.2**
Thiamin (mg)	1.1	1.1 (±0.3)	**89.4**	1.0 (±0.2)	**86.1**	1.05 (±0.2)	**95.5**
Riboflavin (mg)	1.1	1.5 (±1.1)	**136.3**	1.3 (±1.1)	**120.9**	1.4 (±0.8)	**128.6**
Niacin (mg)	14	16.2 (±9.3)	**116.0**	19.4 (±9.0)	**138.6**	17.8 (±6.2)	**127.3**
Vit B_6 (mg)	1.3	1.4 (±0.9)	**90.0**	1.7 (±1.1)	**129.2**	1.6 (±0.7)	**120.0**
Folic acid (µg)	400	212.1 (±179.8)	**53.0**	261.3 (±370.1)	**65.0**	236.7 (±213.4)	**59.2**
Vit B_{12} (µg)	2.4	3.9 (±9.7)	**162.5**	4.6 (±9.3)	**191.7**	4.25 (±9.2)	**177.0**
Pantothenic acid (mg)	5	4.0 (±3.2)	**78.9**	6.4 (±4.6)	**129.6**	5.2 (±2.9)	**104.2**
Biotin (mg)	30	27.0 (±36.1)	**89.5**	43.7 (±94.6)	**145.7**	35.3 (±51.6)	**117.6**
Vit C (mg)	75	75.0 (±82.5)	**100.0**	108.7 (±111.1)	**145.0**	92.0 (±68.4)	**122.5**
Vit E (mgTE)	15	8.6 (±8.0)	**57.6**	9.2 (±5.5)	**61.5**	8.9 (±4.9)	**59.3**

(n = 60)

SD (±) = standard deviation

mg = milligrams; µg = micrograms

RDA = Recommended Dietary Allowance; AI = Adequate Intake

* Sizer & Whitney (2001:A)

4.8 Comparison of nutrient intakes with other studies

4.8.1 Description of dietary methodology used in studies

Although a direct comparison cannot be made with other studies, owing to the differences in the methodology used to determine dietary intake, the size of the sample, the location in which the study took place and the time period, this comparison suggests that student catering arrangements can account for some of the differences in nutrient and energy intakes among students at tertiary institutions.

In this study, the dietary intake of 60 black female students, residing in self-catering residences, was determined using two 24-hour dietary recalls. Eves et al. (1994:367) reported on the findings of a six-year study (1986 – 1991) that was conducted in the UK among first-year students living in self-catering residences. In the UK study, a seven-day diet diary was used and the number of female students varied between 32 in 1988 and 58 in 1991. These students came from a variety of social backgrounds, but were all studying for a degree in Catering and Hotel Management.

In the South African context, Senekal (1988:127) used a quantified food frequency questionnaire to determine the dietary intake of white, female first-year students (n = 316) living in the residences of the University of Stellenbosch. In these residences, three daily meals were supplied to the students. At present, only the Cape Technikon residences situated in Mowbray and Wellington have catering facilities. One week's menu compiled from randomly selected days from the four-week menu cycle used by the catering company supplying meals to the students in the Viljoenhof residence located at Mowbray was analysed to be used in comparison with the self-catering intake of this study (see Table 4.27). The nutrient data analysed from these menus was based on medium portions of the foods served according to the menu, and does not include any additional intake between meals. The residence at Mowbray houses male and female students from various cultural groups. The Mowbray residence, rather than the residences at Wellington, was chosen, as it related better to the self-catering residences being in an urban setting and housing students of comparable ethnic backgrounds.

Steyn et al. (2000a:53) used a quantified food frequency questionnaire to determine the dietary intakes of 115 black female students attending a first-year pre-registration programme at the University of the North. Dietary data of the study by Steyn et al. (2000a:53) was based on the period before the students entered the university.

4.8.2 Comparison of energy and macronutrient intakes

Table 4.28 indicates the macronutrient and energy intakes of students in self-catering and catered residences and prior to living in a residence. The energy intake of respondents living in the self-catering residences (Eves et al., 1994:367) was lower than the energy intake of respondents living in catered residences (Senekal, 1988:168), as well as the pre-residential energy intake noted by Steyn et al. (2000a:53). Senekal (1988:168) and Steyn et al. (2000a:53) used a quantified food frequency questionnaire to determine the dietary intake of the students. According to Steyn and Nel (2001:24) average quantities consumed per food items were greater when the food frequency method was used if compared to the 24-hour dietary recall. Lower energy intakes were also noted in this Cape Technikon study in which the 24-h dietary recall method was used to collect data (Table 4.28). A possible reason for the lower energy intake of respondents living in self-catering residences is the poor food purchasing and preparation practices of the students due to time constraints and a lack of knowledge and skills. In terms of the catered residences, the mean energy content of the Viljoenhof menus was lower than that provided by the residences in the study by Senekal (1988:168). A possible reason for this is that the data from the Viljoenhof residence was based only on the three meals per day as indicated on the cycle menus and did not take the consumption of any food items or drinks consumed between meals into account. The highest energy intake was reported by students prior to entering university (Steyn et al., 2000a:54). Edwards and Meiselman (2003:21) found that the intakes of energy, protein, fat and carbohydrates as reported by students declined significantly ($p < 0.05$) from the time before they entered university to four months into their academic year.

Students living in the self-catering residences of the Cape Technikon had similar intakes of protein to those reported by Eves et al. (1994:367). The protein content of the Viljoenhof menus was higher than the protein intake reported by respondents living in self-catering residences, but not as high as the protein intake provided by the catered residences investigated by Senekal (1988:168). The protein content of the pre-residential dietary intake (Steyn et al., 2000a:54) falls in between these intakes (Table 4.28). A reason for the lower protein intake in self-catering residences may be due to the high price of animal protein foods. Students may not have the knowledge or time to prepare cheaper animal protein foods and may purchase high priced, quick preparing protein foods in smaller quantities or infrequently. In addition, in this study very few respondents indicated consuming plant protein foods.

A similar trend was seen in fat intake with the intake of the students in the self-catering residences (Eves et al., 1994:367) being similar to one another and the catered residences investigated by Senekal (1988:168) providing the highest fat intake, followed by the pre-residential intake recorded by Steyn et al. (2000a:53) (Table 4.28).

The carbohydrate intake of students from the self-catered residences recorded by Eves et al. (1994:367) was the lowest, followed by the intake from this study. The pre-residential intake of carbohydrates recorded by Steyn et al. (2000a:53) was the highest. In conclusion, higher intakes of energy, protein, total fat, and carbohydrates were recorded by Senekal (1988:168) in the catered residences and by Steyn et al. (2000a:54) for the period before residential living compared with the self-catering residence intakes.

Values for plant protein, cholesterol, dietary fibre and saturated, mono-unsaturated and polyunsaturated fat intakes only were available for this study and the pre-residential intake recorded by Steyn et al. (2000a:54). The pre-residential intake of plant protein was far higher than the plant protein intake in this study. The pre-residential intake of both saturated and mono-unsaturated fats was comparable with the Viljoenhof menu analysis followed by the intake in this study. However, the polyunsaturated fat content of the Viljoenhof menu analysis was the highest, followed by the intakes from this study, the pre-residential intake being the lowest. The pre-residential data was the highest, for both the cholesterol and dietary fibre intakes, followed by the menu analysis of the Viljoenhof catered residence with the lowest intakes reported in this study (Table 4.27).

Table 4.28 Mean (SD) energy and macronutrient intakes of students in self-catering and catered residences and prior to living in a residence

	Self-catering residences		**Catered residences**		**Pre-residential intake**
	Cape Technikon	**Eves et al. (1994)**	**Cape Technikon**	**Senekal (1988)**	**Steyn et al. (2000a)**
Energy (MJ)	7.4 (±2.3)	6.68 (±1.8)	7.9 (±2.1)	9.5 (±3.3)	10.0 (±3.3)
Protein (g)	60.3 (±22.0)	58.1 (±17.2)	71.9 (±11.7)	85.0 (±27.3)	76.5 (±27.7)
Plant protein (g)	21.4 (±9.5)	*	21.3 (±3.3)	*	34.6 (±12.6)
Total fat (g)	62.7 (±25.1)	63.0 (±12.4)	75.6 (±13.9)	89.4 (±37.9)	78.6 (±32.9)
Saturated fat (g)	20.0 (±10.1)	*	24.4 (±5.9)	*	24.6 (±12.1)
Mono-unsaturated fat (g)	20.0 (±9.3)	*	27.1 (±7.4)	*	26.6 (±13.1)
Polyunsaturated fat (g)	17.1 (±8.1)	*	17.5 (±3.7)	*	15.4 (±7.5)
Cholesterol (g)	248.9 (±208.5)	*	298.7(±140)	*	417 (±324)
Carbohydrate (g)	222.1 (±75.3)	193.0 (±29.3)	211.1 (±20.9)	264 (±105)	343 (±123)
Fibre (g)	16.3 (±6.4)	*	18.4 (±4.9)	*	28.6 (±12.6)

(n = 60)

SD (±) = standard deviation

* Information not available

The results of these studies point to the following trend: students living in catered residences had higher intakes of energy and macronutrients, with the exception of carbohydrates, compared with the intakes of students living in self-catering residences.

4.8.3 Comparison of micronutrient intakes

A different trend was found with regard to vitamin and mineral intakes as the self-catering and catered residences had comparable results. However, Eves et al. (1994:367) reported higher values for calcium and niacin intakes than reported for the catered and self-catering residences in this study. In contrast, the Cape Technikon catered residences provided higher intakes for zinc, vitamin A and vitamin C. However, the highest values for all the micronutrients, with the exception of calcium, were recorded by Steyn et al. (2000a:54) for the pre-residential intake. No information regarding micronutrient intake were available from the study conducted by Senekal (1988:168). Table 4.29 indicates the mineral and vitamin intakes of students in self-catering and catering residences and prior to living in a residence.

Table 4.29 Mean (SD) mineral and vitamin intakes of students in self-catering and catering residences and prior to living in a residence

	Self-catering residences		Catered residences		Pre-residential intake
	Cape Technikon	**Eves et al. (1994)**	**Cape Technikon**	**Senekal (1988)**	**Steyn et al. (2000a)**
Minerals:					
Calcium (mg)	426.2 (±237.0)	742.0 (±324.8)	568.0 (±305.4)	*	659.0 (±362)
Iron (mg)	11.0 (±5.3)	10.6 (±3.9)	10.5 (±1.5)	*	13.2 (±4.8)
Zinc (mg)	7.93 (±3.2)	*	9.0 (±2.6)	*	10.5 (±4.8)
Vitamins:					
Vitamin A (mcg)	1030.6 (±1602.0)	830.2 (±623.8)	1975.8 (±2079)	*	1831 (±1617)
Thiamin (mg)	1.05 (±0.2)	1.0 (±0.4)	1.1 (±0.2)	*	1.4 (±0.6)
Riboflavin (mg)	1.4 (±0.8)	1.3 (±0.6)	1.54 (±0.41)	*	2.1 (±1.2)
Niacin (mg)	17.8 (±6.2)	29.3 (±12.4)	19.01 (±6.03)	*	17.8 (±6.9)
Vitamin B6 (mg)	1.6 (±0.7)	*	1.6 (±0.52)	*	1.9 (±0.9)
Folic acid (mcg)	236.7 (±213.4)	112 (±48)	240.5 (±60.9)	*	286.0 (±149)
Vitamin C (mg)	91.88 (±68.4)	82.7 (±52.2)	197.7 (±102)	*	207.0 (±210)
Vitamin B12 (mcg)	4.25 (±9.2)	*	4.017 (±1.42)	*	7.9 (±11.6)

(n = 60)
SD (±) = standard deviation

* Information not available

4.9 Weight status

4.9.1 Sample

Not all the participants in this study attended their appointments to be weighed and measured. Weights and heights of 54 participants were obtained. It is possible that the absence of non-respondents could have caused bias in the data. The six participants who did not attend their appointments indicated their body weight status as follows: two participants described themselves as overweight, while four participants indicated that their body weights were "right" (see Section 4.9.4). The following table (Table 4.30) indicates the weights, heights and Body Mass Index (BMI) calculations of the participants.

Table 4.30 Mean(SD), maximum and minimum weight, height and Body Mass Index (BMI) calculations of respondents

Measurement	Mean (SD)	Minimum	Maximum
Weight (kg)	60.8(±11.2)	41.5	89.0
Height (m)	1.62(±0.08)	1.43	1.79
BMI (kg/m^2)	23.3 (±3.7)	15.5	33.7

(n = 54)

SD (±) = standard deviation

4.9.2 Body mass index

According to Williams (1993:146), the health maintenance BMI range for adults is 20 to 25 kg/m^2. In this study more than half of the respondents (68.5%; n = 37) were of an optimal body weight (19 – 24 kg/m^2), while 9.3% (n = 5) were underweight (<18.5 kg/m^2), 20.3% (n = 11) overweight (25 – 29.9 kg/m^2) and 1.9% (n = 1) obese (30 – 34.9 kg/m^2). Overweight and obesity are escalating health issues among young women and place them at risk of obesity-associated chronic diseases, as well as the emotional and social-economic problems associated with obesity (Gillis & Williams, 2002:1).

4.9.3 Comparison with other studies

The percentage of black, female respondents in this study that were overweight is lower than the data from the study conducted by Steyn et al. (2000a:53), who found that 22.7% of the urban background black female students at the University of the North and 22.9% of the students with a rural background were overweight (BMI ≥ 25 kg/m^2). However, in a study conducted by Senekal (1988:153), only 7.65% of the white first-year female students at the University of Stellenbosch had a BMI larger or equal to 25 kg/m^2. Table 4.31 compares the heights, weights and BMI of the three different studies conducted in South Africa on tertiary education female students.

Table 4.31 Anthropometric data of female students at tertiary institutions in South Africa

Study	Height (cm)	Weight (kg)	BMI (kg/m^2)
	Mean (SD)	Mean (SD)	Mean (SD)
Cape Technikon	162.00 (±0.08)	60.8 (±11.2)	23.3 (±3.7)
Steyn et al. (2000a)	159.08 (±6.21)	56.77 (±10.70)	22.42 (±3.85)
Senekal (1988)	167.00 (±6.00)	59.80 (±8.00)	21.50 (±2.70)

BMI = Body Mass Index

SD (±) = standard deviation

In studies conducted in the USA, the following weight status results were noted. According to the USA National College Health Risk Behavior Survey conducted in 1995, 13.9% (± 1.8) of female students, aged 18 to 24 years, were classified as being overweight based on their BMI (Center for Disease Control, 1997:32). Anding et al. (200:167) found that a larger number (25%) of female college students were overweight. The BMI of their group ranged from 15 to 43 kg/m^2 with a mean of 23 kg/m^2 (± 5.1). DeBate et al. (2001:819) used self-reported heights and weights and found a mean BMI of 23 kg/m^2. African-American females were found to be heavier than white females with a BMI of 26 kg/m^2 compared with the 22 kg/m^2 of the white students. Haberman and Luffey (1998:189) found that 90.1% of their female college student respondents had a normal BMI based on self-reported heights and weights, only 6.6% of their respondents were overweight and 3.3% underweight. In the

South African Demographic and Health Survey 9.5% of women in the age group 15 to 24 years were underweight (BMI < 18.5 kg/m^2), 60.7% were of a normal weight (BMI 18.5 to 24.9 kg/m^2), 20.0% were overweight (BMI 25 to 29.9 kg/m^2) and 9.6% were obese (BMI 30+ kg/m^2) (South African Department of Health, 1999:274).

4.9.4 Personal view of weight status

All 60 respondents gave an answer to the question on the description of their own body weight status (Addendum C, Section D, Question D20). Forty-eight respondents (80.0%) described their body weight as "right" (optimal), although only 37 respondents (68.5 %) from the 54 respondents who were weighed and measured had an optimal BMI. Only one respondent (1.7%) considered herself as underweight, although five respondents (9.3%) were underweight. Seven respondents (11.7%) described themselves as overweight, while 12 respondents (22.2%) were overweight or obese (class 1). Four respondents indicated that they could not describe their own body weight status. No significant difference ($p > 0.05$; $p = 0.112$) was found between the respondents' own view of their weight status and their actual weight status.

The results of this study are in contrast with the findings of studies conducted in the USA. Miller et al. (1980:561) found that almost 70% of female college students thought of themselves as slightly overweight or overweight, even though only 39% could be classified as such based on their reported weights and skin fold measurements. According to the National College Health Risk Behavior Survey conducted in 1995, 41.8% (± 2.5) of female students, aged 18 to 24 years, thought that they were overweight, although only 13.9% were actually overweight, based on their BMI (Center for Disease Control, 1997:35). Haberman and Luffey (1998:189) found that although 37.6% of the female college student respondents perceived themselves as overweight, only 6.6% of the respondents were overweight based on their BMI. In a study conducted by Beerman et al. (1990:219), only 23% of the female college respondents exceeded the recommended weight range, although 71% of the respondents indicated that they were dissatisfied with their weight, considering themselves overweight.

The results of this study are supported by the results of a study conducted in Cape Town in which the weight satisfaction of three ethnic groups of adolescent schoolgirls was compared. In this study by Caradas et al. (2001:111), the black girls had significantly higher mean BMI (kg/m^2) values (24.1 ± 3.3) compared with the white (21.9 ± 3) or coloured girls (22.1 ± 3.7), but dissatisfaction with their present body shape was significantly higher ($p < 0.001$) in the white group, compared with the black and coloured groups. In the South African Demographic and Health Survey 12.9% of women in the 15 to 24 year age group perceived themselves as underweight, while 9.5% were underweight (BMI < 18.5 kg/m^2). Differences between perception and actual weight were also found regarding normal weight as 66.4% of the women perceived themselves to be a normal weight, while 60.7% were of a normal weight (BMI 18.5 to 24.9 kg/m^2). Only 15.5% of the women in this age group, in the South African Demographic and Health Survey, perceived themselves as overweight, but 29.6% were either overweight (BMI 25 to 29.9 kg/m^2) or obese (BMI 30+ kg/m^2) (South African Department of Health, 1999:274).

4.10 Information on food safety and nutrition

Thirteen respondents (21.7%) indicated that the course that they were studying at the Cape Technikon included information on food hygiene, as part of a subject such as microbiology, environmental studies or food preparation, while six respondents (10.0%) indicated that their course included information on nutrition (Addendum C, Section A, Question A38 and Section D, Question D22).

In this study, more than half (60.0%; n = 36) of the respondents indicated that they had learned about food preparation from their parents or family, 18.3% indicated having learned from school, 10.0% from friends and 11.7% (n = 7) indicated acquiring their knowledge through their own experience (Addendum C, Section A, Question A39). Similar results were reported by Jay et al.

(1999a:927), in that 61% of the respondents in an Australian telephone survey indicated learning about food preparation from their parents. However, only 7% indicated learning it at school, 3% from work training and 23% from their own experience. Hertzler and Bruce (2002:344) found that the most frequently used recipe source of female college students was family, followed by package/can labels.

Forty-three respondents (71.7%) in this study indicated that they would be interested in gaining knowledge of nutrition, while 50 respondents (83.3%) indicated that they would be interested in gaining knowledge of food hygiene (Addendum C, Section A, Question A40 & Section D, Question D23). Eleven respondents (18.3%) were not sure about this with regard to nutrition and five respondents (8.3%) were not sure about this with regard to food hygiene.

According to Worsley (2002:S579), studies investigating the influence of nutrition knowledge on food behaviour have reached conflicting conclusions. Axelson et al. (1985:51) reported that in nine studies where education as a means of improving dietary intake was investigated, a significant association between nutritional knowledge and dietary behaviour was found, but that the effect-sizes of these relationships were relatively small. Steenhuis et al. (2004:221) examined the effect of nutrition education and supermarket shelf-labelling on the fat intake of consumers and found no significant effect on total fat intake or the psychosocial determinants of eating less fat. In a local context, a study conducted at the University of the North and two secondary schools found that the choice of everyday food intake of black male and female students was not associated with their nutrition knowledge (Peltzer, 2002:4).

Worsley (2002:S579) concluded that nutrition knowledge may play a small, but pivotal, role in the adoption of healthier eating habits. Makrides et al. (1998:171) investigated risk factors for cardiovascular disease in university students in residence living in Canada, and found that as perceived knowledge of cardiovascular disease increased, so did the level of physical activity as well as the consumption of fruits and vegetables. Similarly, Wardle et al. (2000:269) found that nutritional knowledge regarding the intake of fat, fruits and vegetables was significantly associated with healthy eating. The findings of studies conducted by Matvienko et al. (2001:95) and Abood et al. (2004:135) showed a similar positive effect. In the study by Matvienko et al. (2001:95), students, with a BMI higher than 24 kg/m^2, who attended a nutrition course emphasising the fundamental principles of human nutrition, energy metabolism and genetics, maintained their baseline body weight, in contrast with a control group, who gained weight during their first year of college life. Abood et al. (2004:135) reported that college female athletes who attended a nutrition education intervention had significantly improved nutrition knowledge and positive dietary changes compared with the control group. Wardle et al. (2000:269) concluded that knowledge is an important factor in explaining variations on food intake.

The majority of respondents indicated their preference for a brochure as the form in which the information on food hygiene (72.7%) and nutrition (85.2%) is to be provided to them (Addendum C, Section A, Question A41 & Section D, Question D24). The second most popular method was a video programme, and 23.6% of the respondents respectively indicated this as their choice for information on food hygiene and on nutrition. About 14% (14.5%) of the respondents indicated informal lectures as a source of information on food hygiene, compared with 5.5% for nutrition. In addition, four (7.3%) and three (5.6%) respondents respectively indicated the use of the internet or e-mail for food hygiene and nutrition information.

According to Bruhn (1997:514), communicating food safety information effectively to consumers is a challenge. Surveys in the USA indicate that consumers obtain most of their information regarding food, nutrition and science from the media. Bruhn (1997:514) furthermore states that brochures can enforce food safety messages and can serve as useful references, although they are not as widely seen as media stories. McIntosh et al. (1994:93) found that the use of the printed media as a source of food safety information had an effect similar to television with regard to consumers' willingness to change their cooking practices. Nichols et al. (1988:233) found little evidence that a nutritional leaflet increased the knowledge of consumers. However, in their study, leaflets were sent to a group of consumers who had not requested them. In contrast, the results of this study found that respondents indicated an interest in food safety and nutrition information and specified brochures as the preferred medium of communication. According to Griffith et al. (1994:18), care should be taken in the compilation of brochures. The message delivered by a brochure should be understandable, accurate and be perceived as credible.

Other information sources have had limited success. In the USA, safe handling instructions on the labels of all raw or partially cooked meat and poultry products have been compulsory since 1994. However, fewer than half (45%) of the consumers, surveyed by the Food Marketing Institute in 1997, reported that they had changed their meat handling practices as a result of the information on the labels (Bennion & Scheule, 2004:61).

This chapter focussed on the results obtained in the research study. The self-reported food safety practices, e.g. food purchasing, storage and preparation, were described and compared to the stated food safety guidelines. The observed food storage and preparation practices were reported and compared to the self-reported practices. The dietary intake of the students were reported and compared to the Daily Food Guide and the South African Food-Based Dietary Guidelines. In addition the dietary intake of the students was compared to the Dietary Reference Intakes for their gender and age grouping.

CHAPTER 5
SUMMARY AND CONCLUSIONS

5.1 Limitations of the study

In this study the food safety practices and dietary intake of 60 female students living in self-catering residences were determined. As a small sample was used the results could not be generalised to the population of self-catering residential students as a whole. However, the results obtained in this study do provide a description of the current food safety practices and dietary intake of the sample studied.

Interviews utilizing structured questionnaires were used to collect the self-reported food safety and dietary intake data. According to Bowling (2002:261) questionnaires can, if carefully compiled for the specific topic yield accurate data. The validity and reliability of the questionnaire as such was determined on a limited basis. In this study the questionnaires were compiled based on the results of the preliminary study as well as food safety guidelines from recognized sources (see Section 3.6.2). The questionnaires were tested on a convenient sample of female students from self-catering residences (see Section 3.9.1). The nine students making up the sample were all studying the ND: Consumer Science: Food and Nutrition programme, which would make them more knowledgeable about the content of the questionnaire, compared to the general population, as food safety and preparation forms part of their course content. This could have influenced their understanding of the questions. Some changes were, however, made to the questionnaire in the pre-testing of the study.

Regarding the wording used in the questionnaire; the question on the cleaning of the refrigerator (Addendum C, Section A, Question A7) may have been "loaded" as the results obtained in this study regarding the cleaning of the refrigerator were far more in line with food safety guidelines than the results from other studies (see Section 4.2.2.2). The utilization of mostly close-ended response categories, providing a number of options, provided for a greater uniformity of responses. All the completed questionnaires were screened by the researcher to clarify vague or inconsistent response information and to identify and collate the "other" responses provided. The structured response format of the questionnaire, made possible by the preliminary study and pre-testing of the study and the fact that the interviewers were knowledgeable in the topic fields of the research study support the inter-observer reliability testing done that did yield identical observer results.

As the food practices exhibited by consumers may not be an accurate reflection of either their food safety knowledge or self-reported behaviour the interviews were supplemented with structured observations. Although Redmond and Griffith (2003b:17) concluded that observational data provided the most reliable information regarding the actual food safety behaviour of consumers, Bowling (2002:153) indicated there are many threats to the reliability and validity of all studies.

In this study observations were carried out in the domestic kitchens of the self-catering residences. This made it more difficult to control outside variables, compared to conducting an observation in a laboratory setting. Outside variables may influence the observation of actions, which could result in an increased potential for observer and reactivity bias (Redmond and Griffith, 2003b:26). To limit the effect of outside variables, interviewers with knowledge and experience of food preparation in self-catering residences were used in this study. Construct validity and rater reliability is of importance as the objectivity and consistency of the interviewers can affect validity and reliability (Mason & Bramble, 1989:298). To overcome this, interviewers were trained in the procedures to be used to gather data (see Section 3.8.2).

The following types of bias and error, as indicated by Bowling (2002:153), are associated with an interview and observational situation: reactive effects, social desirability and recall bias. Reactive effects refer to the effect that the knowledge that they are being studied have on those under observation. This may influence their usual behaviour. This is also known as the "Hawthorne effect". Social desirability bias may influence the respondents making them feel the need to create a good impression. In this study respondents may have given answers on food safety that is more in line with food safety guidelines than their actual behaviour and may have exhibited behaviour in the observation that differs from their normal food safety practices. Recall bias refers to the respondents' selective memories in recalling past behaviour.

The 24-hour dietary recall method was used in this study to determine the dietary intake of the respondents. When using the 24-hour dietary recall method, subjects may fail to mention all foods and amounts consumed. They may also not be aware of the ingredients used in mixed dishes or specific brands (Biro et al., 2002:S27). A further possible error lies in the quantification of portion sizes. Although the interviewers were trained in the collection of and quantification of dietary intake data (see Section 3.8.2) accurately describing portion sizes even with the aid of measurement devices is a complex process for the respondents in which perception, conceptualisation and memory play a role (Biro et al., 2002:S29). Due to recall errors the reported differences in mean energy intakes calculated from 24-hour recalls, compared with calculations from observed intakes, ranged from no significant differences to 19% less for recalled intakes. Overall, recalls tend to underestimate intake by 10% compared with observed intakes (Willett, 1998:3).

Despite the limitations the results from this study does add to the existing knowledge regarding students' food safety practices, dietary intake and weight status.

5.2 Food safety practices

The results of this study reflect the findings of a number of other studies. Students living in self-catering residences reported following some, but not all of the stated food safety guidelines. Positive and negative food safety practices were reported and observed. Respondents reported following safe food purchasing practices and in many cases stored ingredients and leftover food items safely. However, personal hygiene practices, e.g., washing hands with soap and water, and general hygiene practices, e.g., avoidance of cross-contamination between raw and cooked food items, were neglected. Although respondents also cooked food items thoroughly, leftover food items were not reheated sufficiently.

5.2.1 Self-reported behaviour

Regarding self-reported adherence to food safety guidelines, 70% to 100% of the respondents reported that they usually followed the guidelines listed below:

- Purchase ingredients for food preparation at supermarkets.
- Pack ingredients away immediately on arrival at the residence after shopping.
- *Store raw meat or chicken in the refrigerator, and/or freezer.*
- Store leftover food in the refrigerator.
- Store leftover food in the refrigerator for three days or less.
- Store food cooked in advance in the refrigerator.
- Defrost raw meat and chicken before cooking.
- Defrost meat or chicken in the microwave oven or refrigerator.
- Cook burger patties to the well-done stage.
- Reheat leftover foods only once.
- Do not consume raw fish.
- Do not consume dishes containing raw eggs.

The following food safety guidelines were followed less stringently as approximately 50% of the respondents reported that they usually applied these guidelines:

- Purchase ready-to-eat food items from fast food outlets.
- Not cooking food in advance of consumption.
- Consider food safety characteristics, such as freshness and sell-by-date, when purchasing food items.

The following food safety guidelines are a cause for concern as none or fewer than 25% of the respondents reported applying these safety guidelines:

- Heating leftover foods to safe temperatures.
- Immediately placing warm food items to be stored in the refrigerator.
- Using the expiry date as a guideline for determining the storage time of perishable food items.
- Storing raw meat or chicken in a container with a lid.

5.2.2 Correspondence between observed and self-reported behaviour

Consistent with the results from other studies, the reported practices of the respondents were more in line with food safety guidelines than the practices, which were observed. Although 30% of the respondents reported that they would wash their hands with soap and water prior to food preparation it was observed in only 10% of the cases. Similar discrepancies were found regarding the washing of hands after handling raw chicken. While 63% of the respondents were observed attempting to wash their hands, 75% of the respondents reported that they usually washed their hands after handling raw chicken (or meat). Fifty five percent of the respondents indicated that they usually rinsed a spoon in between using it for tasting and stirring the food being prepared while this action was observed in only 38% of the cases. Similarly 48% of the respondents reported usually using the same cloth to clean surfaces and/or raw foods and to clean and dry dishes, while this action was observed in 62% of the cases.

Although large discrepancies were found between single observed and self-reported actions, significant differences between the observed and self-reported behaviour patterns as demarcated in this study were found only for the following:

- The washing of hands prior to food preparation ($p < 0.05$; $p = 0.023$)
- The manner in which hands were washed prior to food preparation ($p < 0.05$; $p = 0.031$).
- The way in which hands were dried following washing prior to food preparation ($p < 0.05$; $p = 0.00$).

- The washing of hands after handling raw chicken (or meat) ($p < 0.05$; $p = 0.025$).
- The way in which hands were dried after washing following the handling of raw chicken (or meat) ($p < 0.05$; $p = 0.025$).
- *The use of the same knife for slicing raw and ready-to-eat food items* ($p < 0.05$; $p = 0.018$) and
- The use of the same plate/chopping board for raw and ready-to-eat food items ($p < 0.05$; $p = 0.05$).
-

Regarding adherence to food safety guidelines; 70% or more of the respondents were observed and 70% or more of the respondents reported that they usually followed the guidelines listed below:

- Storing perishable food items in the refrigerator.
- Having sufficient space in the refrigerator.
- Attempting to wash hands before starting food preparation.
- *Not using chipped or cracked crockery or glasses.*
- Cooking chicken till the juice is clear and it is white next to the bone.

Between 60% and 65% of the respondents were observed and between 60% and 75% of the respondents reported that they usually adhered to the following food safety guidelines:

- Attempting to wash hands after handling raw chicken (or meat).
- Washing fruit and vegetables before preparation/ consumption.
- Not using the same plate/chopping board for raw and ready-to-eat food items.
- Cleaning the refrigerator on a regular basis.

Between 30% and 45% of the respondents were observed and between 30% and 50% of the respondents reported that they usually adhered to the following food safety guidelines:

- Not using the same knife for raw and ready-to-eat food items.
- Not using the same cloth for wiping raw food items and/or surfaces and to clean or dry dishes.

- Not using the same spoon for stirring and tasting of food items being prepared.

Of concern is the fact that only 20% or less of the respondents was observed and 30% or less of the respondents reported that they adhered to the following food safety guidelines:

- Washing hands correctly, with soap and water, prior to food preparation.
- Drying hands correctly, using a clean hand towel or disposable paper towel, following washing before starting food preparation.
- Washing hands in the correct manner, with soap and water, after handling raw chicken (or meat)
- Drying hands correctly, using a clean hand towel or disposable paper towel, following washing after handling raw chicken (or meat).
- Cleaning a knife correctly, with soap and water, in between using it for raw and ready-to eat food items.
- Cleaning a plate/chopping board correctly, with soap and water, in between using it for raw and ready-to eat food items.
- Cleaning a spoon correctly, with soap and water, in between using it for stirring and tasting food items being prepared.

Although respondents attempted in some way to clean and dry their hands before starting food preparation and after handling raw chicken (or meat) as well as to clean utensils in between using it for raw and ready-to-eat food items their attempts was not adequate in preventing cross-contamination in the majority of cases.

5.2.3 Food safety awareness

Respondents' awareness of food safety issues was poor. This was concluded from the fact that more than 70% of the respondents reported that unsafe food can be identified by the way it looks and smells and a similar number reported that unsafe food can be identified by the way it tastes. More than 70% of the

respondents also did not know the association between *E. coli* and food poisoning or the association between *Salmonella* and food poisoning.
Approximately 50% of the respondents could not name any bacteria associated with food poisoning, reported that they were not aware of the term "cross-contamination" or mentioned only food stored for too long and bacteria as causes of food poisoning. In addition only about one-third of the respondents could indicate the correct temperature for their refrigerator, namely 1 to 5 ^{0}C.

Respondents thus showed a lack of awareness regarding the causes of food-borne disease, foods that are at risk due to the possible occurrence of organisms causing food-borne disease, as well as the need to avoid cross-contamination.

5.2.4 Occurrence of food-borne disease

Only a small percentage (22%) of respondents reported that they could have been ill with food poisoning since living in the residence. In the majority of cases, these respondents who reported suffering from possible food poisoning were not diagnosed as such by either a medical practitioner or a clinic sister. However, more than double this number (51.7%) thought it very likely or likely that in future, while still living in the residence, they might experience food poisoning.

5.3 Dietary intake

5.3.1 Adherence to Food-Based Dietary Guidelines and Daily Food Guide

Adherence of the respondents to each of the Food-Based Dietary Guidelines are stated, and adherence to each of these guidelines, and where applicable adherence to the Daily Food Guide, indicated below:

- *Enjoy a variety of foods.* A lack of dietary variety was reported as more than half of the respondents (60%) indicated eating the same or similar foods every day during the term while living in the residence. In addition the two 24-hour dietary recalls indicated an intake of a far lower number of different food items compared with other studies conducted in the same area. Some variety was found within the various food groups making up the diets of the respondents. In addition the majority (86.7%) of the respondents indicated not eating the same food items during the holidays compared with during the term.

- *Be active.* The majority (83.4%) of the respondents reported following an active or very active lifestyle. However, only half (50%) of the respondents who indicated following an active lifestyle, reported accumulating 30 minutes or more of moderately intensive exercise on most days of the week.
- *Make starchy foods the basis of most meals.* The mean intake from the bread, cereal, rice and pasta group was within the daily range of 6 to 11 servings as recommended by the Daily Food Guide. However, fewer than half (44.9%) of the respondents reported consuming any of these foods in a wholegrain form.
- *Eat plenty of fruit and vegetables every day.* Very low intakes of vegetables and fruit were reported, with mean intakes of 1.4 and 0.72 servings respectively, that do not meet the recommended 5 servings of fruit and vegetables per day.
- *Eat dry beans, peas, lentils and soya regularly.* About half (51.7%) of the respondents reported eating legumes. Although only 36.7% of the respondents indicated consuming textured vegetable protein products, 68.1% of these respondents reported eating these foods weekly. In comparison less than half (41.9%) of the respondents who indicated eating legumes reported eating them weekly.
- *Meat, fish, chicken, milk or eggs can be eaten daily.* The intake of foods from the meat, fish, poultry, dry beans, eggs and nuts group was lower than the recommended two daily servings, with a mean of 1.48 servings. A further cause for concern is the very low reported intakes from the milk, yogurt and cheese group, with a mean intake of only 0.62 servings instead of the 3 daily servings recommended for this age group.

- *Eat fats sparingly.* More than half (58.7%) of the respondents indicated consuming high fat and/or sugar snacks and slightly more than half (53.3%) of the respondents indicated using frying in oil or hard margarine as a cooking method during the dietary recall period. However, nutrient analysis indicated that macronutrient contributions to energy intake were within the recommended limits. Fast foods were consumed by only 21.7% of the respondents during the dietary recall period.
- *Use salt sparingly.* Although about half (55%) of the respondents indicated a liking for salty foods, only 42.3% of these respondents sprinkled salt over their food and only 5% would not first taste the food before adding additional salt.
- *Eat foods and drinks containing sugar sparingly and not between meals.* The mean added sugar intake of 45.9g was lower that the 48g recommended by the USA Department of Agriculture. However, other food items such as cool drinks, chocolate, jam and sweets, which are all high in sugar, featured amongst the top 30 food and drink items consumed by the respondents during the dietary recall period.
- *Drink lots of clean, safe water.* The majority (83.4%) of the respondents reported that they routinely drank water. However, only 14% of the respondents reported drinking the 2.2 l of water per day that is recommended.
- *If you drink alcohol, drink sensibly.* More than half (55%) of the respondents reported consuming alcoholic drinks and of these respondents 51.5% reported consuming alcoholic drinks less frequently than once a week. However, of much concern is the fact that half (51.5%) of the respondents reported drinking 4 to 6 drinks at a time, which reflects a binge drinking habit.

It can be concluded that the food and beverage intake of respondents during the dietary recall period complied only in part with the South African Food-Based Dietary Guidelines and the Daily Food Guide.

5.3.2 Meal patterns

In this study only 10% of the respondents indicated consuming all three meals either daily or 5 to 6 days per week, whereas 38.8% indicated skipping one of the three meals daily or 5 to 6 days per week. Lunch was the meal most often skipped by the respondents with only 29.2% consuming it on a daily basis. Approximately half (47.9%) of the respondents reported that they consumed lunch three to four times a week. Breakfast was consumed more often, with 39.6% of the respondents consuming it on a daily basis. In addition, a further 15% of respondents reported consuming breakfast five to six days per week. Supper was consumed most frequently, with 70% of the respondents consuming it every day. In addition, a further 13.3% indicated consuming supper five to six days a week. It is likely that the failure to meet the number of food group servings as recommended by the Daily Food Guide was due to the large percentage of respondents who skipped meals.

The most popular times for consuming snacks were between breakfast and lunch times and between lunch and supper times. During both these periods 66.7% of the respondents indicated consuming snacks. A smaller percentage (40%) of the respondents indicated consuming snacks after dinner and before going to bed. The daily routine of the respondents, during weekdays when attending classes at the Cape Technikon, allow times, such as while waiting for classes to commence and during tea breaks, for the consumption of snacks. The cafeterias and kiosks at the Technikon also carry numerous snack food items. Similarly, kiosks selling snacks are within the grounds or in the vicinity of the residences, making it easy for respondents to purchase and consume snacks over week-ends. Due to the self-catering system respondents may consume their evening meal relatively late, thus not leaving much time for snacking after the evening meal.

5.3.3 Energy, macro- and micronutrient intakes

The intakes of the respondents met or exceeded the RDA/AI recommendations for protein, zinc, copper, phosphorus, chromium, vitamin A, thiamin, riboflavin, niacin, vitamin B_6, vitamin B_{12}, pantothenic acid, biotin and vitamin C. In addition, the macronutrient contributions to energy intake were within the recommended limits. Intakes of energy and magnesium, however, were lower with the intakes of calcium, iron and folic acid a cause for concern as these intakes were lower than 62% of the recommendations. The respondents' consumption of fewer servings than the recommended number per food group and the regular skipping of meals possibly brought about these low nutrient intakes. . A significant difference was found between the weekday 24-hour dietary recall and the weekend day 24-hour dietary recall for the following micronutrients: calcium ($p < 0.05$; $p = 0.028$), zinc ($p < 0.05$; $p = 0.023$), chromium ($p < 0.05$; $p = 0.002$) and vitamin A ($p < 0.05$; $p = 0.047$). The difference between the weekday and weekend day 24-hour recalls could be due to the fact that more meals were eaten on the weekend day compared to the weekday.

5.3.4 Comparison with other studies

In comparing the dietary intake results from this study with other similar studies conducted in the UK and South Africa, it can be concluded that student-catering arrangements have an effect on the energy and nutrient intakes of students at tertiary education institutions. In general, students living in self-catering residences had lower intakes of energy and most nutrients compared with a pre-residential intake and intakes of students living in catered residences.

5.4 Weight status and personal view of weight

Although not all the participants in the study were weighed and measured, the results obtained indicated that more than half (68.5%) of the respondents were of an optimal body weight and 22.2% of the respondents were either overweight or obese. The mean energy intake of the respondents during the dietary recall period and the self-reported active lifestyle do not correspond with the number of overweight or obese respondents. However, factors such as the lower level of activity than perceived, may be partly responsible for this discrepancy. The mean Body Mass Index (23.3 kg/m^2) was slightly higher than the results obtained in two other South African studies involving female students at tertiary education institutions. Most (80%) of the participants described their body weight as optimal, while 11.7% described themselves as overweight or obese in contrast with the 18.5% found to be overweight or obese, indicating perceptions of own body weight status that is not in line with the "Western" (non-African) weight perception of estimating body weight status.

5.5 Information on food safety and nutrition

Only a small number of respondents reported that the course they were studying included information on food hygiene and nutrition (21.7% and 10% respectively). The majority of respondents seemed to be aware that they lack knowledge regarding these topics as they indicated an interest in gaining information on food hygiene and nutrition (83.3% and 71.7% respectively). The majority of these respondents indicated that they preferred information on the above-mentioned topics to be presented to them in the form of a brochure (72.7% for food hygiene and 85.2% for nutrition respectively.

CHAPTER 6
RECOMMENDATIONS

The change from a catered residential food provision system to a self-catering system has been necessitated by rising costs. Institutions of higher education are at present more assessable to students from previously disadvantaged backgrounds and this has resulted in an increase in the number of students with limited financial resources. A return to the previous system of catered meals is thus not financially viable.

Studying is a stressful time for many students, even more so for students who lack financial support. In general emotional problems, such as stress and depression, increase, and physical health declines during study periods (Sax, 1997:261). The absence of food-borne illness and the consumption of a balanced diet can contribute to an improvement in the overall health of students. Being healthy is an important factor for success at college, as findings indicate that physical and psychological health is associated with academic development, leadership qualities, and overall satisfaction with life at college (Astin, 1993:129 &194).

The time spent attending tertiary institutions has also been identified as one of the most influential times in students' lives, providing the perfect opportunity to instil lifelong healthy habits (Klemmer, 2002:98). According to Huang et al. (2003:83), colleges and universities can be ideal settings for interventions because students are still forming lifestyle patterns. Although all consumers would benefit from food safety interventions, results of studies conducted by Williamson et al. (1992:100) and Woodburn and Raab (1997:1109) indicate that food safety programmes should be directed towards consumers younger than 35 years of age. In a survey conducted by the Canadian Food Inspection Agency (1998:4), younger respondents (aged 18 – 29) were more likely than others to want information about the proper way to cook, store, and handle food. By targeting young adults, such as students to adopt safe food-handling practices, the incidence of food-borne disease can be lowered or even avoided.

The results of this study indicated that although students adhered to some food safety guidelines such as safe purchasing and storage practices, personal and general hygiene practices were neglected. Students' awareness of food safety issues was also low. It is thus recommended that:

- An intervention programme aimed at improving food safety practices of female students living in self-catering residences be designed and implemented.
- As part of this programme, a brochure on food safety practices should be compiled and distributed.

Students can play a crucial role in the prevention of food-borne disease, since all safety measures involved in the production of food can be negated by poor food handling practices in the domestic kitchen. Several studies then also conclude that education regarding food safety is needed if standards are to improve (Barrett et al., 1996:89; Ropkins & Beck, 2000:105; Medeiros et al., 2001b:1326; Gorman et al., 2002:144; Li-Cohen & Bruhn, 2002:1287). Consumers who are uninformed regarding food safety are also more susceptible to misinformation (Kastner, 1995:2742).

Approximately half of the respondents in this study thought it likely that they would suffer from food-borne disease while living in the residence. The Health Belief Model indicates that consumers will, in response to a perceived threat to their health, be motivated to carry out preventative health behaviours (Rutter & Quine, 2002:9). According to this model consumers must be exposed to a cue for a specific health action to be realised (Brown, 1999:3). The majority of the respondents then also indicated that they would be interested in information on food safety. This shows a willingness to learn, a possible cue to action.

The students involved in this study indicated that they would prefer information on food safety issues in the form of a brochure. The provision of brochures, by training institutions, as a method of disseminating food safety information, has been advocated by Beard (1991:124). The proposed brochure on food safety should include basic information on the aetiology of food-borne disease. This will increase the students' understanding not only of food items, that pose a risk to their health, but also the role that they can play in the prevention of food-borne disease.

The proposed brochure should furthermore take into account the particular circumstances of the students. While all applicable guidelines should be noted special emphasis should be given to those guidelines that would correct the incorrect behaviour displayed in this study. According to Medeiros et al. (2001a:108), food safety education is most effective when messages are targeted towards behaviours most likely to cause food-borne disease. In addition, messages are most likely to be effective if directed specifically toward the audience. Similarly to the results of this study, these researchers recommended that food safety educators should focus primarily on hand washing, adequate cooking and avoiding cross-contamination.

Although knowledge does not necessarily lead to positive changes in behaviour, target groups with little food safety knowledge, as in this study, are more likely to exhibit changes in behaviour following an intervention programme than a target group with a higher level of knowledge (Rennie, 1995:77). According to the Theory of Reasoned Action, consumers can only make rational decisions about health behaviour if they are aware of the associated problems, have some knowledge regarding these problems and have some judgement as to the level of risk involved in not changing their behaviour (Wilcock et al., 2004:60).

The lifestyles of students may compromise their food intake and place them at risk for poor nutritional health. The adoption of balanced eating habits by students will not only prevent future chronic diseases such as coronary heart disease, stroke, hypertension, non-insulin-dependent diabetes mellitus, osteoporosis, obesity, some types of cancer, and mental problems (Williams, 1993:11; Gillis & Williams, 2002:1), but also improve their present health status and well-being. The results of this study revealed that the food and beverage intakes of the female students, based on two 24-hour dietary recalls complied only in part with the recommendations of the Daily Food Guide and the South African Food-Based Dietary Guidelines. It is recommended that:

- An intervention programme aimed at improving the dietary intake by female students residing in self-catering residences be designed and implemented.
- As part of this programme, a brochure on healthy eating habits should be compiled and distributed.

To promote healthy eating habits it is recommended that a brochure focussing on the Food-Based Dietary Guidelines and the Daily Food Guide be compiled for distribution to the female students living in self-catering residences. The following should be emphasized in this brochure:

- The consumption of regular meals;
- The intake of milk and milk products, fruit, vegetables and whole grain products;
- The consumption of food items that are good sources of calcium, iron and folic acid;
- The intake of high nutrient dense snack foods;
- The dangers of binge drinking; and
- The maintenance of a healthy body weight.

In addition it is recommended that further brochures on the practical application of the Food-Based Dietary Guidelines and the Daily Food Guide be compiled and distributed to female students in self-catering residences. As many of the students living in residences have limited financial resources and lack food preparation skills, these brochures should focus on easy-to-prepare, low cost, nutrient dense food items and meals.

Authorities at tertiary institutions should be aware of the current health behaviour of their students so as to best prepare for and respond to their needs (Sax, 1997:252). This study was a once-off observation of the food practices of female students living in self-catering residences at the Cape Technikon. Male students residing in self-catering residences were not included in this study. It is assumed that they will exhibit similar behaviour to the female students, but this assumption has not been empirically tested. A large number of students also do not live in residences, but in flats or rooms, where they are responsible for their own food provision. The facilities available to them differ from those provided in the residences, which may in turn affect their food practices. It is thus recommended that:

- The food practices of male students in self-catering residences and of those students living in flats or rooms also be investigated.
- Based on the results of these studies the interventions that are recommended for the female students be extended to include male students in self-catering residences and all students who are responsible for their own food provision.

Limited information is available regarding the food safety practices of the South African consumer. To decrease the incidence of food-borne disease, the food safety practices of consumers must be determined and recommendations for change made. As it is not always possible, owing to cost and time constraints to conduct studies measuring actual behaviour, it is recommended that evaluation tools, such as questionnaires be developed that will accurately measure food safety behaviour.

In contrast to other Westernized countries such as the USA, Great Britain, Australia and New Zealand very little information on consumer food safety guidelines are available to the South African consumer. Safe food practices that will combat the occurrence of food-borne disease are especially important to vulnerable groups, such as people infected with HIV/Aids. It is lastly recommended that national consumer food safety interventions be made a priority and consumer food safety guidelines be made available free of charge to the general public.

CHAPTER 7
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Addendum A

Daily Food Guide

Food group	**Recommended serving range**	**Recommended servings for *teenage girls and* active women***	**Serving sizes**
Bread, cereal, rice, and pasta	6 – 11	9	1x30 g slice bread 125 ml (½ cup) rice, cooked cereal, pasta, samp 30 g (½ cup) ready-to-eat cereal ½ bread roll
Vegetables	3 – 5	4	125 ml (½ cup) cooked or raw vegetables 250 ml (½ cup) leafy raw vegetables
Fruits	2 – 4	3	1 medium fruit 1 melon wedge 190 ml (½ - ¾ cup) fruit juice 125 ml (½ cup) canned fruit 65 ml (¼ cup) dried fruit
Meat, poultry, fish, dry beans, eggs, and nuts	2 – 3	2	90 g lean meat, fish or poultry 60 ml (4 tbsp) peanut butter 125 ml (½ cup) nuts
Milk, yoghurt, and cheese	2 – 3	3	250 ml (1 cup) milk or yoghurt 45 g cheese 500 ml (2 cups) cottage cheese

Adapted from the USA Department of Agriculture, revised edition of former *Basic Four Food Groups Guide*, 1985. (Williams, 1993:10)

* Whitney et al. (2002:42)

Addendum B

Preliminary study questionnaire

Questionnaire on Food Practices at Cape Technikon Self-Catering Residences

Respondent no.

Please answer the following questions by making a cross in the applicable block or neatly indicate the information required:

1. Residence where you are staying

Grootte Schuur	Down Town Lodge	J & B	Waterside	EWR

2. Eating habits: Breakfast

2.1 Do you eat breakfast?

Usually	Seldom or never

If your answer is usually, go to Question 2.2. If your answer is seldom or never, go to Question 3.

2.2 Do you prepare your own breakfast at the residence?

2.2.1 During the week: Monday to Friday?

Usually	Seldom or never

2.2.2 During the weekend: Saturday and Sunday?

Usually	Seldom or never

If you usually prepare your own breakfast, go to Question 2.3. If you seldom or never prepare your own breakfast at the residence, go to Question 3.

2.3 If you usually prepare your own breakfast during the week, name some of the food items or drinks that you mostly prepare for your breakfast.

2.4 If you usually prepare your own breakfast during the weekend, name some of the food items or drinks that you prepare over the weekend that you do not usually prepare during the week.

3. Eating habits : Lunch

3.1 Do you eat lunch?

Usually	Seldom or never

If your answer is usually, go to Question 3.2, if your answer is seldom or never, go to Question 4.

3.2 Do you prepare your own lunch at the residence?
3.2.1 During the week: Monday to Friday?

Usually	Seldom or never

3.2.2 During the weekend: Saturday and Sunday?

Usually	Seldom or never

If you usually prepare your own lunch, go to Question 3.3. If you seldom or never prepare your own lunch, go to Question 4.

3.3 If you usually prepare your own lunch during the week, name some of the food items or drinks that you mostly prepare.

3.4 If you usually prepare your own lunch during the weekend, name some of the food items or drinks that you prepare over the weekend that you do not usually prepare during the week.

4. Eating habits : Supper / evening meal

4.1 Do you eat supper?

Usually	Seldom or never

If your answer is usually, go to Question 4.2. If your answer is seldom or never, go to Question 5.

4.2 Do you prepare your own supper at the residence ?
4.2.1 During the week : Monday to Friday

Usually	Seldom or never

4.2.2 During the weekend : Saturday and Sunday ?

Usually	Seldom or never

If you usually prepare your own supper, go to Question 4.2. If you seldom or never prepare your own supper, go to Question 5.

4.2 If you usually prepare your own supper during the week, name some of the food items or drinks that you mostly prepare for your supper at the residence.

4.3 If you usually prepare your own supper during the weekend, name some of the food items or drinks that you usually prepare for your supper over the weekend that you do not prepare during the week.

5. Equipment and utensils:

5.1 Mark the equipment/utensils/supplies that you have available at the residence for preparing meals

Stove	Microwave oven	Electric kettle	Toaster
Chopping board	Knives (sharp)	Egg lifter or other utensil	Mixing bowl
Measuring jug, cups or spoons	Plates	Cups or mugs	Table knife, fork and/or spoons
Refrigerator	Freezer	Pots and/or frying pan	Refuse bin
Cloth or sponge for washing up	Cloth for drying	Basin for washing dishes	Storage cupboard for cooking utensils
Soap for washing hands	Dishwashing liquid	Other, please state:	Electric mixer

6. Cleaning:

6.1 Who is responsible for cleaning utensils such as pots, pans and dishes used in food preparation?

Yourself	Cleaning company personnel	Other, please state:

6.2 Who is responsible for cleaning the kitchen surfaces, e.g., the counter, table and/or stove top?

Yourself	Cleaning company personnel	Other, please state: Both

6.3 Who is responsible for cleaning the inside of the refrigerator and the oven?

Yourself	Cleaning company personnel	Other, please state: Not sure

6.4 Who is responsible for sweeping and washing the kitchen floor?

Yourself	Cleaning company personnel	Other, please state:

Thank you for your cooperation.

Addendum C

Study Questionnaire

Questionnaire I

Respondent number

Questions asked before preparation:

Section A: Food Practices

Purchasing:

A1. Where do you usually buy ingredients to prepare food at the residence?

	Yes	***No***
Supermarket such as Checkers, Pick 'n Pay	1	2
Small store	1	2
Street seller	1	2
Other (please specify)		

A2. Where do you usually buy ready-to-eat foods such as pies, pizza, cooked sausage and chips?

	Yes	***No***
Fast food outlet such as Steers	1	2
Technikon cafeteria	1	2
Retail store	1	2
Street seller	1	2
Other (please specify)		

A3. ***What characteristics of the products do you look at when you are buying ingredients?***

	Yes	***No***
Price	***1***	***2***
Freshness	***1***	***2***
Sell by date	***1***	***2***
Brand	***1***	***2***
Packaging	***1***	***2***
Taste	***1***	***2***
Other (please specify)		

Storage of ingredients:

A4. When you arrive at the residence after shopping when do you pack your ingredients away?

Immediately	1
After some time	2
Other (please specify)	

A5. Where do you store perishable ingredients such as fresh milk, cheese and polony?

Own fridge	1
Shared fridge	2
Other (please specify)	

If other, go to Question 10

A6. *What do you think the temperature of the fridge should be?*

1 - 5 °C	*1*
6 - 10 °C	*2*
11 – 15 °C	*3*
More than 15 °C	*4*
Don't know	*5*

A7. How often is the inside of the fridge cleaned?

More often than once a month	1
Once a month	2
Every time something spills	3
Other (please specify)	

A8. Do you usually find that there is enough space in the fridge for all your ingredients?

Yes	1
Sometimes	2
No	3

A9. For how long do you usually keep food items such as fresh milk, cheese and polony in the fridge?

Less than a week	1
One to two weeks	2
Until the expiry date	3
Until it shows signs of decay	4
Other (please specify)	

A10. Do you ever buy raw (uncooked) meat or chicken?

Yes	1
Sometimes	2
No	3

If No, go to Question A16

A11. Where do you store the raw meat or chicken?

In the fridge	1
In the fridge and freezer	2
In the freezer or the freezer compartment of the fridge	3
Other (please specify)	

If only in the freezer, go to Question A14.

A12. Where in the fridge do you usually store the raw meat or chicken?

Top shelf	1
Middle shelf	2
Bottom shelf	3
No particular place	4

A13. Do you usually store the raw product in a container with a lid?

Yes	1
Sometimes	2
No	3

A14. Do you usually defrost the frozen meat or chicken before cooking?

Yes	1
Sometimes	2
No	3
Only if it states on the label	4

If No, go to Question A16.

A15. How do you usually defrost the frozen meat or chicken?

Placing in fridge	1
Placing outside on counter or in a cupboard	2
In the microwave	3
In warm water	4
Other (please specify)	

Storage of leftover food:

A16. Do you ever cook food in advance, e.g., cook the food in the morning to eat in the evening?

Yes	1
Sometimes	2
No	3

If No, go to Question A19.

A17. Where do you store the food you have prepared in advance?

In the fridge	1
In a cupboard	2
On the stove	3
Other (please specify)	

If not in the fridge, go to Question A19.

A18. Do you cool the prepared food at room temperature first and then put it in the fridge?

Yes	1
Sometimes	2
No	3

A19. If you have leftover food, after eating a meal that you have prepared or eating take-aways, where do you store it?

On a kitchen counter	1
In a cupboard	2
In the fridge	3
Other (please specify)	

A20. Do you store leftover food in a container with a lid?

Yes	1
Sometimes	2
No	3

A21. For how long do you usually store the leftover food ?

1 day	1
2 – 3 days	2
4 days	3
More than 4 days	4

Cooking of leftover food:

A22. Do you reheat leftover food or food that you have prepared in advance until it is hot, warm or boiling hot?

Hot	1
Warm	2
Boiling hot	3

A23. Do you reheat leftover food more than once?

Yes	1
Sometimes	2
No	3

Food Safety:

A24. Do you ever eat or drink foods that contain raw eggs, such as homemade chocolate mousse or protein shakes?

Yes	1
Sometimes	2
No	3

A25. Do you ever eat raw fish such as sushi?

Yes	1
Sometimes	2
No	3

A26. Do you think that food that is not safe can be identified by the way it looks and smells?

Yes	1
Sometimes	2
No	3

A27. Do you think that food that is not safe can be identified by the way it tastes?

Yes	1
Sometimes	2
No	3

A28. *What do you think causes food poisoning?*

	Yes	***No***
Bacteria	*1*	*2*
Viruses	*1*	*2*
Contaminated food items	*1*	*2*
Food held at warm temperatures for too long	*1*	*2*
Hands not washed	*1*	*2*
Cross contamination between raw and cooked foods	*1*	*2*
Dirty equipment and utensils	*1*	*2*
Food items not cooked to well done	*1*	*2*
Poor hygiene practices	*1*	*2*
Food stored for too long	*1*	*2*
Food not cooled quickly after cooking	*1*	*2*
Contact with animals and flies	*1*	*2*
Leftovers not reheated to boiling point	*1*	*2*
Contaminated water	*1*	*2*
Other micro-organisms e.g. mould	*1*	*2*
Don't know	*1*	*2*
Other (please specify)		

A29. Since living in the residence, have you been ill with food poisoning? (Symptoms are fever, stomach cramps, diarrhoea, nausea and/or vomiting.)

Yes	1
No	2

If No, go to Question 32.

A30. Did a medical doctor or clinic sister diagnose the illness as food poisoning?

Yes	1
No	2

A31. What do you think was the cause of the food poisoning that you experienced in the residence?

	Yes	***No***
Bacteria	*1*	*2*
Viruses	*1*	*2*
Contaminated food items	*1*	*2*
Food held at warm temperatures for too long	*1*	*2*
Hands not washed	*1*	*2*
Cross contamination between raw and cooked foods	*1*	*2*
Dirty equipment and utensils	*1*	*2*
Food items not cooked to well done	*1*	*2*
Poor hygiene practices	*1*	*2*
Food stored for too long	*1*	*2*
Food not cooled quickly after cooking	*1*	*2*
Contact with animals and flies	*1*	*2*
Leftovers not reheated to boiling point	*1*	*2*
Contaminated water	*1*	*2*
Other micro-organisms e.g. mould	*1*	*2*
Don't know	*1*	*2*
Other (please specify)		

A32. How likely is it, do you think, that you may experience an episode of food poisoning in future, while still living in the residence?

Very likely	1
Likely	2
Unlikely	3

A33. ***Name any bacteria that you associate with food poisoning.***

	Yes	No
Bacillus Cereus	1	2
Campylobacter Jejuni	1	2
Clostridium Botulinium	1	2
Clostridium Perfringens	1	2
Eschericia Coli	1	2
Listeria Monocytogenes	1	2
Salmonella	1	2
Shingella	1	2
Staphylococcus Aureus	1	2
Don't know	*1*	*2*
Other (please state)		

A34. ***What do you understand by the term cross contamination?***

Preparing food on a contaminated surface	*1*
Contact between raw and cooked foods	*2*
Using the same knife for raw and cooked foods	*3*
Don't know	*4*
Other (please specify)	

A35. ***With what type of food or food preparation practice do you associate Salmonella food poisoning?***

Chicken and eggs	*1*
Inadequate cooking	*2*
Cross contamination	*3*
Don't know	*4*
Other (please specify)	

A36. **With what type of food or food preparation practice would you associate *E. Coli* food poisoning?**

Raw foods	*1*
Inadequate cooking	*2*
Cross contamination	*3*
Don't know	*4*
Other (please specify)	

Demographic information:

A37. In which faculty is the course that you are studying?

Applied Sciences	1
Management	2
Engineering	3
Built Environment and Design	4
Education	5
Business Informatics	6

A38. Does your course include information on food hygiene, as part of a subject such as microbiology, environmental studies or food preparation?

Yes	1
No	2

A39. How did you learn about food preparation?

From parents or family	1
From school	2
From friends	3
From own experience	4
Other (please specify)	

A40. Would you be interested in gaining knowledge of food hygiene?

Yes	1
Not sure	2
No	3

If No, this is the last question before the observation.

A41. In which form would you like the information on food hygiene to be provided to you?

	Yes	No
Informal lectures	1	2
Brochure	1	2
Video programme	1	2
Other (please specify)		

Section B: Behaviour observed during preparation:

Food preparation:

B1. Were hands washed before preparation started?

Yes	1
No	2

If No, check action B4.

B2. How were hands washed?

Using water and soap	1
Rinsed in water	2
Other (please specify)	

If wiped on a cloth, check action B4.

B3. On what were hands dried?

Kitchen cloth	1
Drying cloth	2
Paper towel	3
Other (please specify)	

B4. Were hands washed after handling the raw chicken?

Yes	1
No	2

If No, check action B7.

B5. How were hands washed after handling the raw chicken?

Using water and soap	1
Rinsed in water	2
Other (please specify)	

B6. On what were hands dried after handling the raw chicken?

Kitchen cloth	1
Drying cloth	2
Paper towel	3
Other (please specify)	

B7. Were the tomatoes washed before slicing?

Yes	1
No	2

B8. Was the same knife used for slicing the raw and cooked chicken (or the raw chicken and tomatoes or bread rolls)?

Yes	1
No	2

If No, observe action B10.

B9. In between using the same knife for the raw and cooked foods were any of the following observed?

Knife rinsed in water	1
Knife washed with soap and water	2
Knife wiped on a cloth	3
Other (please specify)	

B10. Was the same chopping board or plate used for the raw and cooked chicken (or the raw chicken and tomatoes or bread rolls)?

Yes	1
No	2

If No, observe action B12.

B11. In between using the same chopping board or plate for the raw and cooked foods, were any of the following observed?

Board/plate rinsed in water	1
Board/plate washed with soap and water	2
Board/plate wiped with a cloth	3
Other (please specify)	

B12. Was the same spoon used for stirring and tasting the food?

Yes	1
No	2

If No, observe action B14.

B13. In between using the same spoon for stirring and tasting the food, were any of the following observed?

Spoon rinsed in water	1
Spoon washed with soap and water	2
Spoon wiped with a cloth	3
Other (please specify)	

B14. Was the same cloth/sponge used for wiping surfaces or raw food items and to clean or dry dishes?

Yes	1
No	2

B15. Were any of the glasses or crockery used chipped or cracked?

Yes	1
No	2

B16. To what stage was the chicken cooked?

Juices clear, but still pink next to bone	1
Juice clear and white next to bone	2
Other (please specify)	

Storage:

B17. Are perishable food items stored in a fridge?

Yes	1
No	2
Some	3
Not applicable	4

B18. Is the fridge overloaded?

Yes	1
No	2

B19. Does the fridge appear clean?

Yes	1
No	2

B20. Are ready-to-eat food items in the fridge covered?

Yes	1
No	2
Some	3
Not applicable	4

B21. Are raw meats or poultry stored on the bottom rack of the fridge?

Yes	1
No	2
Some	3
Not applicable	4

Section C: Questions asked after completion of observations

Food Preparation:

C1. Do you usually wash your hands before starting to prepare food?

Yes	1
Sometimes	2
No	3

If No, go to Question C4.

C2. How do you usually wash your hands before starting to prepare food?

Using water and soap	1
Rinsed in water	2
Other (please specify)	

C3. On what do you usually dry your hands after washing them?

Kitchen cloth	1
Drying cloth	2
Paper towel	3
Other (please specify)	

C4. Do you usually wash your hands after handling raw meat or chicken before you continue cooking?

Yes	1
Sometimes	2
No	3

If No, go to Question C7.

C5. How do you usually wash your hands after handling raw meat or chicken?

Using water and soap	1
Rinsed in water	2
Other (please specify)	

C6. On what do you usually dry your hands after washing them before you continue cooking?

Kitchen cloth	1
Drying cloth	2
Paper towel	3
Other (please specify)	

C7. Do you usually wash fruit (such as apples) or vegetables (such as tomatoes) before eating them?

Yes	1
Sometimes	2
No	3

C8. Would you use the same knife for slicing ready-to-eat food after you have used it on raw meat or chicken?

Yes	1
Sometimes	2
No	3

If No, go to Question C10.

C9. When using the same knife for the raw and ready-to-eat food, would you rinse the knife, wash it with soap and water or wipe it with a cloth?

Rinse	1
Wash with soap and water	2
Wipe with cloth	3
Other (please specify)	

C10. If you stored raw meat or chicken on a plate or chopping board, would you use the same plate to serve or store ready-to-eat food?

Yes	1
Sometimes	2
No	3

If No, go to Question C12.

C11. When using the same plate or chopping board for the raw and ready-to-eat food, would you rinse the plate, wash it with soap and water or wipe it with a cloth?

Rinse	1
Wash with soap and water	2
Wipe with cloth	3
Other (please specify)	

C12. Would you use the same spoon for tasting and stirring the food you are cooking?

Yes	1
Sometimes	2
No	3

If No, go to Question C14.

C13. In between using the same spoon for stirring and tasting food, would you rinse the spoon, wash it with soap and water or wipe it with a cloth?

Rinse	1
Wash with soap and water	2
Wipe with cloth	3
Other (please specify)	

C14. Would you use the same cloth for wiping tomatoes, cleaning surfaces, and cleaning or drying dishes?

Yes	1
Sometimes	2
No	3

C15. Would you use chipped or cracked equipment when preparing food?

Yes	1
Sometimes	2
No	3

C16. To what stage do you cook chicken or like it to be cooked?

Juices clear, but still pink next to the bone	1
Juice clear and white next to the bone	2
No preference	3

C17. To what stage do you cook burger patties or like them to be cooked?

Half done (brown outside, pink inside)	1
Well done (brown outside and inside)	2
No preference	3

Section D: Dietary intake

D1. During the term, while living in the residence, do you usually eat the same or similar foods every day?

Yes	1
Sometimes	2
No	3

D2. During the holidays, when not living in the residence, do you usually eat the same or similar foods as during the term?

Yes	1
Sometimes	2
No	3

D3. Do you usually eat dried beans, dried peas or lentils?

Yes	1
Sometimes	2
No	3

If no, go to Question D5.

D4. How often do you eat dry beans, peas or lentils?

Every day	1
5 to 6 days per week	2
3 to 4 days per week	3
2 days or less per week	4
Other (please specify)	

D5. Do you eat soya mince products such as Imana?

Yes	1
Sometimes	2
No	3

If no, go to Question D7.

D6. How often do you eat soya mince products?

Every day	1
5 to 6 days per week	2
3 to 4 days per week	3
2 days or less per week	4
Other (please specify)	

D7. Do you like salty food?

Yes	1
Sometimes	2
No	3

D8. Do you usually sprinkle salt over your food at the table or when eating snacks?

Yes	1
Sometimes	2
No	3

If No, go to Question D10.

D9. Do you usually taste the food first before adding salt?

Yes	1
Sometimes	2
No	3

D10. Do you routinely drink water ?

Yes	1
Sometimes	2
No	3

If no, go to Question D12.

D11. How much water do you usually drink during a day?

Less than 1 glass or ½ bottle (< 250 ml)	1
1 to 2 glasses or 1 bottle (250 - 500 ml)	2
3 to 4 glasses or 2 bottles (500 ml - 1 litre)	3
5 to 6 glasses or 2 ½ bottles (1 – 2 litre)	4
7 to 8 glasses or 3 bottles (> 2 litre)	5
Other (please specify)	

D12. Do you consume any alcoholic drinks?

Yes	1
Sometimes	2
No	3

If no, go to Question D15.

D13. How often do you consume alcoholic drinks?

Less than once a week	1
Once a week	2
Twice a week	3
Three to five times a week	4
Other, please specify	

D14. How many drinks do you usually drink at a time? 1 drink = 1 glass of wine, 1 bottle/can of beer, cider or cooler, 1 shooter, 1 tot (25 ml) brandy, whisky etc. (straight or with a mixer), 1 cocktail (medium glass)

1 drink or less	1
2 – 3 drinks	2
4 – 6 drinks	3
More than 6 drinks	4
Other (please specify)	

D15. Do you take a vitamin and/or mineral supplement?

Yes	1
Sometimes	2
No	3

If no, go to Question D18.

D16. Do you usually follow the dosage instructions on the label?

Yes	1
Sometimes	2
No	3

If yes, go to Question D18.

D17. Do you take more or less than the recommended amount?

More	1
Less	2
Depends on circumstances	3

D18. Would you describe your lifestyle as moderately active, not active or very active?

Moderately active	1
Not active	2
Very active	3

If not active, go to Question D20.

D19. Do you think that on most days you accumulate 30 minutes or more of moderate intensity exercise?

Yes	1
Sometimes	2
No	3

D20. How would you describe your body weight?

Underweight	1
Right weight	2
Overweight	3
Don't know	4
Other (please specify)	

D21. What is your age?

15 – 18	1
19 – 24	2
25 +	3

D22. Does your course include information on nutrition?

Yes	1
No	2

D23. Would you be interested in gaining knowledge of nutrition?

Yes	1
Not sure	2
No	3

If no, go to Question E1.

D24. In which form would you like the information on food hygiene to be provided to you?

	Yes	**No**
Informal lectures	1	2
Brochure	1	2
Video programme	1	2
Other (please specify)		

Section E: 24-hour dietary recall: Weekday

E1. Do you usually eat breakfast?

Yes	1
Sometimes	2
No	3

If no, go to Question E5.

E2. How often do you eat breakfast?

Every day	1
5 – 6 days per weekdays	2
3 – 4 days per week	3
2 days or less per week	4
Other (please specify)	

E3. Did you eat breakfast yesterday morning?

Yes	1
Some times	2
No	3

If no, go to Question E5.

E4. What did you have for breakfast?

Breakfast			
Item	**Type**	**Quantity**	
Porridge			
Cereal			
Milk			
Sugar			
Yoghurt			
Fruit juice			
Cool drink			
Coffee or tea			
- milk			
- sugar			

Breakfast			
Item	**Type**	**Quantity**	
Bread			
Rolls			
Butter			
Margarine			
Jam			
Syrup or honey			
Peanut butter			

E5. Do you have any snacks (food or drink) in the morning between breakfast and lunchtimes?

Yes	1
Sometimes	2
No	3

If no go to Question E9.

E6. How often do you have snacks in the morning between breakfast and lunchtimes?

Every day	1
5 to 6 days per week	2
3 to 4 days per week	3
2 days or less per week	4
Other, please specify	

E7. Did you have any snacks between breakfast and lunchtime yesterday?

Yes	1
No	2

If no, go to Question E9.

E8. What snacks did you have?

Snacks			
Item	**Type**	**Quantity**	
Sweets			
Chocolate bars			
Other chocolates			
Crisps			
Popcorn			
Peanuts			

Snacks		
Item	**Type**	**Quantity**
Muffin		
Biscuit		
Fruit juice		
Cool drink		
Coffee or tea		
- milk		
- sugar		

E9. Do you eat lunch?

Yes	1
Sometimes	2
No	3

If no, go to Question E13.

E10. How often do you eat lunch?

Every day	1
5 to 6 days per week	2
3 to 4 days per week	3
2 days or less per week	4
Other, please specify	

E11. Did you eat lunch yesterday?

Yes	1
No	2

If no, go to Question E13.

E 12. What did you have for lunch?

Lunch			
Item	**Type**	**Quantity**	
Bread			
Rolls			
Butter			
Margarine			
Ham			
Tuna mayonnaise			
Chicken mayonnaise			
Cheese			
Tomato			
Lettuce			
Cucumber			
Sausage			
Burger patty			

Lunch			
Item	**Type**	**Quantity**	
Pie			
Pizza			
Chips			
Crisps			
Muffin			
Sweet roll			
Yoghurt			
Ice cream			
Cool drink			
Fruit juice			
Coffee/tea			
- milk			
- sugar			

E13. Do you have any snacks (food or drink) in the afternoon between lunch and suppertimes?

Yes	1
Sometimes	2
No	3

If no, go to Question E17.

E14. How often do you have snacks in the afternoon between lunch and suppertimes?

Every day	1
5 to 6 days per week	2
3 to 4 days per week	3
2 days or less per week	4
Other, please specify	

E15. Did you have any snacks between lunch and suppertimes yesterday?

Yes	1
No	2

If no, go to Question E17.

E16. What snacks did you have?

Snacks			
Item	**Type**	**Quantity**	
Sweets			
Chocolate bars			
Other chocolates			
Crisps			
Popcorn			
Peanuts			

	Snacks	
Item	**Type**	**Quantity**
Muffin		
Biscuit		
Fruit juice		
Cool drink		
Coffee or tea		
- milk		

- sugar			

E17. Do you eat supper?

Yes	1
Sometimes	2
No	3

If no, go to Question E21.

E18. How often do you eat supper?

Every day	1
5 to 6 days per week	2
3 to 4 days per week	3
2 days or less per week	4
Other, please specify	

E19. Yesterday, did you eat supper?

Yes	1
No	2

If no, go to Question E21.

E20. What did you have for supper yesterday?

Supper			
Item	**Type**	**Quantity**	
Combination Dish:			
Red Meat :			
Cut			
Trimmed of fat			
Cooking method			
Additions:			
Chicken :			

Supper			
Item	**Type**	**Quantity**	
Cereals, starch rich foods:			
Maize			
Rice			
Potatoes			
Samp			
Pasta			
Cooking method:			
Additions:			
Pulses			

Skin included			
Cooking method			
Additions:			
Fish:			
Cooking method			
Additions:			
Salad:			
Lettuce			
Cucumber			
Tomato			
Peppers			
Dressing			
Fruit			
Dessert			

Vegetables			
Beans			
Broccoli			
Butternut			
Carrots			
Courgettes			
Green pepper			
mushrooms			
onions			
pumpkin			
spinach			
cooking method:			
additions:			
Cool drink			
Fruit juice			
Coffee/Tea			
- milk			
- sugar			

E21. Do you have any snacks in the evening after supper and before you go to bed?

Yes	1
Sometimes	2
No	3

If No, go to Section F.

E22. How often do you eat snacks in the evening after supper?

Every day	1
5 to 6 days per week	2
3 to 4 days per week	3
2 days or less per week	4
Other, please specify	

E23. Yesterday evening did you have any snacks after suppertime?

Yes	1
No	2

If No, go to Section F.

E24. What snacks did you have?

Snacks			
Item	**Type**	**Quantity**	
Sweets			
Chocolate bars			
Other chocolates			
Crisps			
Popcorn			
Peanuts			

Snacks			
Item	**Type**	**Quantity**	
Muffin			
Biscuit			
Fruit juice			
Cool drink			
Coffee or tea			
- milk			
- sugar			

Section F:

Appointments:

Saturday or Sunday 24-hour recall:
Date:
Time:

Measurements:
Date:
Time:

Questionnaire II

Section G: 24-hour dietary recall: Saturday or Sunday

G1. Yesterday morning did you eat breakfast?

Yes	1
No	2

If NO, go to Question G3.

G2. What did you have for breakfast?

Breakfast			
Item	**Type**	**Quantity**	
Porridge			
Cereal			
Milk			
Sugar			
Yoghurt			
Fruit juice			
Cool drink			
Coffee or tea			
- milk			
- sugar			

Breakfast			
Item	**Type**	**Quantity**	
Bread			
Rolls			
Butter			
Margarine			
Jam			
Syrup or honey			
Peanut butter			

G3. Did you have any snacks between breakfast and lunchtime yesterday?

Yes	1
No	2

If no, go to Question G5.

G4. What snacks did you have?

Snacks			
Item	**Type**	**Quantity**	
Sweets			
Chocolate bars			
Other chocolates			
Crisps			
Popcorn			
Peanuts			

Snacks			
Item	**Type**	**Quantity**	
Muffin			
Biscuit			
Fruit juice			
Cool drink			
Coffee or tea			
- milk			
- sugar			

G5. Did you eat lunch yesterday?

Yes	1
No	2

If no, go to Question G7.

G6. What did you have for lunch?

Lunch			
Item	**Type**	**Quantity**	
Bread			
Rolls			
Butter			
Margarine			
Ham			
Tuna mayonnaise			
Chicken mayonnaise			

Lunch			
Item	**Type**	**Quantity**	
Pie			
Pizza			
Chips			
Crisps			
Muffin			
Sweet roll			
Yoghurt			

Cheese			
Tomato			
Lettuce			
Cucumber			
Sausage			
Burger patty			

Frozen yoghurt			
Ice cream			
Cool drink			
Fruit juice			
Coffee/tea			
- milk			
- sugar			

G7. Did you have any snacks between lunch and suppertime?

Yes	1
No	2

If No, go to Question G9.

G8. What snacks did you have?

Snacks			
Item	**Type**	**Quantity**	
Sweets			
Chocolate bars			
Other chocolates			
Crisps			
Popcorn			
Peanuts			

Snacks			
Item	**Type**	**Quantity**	
Muffin			
Biscuit			
Fruit juice			
Cool drink			
Coffee or tea			
- milk			
- sugar			

G9. Did you have supper yesterday?

Yes	1
No	2

If no, go to Question G11.

G10. What did you have for supper yesterday?

Supper			
Item	**Type**	**Quantity**	
Combination Dish:			
Red Meat :			
Cut			
Trimmed of fat			
Cooking method			
Additions:			
Chicken :			
Skin included			
Cooking method			
Additions:			
Fish:			
Cooking method			
Additions:			
Salad:			
Lettuce			
Cucumber			
Tomato			

Supper			
Item	**Type**	**Quantity**	
Cereals, starch rich foods:			
Maize			
Rice			
Potatoes			
Samp			
Pasta			
Cooking method:			
Additions:			
Pulses			
Vegetables			
Beans			
Broccoli			
Butternut			
Carrots			
Courgettes			
Green pepper			
Mushrooms			
Onions			
Pumpkin			
Spinach			
Cooking method:			

Peppers				Additions:			
Dressing							
Fruit				Cool drink			
Dessert				Fruit juice			
				Coffee/Tea			
				- milk			
				- sugar			

G11. Did you have any snacks after suppertime yesterday evening?

Yes	1
No	2

If No, this is the last section.

G11. What snacks did you have?

Snacks			
Item	**Type**	**Quantity**	
Sweets			
Chocolate bars			
Other chocolates			
Crisps			
Popcorn			
Peanuts			

Snacks			
Item	**Type**	**Quantity**	
Muffin			
Biscuit			
Fruit juice			
Cool drink			
Coffee or tea			
- milk			
- sugar			

Addendum D:

INSTRUCTIONS TO INTERVIEWERS

INSTRUCTIONS TO INTERVIEWERS

Section A: Sampling procedure

1. Compile a list of the names of all the students using the kitchens allocated to you for your interviews (see table at the end of the instructions).

2. Randomly select the allocated number of respondents (using the provided list of random numbers) from the list of students.

3. Contact these students and enquire whether they will participate in the study, explaining the interview procedure that will be followed and choosing a time convenient to the student.

4. Determine the date for each interview. Appointments can be on any Tuesday to Saturday from 6 to 24 May.

5. If any student is not willing to participate, randomly select another student from your name list.

6. Provide all information obtained to Ms Du Toit on 23 April 2003.

   Note: Names of respondents will only be known to the particular interviewer, therefore, respondents will remain anonymous. All information received will be treated confidentially.

Section B: Interview procedure

1. As the interviewer you will ask the respondent questions on the buying, storage, preparation and consumption of food items as indicated in the questionnaire.

2. When you interview a respondent follow the rules stated below:

   2.1 Don't be hurried, impatient or aggressive. Do not be too friendly or accommodating, but be neutral and professional.

   2.2 Read the questions exactly as they appear on the questionnaire.

   2.3 Give a respondent sufficient time to answer.

   2.4 Indicate the answer of the respondent by marking the specific option with a cross.

2.5 If questions are inadequately answered, give the respondent the list of possible answers. **For questions typed in bold italics <u>no answers</u> may be given. You may only enquire if the respondent could add anything to the already mentioned answer. Use the words "anything else".**

2.6 Continue numerically with the questions, unless it is indicated that questions should be skipped if a negative answer is given.

2.7 Record all answers as given.

2.8 **Section C questions may only be asked after all the actions have been observed in Section B.**

2.9 Do not express your own view or judge the answer of the respondent in any way.

Section C: Observational procedure

1. After completing Section A of the questionnaire you will hand the respondent the raw chicken portions, tomatoes, butter and bread rolls and ask her to prepare these ingredients.

2. The chicken is to be cooked, but the tomatoes are only to be sliced, and not cooked. No recipe or instructions regarding the preparation must be supplied (except informing the respondent that the chicken is to be cooked and the tomatoes are to be kept raw).

3. During the preparation you will note the techniques used by the respondent as indicated in Section B of the questionnaire. Note: The food prepared is for the respondent's consumption.

4. After the preparation is completed you will continue with the questionnaire asking the respondent further questions on food preparation, her dietary intake and completion of the respondent's 24-hour dietary recall.

Section D: Recording the 24-hour dietary recall

1. Use the provided measuring spoons, cups, glass and bowl and determine the amount in ml of the glasses, mugs, bowls, serving spoon, table and teaspoon normally used by the respondent. Compare the size of the plates provided with the plates normally used by the respondent. Remember to make a note of each measurement.

2. After asking the questions on breakfast habits, enquire what the respondent had for breakfast the previous day. Indicate each food item mentioned with a mark in the appropriate space.

3. Once the respondent has listed all the food items she ate for breakfast the previous day, ask her whether she had anything to drink.

4. Then return to the first marked item (e.g. porridge) and enquire the type (e.g. oat porridge) and the brand name (e.g. Jungle oats). Indicate the quantity in ml. Also ask the respondent about any additions to the food item (e.g. milk and/or sugar with the porridge). Follow the same procedure by enquiring the type of milk (e.g. full cream) and the brand name (e.g. Dairybelle). Again indicate the quantity in ml.

5. For food items such as slices of bread, fruit, etc., enquire as to the size, e.g., a thin, medium or thick slice of bread and a small, medium- or large-sized fruit. For pre-sliced bread, indicate medium.

6. Follow the same procedure for recording the snack intake of the respondent.

7. For supper, or if the student had these items for lunch the previous day, the following is important:

7.1.1 Meat : Record the cut of meat (e.g. mini beef steak), whether fat was trimmed and how it was cooked.

7.1.2 Chicken: Record the specific portion (e.g. chicken thigh), whether the skin was removed and how it was cooked.

7.1.3 Indicate the quantity of these food items by asking the respondent the surface of the plate that the item would cover (e.g. medium-sized lamb rib chop would cover ¼ of the large plate). Also ask whether the cut of meat was thick, medium or thin.

7.1.4 For all vegetables, remember to ask if margarine and/or sugar was added during preparation.

7.1.5 If the respondent indicates a cooking method such as frying, ask whether oil, margarine or fat was used for the frying. Remember to indicate the brand name of the oil, margarine or fat.

8. Do not be in a hurry; it is important to record the dietary intake as accurately as possible.

On completion: Thank the respondent for her participation

Section E: Further arrangements

1. Remember to make an appointment for the collection of a second 24-hour dietary recall at the residence. The date must be on a Sunday or Monday.

2. Also, make an appointment for the recording of the body weight and height of the respondent during the week (20 – 24 May) in Room: 3.90, Dept Food and Agricultural Sciences at the Cape Technikon.

3. On the day of the interview: Collect the following from Ms Du Toit at the end of the day, before leaving for the residence.

- Questionnaire I & II, black pen
- cool bag with ice block, chicken portions, bread rolls, butter and tomatoes.
- bag with measuring equipment samples : 2 glasses, 1 large and 1 small plate, 1 bowl, 1 set of measuring cups.

3. On the morning following each interview: Return the following to Ms Du Toit:

- cool bag and ice block
- completed Questionnaire I.

5. Return Questionnaire II to Ms Du Toit as soon as it has been completed.

6. Return all measuring equipment at the end of your interviews.

Interviewer	Number of respondents	Residential kitchen numbers
1.	4 2	Groote Schuur (1,2) Waterside (1)
2.	3 3	Grootte Schuur (3,4) DTL (1,2,3)
3.	3 3	Groote Schuur (5,6) EWR (3)
4.	3 3	Grootte Schuur (7,8) EWR (11)
5.	3 3	Groote Schuur (9,10) DTL (4,5,6,7)
6.	5 1	Groote Schuur (11,12) J&B (1,2,3,4,5)
7.	6	EWR (1,2,3,4,5)
8.	6	EWR (6,7,8,9,10)
9.	4 2	Groote Schuur (13,14) Waterside (1)
10.	6	Groote Schuur (15,16, 17, 18)

Addendum E

BODY WEIGHT STATUS DETERMINATION

INSTRUCTIONS TO DETERMINE BODY WEIGHT STATUS OF RESPONDENTS

Section : A

1. Measuring the weight of each respondent:

    - place a square of paper as provided on the scale plate
    - ask the respondent to remove her shoes and any excess clothing, such as a jacket and/or head gear, and place it with her bag on the chair provided
    - ask the respondent to step onto the scale plate, standing up straight (in the centre of the scale plate) with her arms hanging along her sides
    - place the bottom weight in the weight category as you have visually determined
    - move the top weight to the required position until the indicator is in balance
    - check the measurement for 3 seconds
    - ask the respondent to step off the scale
    - fill in the weight (in kg) on the form provided

2. Measuring the height of each respondent:

    - check that the respondent's shoes and any excess clothing are still removed
    - check the respondent's hair to determine if it may influence her height measurement, if necessary part her hair
    - ask the respondent to step onto the measuring platform, standing up straight (in the centre of the platform) with her arms hanging along her sides
    - check that her heels, buttocks and back are touching the measuring apparatus
    - ask the respondent to look at the wall, straight in front of her, not up or down
    - place the horizontal moveable headpiece straight on her head
    - read the measurement at the bottom of the movable headpiece from the side while the respondent is still on the device
    - fill in the height (in m) on the form provided

3. Determine the respondent's body weight status (Section B).

Section : B

Determining body weight status

1. Weight ---------- kg

2. Height ---------- m

3. Calculate the respondent's Body Mass Index (BMI)

$$\frac{\text{Body weight (kg)}}{\text{Height (m) X Height (m)}} \qquad \frac{\text{kg}}{\text{m}^2} = \qquad \text{kg/m}^2$$

4. Determine the respondent's body weight status.

Age : 19 – 24 years

Optimal body weight	BMI 19 – 24 kg/m²
Underweight	BMI < 18.5 kg/m²
Overweight	BMI 25 – 29.9 kg/m²
Obese (class I)	BMI 30 34.9 kg/m²
Obese (class II)	BMI 35 – 39.9 kg/m²
Obese (class III)	BMI 40+ kg/m²

5. Body weight status ----------