BIOACTIVE FOOD INGREDIENT ACCEPTANCE OF HEALTH CONSCIOUS CONSUMERS IN TWO ADJOINING SUBCOUNCILS OF THE CITY OF CAPE TOWN

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by

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Thesis submitted in fulfilment of the requirements for the degree

Master of Technology
Consumer Science: Food and Nutrition

in the Faculty of Applied Sciences

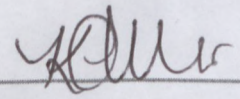
at the Cape Peninsula University of Technology

Supervisor: Ms I Venter

Cape Town
November 2010

DECLARATION

I, Karen O'Connor, 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 Peninsula University of Technology.



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Signed **Date**

CONFLICT OF INTEREST

Corporate sponsorship for food research may not give the researcher the most objective view of the study and may lead towards more favourable results towards the sponsor's products (Nestle, 2001:1015). It is therefore important to note that there is no conflict of interest in this study. This is an institutional study with no involvement from the researcher's employer in terms of the planning, execution, funding and reporting of the research as it was done independent from the researcher's employer.

SUMMARY

Globally, and in South Africa, consumers have become concerned about living healthier lifestyles as well as acquiring an understanding of health and using self-medication as disease preventative measures. This has resulted in an expanding consumer interest in functional foods and the non-nutrient bioactive ingredients in foods that support health. The aim of this study therefore was to determine: (i) the level of awareness, knowledge and understanding (i.e. acceptance) of functional foods and a number of bioactive food ingredients of health conscious consumers in two adjoining subcouncils of the City of Cape Town and (ii) the demographic, health and lifestyle characteristics and other socio-environmental influences affecting their acceptance of bioactive ingredients in functional foods to describe the consumer market for functional foods and the bioactive food ingredients investigated.

For the purpose of this study two groups of respondents representing the health conscious consumer were purposefully sampled. One hundred and thirty nine respondents representing the health conscious market, which includes gym subscribers and dietary supplement users, anonymously and voluntarily participated (67% response rate) from the two subcouncils, De Grendal and Blaauwberg, representing a higher economically active segment of the City of Cape Town Metropolitan Municipality.

A cross sectional descriptive study of a quantitative nature was used. The data was collected through a survey, which took the form of a pilot-tested questionnaire and gathered information from the respondents regarding their demographic, health, lifestyle and socio-environmental characteristics as well as their awareness, knowledge and understanding about the listed stimulus words representing functional foods, phytochemicals and the bioactive food ingredients soy protein, probiotics, omega – 3 fatty acids, isoflavones, lycopene, beta carotene, plant sterols (or stanols), glucosinolates, flavonoids and antioxidants using free word association. The bioactive ingredients chosen for this study were influenced by the most recurrently used functional ingredients in the market and the ingredients already identified by the British Nutrition Foundation as bioactive food ingredients that can help prevent chronic diseases. In order to categorise the word association correctly, the triangulation method of data analysis was used. Majority respondent awareness, knowledge or understanding (i.e. acceptance) of functional foods and the bioactive food ingredients were used in this study to represent the consumer evolution stages of bioactive food ingredients, i.e. the emerging, growth or mature stages, respectively. Response frequencies were determined and the Pearson's chi-squared analysis used for the determining of associations or differences between the acceptance (i.e. awareness, knowledge and understanding) of functional foods and the bioactive food ingredients and the

respondent demographic, lifestyle and other characteristics. A significance level of 5 percent ($p < 0.05$) was used.

The majority of the respondents were female (71.9%), aged between 25 and 34 years (42.4%) and of white ethnic origin (66.2%). The educational levels achieved by most of the respondents were Grade 12 only (28.8%) or Grade 12 plus a diploma (23.7%). The majority of the respondents earned within the two lowest per annum income brackets (38.1% between nil and R122 000 per annum and 23% between R122 001 and R195 000 per annum) and were married or living together with children (34.8%) and without children (31.2%). The majority of the respondents also did not suffer from any chronic disease (82.7%) and participated in regular physical activities (63.3%). Just more than half (56.8%) of the respondents consumed dietary supplements daily. The majority of the respondents viewed their level of health and wellness knowledge and nutrition knowledge as being well informed (22.3% and 17.3% respectively) and moderately informed (66.9% and 65.5% respectively). While just over half (52.5%) of the respondents were 'very interested' in food and nutrition, nearly three quarters (70.5%) of the respondents were 'very interested' in health and wellness. These respondent characteristics are in agreement with those of health conscious consumers.

Of the listed bioactive food ingredients, the majority of the respondents recognised omega - 3 fatty acids (97.1%), after which antioxidants were highly recognised (87.1%), closely followed by probiotics (84.9%) and soy protein (83.5%) and then beta carotene (68.3%). Less than half (40.3%) of the respondents recognised functional foods, about a third (32.4%) recognised flavonoids and about a quarter (26.6% and 25.9% respectively) plant sterols (or stanols) and lycopene. The other bioactive food ingredients (i.e. isoflavones, phytochemicals and glucosinolates) were recognised by 20.9%, 20.9% and 15.1% respectively.

None of the studied bioactive food ingredients fell into the mature stage of consumer acceptance. This indicates that the majority of the respondents did not have an understanding of any of the studied bioactive food ingredients. Soy protein, probiotics and omega-3 fatty acids all had high levels of respondent recognition, with the majority of these respondents having knowledge of these bioactive food ingredients (61.2%, 47.5% and 40.7% respectively). This placed these ingredients in the growth stage of consumer acceptance. Soy protein, however, had an unexpected low respondent percentage (5.2%) understanding of it, despite this ingredient being highly recognised and on the market for a length of time. Respondent understanding of this ingredient was the second lowest across all the bioactive food ingredients studied. Omega-3 fatty acids had the highest overall respondent recognition and also had the highest percentage (32.6%) of respondents with understanding indicating

that this ingredient is the closest ingredient to move into the mature stage of consumer acceptance. Antioxidants had the second highest overall respondent recognition. However, it was placed in the emerging stage, indicating that education and/or marketing efforts were still required to move it across to the growth stage of consumer acceptance. Although isoflavones had an equal level of respondent recognition as phytochemicals (20.9% respectively) and both had high respondent awareness (65.5% and 55.2% respectively), the respondents with understanding of isoflavones was more than double that of phytochemicals (27.5% versus 10.3%). Glucosinolates had the lowest respondent recognition (15.1%) and was the only ingredient to have no respondent understanding of it.

The respondent acceptance of isoflavones, beta carotene, glucosinolates, phytochemicals and functional foods were not significantly ($p > 0.05$) influenced by any of the studied respondent demographic characteristics, health and lifestyle characteristics or foods/beverages with added health benefits purchase intention behaviours. While only four significant associations/differences ($p < 0.05$ for each) were evident between the bioactive food ingredient acceptance and the respondent demographic characteristics (soy protein and flavonoids with gender, probiotics with population groups and omega-3 fatty acids with marital status) and only two associations/differences evident between the respondent food/beverage with added health benefits purchase behaviour and intention characteristics (probiotics and lycopene each with purchase frequency of beverages with added health benefits), there were ten significant associations/differences between the bioactive food ingredient acceptance and the respondent health and lifestyle characteristics (probiotics with frequency of moderate physical activity; probiotics, omega-3 fatty acids and antioxidants with perceived level of nutrition knowledge; probiotics and omega-3 fatty acids with perceived health and wellness knowledge; antioxidants with degree of interest in health and wellness; omega-3 fatty acids and antioxidants with degree of interest in food and nutrition and plant sterols or stanols with incidence of chronic disease).

The overall respondent characteristics to drive the consumer acceptance evolution of bioactive food ingredients identified in this study were health and lifestyle characteristics, particularly consumer's perceived knowledge and their degree of interest in nutrition, health and wellness. In order for respondents to become informed, they need to show some degree of awareness of and interest in these ingredients to the extent that they can at least be considered to be moderately informed. Marketers need to awaken this interest in respondents in order to sway their acceptance of bioactive food ingredients, in particular of those bioactive food ingredients where the health and lifestyle characteristics as yet have made no impact, including isoflavones, beta carotene, glucosinolates, phytochemicals and functional foods.

ACKNOWLEDGEMENTS

I wish to thank:

Ms Irma Venter, for the continuous guidance and ongoing support throughout this study.

Ms Hannelise Louwrens, for her assistance in the verification of the respondent word association results.

Prof de Wet Schutte, for his advice and time in setting up the structure of the questionnaire.

Ms Corrie Uys, for the statistical analysis of the data.

All the participants, for participating in the study, which would not have been possible without them.

GLOSSARY

Terms/Acronyms/Abbreviations	Definition/Explanation
Acceptance	For the purpose of this study, 'acceptance' relates to consumer acceptance of bioactive food ingredients as represented by their awareness, knowledge and understanding of it (Witwer 1999:52).
Aware (adjective)	Aware 'implies vigilance in observing or alertness in drawing inferences from what one experiences' (Merriam-Webster's Online Dictionary). For the purpose of this study, 'awareness' indicates that a respondent has heard of the bioactive food ingredient stimulus word, however, indicated no additional knowledge of that bioactive food ingredient.
Bioactive food ingredients	Bioactive ingredients are ingredients in food or food components that deliver biological benefits to health when consumed (Witwer, 1999:50).
DSHEA	Dietary Supplement Health and Education Act (Wrick, 2003:1)
FDA	Food and Drug Administration (Platzman, 1999:2)
FOSHU	Foods for Specific Health Uses (Platzman, 1999:1)
Free word association	Free word association is the process of evaluating results gained from respondents, who write down as many free words achievable to the provided stimulus word. The selection of the stimulus word is dependant on the objective of the study (Grenard, 2003:7).
Functional foods	Foods which supply health benefits beyond the nutrients it usually contains (Hasler, 2000:499S).
Knowledge (noun)	'An acquaintance with or understanding facts' (Harber & Payton, 1979:599). For the purpose of this study, respondents displayed 'knowledge' of bioactive food ingredients if they correctly listed a food source and/or property of the bioactive food ingredient.

NLEA	Nutrition Labelling and Education Act (Pearl, 2001:3)
Neutraceutical	A product isolated or purified from foods that are generally sold in medicinal forms because it has a physiological benefit or provides protection against chronic disease (Jones, 2002:1556).
Phytochemical	Phytochemicals are biologically active chemicals found in plant sources that contribute to reducing the risk of chronic diseases when consumed (Hasler, 1998:63).
Understand (adjective)	'To apprehend the meaning, significance, nature or explanation of...'(Harber & Payton, 1979:1199). For the purpose of this study, respondents displayed an 'understanding' if they grasped a health connection or benefit of consuming the bioactive food ingredient in addition to correctly indicating a food source and/or property of that bioactive food ingredient.

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CHAPTER ONE
INTRODUCTION

The terms 'functional foods' and 'neutraceuticals' are often used to describe the union of key industry trends resulting in the merging of food products and dietary supplements into food products ('functional foods') that contain components ('neutraceuticals') that offer preventative or therapeutic health benefits. The food components or 'bioactive ingredients' draw the attention to the biological benefits promised by these foods (Witwer, 1999:50). The concept of functional foods has been a known one within the food industry since the Japanese first introduced the term in the 1980's (Hasler, 1998:63). In the early 1990's, the functional food concept began to catch on and ran in response to the trend of reducing salt and sugar, the less-desirable food components (Wrick, 2003:1). Changes in consumer lifestyles have transformed food consumption patterns resulting in consumer interest in eating healthily, which is not just a fad, as many people around the world are already purchasing functional foods. Many, however, may not be aware that they are purchasing functionally enhanced foods, which include folate-fortified bread or vitamin and mineral enriched foods (Pearl, 2001:1).

In 1997, with the grocery industry in the United States (U.S.) only achieving a 0.6% growth, the dietary supplement industry grew at 13% in one year (Witwer, 1999:50). The U.S. food industry's history of avoiding conflict with the Food and Drug Administration (FDA) resulted in a slower start to the functional food category than that achieved with dietary supplements following the 1994 Dietary Supplement Health and Education Act (DSHEA) (Wrick, 2003:1). This slow approach may have supported a more prolonged and sustainable growth curve in the functional food sector, as in 2001 and 2002, the functional food market grew at 7% and 9% respectively, valued at US$ 20.1 billion in 2002, whereas the entire U.S. food industry only grew at 3% for 2002, which was estimated at US$ 518 billion (Wrick, 2003:1). With annual sales of US$ 92 billion, the fastest growing segment of today's food industry is neutraceuticals, which is perfectly positioned to capture the changing consumer attitudes towards health and well-being (Sloan, 1999:40).

With the rapidly aging populations of Western countries, an increasing number of adults are suffering from the so-called diseases of affluence, regardless of the incidence of awareness in health. This has resulted in the increased interest in the possibility of using the diet to reduce the chance of contracting universal diseases like cancer, osteoporosis, diabetes and coronary heart disease (CHD) (Tekes, 2004:2).

In South Africa (S.A.), with reference to CHD, 195 people died every day between 1997 and 2004 as a result of some form of cardiovascular disease (CVD) and it is suggested that by

2010, 666 people will die per day from these chronic diseases (Steyn, 2007:2). The term CVD refers to any disease affecting the heart and/or blood vessels and may include strokes, diseases of the heart, heart attacks, heart failure and heart diseases caused by high blood pressure (Steyn, 2007:3). Reduced life expectancy, life quality and income through medical costs and lost productivity, are side effects of these diet-related diseases (Pinhão, 2006:2).

The supermarket 'self-care' movement in the U.S. was estimated to be 55 million consumers strong by the Food Marketing Institute (Sloan, 1999:40) and with information being available more than ever before, it is suspected that consumers reaching middle age may be trying to postpone the symptoms of aging and disease and could be contributing to growth of the dietary supplement industry (Witwer, 1999:50). The steering force of the self-care movement will also help to keep momentum to the functional food trend well into the future as the population is aging and with that the chronic disease incidence is increasing (Hasler, 2000:500S). As with the U.S., S.A. has its share of consumers regularly buying healthy foods (AC Nielsen, 2005:1) and dietary supplements (Agriculture and Agri-Food Canada, 2007a:4).

The primary objectives of the study were therefore to determine: (i) The level of awareness, knowledge and understanding of functional foods and a number of bioactive food ingredients of health conscious consumers in the City of Cape Town (being represented by two adjoining subcouncils). Through determining the consumer awareness, knowledge and understanding that represents the consumer acceptance of these bioactive food ingredients, the stages originally compiled by Witwer (1999:52) representing the 'Evolution of consumer acceptance of bioactive ingredients in the United States' were identified for each investigated bioactive food ingredient. (ii) The demographic, health and lifestyle characteristics and other socio-environmental influences affecting the consumer awareness, knowledge and understanding (i.e. acceptance) of bioactive ingredients in functional foods was used to describe the consumer market for functional foods and the bioactive food ingredients investigated.

Currently, there is lack of local data among South African consumers and their acceptance of functional foods and bioactive food ingredients. It is, therefore, important to determine the level of consumer awareness, knowledge and understanding of (the studied) bioactive food ingredients to guide the marketing efforts to be taken by the food industry as for some of the bioactive food ingredients the level of consumer awareness might firstly have to be increased, while for others, only the level of consumer knowledge and understanding might have to be increased to obtain consumer acceptance. The consumer demographic, health and lifestyle characteristics and other socio-environmental influences also need to be determined to ensure that marketing efforts for (the studied) bioactive food ingredients are directed at a suitable target market.

CHAPTER TWO
LITERATURE STUDY

Functional foods are foods that contain biologically active components, e.g. probiotics or phytochemicals or antioxidants, which are also known as bioactive food components or ingredients (Food Quality and Standards Service, 2007:4). Changes in consumers lifestyles (Pearl, 2001:1) as well as many consumers identifying the link between nutrition and health (Kalaitzandonakes, 2000:2) has resulted in consumer interest in eating healthily with many consumers around the world already purchasing and consuming functional foods (Pearl, 2001:1). A survey, in the form of a questionnaire, was conducted with health conscious consumers in the City of Cape Town, represented by two adjoining subcouncils, where information was gathered from the respondents regarding their recognition and acceptance of the different bioactive food ingredients, their demographic, health and lifestyle characteristics and other socio-environmental influences that may affect their acceptance. The literature studied formed the basis to the deconstruction of the selected bioactive food ingredients and of the consumer recognition and acceptance of the ingredients studied, which was broken down into awareness, knowledge or understanding, to determine at what level the consumer recognition and acceptance of the studied bioactive food ingredients is at. The literature on the factors affecting consumer decision-making and purchasing was specifically studied to form the basis to the deconstruction of the demographic, health and lifestyle characteristics and other socio-environmental influences that may affect the acceptance.

2.1 Functional foods

As all foods provide taste, aroma and some nutritional value, all foods can, to a degree, be seen as functional. However, today foods are being scrutinised for additional physiological benefits (or functions) which may contribute to reducing chronic diseases or promoting optimal health, placing a new emphasis on food and health promotion and disease prevention (Hasler, 2002:3772).

2.1.1 Description of functional foods, neutraceuticals and bioactive food ingredients

There is no unanimously accepted definition for functional foods (Hasler, 2002:3772). For the purpose of the study, functional foods is understood to be those foods supplying health benefits further to that of basic nutrition and can include whole, fortified, enriched or enhanced foods, all of which, when consumed on a regular basis at effective levels as part of a varied diet, have a potentially advantageous effect on health (Hasler, 2000:499S). Functional foods can also be any food or drink that has an influence on specific bodily

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functions and in that way offering health, well-being or performance benefits beyond regular nutritional value (Williams, Pehu & Ragasa, 2006:1) or simply any food that delivers additional physiological benefits to consumers by delivering more than simple nutrition thereby contributing to reducing the risk of chronic diseases (Jones, 2002:1555). A functional food need not be functional for the entire population, but could be aimed at most of the population or a particular subgroup, e.g. consumers with CVD, gastrointestinal disorders or obesity (Palou, Serra & Pico, 2003:S513). In the early 1980's, the first research on functional foods began in Japan, where 86 research programmes were funded by the Ministry of Education to focus on the 'systematic analysis and development of food functions' (Roberfroid, 2000:1661S). In Japan, after passing the Foods for Specific Health Uses (FOSHU) regulations, nearly 300 food products were FOSHU approved by July 2002. While the U.S. has no regulatory identity like Japan, the International Life Sciences Institute defines functional foods as 'foods that, by virtue of the presence of psychologically-active components, provide a health benefit beyond basic nutrition' (Hasler, 2002:3772).

Health benefits or attractive physiological effects are conveyed by biologically active components in functional foods, represented by traditional foods and newly developed foods with added beneficial components (International Food Information Council, 2007a:1). Functional foods can be any food that contains these biologically active components e.g. probiotics, phytochemicals or antioxidants. These biologically active components are also known as bioactive food components or ingredients (Food Quality and Standards Service, 2007:4). The term neutraceuticals came about by joining 'nutrients' and 'pharmaceuticals' (Castellini, Canavari & Pirazzoli, 2002:3) in 1991 by the Foundation for Innovation in Medicine and refers to almost any bioactive compound that offers a health benefit (Hasler, 2002:3772).

Functional foods can be produced through five different approaches:

i) By the elimination of a component causing or known to cause detrimental effects when consumed;
ii) By increasing the concentration of a beneficial component already in a food to the point of having positive effects;
iii) By adding a component that has shown beneficial effects, but is not usually present in that food and is not a macro- or micronutrient;
iv) By replacing a component known to cause negative effects to the body and replacing it with another with beneficial effects; and
v) By stabilising or escalating the bioavailability of a component generating functional effects (Roberfroid, 2000:1661S).

The market for convenience foods that have taste and helps with the reduction of diseases was borne as a result of many people wanting to eat a healthy diet but, believe that these foods taste poorly and take a long time to prepare. This lead to the marketing of the first 'physiologically functional foods' in Japan in the 1980's. These foods/ingredients were approved based on a voluntary system developed by the Ministry of Health and Welfare to determine whether these foods warrant the FOSHU's label. Claimed to explicitly or implicitly improve health or well being, functional foods are not the same as dietary supplements. As described by the European Union (EU), dietary supplements are concentrated sources of nutrients that are marketed in doses and are designed to be consumed in small quantities. The U.S. regulation includes drinks and bars with tablets and capsules in their definition for dietary supplements (Katan & de Roos, 2003:206).

2.1.2 Consumer awareness and use of functional foods

A noteworthy portion of the population is interested in the 'foods-as-medicine' concept as well as the prevention of disease through dietary and lifestyle changes (Witwer, 1999:51). Despite using and being influenced by label claims, some consumers are unconvinced about food claims and view them as a marketing attempt by food manufacturers (EdComs, 2007:4). Complicated and individualised consumer dynamics make it very difficult to research consumers' objectives and correctly predict the way in which they will make decisions to work toward improved health through dietary means, acquire the information or expertise necessary to make the dietary changes and then follow through their decisions (Witwer, 1999:51). Changes in food regulations and the growing self-care movement, which is supported by overwhelming scientific evidence highlighting the critical link between diet and health, has caused the interest in functional foods to amplify over the past decade (Hasler, 2000:499S). Willing to adjust their diets to improve their health, many consumers recognise the link between nutrition and health and seem interested in the concepts of neutraceuticals and functional foods (Kalaitzandonakes, 2000:2). However, there are still many that do not recognise the link. Just over one thousand (n = 1012) U.S. adult respondents were asked in a study what their awareness of some functional food relationships with disease prevention was. Only 30% were aware that plant sterols reduce the risk of heart disease and only 41% and 54% knew that soy reduces the risk of heart disease and cancer respectively. Forty six percent were aware that probiotics helped maintain a healthy immune system (Reinhardt, 2005:21). A local study found that although less than half (40%) of Cape Town city health food store visitors were aware of lycopene, less than half of these respondents were able to provide a food source and indicate the major health benefit of it (Braun & Venter, 2008:36).

A study conducted in Portugal and Northern Ireland between July 2004 and February 2005 (Pinhão, 2006:4) among 100 consumers between 18 and 58 years of age (Pinhão, 2006:5)

found that consumers do not yet recognise the concept of functional foods (Pinhão, 2006:6). Respondents between the ages of 18 and 25 had never heard of the term functional foods and those between 26 and 33 years were not sure what the term meant (Pinhão, 2006:13). When researchers revisited the questions explaining that functional foods were foods that could help treat or prevent some health conditions, some respondents between the ages of 26 and 41 years recognised some products already being marketed for this reason (Pinhão, 2006:16). These consumers also viewed healthier foods as more expensive to purchase (Pinhão, 2006:12). Some respondents did express their concern about the legitimacy and accuracy of health claims (Pinhão, 2006:17).

In a study released by ACNielsen (ACNielsen, 2005:1), conducted in 2005 across 38 countries, including S.A., Europe, North and Latin America, with over 2100 respondents, it was noted that consumers are yet to be persuaded of the value of foods fortified with added vitamins or other components, which promote specific health benefits. Regular internet users were asked in the study what foods, in the list of ten major food types given, that promote specific health benefits they purchased (refer Table 2.1). Only four of the ten food types were purchased frequently by at least one third of the consumers (refer Table 2.1); over one third of the consumers would not consider purchasing another four of the food types and two types had never been heard of by one tenth of the consumers (ACNielsen, 2005:1). As can be seen in Table 2.1, S.A. in particular, has the share of regular buyers of healthy foods. South Africa together with Brazil, Chile and Mexico has consumers who are the most convinced of the value of foods with health benefits (ACNielsen, 2005:1).

Table 2.1: Regular purchase of foods that promote specific health benefits across countries (obtained from ACNielsen, 2005:2)

Regular food purchase	Countries					
	Asia Pacific %	Europe %	North America %	Latin America %	South Africa %	Global average %
Whole grain, high fibre products	37	38	55	51	61	40
Iodine enhanced cooking salt	32	30	24	56	30	32
Cholesterol reducing oils and margarines	28	27	41	54	58	31
Fruit juices with added supplements/vitamins	32	26	32	36	43	30
Yoghurt with *Acidophilus* cultures/probiotics	30	20	22	27	44	25
Milk with added supplements /vitamins	25	12	23	30	18	19
Bread with added supplements/vitamins	24	10	25	26	43	18
Fermented drinks containing 'good' bacteria	21	14	4	21	9	17
Soya milk	27	6	10	13	8	14
Cereal with added folate	14	7	12	21	21	11

There is still a large amount of distrust towards foods with health benefits and consumers are questioning whether the foods deliver what they claim, as represented in Table 2.2. An average of over 40% of the consumers in Asia Pacific, Europe and S.A. voiced this concern about fruit juices, while approximately a third of North and Latin Americans questioned the claims of oils and margarines that lower cholesterol levels (ACNielsen, 2005:2).

Table 2.2: Strength of viability as reason across countries for not purchasing four specific foods with attributed health benefits (obtained from ACNielsen, 2005:3)

Reason: I don't believe they offer additional health benefits	Countries					
	Asia Pacific %	Europe %	North America %	Latin America %	South Africa %	Global Average %
Cholesterol reducing oils and margarines	31	42	36	27	40	38
Whole grains, high fibre products	24	29	20	13	26	26
Fruit juices with added supplements/vitamins	42	48	32	23	45	44
Iodine enhanced cooking salt	32	37	32	22	30	34

South Africa is home to natural remedies like rooibos, aloe ferox and hoodia through which it has gained a strong presence in the world health market. South Africa was, however, not acknowledged as a top competitor in this health supplement market when rated on its growth between 2001 and 2005. The top ten rated countries are listed in Table 2.3 and the top African country was Nigeria, in 13th place (Agriculture and Agri-Food Canada. 2007a:3).

Table 2.3: Top rated countries for emerging markets for health and dietary supplements (obtained from Agriculture and Agri-Food Canada, 2007a:3)

1. Serbia and Montenegro	6. Uzbekistan
2. Venezuela	7. Argentina
3. Belarus	8. Indonesia
4. Turkey	9. Russia
5. Romania	10. Lithuania

Since 2005, awareness of some specific food and health associations among U.S. consumers has decreased. Awareness of folic acid reducing the risk of neural tube birth defects dropped from 63% to 55%, the awareness of fibre aiding a healthy digestive system dropped from 92% to 86% and the benefit of vitamin D in aiding bone health dropped from 88% to 81%. The people most likely to be aware of specific food components or nutrients for health benefits were dietary supplement users and consumers older than 65 years of age. However, consumers most likely to be consuming specific food components or nutrients for health benefits are consumers 55 years and older (International Food Information Council, 2007b:8).

In a study conducted with 1000 adult American consumers of 18 years and older in April 2007, 75% of the respondents believed that food and nutrition play the predominant role in maintaining or improving health, more than exercise or family history, as were indicated by 66% and 43% of the respondents respectively. Heart and circulatory health issues were the top health concerns of these respondents, with 53% rating this as their main concern. This is in line with the results from 2005 (54%), but higher than the 2002 and 2000 results with 41% and 40% respectively. The number of Americans troubled with cholesterol levels has increased from 5% in 2000 to 13% in 2007. Body weight remains a bigger concern than cancer, as 33% versus 24% of the respondents indicated these respectively. Diabetes was fourth with 17% of the respondents concerned about this risk (International Food Information Council, 2007b:4). Only about 25% of consumers indicated actively adding more fruit and vegetables, grain and fibre to their diets and drinking more water. When questioned about their confidence in functional foods, 85% of respondents agreed that functional foods might reduce the risk of disease and other health concerns. Those consumers who believed that they are in command of their health are those who presumably 'strongly agree' to certain foods having health benefits beyond basic nutrition (International Food Information Council, 2007b:5).

American consumers are increasingly aware of food and health relationships that have been promoted over time, like calcium's relationship with building strong bones. They are, however, becoming more aware of more recent health benefits from foods and bioactive ingredients, such as soy/soy protein and probiotics. As they are becoming more aware of new associations of health benefits from foods, they do not necessarily make the connection between the food component and the health benefit as they identify with whole foods more easily; i.e. consumers may identify that consuming flax or fish oils or nuts is beneficial to their heart, yet may not realise that the omega-3 fatty acids is the common health component (International Food Information Council, 2007b:15).

In 2007, the top functional foods named by American consumers were fruit and vegetables, followed by fish/seafood/fish oil, milk, whole grains, fibre, oats/oat bran/oatmeal, green tea, meat, water, herbs and spices, other dairy products, cereals, nuts and juice (International Food Information Council, 2007b:6). With 41% 'very interested' and 42% 'somewhat interested', Americans remain greatly interested (83%) in learning more about functional foods (International Food Information Council, 2007b: 6), while responses from 2627 adults in the United Kingdom (U.K.), who were interviewed between August and October 2007, indicated a general decrease in concern about overall healthy eating (Food Standards Agency, 2008:49). Results showed that the youngest respondents (16 to 25 years), men and

respondents with a lower level of education were less focussed towards healthy eating, both in their awareness and claimed behaviour (Food Standards Agency, 2008:3).

2.1.3 Consumer bioactive food ingredient acceptance for functional food use

The health benefits of bioactive ingredients included in dietary supplement formulations have been vigorously promoted by the dietary supplement industry as dietary supplements keep on making their way into conventional markets and out of health food stores (Witwer, 1999:52). The top dietary supplements with the accompanying bioactive ingredients in S.A. are calcium, other mineral supplements and fish oils, in terms of volume and sales. Garlic, ginseng, ginko biloba, evening primrose oil, Echinacea and St John's wort are examples of other dietary supplement ingredients making an impact on the South African market (Agriculture and Agri-Food Canada, 2007b:3). Figure 2.1 represents the understanding of the health benefits of bioactive ingredients by American consumers that follows a S-curve graph pattern (Witwer, 1999:52).

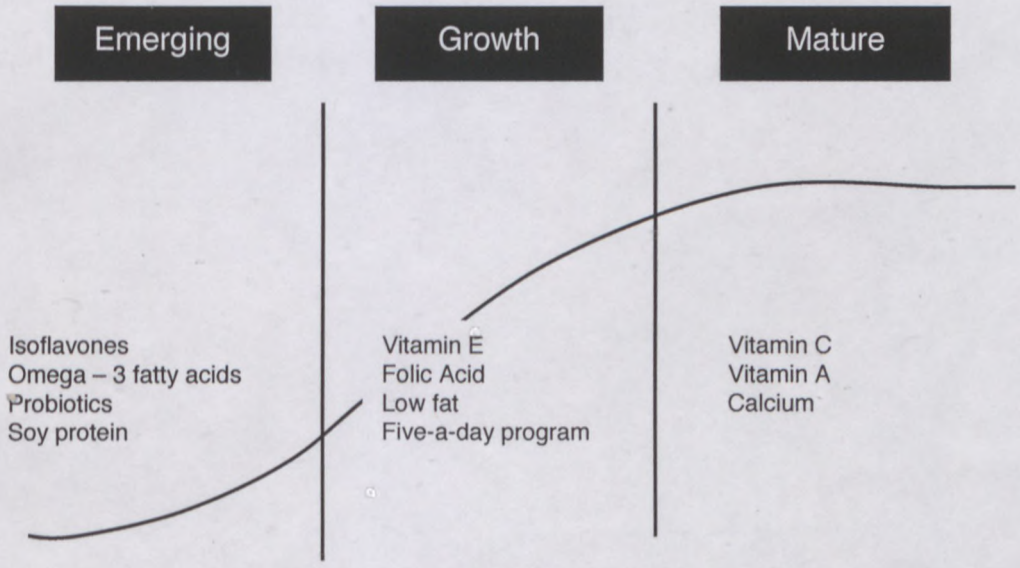

Figure 2.1: Evolution of consumer acceptance of bioactive ingredients in the United States (obtained from Witwer, 1999:52)

2.1.3.1 Emerging stage

This segment includes new trends that are beginning to enter the 'radar screen' and have not reached a certain level of popularity (Sloan, 1998:37). The majority of bioactive ingredients fall into the emerging segment of consumer knowledge and acceptance (Witwer, 1999:52). Manufacturers who identify emerging trends that will be offering new opportunities by 2020 will be well positioned to profit from this market (Sloan, 1998:37).

Bioactive ingredients like omega-3 fatty acids and probiotic cultures in yoghurts and their respective health benefits will be understood by some educated and up-to-date consumers. However, most of the general population are only just becoming aware of these benefits and food companies and marketers need to continue to conduct research, market these ingredients and educate consumers to promote these bioactive ingredients (refer Figure 2.1) (Witwer, 1999:52). With phytochemical compounds only being confirmed by science in the late 1990's, it is a clear example of an emerging trend (Sloan, 1998:37).

2.1.3.2 Growth stage

Consumers are slowly becoming aware of the bioactive ingredients in this segment and over time the ingredients will move to the mature stage. The food industry will have to, however, continue to market these ingredients while in this stage, which includes, among others, folic acid, vitamin E, low fat and the 'five-a-day program' (Witwer, 1999:52) (refer Figure 2.1). The above-mentioned emerging trends enter the growth stage when mainstream consumers reach a level of interest, knowledge and understanding of these trends. Product development of functional foods should take place within this stage (Sloan, 1998:37).

In a study conducted in 2007, 78% of U.K. consumers were aware of and answered correctly to questions with regards to the 'five-a-day' program, compared to 71% in 2006, showing that the trend continues to climb year on year with more and more consumers being aware of this program (Food Standards Agency, 2008:9), providing for it to reach the mature stage some time. Marketers actively promote the health benefits of fruit and vegetables with most consumers being at least aware of the 'five-a-day' program (Witwer, 1999:52). One of the contributing factors that sparked the interest in functional foods was the discovery that diets high in fruit and vegetables is matched with lower risks of heart disease and cancer. Evidence has shown that the phytochemicals in fruit and vegetables contribute to this better state of health (Milner, 1999:1395S) and that adequate consumption of fruit and vegetables can aid in reducing deaths from diet-related diseases (Kamphuis, Giskes, de Bruijn, Wendel-Vos, Brug & van Lenthe, 2006:620). Antioxidants present in fruit and vegetables scavenge harmful free radicals in the body, which in turn helps reduce the risk or onset of the diet-related degenerative diseases (Kaur & Kapoor, 2001:703).

2.1.3.3 Mature stage

In the mature segment, manufacturers of functional foods should already be in the market place (Sloan, 1998:37). Most consumers have sufficient knowledge of the bioactive ingredients in this segment, which includes vitamins C and A and calcium. The importance of

these micronutrients is taught to consumers from a very young age. Without providing any additional information, it can be believed that most consumers know that vitamin C fights against colds, vitamin A promotes better eyesight and calcium helps build strong bones. Products are readily fortified with these ingredients by the food industry with products being differentiated by bioavailability, taste or solubility (Witwer, 1999:52).

2.2 Factors affecting consumer food decision-making and purchasing

Based on a variety of internal, mostly physical and psychological, and external, mostly demographic and sociological, influences, consumers build up lifestyles that generate needs and desires (Hawkins, Mothersbaugh & Best, 2007:26). Both internal and external influences determine the way consumers live and view themselves (Hawkins *et al.,* 2007:27). There are numerous internal and external factors contributing to the interest in functional foods: the increasing health care costs associated with chronic diseases; the aging health conscious baby-boomers; technological advances and scientific discoveries; food regulation changes and market opportunities (Hasler, 2000:500S). Consumer interest in functional foods is ultimately fuelled by speedy advances in science and technology, increasing costs of health care, an aging population and renewed interest in obtaining improved health through diet (International Food Information Council, 2007a:1).

Figure 2.2 represents the typical model of consumer decision-making behaviour. As part of the input stage, the consumer takes into account marketing influences as well as socio-cultural environmental influences that influence their ultimate purchase decision (Schiffman & Kanuk, 2000:443). Only the demographic and socio-cultural environment influences which form part of the input stage of the consumer decision-making process is relevant to this study and will be used to provide input towards the marketing efforts on completion of the study as the study examined the consumer acceptance (as the awareness, knowledge and understanding) of functional foods and a number of bioactive ingredients and not the process and output stages of purchasing decisions with regard to bioactive ingredients and functional foods.

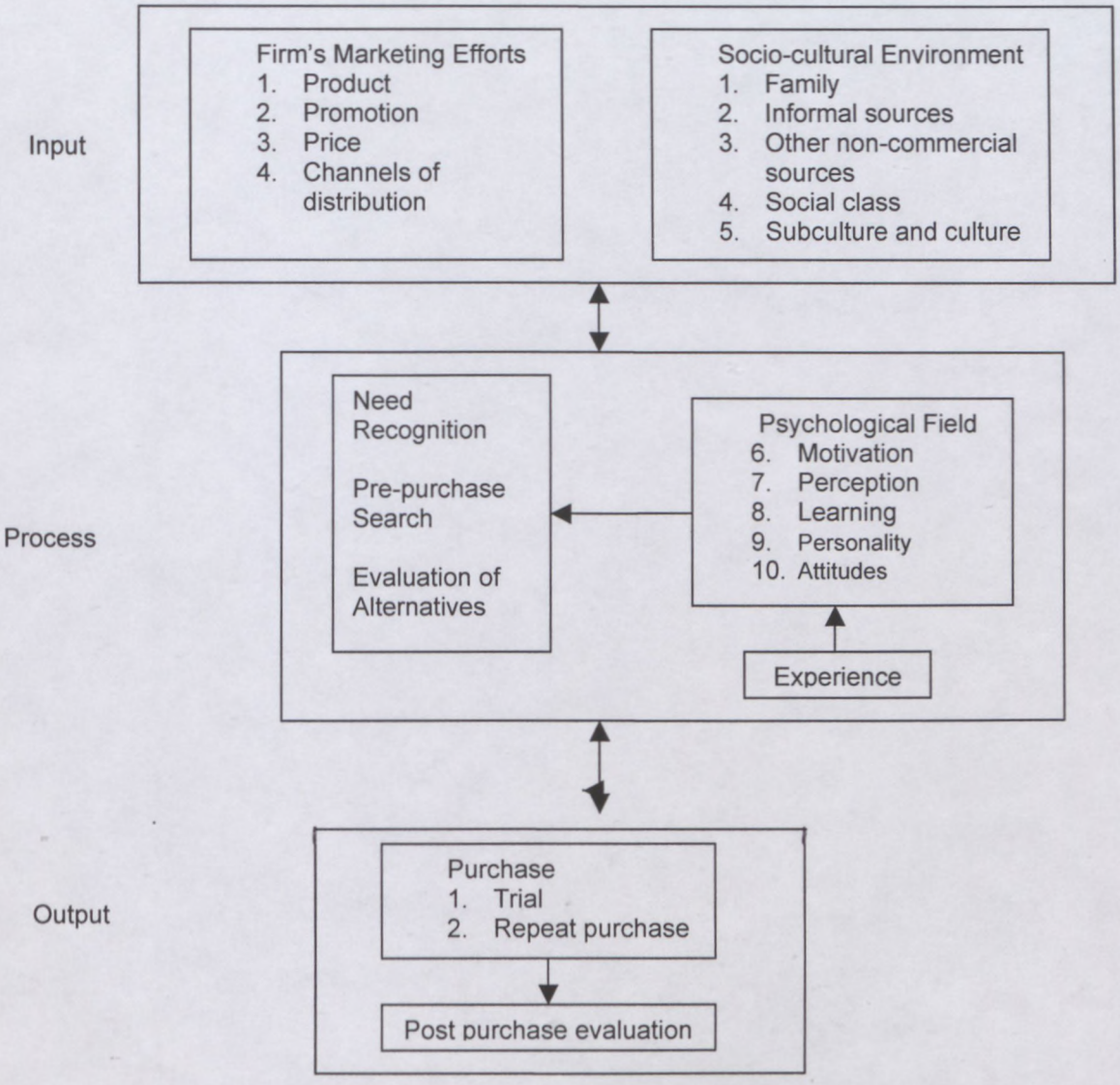

Figure 2.2: Simple model of consumer decision-making (obtained from Schiffman & Kanuk, 2000:443)

2.2.1 Demographic influences

Consumption behaviours are influenced by demographics both directly and indirectly by affecting other individual attributes, like personal values and decision-making styles (Hawkins *et al.*, 2007:116). Along with demographic factors, food consumption patterns and the market demand for functional foods are influenced by individuals' attitudes towards food, nutrition and health (Kalaitzandonakes, 2000:2). Demographic segmentation takes into account consumers desires, references and frequency of use of a product. Looking at consumers' lifestyle, marketers can learn and understand more about them and how they live and spend their time and money. Lifestyle takes into account consumers opinions and interests (Cavicchi, Lobb, Mazzocchi, Romano, Stefani & Trail, 2005:4).

The food industry is expected to experience changes by 2020 as consumer food preferences, demographics and psychographics experience noteworthy changes (Sloan, 1998:37). South Africa has undergone several social and economic changes since the end of apartheid. This resulted in many South Africans having experiencing lifestyle changes and having more opportunities. The demographic breakdown of S.A. is listed in Table 2.4. The negative growth rate in S.A. can be in part attributed to the prevalence of Human Immunodificiency Virus/Acquired Immune Deficiency Syndrome (HIV/AIDS) and improved literacy (Agriculture and Agri-Food Canada, 2007c:8).

Table 2.4: South African demographic statistics (obtained from Agriculture and Agri-Food Canada, 2007c:7)

Demographic characteristic	**Statistic**
Total population	48.6 million (2005)
Population growth	-0.4% (2006)
Age breakdown	
0 – 14 years	29.7%
15 – 64 years	65.0%
65 years and older	5.3%
Median age	24.1 years (2006)
Life expectancy	42.7 years (2006)
HIV/AIDS adult prevalence rate	21.5% (2003)
Population living with HIV/AIDS	5.3 million (2003)

2.2.1.1 Age

Consumers that are of different ages have different needs and wants. These consumers, although they may be different in many ways, still share common cultural experiences and values (Solomon, 2006:10). Age is a critical positioning tool for many products as it holds with it culturally defined behavioural and attitudinal habits (Hawkins *et al.,* 2007:2). For example, older consumers tend to search less to satisfy their food intake desires, possibly due to gained knowledge over time (Hawkins *et al.,* 2007:549). Younger consumers are more likely to consult the calorie and fat contents of food products as well as both the product ingredient lists and nutritional labels, whereas older consumers are likely to only assess the product ingredient list (ACNielsen, 2007:13).

The consumer segment of young adults (20 to 39 years of age) is expected to grow 26% to 44% between 2000 and 2015 and is becoming an increasingly lucrative market consumer group (Agriculture and Agri-Food Canada, 2007c:10). The young South African adult population between 15 and 29 years of age represents 30% of the population and although

they have some disposable income, they have low spending power. This segment shows the highest consumption levels of vitamins and dietary supplements, complementing their gymnasium and aerobic club memberships. With a -0.4% population growth and a median age of 24.1 years, S.A. is a young population (Agriculture and Agri-Food Canada, 2007a:6), as indicated in Table 2.4.

Consumers in the middle-aged adult segment are forecasted to increase by 40%, 'baby boomers' by 45% and pensioners by 41% between 1990 and 2014. These segments present marketing opportunities for vitamin and dietary supplements as consumers begin to pay more attention to their health (Agriculture and Agri-Food Canada, 2007a:6). The exponential growth in the age of the population has out paced the investment into research of chronic diseases and it is expected that 70 million people will be over 65 years by 2035 (Hasler, 2000:502S).

Age and education both seem to play a significant role in the level of socio-demographic differences influencing dietary habits, with an older age and higher education both being positively associated with an increase in fruit and vegetable consumption (Dynesen, Haraldsdóttir, Holm & Astrup, 2003:1596). A survey conducted via private telephone conversations in Denmark with a random sample of geographically stratified men and women (480 and 515 respectively) aged 15 to 50 years, found that consumers tend to consume more cooked vegetables with increasing age, while green salad or shredded vegetables were consumed more frequently by women or consumers with higher education levels (Dynesen *et al.*, 2003:1590).

There does not seem to be a distinct age group interested in functional foods. Although, middle aged consumers (35 to 54 years) seem to be more interested than older consumers (55 years and older) and younger consumers (18 to 34 years), all age groups show an interest in functional foods (Canada. National Institute of Nutrition, 2000:8).

2.2.1.2 Gender

Marketers target consumers by differentiating gender from a very early age (Solomon, 2006:10). Numerous studies have indicated that women are more likely to read nutritional product labels than men (EdComs, 2007:13) and some evidence suggests that women have a greater tendency to accept functional foods and natural health products than men (Blandon, Cranfield & Henson, 2007:2). Men as a whole tend to focus on product ingredient lists rather than claims and look for nutritional information regarding cholesterol, while women search more for nutritional information on fat, calories, vitamins and minerals and are

inclined to use both the product ingredient list and nutritional claims (EdComs, 2007:13). Dietary studies of gender have also consistently shown that women were far more likely to conform to dietary recommendations. Although the exact reasons for this may be unclear, many explanations have been proposed (Bogue, Coleman & Sorenson, 2003:8).

In a study conducted between 1996 and 1997 by the National Food Agency in Denmark, it was observed that men's diets are higher in meat, potatoes and alcohol, while women's diets are higher in fruit and vegetables, fish and some dairy products. Similar patterns were reported in other gender-dietary surveys undertaken in Great Britain, Ireland, Finland, Sweden and the Netherlands (O'Doherty Jensen & Holm, 1999:352). A survey conducted between July 2000 and June 2001 in the U.K. of adults aged 19 to 64 years found that women on average consumed 2.9 servings and men 2.7 servings of fruit and vegetables daily. Only 13% of men and 15% of women met the five-a-day target, while consumers between the ages 19 and 24 consumed less fruit and vegetables than adults aged 50 to 64 years of age (Food Standards Agency, 2004:14).

Women tend to consume more sweet foods like cake, biscuits, puddings, chocolates and sweets. Salads, vegetarian meals and soups have also been reported as favourites amongst women. Men rather regard these dishes as part of a main meal and not as a meal on its own (O'Doherty Jensen & Holm, 1999:353). While women are more prone to skip meals, men tend to eat larger, but fewer meals (O'Doherty Jensen & Holm, 1999:354) and women do tend to consume fruit more regularly than men. Men with higher education of an older age were more inclined to consume a healthy diet, however, these traits weren't significant in women (Dynesen *et al.*, 2003:1593). It has further been shown that women are more apprehensive about food quality and safety than men and that women tend to have healthier eating habits than men, indicating that they are more concerned about health (O'Doherty Jensen & Holm, 1999:355). Although there are slight differences in the weighting towards healthier eating, female consumers view healthy eating more importantly than men in all age groups (Food Standards Agency, 2008: 11).

2.2.1.3 Race

Consumption of western style foods has been an increasing trend in the black South African population since urbanisation, while the white South African population is increasingly experimenting with the traditional African cuisine (Agriculture & Agri-Food Canada, 2007c:8). This change in the diet of the black South African population has been reported over the last four decades and is believed to be a result of migration, urbanisation, acculturation, education and economic development (Viljoen, Botha & Boonzaaier, 2005:46), as well as the

influences of white people, convenience, changed education and health related and social characteristics of black South Africans (Viljoen *et al.,* 2005:57). The traditional diet of the black South African includes staple foods of wheat products (bread and cereals), mealie meal, meat (beef, pork, poultry) and fish, as well as potatoes, rice and pasta that are typically in the white population's diet (Agriculture and Agri-Food Canada, 2007c:8). With this change in diet to western-orientated food habits, black South Africans started consuming diets higher in saturated fats, sugars and refined foods, which in turn has increased the incidence of deaths from chronic diseases, typically associated with westernised food consumption patterns (Viljoen *et al.,* 2005:47).

However, importantly, many consumers are consuming healthier foods and are more health conscious as a result of increased education and the rise in the number of middle-class households (Agriculture and Agri-Food Canada, 2007c:8), two developments related to the black South African population. In the U.K. in 2007, it was found that non-white consumers read food product labels more than white consumers, with time the most commonly stated restricting factor to reading food product labels (EdComs, 2007:13).

2.2.1.4 Income, education and occupation

The three demographic variables, namely, income, education and occupation, are often combined as they tend to be closely related, with each affecting each other (Schiffman & Kanuk, 2000:42). Strongly associated with occupation, education can determine occupation and in turn, income can be determined by occupation (Hawkins *et al.,* 2007:116). Consumers will seldom be found with little education in high-level occupations (Schiffman & Kanuk, 2000:42). Studies have continuously shown that the level of education achieved and occupation are the clearest indicators of a person's socio-economic status (Bogue *et al.,* 2003:7).

Income is such a strong determinant of whether a consumer can or cannot afford a product or type of product. As a result, marketers have long used income as a vital variable to differentiate amongst market segments (Schiffman & Kanuk, 2000:40). Individuals with a lower income are usually at a disadvantage in terms of earning money, as well as knowing how to spend it wisely. Education influences how one thinks, relates to others and makes decisions (Hawkins *et al.,* 2007:119). Education and occupation have direct sway preference on products and media activities and income provides the resources to purchase them. Income is therefore more effective as an attribute for segmentation when used in conjunction with other demographic attributes (Hawkins *et al.*, 2007:120).

The average American standard of living continues to improve, despite them probably saying that they don't make enough money. Two key factors can be linked to the increased incomes: an increase in education and the increase in the number of women that are working. The fastest growing segment in the work place is women with pre-school going children, with many of them in jobs in high paying occupations like medicine and architecture, previously dominated by men. Although still a minority in most occupations, the number of working women continues to increase. In general, consumers who have graduated from college earn about 50% more than those who did not go to college. Tertiary educated women can earn 60% more than their peers with less schooling (Solomon, 2006:453).

Income is often combined with other demographic variables when trying to characterise a target market. For example, the 'affluent elderly' segments came about by combining high income and age. The 'yuppie' segment is focused on when combining income, age and occupational status, which is an essential sub-group of the 'baby boomers' (Schiffman & Kanuk, 2000:41). The Baby Boom generation is characterised by high education levels, high incomes and dual-income households and are often challenged by time scarcity as they manage two careers and family responsibilities (Hawkins *et al.,* 2007:128). By focussing on age, education and occupation, marketers can also focus on the impressionable college students (Schiffman & Kanuk, 2000:41).

Most studies have focused on individual level factors when investigating the relationship between socio-economic status and diet and consumers are grouped according to similar socio-economic characteristics like occupation, education or income and then their food and nutrient intakes and dietary behaviours are compared (Turrell, Blakely, Patterson & Oldenburg, 2004:208). Socio-economically disadvantaged groups are often shown to be less likely to engage in behaviours in line with healthy eating and are more likely to consume foods with nutrient intake profiles that correspond with their higher incidence of diet related diseases (Turrell *et al.*, 2004:209). Dietary differences between socio-economic groups are believed to contribute partly towards the onset and degeneration of chronic diseases in the disadvantaged socio-economic groups (Turrell *et al.,* 2004:208). A number of studies found that people less likely to buy or consume foods and beverages according to the recommended dietary guidelines, were from a lower socio-economic status. Similarly, people from higher socio-economic groups consumed more fresh fruit and vegetables, whole grains and less fatty foods and meat (Bogue *et al.*, 2003:7). Socio-economic groups differ in mortality rates for many cancers, CVD and type 2 diabetes and research shows that the socio-economically disadvantaged groups experience the highest mortality for these diseases (Turrell *et al.*, 2004:208). The difficulty in procurement of healthy foods in socio-economically-disadvantaged groups in Australia was noted through studies, as it is possible

that some urban regions are differentiated in terms of food availability, accessibility and affordability (Turrell *et al.*, 2004:209).

Research conducted in the U.S. and Canada indicated that people of a lower income level are less likely to read food labels than people of a higher level. Product information on calories, sodium, fibre and fat are most likely to be read by people of a higher income level (EdComs, 2007:13). While people with lower education tend to only focus on product nutrition lists, those with higher education tend to read both the product nutritional list and the ingredient list (Edcoms, 2007:14). The degree to which consumers pay attention to product health claims is whether they feel they are at risk of the health benefit claimed (Edcoms, 2007:26).

A rise in income and subsequent increase in disposable income in recent years has allowed consumers to look after themselves and their well-being. This socio-economic trend is typical of industrialised countries (Castellini *et al.,* 2002:2). Those consumers with larger disposable incomes and those who buy into the health and fitness trends are most likely to purchase vitamins and other dietary supplements (Agriculture and Agri-Food Canada, 2007a:4). Although food choice has lost the aspirational influence to show a level of social and economic status, as was indicated in the surge of red meat sales 40 years ago, it is now rather dependant on the craving to be both physically and mentally healthy and to prevent the risk of disease (Castellini *et al.,* 2002:2). It has been revealed that people with a higher education level consumed less butter, less full-cream milk and refined sugars and had a higher fibre intake (Bogue *et al.*, 2003:7).

The income distribution linked to demographics in S.A. is highly skewed with the division of the consumer market into two segments – a well-to-do, mostly white consumer segment group and a poor, largely black consumer group (Agriculture and Agri-Food Canada, 2007c:8). The black consumer population is increasingly earning higher incomes as a result of improved education and better accessibility to training, thereby improving their buying power. South Africa has a strong emerging middle-class that is expected to outgrow the lower- or upper-income consumer segments (Agriculture and Agri-Food Canada, 2007c:8). South Africa's middle class consumer has also expanded with the government's Black Economic Empowerment Initiative. This emerging black middle class constitutes two million consumers and represents more than 40% of total black spending power, according to South Africa's University of Cape Town Unilever Institute and Research surveys and growing at an estimated 50% per year. Their spending power is now estimated at US$ 19 million (Agriculture and Agri-Food Canada, 2007a:5).

The annual disposable income per capita for South Africans was estimated at US$ 2360 in 2005, which is forecasted to increase by 51% between 2000 and 2015 (Agriculture and Agri-Food Canada, 2007a:5). Nineteen percent of consumer expenditure in S.A. is spent on food and non-alcoholic beverages, which is expected to grow by 26% between 2005 and 2015. This expenditure totalled US$ 527 per capita in 2005 (Agriculture and Agri-Food Canada, 2007c:8). It is also estimated that in 2015, approximately 8% of total consumer expenditure in S.A. will be spent on dietary supplements (Agriculture and Agri-Food Canada, 200a:5).

Income appears to be the most important determining factor of food consumption, followed by education. Fruit and vegetables and dairy products are affected most in the diets of consumers of lower income groups (Power, 2005:S38). One of the main causes of chronic diseases affecting developed countries is a lack of an optimal healthy diet. Consumers following diets rich in fruit and vegetables are known to have a lower risk of contracting certain cancers and heart disease (Dibsdall, Lambert, Bobbin & Frewer, 2002:159). Fruit and vegetable consumption is higher in consumers with a higher education, income and socio-economic status (Pollard, Kirk & Cade, 2002:375) and have therefore a lower risk at developing chronic disease at an early age (Dibsdall *et al.*, 2002:159).

Evidence from multilevel studies conducted in the U.S. and Britain indicate that neighbourhood socio-economic factors effects ones diet, separate to individual factors. Typically, poorer diets are found in people of socio-economically disadvantaged areas than people's diets of advantaged areas (Turrell *et al.*, 2004:212). Consumers from socio-economically disadvantaged households spent more of their income on food as a percentage of their income than consumers of higher socio-economic status (McGanahan, 2008:1). Increases in food prices therefore hit consumers of socio-economically disadvantaged households harder than their wealthier counterparts. Rise in food prices beyond what consumers can afford leads to limited food consumption as well as less-balanced diets (Von Braun, Ahmed, Aseno-Okyere, Fan, Gulati, Hoddinott, Pandya-Lorch, Rosegrant, Ruel, Torero, van Rheenen, & von Grebmer, 2008:6).

2.2.1.5 Geographical positioning

A study conducted by the Medical Research Council, S.A. found that people who lived in the city regularly consumed a diet higher in fat, refined carbohydrates and added sugar. However, this is still regarded as healthy when weighed against the more traditional diet consumed by people living in rural areas. Their diets often constitute low fruit and vegetable and fibre intakes, a high fat intake and a high and increasing alcohol intake. In 1962 South

African's consumed 185g of fruit and vegetables per day and in 2001 they consumed 220g, still far off from the 400g per day recommended dietary intake (Steyn, 2007:12).

Access to and availability of certain foods can be influenced by the physical environment or geographical positioning of consumers. Healthy eating patterns are condemned when healthy food choices are not available for consumption. This is particularly evident in rural area communities or low-income communities living in urban areas who have less access to inexpensive healthy foods (Raine, 2005:S10). The urban areas of Cape Town, Johannesburg and Durban are home to about 55% of S.A.'s population (Agriculture and Agri-Food Canada, 2007a:6). Food choice is also influenced in restricted physical environments, like schools or hospitals, as the food choice is influenced by the food on offer, e.g. healthy food versus foods low in nutrient density (Raine, 2005:S10).

2.2.1.6 Marital status

Living together with a partner or being married will have similar socio-environmental influences to a family as the eating or purchasing patterns of other people in the household can influence an individuals' fruit and vegetable intake as well as general food consumption (Kamphuis *et al.,* 2006:631), as will be indicated in Section 2.2.2.1. Numerous studies have found that married consumers tend to consume more fruit and vegetables than their unmarried counterparts (Pollard *et al.,* 2002:378).

Although the 'family' has been the main focus of marketers in the past for various products and services, the 'household' as a whole nowadays continues to be the relevant element of consumption. Marketers are interested in obtaining the demographic outline of the household decision-makers, as well as the number and kinds of households that buy and consume products. This will aid in developing appropriate marketing strategies. The success of focusing marketing efforts on particular marital status groups like singles, divorced individuals, dual income married couples and single parents have been noticeable (Schiffman & Kanuk, 2000:277). In S.A., the household segment with single occupants grew from 11% in 1990 to 22% of total households in 2005 and is expected to reach 24% by 2015. This segment largely consists of career conscious consumers with large disposable incomes and indicates growth opportunities in the market segment of healthy, ready-made meals and convenience foods (Agriculture and Agri-Food Canada, 2007c:10).

2.2.1.7 Lifestyle

Consumer's lifestyles are changing as they increasingly become more affluent, accompanied with an accelerating change in consumer demand. Currently, 'healthy eating, dieting, low-fat and greater willingness to try new products' are consumer-common denominators, according to Pearl (2001:2) and are 'governed by convenience and price and tempered by indulgence and conservation'. Health concerns vary widely from one country to another, with the French more concerned about stress, the Japanese more concerned about cancer and the Americans concerned most about heart disease (Pearl, 2001:2). The lifestyle factors of South African black consumers have changed over the last few years, altering from their more traditional lifestyle to a more western lifestyle, which incorporates changed food purchasing and consumption behaviours (Viljoen *et al.*, 2005:46).

2.2.1.8 Personal values

Consumer's personal values have an influence on their attitudes when making a purchase. Being one of the most important factors influencing consumer purchase and consumption patterns, values outline the needs and desires of consumers which subsequently influences everything around them (Cant, Brink & Brigball, 2006:63).

2.2.2 Socio-cultural environmental influences

Environmental factors influencing food consumption among others include food pricing, television product advertising, product nutrition labelling, and national media campaigns to promote healthy eating (French, Story & Jeffrey, 2001:315).

2.2.2.1 Family

The extended family was once a common occurrence with three generations living together in unity. Later, the nuclear family, consisting of a mother, father and one or more children, became the norm. Yet, this is not necessarily the norm anymore and therefore, regardless of the relationships of the people living together, the U.S. Census Bureau now regards any occupied housing unit as a household. With the U.S. divorce rate over a million a year, approximately 20 million children under the age of 18 years live with just one of their parents, 84% of the time being their mother. A U.S. census also showed that the figure of women in the workforce with children under the age of one dropped from 59% to 55% from 1998 to 2000. Most of these women are well educated with college degrees and were high achievers, aged between their thirties and forties. This indicates that the traditional family

seems to be making a comeback, with only one breadwinner in the families who have the means to do this. Marketers have had to adjust over the past few years to adapt to the ever-changing family household. Opportunities become apparent to marketers where normal purchasing patterns become unfrozen with people making new choices about products and brands (Solomon, 2006:420).

Respondents from a Danish survey conducted via telephonic conversations with a random sample of geographically stratified men and women (480 and 515 respectively) aged 15 to 50 years, living in households with children consumed fruit more frequently than those without children (Dynesen *et al.*, 2003:1593), while a study conducted in the U.K. indicated that consumers cooking only for themselves and not for others within their household spent less time preparing vegetables or salads (Pollard *et al.,* 2002:378). If a family can influence the intake of fruit and vegetables in children of all ages within the family, the family can have both positive and negative influences on the eating patterns of these household members (Raine, 2005:S10). Research has shown that children who do not eat meals together with their family have less healthy food consumption patterns with a lower nutrient intake. Similarly, children who eat meals in front of the television and not with family members are at a higher risk for nutritional deficiencies (Patrick & Nicklas, 2005:85). Children tend to pick up or copy food preferences of their parents, both negative and positive (Kazmi, Khawar & Bano, 2006:2). If parents are selective eaters, children tend to be the same (Kazmi *et al.,* 2006:3).

2.2.2.2 Information sources

In a study conducted in 2008 by the Food Standards Agency (FSA), respondents were asked to indicate where they obtained information about food-associated issues. Television programming proved to be the main source of information for healthy eating with 34% of the respondents indicating this as their main source. When queried about unprompted statements regarding healthy eating, the government came out tops at 35% followed by food manufacturers at 15% and supermarkets at 13%. When respondents were prompted with a list of providers, Government still came out tops at 41%, but supermarkets jumped up to 35% (Foods Standards Agency, 2008:49). In a study conducted in S.A. among 394 black urban women (Charlton, Brewitt & Bourne, 2004:802), 41.4% of the respondents had received nutritional information through the radio and television once a month or more, while 35.1% responded that they had gathered nutritional information from magazines and 32.3% from food labels (Charlton *et al.,* 2004:804).

The average American adult watches television for approximately two hours per day. With the increase in food advertising, the average viewer can be exposed to 90 minutes of

commercial food advertising per week (French *et al.,* 2001:315). In the U.S. in 1997, manufacturers spent over $7 billion on food advertising. While snacks and confectioneries, convenience foods and soft drinks are among the foods most often advertised, they are also the foods that are over consumed (French *et al.,* 2001:316). Less money is being spent on fruit and vegetable advertising, with the low level of food branding contributing to this. With more advertising being spent on snack foods and drinks, consumers are not being encouraged to adopt a healthy eating pattern (Pollard *et al.,* 2002:383). A combination of communication, education and marketing efforts will be the determining factors to long-term consumer behavioural change (Wansink & Cheney, 2005:393).

Purchasing behaviour is also influenced by reading food labels, which in turn has an influence on a better dietary intake and a reduced consumption of 'unhealthy' foods (ACNielsen, 2007:12). Correct and concise information available on food labels is essential as most consumers come into contact with food labels and their nutritional content while purchasing or preparing food (French *et al.,* 2001:317). Consumers do not interpret label claims the same way as people in the food manufacturing industry do, e.g. nutrient, health and disease reduction claims. It has been shown that consumers do not necessarily understand the difference between these claims and once they are familiar with a nutrient-disease relationship, some nutrient claims may be interpreted as health claims (ACNielsen, 2007:5).

There is a concern that 'low fat' labels could lead consumers to over consume these products, especially among people who are already overweight. These foods are usually high in calories and low in nutrients and although no marketer would want to discourage consumption of its product, it would be in the consumers' best interest to use relative health and nutrition claims pertaining to 'low fat' products and encourage consumers to exercise portion control of such foods (Wansink & Chandon, 2006:605). A range of studies conducted by the FDA in the U.S. found that snacks labelled as low fat resulted in an increased consumption of up to 50%. The consumption of low fat labelled foods by normal-weight consumers are increased in foods that are believed to be healthy, whereas overweight consumers increased consumption across all foods labelled as 'low fat' (Wansink & Chandon, 2006:614).

Information regarding health claims is conveyed to consumers primarily through product labels, as well as point-of-purchase displays, friends, family, fitness-professionals and educational campaigns (Wansink & Cheney, 2005:387). Nutrition labels are often perceived as unclear or misleading by consumers and it has become the responsibility of other sources (government, health professionals, medical practitioners) to provide integrity to these claims

(Wansink & Cheney, 2005:388). Generally, women, particularly mothers, with higher education levels and higher incomes are most likely to read food labels and packaging. In the main, the reasons for reading food labels and packaging are because of interest in health and nutrition, a household member has a food allergy, children being present in the household or a consumer's religious belief prevents them from eating certain foods (EdComs, 2007:11). Consumers are more likely to notice, understand and believe a health claim when a short claim is represented on the front of label/pack and a longer explanation on the back of the product (Wansink & Cheney, 2005:393).

COI Communications conducted research on behalf of the FSA in 2007 whereby they gathered information from reports from English speaking countries, including U.S., Canada, Australia, New Zealand and S.A. The South African Bureau of Standards, Department of Health and The South African Association for Food Science and Technology were used as South African sources of information. It was found that consumers who read food labels are those searching for information about the product, such as the ingredients lists on what the product contains or the nutritional information of the product. Although still searched for, the 'use-by' or 'sell-by' dates are read to a lesser extend than the ingredient or nutritional information. Consumers who read food labels are typically those wanting to lead a healthy, balanced lifestyle, or they or members within the household have food allergies or follow a diet due to religious beliefs (Edcoms, 2007:15). The data from this research showed that consumers are more likely to understand claims that are short and simple, with clear, understandable use of language (Edcoms, 2007:39).

2.2.2.3 Social class

Social class refers to people who are of similar incomes and social standing within their community. They work in more or less similar professions and have similar tastes in music, art, clothing and leisure activities (Solomon, 2006:11). Social class is most often measured by comparing several demographic variables, like income, education and occupation (Schiffman & Kanuk, 2000:45), which was already discussed in Section 2.2.1.4.

Social influences on healthy eating is affected by both the physical and economic environments surrounding consumers as well as the embedded social act of eating learned from marketing activities and dietary guidelines (Raine, 2005:S11). Both overweight men and women are seen in the lower social classes, however, in the middle and upper social classes, both men and women have been reported to be concerned about health and fitness (O'Doherty Jensen & Holm, 1999:355).

2.2.2.4 Culture and subculture

Including almost everything that persuades an individual's process of thought and behaviour, culture is a multi-faceted concept that includes knowledge, beliefs, art, law, morals, customs and other habits and abilities gained as members of a society (Hawkins *et al.*, 2007:42). In a broad sense, culture entails all entities of social behaviour within the broader society. In other words, culture is made up of various aspects, including language, learning, needs, customs, beliefs and symbols and rituals (Cant *et al.*, 2006:55). A defined cultural group existing as a part of a broader more multi-faceted society can be referred to as a subculture. Marketers direct product designs and focus marketing efforts to specific market segments that are made up of various subcultures. Examples of subcultures include nationalities, religions, language groups, racial groups and geographical regions (Schiffman & Kanuk, 2000:47). A common culture within a society comes about when society members can communicate with each other via a common language. Without this, communication could not take place and a shared meaning would be absent (Schiffman & Kanuk, 2000:26). Culture may not influence an individuals biological drives like hunger; however, it can influence how and when these drives will be satisfied. Culture affects a wide variety of behaviours and it is acquired rather than innate (Hawkins *et al.*, 2007:42).

Food selection is influenced by the availability of food and cultural influences. These cultural influences result in food consumption habits, often influenced by traditions (Steptoe, Pollard & Wardle, 1995:268). Cultural influences cannot be seen, but can represent being part of a community as well as a sense of caring or belonging (Raine, 2005:S11).

2.3 Market potential and market availability of functional foods/bioactive food ingredients

2.3.1 Need for functional foods in South Africa

In S.A., vitamin and mineral supplements are very popular, possibly indicating consumers needs to make up for inadequate diets, thereby keeping illness at bay and to improve mental and physical performance. Vitamins are mainly purchased by South Africans in a multivitamin format. This accounted for 70% of total vitamin sales in 2005 (Agriculture and Agri-Food Canada, 2007a:4). Following an increase in consumer expenditure on vitamins and dietary supplements, corporate spending in S.A. on such advertising in 2005 totalled approximately US$ 2.7 billion, 185% more than the US$ 944 million in 2001 (Agriculture and Agri-Food Canada, 2007a:7). The total South African supplement market was valued at US$ 84.4 million with an estimated growth of 7% forecasted until 2010. Three main contributing

factors to the growth in health supplements sales in S.A. in recent years is an increased health awareness by consumers, successful marketing activities within the market and expansion of health and fitness centres (Agriculture and Agri-Food Canada, 2007a:4).

In 2002, with 29 million deaths reported worldwide, chronic diseases were the largest contributing factor to death. Death from CVD, already the leading cause of death in developed countries, is alleged to increase by 120% for men and 137% for women between 1990 and 2020. The figure for people with diabetes in 2000 was approximated at 171 million globally. This is projected to increase to 366 million, affecting 6.5% of the world's population. The majority of these people will live in developed countries (Yach, Hawkes, Gould & Hofman, 2004:2616).

Having major economic impacts, more than half the deaths taking place before 65 years of age in S.A. are caused by chronic diseases. In S.A., about 60 people die per day because of stroke, 37 because of heart failure and 33 due to heart attack, according to the Medical Research Council of South Africa (Steyn, 2007:2). Half the deaths from CVD, stroke, diabetes (type 2), atherosclerosis and certain types of cancer are diet related, according to the Department of Health and Human Services in the U.S. (Hasler, 2002:3773).

In 2000, approximately 5 million South Africans had high blood cholesterol (Steyn, 2007:26). Serum cholesterol concentrations are fundamentally determined by the consumption of cholesterol and by the proportion of energy consumed from saturated or polyunsaturated fats (Marshall, 2000:301). Blood cholesterol is increased by consuming foods high in cholesterol or foods high in saturated fat and trans fatty acids, including meat, eggs and animal fats (Steyn, 2007:11). The incidence in ischemic heart disease is directly related to cholesterol concentration i.e. it has been estimated that a rise of 0.6 mmol/$\mathcal{L}$ is connected with 38% increase in mortality from ischemic heart disease and a drop by 0.6 mmol/$\mathcal{L}$ results in a 20-30% decrease within five years. Consumers of a younger age experience an even greater reduced risk of ischemic heart disease. All income groups have the opportunity to reduce the risk of ischemic heart disease as lowering cholesterol from any level has health benefits (Marshall, 2000:301). The South African cholesterol figures of adults 30 years and older are listed in Table 2.5.

Table 2.5: Percentage of South African adults, 30 years or older, with blood cholesterol levels above 5 mmol/$\mathcal{L}$ (obtained from Steyn, 2007:26)

South African adult groups	Percentage having %
White men	90
White women	88
Coloured men	82
Coloured women	80
Indian men	87
Indian women	77
African men	24
African women	32

Deaths in people between the ages of 35 and 64 in S.A. as a result of CVD's are expected to rise by 41% between 2000 and 2030. White and black African people in S.A. have the lowest deaths from CVD, with Indians the highest and coloured people coming in second. The patterns differ significantly between white and black South Africans, even though these races have similar disease rates. While black South African's suffer mostly from cardiovascular deaths caused by strokes and heart diseases, white people mainly experience deaths caused by heart attacks (Steyn, 2007:3). Although no data exists on the number of incidences of strokes or heart attacks occurring daily, it is suggested that for every death caused by a heart attack or stroke, three people will survive these occurrences in S.A. (Steyn, 2007:4).

In addition to large-scale monitoring systems that have been set up in S.A. to track the occurrences of chronic diseases, there is a focus on obesity and prevention of nutrition related chronic diseases through the 'healthy schools' initiative. South Africa is one of 14 different countries participating in this initiative, which focuses on education programs increasing nutrition knowledge and understanding, spending more time on physical activity and stopping smoking for learners from more than 1000 schools (Doak, 2002:275). A broadcasting initiative to bring key health issues addressing both undernutrition and overweight to the attention of low income groups was taken in S.A. through the soap opera series, Soul City (Doak, 2002:276).

South African consumers are becoming more concerned about living healthier lifestyles as well as acquiring an improved understanding of nutrition and self-medication for preventative measures (Agriculture and Agri-Food Canada, 2007a:3). Consumers are furthermore increasingly becoming more interested in the concept of functional food science that came about through the hypothesis that the risk of lifestyle related diseases can be reduced through consumption of foods that transform various body functions and in so doing help

sustain a state of health (Arai, Morinaga, Yoshikawa, Ichiishi, Kiso, Yamazaki, Morotomi, Shimizu, Kuwata & Kaminogawa, 2002:2018). This has resulted in an expanding interest in functional foods or foods with bioactive ingredients that help reduce the risk of lifestyle related and chronic diseases as people turn to food to provide both basic nutrition as well as preventative benefits (Canada. National Institute of Nutrition, 2000:1).

2.3.2 Regulatory control of functional foods and included bioactive food ingredients to support beneficial health effects

There are widely reported connections between foods and the bioactive ingredients that they contain and the effect they have on reducing chronic diseases or positively affecting ones health. Some of the claims for these beneficial effects are allowed to be stated on food packaging to allow the consumer to be educated about the effects (South Africa. Department of Health, 2007:112-114). The FDA allows five types of health claims to be on food and dietary supplement labels: i.) *Nutrient claims* indicating a certain nutrient at a particular level; ii.) *Structure and function claims* whereby the effect of dietary components on the normal function and structure of the body are described; iii.) *Dietary guidance claims* where health benefits of broad categories of food are described; iv.) *Qualified health claims* which express a developing relationship between the reduction of risk of disease and components in the diet, and v.) *Health claims,* which verify a relationship between the reduction of a health condition and components in the diet, both approved by the FDA and supported by scientific evidence (International Food Information Council, 2007a:1).

The Foodstuffs, Cosmetics and Disinfectants Act of 1972 (Act 54 of 1972) regulates the permitted function and health claims allowed on South African food products. A list of wording that is permitted on food products claiming reduction of disease risks is listed as a regulatory control. These proposed reduction of disease risk claims as worded in the regulation is included as Appendix A (South Africa. Department of Health, 2007:112-114).

Teams of researchers including epidemiologists, nutritionists, oncologists, biochemists and microbiologists have demonstrated the powerful health effects of numerous foods as part of a traditional diet (Chao, Simmons & Black, 1998:39). Although extremely difficult to define, a food or food component health claim in the U.S. is based on 'significant scientific agreement' on the entirety of publically accessible evidence (Chao *et al.,* 1998:40). In order for a food product to qualify for a health claim it must: i) Significantly contribute to the nutritional make-up of the diet (Lawrence & Rayner, 1998:80) or have a significant impact on the total diet (Chao *et al.,* 1998:40); ii) Not contain excessive levels of a nutrient; iii) Not cause allergic

reactions or be toxic at high consumption levels; and iv) Contain the bioactive ingredients in feasible forms and sufficient quantities (Lawrence & Rayner, 1998:80).

Consumers are more likely to interpret claims accurately when they are familiar with the ingredients referred to in the claim, like fat and salt. They are also more likely to understand simple and brief claims and may ignore or misunderstand longer, more complex claims. Currently in the U.K., disease reduction claims are not authorised on foods and in the U.S., Australia and New Zealand, such health claims are faced with tighter regulations than other claims even though there is no evidence indicating that these claims are more probable to be misunderstood. Basic knowledge of the relationship between the dietary components and the diseases and whether the consumers feel at risk of the described disease is critical for consumer appeal and understanding of the claim (EdComs, 2007:4).

2.3.3 Examples of market availability of functional foods and bioactive food ingredients and the beneficial health effects

In 1999, Sloan (1999:48) published the top ten food trends to look out for in the new millennium. Within these ten food trends, Sloan (1999:48) identified 'living foods' as a key trend. One of the trends is phytochemicals from fruit, vegetables and grains as 'living foods', which will continue to be consumed as part of the 'food-as-medicine' drive (Sloan, 1999:48). Another trend that was identified was the 'self-treatment and trial' trend. The neutraceutical market is flourishing in the U.S. and the two key trends of 'foods-as-medicine' and 'self-treatment and trial' should both be watched out for by the food industry and the marketing industry (Sloan, 1999:55).

Consumers remain cynical regarding functional foods and their health claims (Roupas & Williams, 2007:4) and often view these claims as marketing tools. However, in order to make a health claim, food manufacturers in S.A. must follow the guidelines as stated in the Foodstuffs, Cosmetics and Disinfectants Act, 1972 (Act 54 of 1972) as found in the Government Gazette No. R. 642 of 20 July 2007 (refer Appendix A for the approved reduction of disease risk claims) (South Africa. Department of Health, 2007:59-61), which should assist consumers in viewing health claims more trustworthy. Over the last decades consumers have become more demanding of food manufacturers as they more strongly believe that the foods they consume have a positive effect on their health. Not only do consumers consume foods these days to satisfy their hunger and obtain the necessary nutrition, but also to prevent diet related chronic diseases and to improve mental and physical health. Functional foods satisfy these consumer demands (Siró, Kápolna, Kápolna,

& Lugasi, 2008:457) and consumers can make more informed decisions with these claims on the packaging (Pearl, 2001:3).

Initially, after the launch of functional foods, product development revolved around foods fortified with vitamins and minerals, particularly those of vitamin E, folic acid, zinc, iron and calcium. Since then, the focus has moved to foods being developed with macronutrients, like omega-3 fatty acids, phytosterols and soluble fibres. Products promoting gut health has dominated Japan and Europe recently, particularly products containing probiotics and prebiotics (Siró *et al.,* 2008:459). Functional drinks are an easy way to consume functional ingredients, with cholesterol lowering drinks containing a combination of omega-3 and soy protein proving to be popular (Siró *et al.,* 2008:460). Some meat products can be seen as functional when reformulated to include antioxidants or dietary fibre (Siró *et al.,* 2008:461).

Ingredients with functional qualities of which consumers are aware of the health benefits (e.g. vitamins and minerals) are accepted in the consumers minds far quicker than those ingredients for which they are not familiar with the health benefits (e.g. flavonoids and omega-3 fatty acids). In some instances consumers purchased functional foods, however, were not aware that the foods are functional foods or what the health benefits are. According to a German survey in 2006, a considerable number of consumers purchased functional foods enriched with plant sterols and were not aware of the health benefit and a vast number of these consumers were not the target market (Siró *et al.,* 2008:462).

In a study conducted in 2005 amongst American consumers regarding their awareness of the relationships of certain nutrients and their health benefits, 72% were aware of antioxidants, however, only 52% were already incorporating them in their diet. Only 49% of consumers were aware of the health relationship with lycopene, 47% with soy protein and 30% with plant sterols (International Food Information Council, 2007b:10).

Dairy products, soft drinks, bakery products and breakfast cereals are the most common functional food products available on the market. These food products typically contain antioxidants, lycopene, omega-3 fatty acids, probiotics and isoflavones, which are the most recurrently used functional ingredients in the market. Within the supplement market, the most regularly consumed health products are herbal remedies, vitamins, Echinacea and glocusamine (Blandon *et al.,* 2007:39).

The bioactive ingredients chosen for this study were influenced by the most recurrently used functional ingredients in the market (as indicated above) and the ingredients already identified by the British Nutrition Foundation as bioactive substances that can help prevent

chronic diseases. These bioactive substances include flavonoids, plant sterols and glucosinates (McKevith, Kelly, Stanner, Huges & Buttriss, 2003:261). These functional ingredients or bioactive substances chosen for the study are briefly discussed below that included a few that are already related to health claims and qualified health claims:

2.3.3.1 Soy protein

Soy is believed to help prevent CVD, cancer, osteoporosis and alleviate menopausal symptoms, with the most well known health effect being its ability to aid in lowering cholesterol levels (Hasler, 1998:64). The risk of CVD is reduced by soy protein which helps lower the LDL cholesterol circulation in the body, partially due to its amino acid profile (Jones, 2002:1557). A meta-analysis of 38 separate studies in 1995 with a total of 413 subjects concluded that soy-protein consumption resulted in a considerable drop of total cholesterol (9.3%), LDL cholesterol (12.9%) and a reduction in triglycerides (10.5%). Protein Technologies International (PTI, St. Louis, Mo) used the above analysis and proposed that only 6.25g of soy with a minimum of 12.5mg of total isoflavones is required to be present in a food to bear a health claim. This proposal was accepted by the FDA (Hasler, 1998:64).

This disease risk reduction claim for South African food industry use states that 'diets which contain at least 25g soy protein (four servings) daily and which are low in saturated fat and cholesterol, may reduce the risk of heart disease by lowering cholesterol levels' (South Africa. Department of Health, 2007:112) (refer Appendix A).

2.3.3.2 Pro- and prebiotics

A probiotic is a 'living micro-organism, which upon ingestion in certain numbers, exert benefits beyond inherent basic nutrition' (Klaenhammer, 2000:415S). Probiotics present numerous health benefits, including maintaining the intestinal microflora, protecting against infections, stimulating the immune system, reducing blood cholesterol and limproving lactose intolerance (Roupas & Williams, 2007:2) with the most common probiotic species being *Lactobacillus acidophilus* and *Bifidobacterium bifidum* (Erickson & Hubbard, 2000:406S). The most densely colonised region of the human body is the gastro intestinal tract, with approximately 10^{12} bacteria/g of contents in the large intestine and is estimated to contain several hundred bacterial species (Klaenhammer, 2000:415S). Probiotics must be consumed in sufficient quantities (>1 x 10^{10}/day) to maintain the amount in the colon, as they do not permanently inhabit the intestine. Only defined about ten years ago, prebiotics is a more recent concept (Venter, 2007:17). Prebiotics are 'non-digestible ingredients in food that beneficially affect the hosts health by selectively stimulating the growth and/or activity of one

or a limited number of bacteria in the colon' (Klaenhammer, 2000:415S), including the probiotic bacteria (Venter, 2007:17).

Roughly 65% of the world's functional food market contains probiotics (Roupas & Williams, 2007:2), largely made up of dairy products (Siró *et al.,* 2008:459). However, most products in S.A. do not state the probiotics present in the functional foods and when they do, the number refers to the number alive at the point of production and not at the point of purchase (Venter, 2007:17). Being cheaper to extract or manufacture than probiotics, prebiotics are also easier to handle in foodstuffs. Prebiotics can be added to a much wider range of foods than probiotics and are heat stable and not sensitive to oxygen. Products available for enrichment include bakery products, table spreads, sauces, infant formulas, snack bars, soups, salad dressings and dairy products (Venter, 2007:18).

Before probiotics can be used in a South African manufactured food, the following requirements need to be met, in accordance with Regulation 63 of R642 of 20 July 2007 (South Africa. Department of Health, 2007:55-58):

i. The genus species and strain must be identified;
ii. The safety of the potential probiotic must be checked;
iii. The efficacy must be assessed; and
iv. Methods need to be determined to identify the bacteria as well as determining the number of bacteria (South Africa. Department of Health, 2007:55).

In an attempt to follow the growing consumer trend of promoting a healthy gut, the Lallemand Group, a probiotic producer, has devised chocolate that is probiotic micro-organism enriched. Chocolate has been identified as a superior carrier of probiotics to the intestines. The patented technology is called 'Probiocap'. In conjunction with this, Tate & Lyle has developed a starch that acts as a dietary fibre as well as assisting food manufacturers to add more fibre to products, called 'Promitor Resistant Starch' (Shaw, 2008:44), that can be used as a prebiotic.

Research indicates that 50% of South African women report experiencing some form of digestive discomfort, bloating and constipation (C.H. Communications, 2006:52). The type of fibre consumed and both their digestibility and fermentability play a significant role in the effect and regularity of colonic functions and not only the amount in the diet. Insoluble fibres such as wheat bran are resilient against fermentation by colonic bacteria and retain water, thereby helping to increase faecal bulk (Chao *et al.,* 1998:46). On the other hand, fruit, vegetables and some grains, like oats and barley, contain soluble fibres that are easily fermented by bacteria and supply an easily available substrate for colonic bacteria growth

(Chao *et al.,* 1998:46). These soluble fibres increase faecal weight by increasing bacterial mass and gasses. Fibres that contribute to increased faecal weight, also contributes to reduced transit time. In this way constipation and impaction risks are reduced and less opportunity exists for absorption and hardening of the intestinal contents (Chao *et al.,* 1998:46). Prebiotic products may therefore be of particular benefit for South African women who do not consume sufficient soluble fibre in their diet.

No health claims for probiotics have yet been issued for functional foods due to the complexity of measuring live microorganisms in these foods. '[*Name of probiotic bacteria*] helps maintain a healthy intestinal microniota' is a possible function claim that could be used for probiotic food labels by Health Canada, the regulatory body responsible for Canadian food label claims (Farnworth, 2008:1253S). In S.A., although such health claims will be allowed, no health claim is allowed on food product labels unless the food conforms with all the regulations set out by the Department of Health. The following probiotic strains also do not need premarket approval: *'Lactobacillus acidophilus; Lactobacillus rhamnosus; Bifidobacterium bifidum and/or Bifidobacterium longum/infantis'* and only live strains will be allowed with a probiotic count of $1x10^8$ or more at the end of the shelf life in a single serving. No claims may indicate the degree of disease risk it can contribute to and probiotic claims will not be allowed for food products that require any further heating or cooking (South Africa. Department of Health, 2007:49).

2.3.3.3 Omega-3 fatty acids

Omega-3 fatty acids, found mostly in fish oils, has also been recognised for its role in the management and prevention of CVD (Jones, 2002:1558) as well as its positive connection in the treatment of cancer and arthritis (Ursin, 2003:4271). There are three main omega-3 fatty acids: α-linolenic acid (ALA), which may help protect against certain cancers; eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) which helps build brain tissue in infants (Platzman, 1999:5). Flaxseed oil is composed of 57% of the omega-3 fatty acid, α-linolenic acid (Hasler, 1998:64). A disease risk reduction claim was issued for omega-3 fatty acid by the South African Department of Health indicating that 'a daily intake of 850mg EPA and DHA omega-3 fatty acids from fish oil or fatty fish may protect against and reduce the risk of coronary heart disease' (South Africa. Department of Health, 2007:112) (refer Appendix A).

2.3.3.4 Isoflavones

Isoflavones are bioactive phytoestrogens provided in the diet through soy products, which are structurally similar to estrogen and act as natural estrogen receptor modulators (Setchell, 2001:354S). Isoflavones are non-steroidal in chemical structure and it has been suggested that, while acting as estrogen receptor modulators, they supply the beneficial estrogen effects, without negative effects on the breast or endometrium (Setchell, 2001:356S). With diets traditionally much higher in soy products, Asian countries, such as Japan and China, have much lower incidences of prostate and breast cancers than European countries or the U.S. Soy isoflavones have been identified as the bioactive ingredient contributing to the reduction in breast and prostate cancers (Atkinson, Warren, Sala, Dowsett, Dunning, Healey, Runswick, Day, & Bingham, 2004:R170).

A disease risk reduction claim was issued by the South African Department of Health for soy products, which include isoflavones, that states that 'diets which contain at least 25g soy protein (4 servings) daily and which are low in saturated fat and cholesterol, may reduce the risk of heart disease by lowering cholesterol levels' (South Africa. Department of Health, 2007:112). Studies have also shown that isoflavones have beneficial effects on limiting osteoporosis in post-menopausal women (Setchell, 2001:357S). This could have contributed to the increase in post-menopausal women in the U.S. consuming soy with isoflavones as a replacement to their hormone replacement therapy. Following the approval of a health claim by the FDA of 25g soy protein per day having an effect of reducing CVD, there has been an increase in commercial soy extracts being included in food products (Guo, Li, Browning, Rottinghaus, Lubahn, Constantinou, Bennink & MacDonald. 2004:181).

2.3.3.5 Lycopene

Eighty six pounds of tomato products are consumed by the average American every year. Tomatoes are high in lycopene, of which 85% of lycopene consumed in the diet comes from tomatoes (Canene-Adams, Campell, Zaripheh, Jeffery & Erdman, 2005:1226). Lycopene is a carotenoid found in plants and has powerful antioxidative properties (Giovannucci, Rimm, Liu, Stampfer & Willet, 2002:391). Studies have shown that lycopene and increased consumption of tomatoes has positive protective effects against CVD (Canene-Adams *et al.,* 2005:1229). Studies have also indicated that increased consumption of lycopene was associated with a reduced risk of prostate cancer (Giovannucci *et al.,* 2002:393). After careful evaluation of scientific evidence presented to the FDA, it concluded that there was credible evidence, although very restricted, that warranted qualified health claims for the link between tomatoes and a reduction in the risk of prostate, gastric, ovarian and pancreatic

cancer, as long as these claims were worded carefully to ensure that consumers were not misled (Kavanaugh, Trumbo & Ellwood, 2007:1082).

2.3.3.6 Plant stanols or sterols

There are more than forty plant sterols that have been identified and stanols are the saturated forms of plant sterols. Absorption of cholesterol in the intestine is reduced by consuming foods rich in plants sterols or stanols, which in turn reduces serum cholesterol levels (Katan, Grundy, Jones, Law, Miettinen & Paoletti, 2003:966). Only recently has food products that contain plant sterols or plant stanol esters, which have shown to reduce levels of blood-cholesterol, been given permission by the FDA to display claims regarding their ability to lower the risk of heart disease (Pearl, 2001:3). This claim issued by the South African Department of Health states: 'Diets low in saturated fat and diets low in saturated fat and cholesterol that include two servings of food that provide a daily total of at least 1.3g plant sterols or 3.4g of plant stanol esters in two meals may reduce the risk of heart disease by lowering cholesterol' (South Africa. Department of Health, 2007:112) (refer Appendix A).

2.3.3.7 Beta carotene

Beta- (ß) carotene is a type of carotenoid that is found in orange fruits and vegetables (Paiva & Russell, 1999:427) and has strong antioxidant properties. Numerous epidemiological studies have shown a positive relationship between higher levels of ß-carotene consumed through the diet and the reduction in risk of a variety of cancers (Paiva & Russell, 1999:429).

2.3.3.8 Glucosinolates

Cruciferous vegetables (e.g. broccoli, cabbage and Brussels sprouts) are particularly rich in glucosinolates. Glucosinolates have antioxidant properties and are associated with reduced risk of certain cancers (Shapiro, Fahey, Wade, Stephenson & Talalay, 2001:501).

2.3.3.9 Flavonoids

Flavonoids are phytochemicals, which are mainly consumed through fruit, vegetables, tea and wine (Ciolino & Yeh, 1999:1340). Various studies suggest that diets rich in flavonoids may protect against the risks of CVD and CHD. This is attributed to their naturally occurring antioxidant properties (Engler, Engler, Chen, Malloy, Browne, Chiu, Kwak, Milbury, Paul, Blumberg, & Mietus-Snyder, 2004:197).

2.3.4 Marketing efforts to support functional food development

As media attention to functional foods increases, some consumers become more confused as to what they need to consume to stay healthy and what makes up a healthy diet and as a result positioning functional foods in the market can be tricky. Gilbert (2000:23) has suggested five different category proposals to direct marketing efforts of functional foods to avoid consumer confusion and allow for a better understanding:

i) Prevention – covers foods that offer disease and symptom prevention through health management;
ii) Performance – covers foods where physical and mental conditions are improved through health enhancement;
iii) Wellness – includes foods to help one feel good and balanced;
iv) Nurturing – includes foods that provide a sense of caring for health and quality of life; and
v) Cosmetics - covers foods that enhance self-esteem through improved personal appearance and physical form (Gilbert, 2000:23).

To achieve the desired marketing effect of functional foods, the message that needs to be delivered to the consumer needs to be determined (Hawkins *et al.,* 2007:20). Hawkins and co-authors (2007:19) suggested that in order to achieve a valuable communication strategy, certain questions have to be answered to ensure that the correct message is conveyed to the consumer. Three such questions as formulated by Hawkins and co-authors (2007:19) are briefly addressed below:

1. 'Who exactly is the target market to communicate with' (Hawkins *et al.,* 2007:19)?

   The concept of market segmentation came about in the 1950's when manufacturers realised that consumers expressed many different purchasing and behavioural patterns and that it would be advantageous to focus their products through advertising to consumers who best suit it or are most likely to purchase it (Cavicchi, *et al.,* 2005:3). In the development of new food products, differentiation and effective market segmentation are proving to be more and more important (Witwer, 1999:53). Through consumer research, companies have segmented consumers into groups that are similar to one another in one or more ways. This allows marketing strategies to be formulated and focused on one or more groups (Solomon, 2006:9). The consumers purchasing bioactive food ingredients or foods for medicine are typically in mid-life and are educated (Gilbert, 2000:24).

Following from suggestions given by Schmidt (2000:17), Gilbert (2000:24) also put together some points for getting functional foods into the marketplace. The author suggested that it is of great importance to understand the consumer market (Gilbert, 2000:24). Five groups of potential purchasers of functional foods were identified through a survey conducted with Polish, German, Spanish and English consumers. The potential consumer target markets of functional foods were categorised as follows: 'Enlightened and convinced' consumers (15% of consumers) who, due to health reasons, purchase functional foods often; 'Hesitating unmotivated' consumers (20% of consumers) who do not purchase functional foods often and when they do, the purchase is not for health reasons but rather for the attractiveness of the product; 'Reasonable health-orientated' consumers (11% of consumers) who although purchasing functional foods for health reasons and have the most knowledge of functional foods, are the lowest purchasers of functional foods; 'Impressed testers' (16% of consumers) have little knowledge of functional foods and purchase these food items mostly for indulgent purposes; and 'Enthusiastic beauty-orientated' consumers (11% of consumers) purchase functional foods for the health benefits, although they have little knowledge about health and nutrition (Horska & Sparke, 2007:351). The 'Enlightened and convinced' group of consumers are considered to be the typical functional food consumers who have knowledge about the concept and are convinced of the benefits of consuming functional foods (Horska & Sparke, 2007:352).

It has been reported that within the first year, 70% to 90% of new functional foods and beverages fail. This can be ascribed to poor consumer education and acceptance, both from a marketing perspective and sensory attributes. Unsuccessful market segmentation, or even incorrectly positioned price, promotions or positioning can also contribute (Bogue & Sorenson, 2006:5).

2. 'What effect should the target audience have from the communication' (Hawkins *et al.*, 2007:20)?

Functional foods compete with conventional foods in the market. Therefore, to achieve consumer acceptance, it is ideal for product developers to design functional foods as close to conventional foods as possible in terms of price, taste and convenience (Blandon *et al.*, 2007:2). A number of new foods designed specifically to enhance health, especially focusing on chronic disease of aging, have made their way into the marketplace. In addition to enhancing health, these foods can include traditional familiar foods for which new health benefits have been highlighted or for

which old beliefs about potential undesirable health effects have been dismissed (Hasler, 2000:499S).

Consumers further need access to accurate information about functional foods and bioactive food ingredients, without being overwhelmed with too much information or being confused with unclear information (Schmidt, 2000:16). Food manufactures are putting more information on food labels than in the past. Consumers read these product labels to gather information about nutrients they want to consume or avoid; however, all the extra information is not necessarily making things easier for consumers, as their stage of understanding has not necessarily increased (EdComs, 2007:11).

3. 'Through what avenues of media should the target audience be reached and what should be communicated to the target audience' (Hawkins *et al.*, 2007:21)?

Surveys were conducted in February 1998 and February 2000 whereby 1000 American adults were questioned to determine the level of consumer interest in and awareness of health promoting foods (Schmidt, 2000:16). From these results, a list of possible ways to communicate the benefits of health promoting foods to consumers was compiled (Schmidt, 2000:17). This list includes basic suggestions like the importance of the education of health professionals and marketers to equal the consumer knowledge; focussing on the positive aspects of eating and not focussing on what not to eat; allowing consumers to better understand functional foods by placing them in the perspective of conventional foods and backing up of claims on functional foods with scientific evidence and ensuring the communication given is accurate (Schmidt, 2000:17). Research and/or clinical trials were identified in a survey by Decision Reports, Inc. in 1998 as the leading factor necessary for functional foods to be commercially successful, even exceeding a FDA approved health claim. It is essential to have sound scientific criteria for health claims on functional foods if the public is to take complete advantage of the possible health benefits these foods can provide (Hasler, 2000:504S).

Different ways of communicating to consumers the functional benefits of certain foods is to supply scientific evidence, to a varying degree, on the label and supplying leaflets with more descriptive details inside packaging or leaflets at stores, which is the most detailed form of information. The importance of supplying sufficient information relating to the communicated message to consumers is that these

products are purchased by consumers to promote health and enable consumers to differentiate between products available in the market (Castellini *et al.,* 2002:13).

Gilbert (2000:24) suggested that health claims and product information should be available to the consumer in various formats including product labels and the media (Gilbert, 2000:24). The main reason why consumers read nutrition labels is to search for information on ingredients in the product they are either trying to consume more of or less of. Most often, consumers are looking for information on fat and calories. Consumers are less likely to search for nutritional information on protein, carbohydrates and vitamins. It is possible that consumers do not look for these ingredients as they do not understand the benefits of consuming them (EdComs, 2007:16). The acceptance of functional foods by consumers is affected by their access to, use and understanding of information regarding these foods, generally accessible through product labels (Blandon *et al.*, 2007:2). A large number of consumers reported being uncertain about what they should pay attention to on nutrition labels and what information is of the most importance. Some consumers were unsure why they should avoid sugar, salt and fat as they weren't sure of their impact on their health. If consumers do not understand the impact of consuming a nutrient, the claims about these nutrients have little influence on the consumer (EdComs, 2007:17). The same result would apply to other bioactive food ingredients.

The understanding of food labels is generally poor among certain groups, even though a significant number of people look at labels. When asked about the amount of fat per 100g of product that claimed to be '80% fat free', only 60% of consumers from data collected from the U.K., U.S., New Zealand, S.A. and Canada responded correctly and 26% didn't know, even though the most important piece of information to the average consumer on a label is the amount of fat in food (EdComs, 2007:6).

2.3.5 Introducing functional foods into the market

In order for functional foods to succeed in the market, it is imperative that they taste good, are convenient and can be trusted by consumers. Most consumers are not willing to sacrifice taste for healthier products and functional foods must not require more effort to prepare than conventional foods. The ideal formats would be read-to-eat or –heat. Consumers are furthermore sceptical about new foods that they have not tried yet and also want simple health claims that they can trust (Weststrate, van Poppel & Verschuren, 2002:S234).

According to Hawkins and co-authors (2007:253), to successfully introduce new food products into the retail market, five determining steps should be addressed at the

development stage to highlight any causes that will contribute to failure. These steps are: i) Consumer interest; ii) Regulatory framework with sufficient scientific information; iii) Nutrition science (safety and efficiency); iv) Technology positioning; and v) Source of materials and distribution (Krul, Kardinaal, Kalk & van den Berg, 2007:44). Steps in the new product adoption, and possibly better suited to consumers purchasing commodity items like food, can also be described in five simple steps as seen in Figure 2.3 (Hawkins *et al.*, 2007:253) and is supportive of the steps reported by Krul and co-authors indicated above to successfully introduce new food products into the market.

The majority of intended purchases in relation to the evaluation stage (stage 3 in the new product adoption process, Figure 2.3) involve partial external search prior to the trial purchase, as they are a result of narrow decision-making requirements. Regular purchases of products, for example, require little or narrow decision-making and limited external search, like purchasing canned foods or soft drinks (Hawkins *et al.*, 2007:546). A consumer requires more external research to support his/her evaluation in order to make a trial decision about a product purchase with a greater number of available alternatives (brands, products, stores) (Hawkins *et al.,* 2007:547). However, for the evaluation stage to occur it must tag on consumer awareness and interest (refer Figure 2.3), which for this study implicates an awareness of and an interest in functional foods and/or bioactive food ingredients before a trial purchase is to follow and such purchasing adopted.

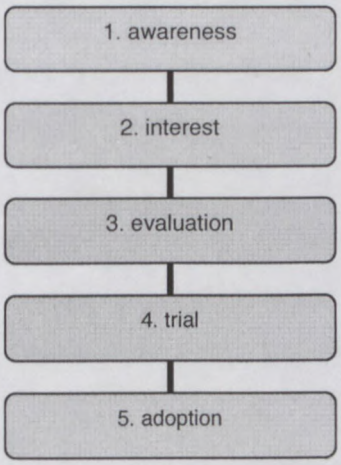

Figure 2.3: Stages in the new product adoption process (obtained from Hawkins *et al.*, 2007:253)

In order to satisfy the needs of consumers, a clear marketing strategy must be compiled. This strategy must dictate how superior consumer values will be supplied to the target market. A coherent marketing mix of product, price, communications, distribution and services provided to the target market must be achieved (Hawkins *et al.*, 2007:19).

CHAPTER THREE
RESEARCH DESIGN AND METHODOLOGY

3.1 Type of study

A cross sectional descriptive study of a quantitative nature was used. Being a cross sectional descriptive study, the purpose thereof was to describe elements such as the demographics and attitudes of consumers or the market potential for a product at a particular point in time (Kotler & Armstrong, 2001:140). The data was collected using the survey procedure, which is a collection of 'sample opinions, etc. in order to estimate the general situation' (Harber & Payton, 1979:1110). The survey procedure and questionnaire technique was used to collect the data. This technique was chosen so that specific information could be gathered from the respondents regarding their demographic, health, lifestyle and socio-environmental characteristics as well as their awareness, knowledge and understanding about the listed stimulus words, which was used to describe the consumer market (i.e. emerging, growth or mature) (refer Figure 2.1) for functional foods and the bioactive food ingredients investigated.

3.2 Data collection

Consumers were 'questioned' by using free word association with stimulus words (refer 3.3). Stimulus words used were extracted from the list of bioactive food ingredients and include those most recurrently used functional ingredients in the market and those identified by the British Nutrition Foundation as bioactive substances that can help prevent chronic diseases (refer 2.3.3). These bioactive ingredients are more extensively researched than others and include those related to health claims and qualified health claims, such as soy protein, probiotics, omega-3 fatty acids, isoflavones, lycopene, beta carotene, glucosinolates, flavonoids, sterols, antioxidants and phytochemicals along with functional foods. This technique of free word association was the major data collection method used in this study.

Through the word association, it was determined at what level health conscious consumers within the South African consumer market had awareness, knowledge or understanding of the different bioactive ingredients. If they had heard of the stimulus bioactive food ingredient word, they fell into the 'emerging stage' of awareness of that bioactive ingredient acceptance. Awareness is the action of having vigilance or alertness (Merriam-Webster's Online Dictionary). Thus, if the respondents were aware of a bioactive ingredient, their knowledge of that bioactive ingredient was determined regarding its food sources and properties (i.e. growth stage) and in addition the health benefit as a reflection of its understanding (i.e. mature stage) (Witwer, 1999:52). Knowledge is the level of association with or understanding of the facts (of the bioactive food ingredients) (Harber & Payton, 1979:599). Understanding is the degree to which respondents grasp the meaning, significance or rationalisation (of the

bioactive food ingredients) (Harber & Payton, 1979:1199). Further questions related to the respondent demographic, health and lifestyle and other socio-environmental aspects were asked to determine the consumer target market for the bioactive food ingredients questioned in the free word association.

3.3 Materials and method

The materials used to collect the data for the associative group analysis included the word association answer papers (refer Appendix B, Section A) and an accompanying questionnaire for the collection of the respondent's demographic, health and lifestyle and socio-environmental information (refer Appendix B, Sections B and C), along with pens. The predominant technique that was used to gather the desired information in this study was by a process of 'associated group analysis' developed and successfully used by Szalaly and his associates proving the validility of the content acquired in associative group analysis (Grenard, 2003:14). The fundamental process to conduct associative group analysis is to evaluate the results gained across a diverse group of respondents from the process of free word association. The respondents write down as many free words achievable to the provided stimulus word. The selection of the stimulus word is dependant on the objective of the study (Grenard, 2003:7). As previously stated, for the purpose of this study, the stimulus words were functional foods and a list of selected bioactive food ingredients. Respondents were explained the process of the word association and that the process is a study of verbal behaviour and therefore there are no right or wrong answers. Respondents were also assured that the responses were kept completely anonymous as indicated by Grenard (2003:8). Impulsive, single word responses were encouraged for the data collection as well as recording as many responses that come to mind. Respondents were also encouraged to steer clear of 'chaining' responses by basing a response on the previous response and to rather look at each stimulus word individually (Grenard, 2003:8). As respondents were not openly asked about their opinions and values, neither were they guided to an answer, the associative group analysis is reasonably free of bias (Grenard, 2003:9).

Two types of questions were included in the questionnaire. The word association section (Section A of the questionnaire as the word association answer papers) used open-ended questions whereby respondents were allowed and encouraged to list their own answers and thoughts (refer Appendix B). Sections B and C of the questionnaire, covering the demographic, health and lifestyle and socio-environmental aspects, mostly used closed-ended questions as multiple-choice questions (refer Appendix B). Close-ended questions list two or more options where the respondent selects one or multiple answers (Taylor-Powell, 1998:5). The content validity of the questionnaire was guided by the literature and accounted

for by a qualified dietician and an experienced researcher in the field of social sciences. Content validity was assured by considering the content selected and used and the degree to which the questionnaire covered the content (Yaghmaie, 2003:25). The bioactive food ingredient word selection (content) for use (Appendix B, Section A) was based on previously researched bioactive food ingredients and includes those related to health claims and qualified health claims, along with functional foods (refer 2.3.3 and 3.2) and the demographic, health and lifestyle and other socio-environment aspects (content) for use (Appendix B, Sections B and C) on 2.2 of the literature study (Chapter 2) incorporating Figure 2.2. The construction of a number of the questions used in sections B and C of the questionnaire were guided by that included in previously used questionnaires by the program and the dietician and experienced researcher in the field of social sciences. Before the pilot study was undertaken, the compiled word association answer paper (Appendix B, Section A) and accompanying questionnaire (Appendix B, Sections B and C) was scrutinised by the dietician and experienced researcher in the field of social sciences as a means to provide for face validity. Basic structural changes were made upon recommendations following the face validity screening. These included Section B and C being swopped around so that the demographic questions appeared at the end of the questionnaire and the selection boxes being shaded and the text centred to allow for easier reading. The various respondents' occupations (refer to question 5 of the questionnaire, Appendix B, Section C) were categorised into six sub-groups, using information from the International Standard Classification of Occupations, as depicted by the International Labour Organization (Bureau of Statistics, 2009), while the annual income brackets (refer to question 6 of the questionnaire, Appendix B, Section C) were broken down according to the taxable income brackets as set by the South African Revenue Service (South Africa. National Treasury & South African Revenue Service, 2008).

3.4 Permission to conduct study

Permission to conduct this study was gained upon approval of the research proposal by the Faculty of Applied Sciences Research Committee at the Cape Peninsula University of Technology and ethical clearance to conduct this study by the Faculty of Applied Sciences Research Ethics Committee (refer Appendix C). Both Planet Fitness, Plattekloof and Diskem, Canal Walk allowed for the study to be conducted on their premises. These premises were selected to represent physically active and dietary supplement user consumer markets. All respondents were informed about the survey as explained on the cover sheet of the questionnaire (refer Appendix B) and provided verbal consent for their voluntary and anonymous participation.

3.5 Pilot study

A pilot study was conducted upon approval of the study to determine the face validity of the questionnaire to identify whether there were any administrative problems, problems in the technical application of the study or time restrictions (Ellis & Levy, 2009:334). Approximately 10% of the planned sample size of the study was used for the pilot study, equating to 15 respondents. No changes were made to the questionnaire following the pilot study apart from indicating that the blocks allocated for the analysis of the results by the researcher were for 'office use' and the respondents were not required to complete these blocks. The words 'office use' were added for Sections B and C on the right hand side of the questionnaire (refer Appendix B).

3.6 Sample size and description

In free word association, using groups of respondents larger than 50 have little impact on the array of responses gained. In a group of 100 respondents, there will be approximately 20 to 30 different responses, with only a small number of unique responses as most would have been listed more than twice (Korshuk, 2000:2). For the purpose of this study two groups of respondents representing the health conscious consumer were purposefully sampled to ensure that sufficient data is collected to access all aspects of the consumer market possibly familiar with functional foods and bioactive food ingredients. A sample size of 150 respondents representing the health conscious market, which includes gym subscribers and dietary supplement users, was envisaged. The sample size was calculated according to the population size of two sub-councils, De Grendal and Blaauwberg in the City of Cape Town Metropolitan Municipality, with a Grade 12 along with a higher qualification, as these persons would be the population representing the chosen sample of health conscious consumers. The sample (n = 150) was selected for participation from the population of 36 928. This provided a final sample with a 95% confidence level and a 8.0 confidence interval (The Survey System, 2009).

Research has established that health conscious consumers are usually the better educated (de Jong, Ocke, Branderhorst & Friele, 2003:280; Robinson & Smith, 2003:177) and more affluent (de Jong *et al.,* 2003:280; Robinson & Smith, 2003:177). For this reason, the two sub-councils in the City of Cape Town Metropolitan Municipality were selected as they represent a higher economically active segment of the City of Cape Town Metropolitan Municipality than the average for the City of Cape Town Metropolitan Municipality. The City of Cape Town Metropolitan Municipality has 70.83% of the economically active population employed, while De Grendel and Blaauberg have 95.67% and 82.09% respectively (City of

Cape Town, 2009). Health conscious consumers are, in addition to being better educated and higher income earners, concerned with nutrition and fitness (Kraft & Goodell, 1993:18). As dietary supplement use (Kirk, Cade, Barrett & Conner, 1999:69) and exercise (Divine & Lepisto, 2005:275) is associated with a healthy lifestyle, dietary supplement users and gymnasium/fitness centre subscribers were chosen as respondents to represent the health conscious consumer. Dietary supplement users were found to be better educated and more affluent individuals than none users (de Jong *et al.,* 2003:280). The intention of the study was to collect equal samples from the two selected sub-councils, however due to possible cross-over movement of the respondents between gymnasium/fitness centre and pharmacy in the respective sub-councils, it was decided to collect an equal number of gym subscribers and dietary or health supplement users.

Only respondents between 25 and 65 years of age were targeted who live in urban areas, as they represent the economically active portion of the sub-councils. South Africa's demographic income distribution pattern is skewed with 10% of its population earning 45% of the national income, represented largely by white South Africans. Comprising mainly black South Africans, the remainder of the population represents 80% of the population that has been previously economically disadvantaged. However, the income distribution is slowly becoming equalised between the two races. Approximately 55% of South Africa's population reside in urban areas such as Cape Town, Johannesburg, Durban and Pretoria (Agriculture and Agri-Food Canada, 2007b:5). Amongst other attributes, it was expected that the typical Cape Town consumer who is aware of and understands bioactive ingredients is one who has higher disposable income, has a higher level of education and lives in the broad middle-to-upper socio-economic urban areas. As a result respondents were sought from such areas.

3.7 Conducting the study

The research was conducted at Planet Fitness, Plattekloof and the Diskem pharmacy, Canal Walk, respectively situated in the adjoining De Grendal and Blaauwberg sub-councils of the City of Cape Town Metropolitan Municipality, in order to collect the required information from gym subscribers and dietary supplement users or health-conscious consumers through purposive sampling. Consumers were approached by the researcher at the entrances of these stores and were asked to participate in the study, which took place over a few weeks between April and May 2009 and covered both week days and week-ends. This period also included various public holidays and approximately two weeks included school and tertiary education holidays. The researcher explained to the consumers the reasons for conducting the study and were asked to complete the questionnaire, which took place across different times of the day.

3.8 Data analysis

Data for the free word association (refer Appendix B, Section A) was evaluated and classified according to four possible responses. Firstly, it was determined whether the respondent indicated whether they were aware of the stimulus word or not. Secondly, if they were aware of the word, the extent to which they were aware of it was determined. This was determined as follows: if a respondent had heard of the word or was aware of it, however indicated no additional knowledge or understanding of that word, they displayed awareness; if they had heard of the word and could identify a food source and/or property of the listed stimulus word, they displayed knowledge; and lastly, if they in addition described and indicated that they grasped the health connection or health benefit for this word, they reflected an understanding for the bioactive food ingredient example (refer Table 3.1). If the respondents had only heard of the bioactive food ingredient stimulus word, it fell into the 'awareness' category, and this bioactive food ingredient for those respondents fell into the 'emerging stage' of evolution of consumer acceptance of bioactive ingredients, as indicated by Witwer (1999:52). Those responses that displayed knowledge or understanding of the bioactive food ingredient, fell in line with the 'growth' or 'mature' stages, respectively, of the model by Witwer (Witwer, 1999:52).

In order to categorise the word association correctly, the triangulation method of data analysis was used. The information gathered was categorised by the researcher as well as independently categorised by the research assistant of the programme Consumer Science: Food and Nutrition, subsequently, any discrepancies were discussed and then verified by the supervisor. This comparison of categorisation is known as triangulation (Guion, 2002:1).

The data collected was analysed using SPSS version 17. Response frequencies was determined and the Pearson's chi-squared analysis used for the determining of associations or differences between the awareness, knowledge and understanding of the bioactive food ingredients and functional foods and the respondent demographic, lifestyle and other characteristics. These associations or differences would only be determined for those bioactive food ingredients and functional foods recognised by 20% or more of the respondents. A significance level of 5 percent ($p < 0.05$) was used.

Table 3.1: Examples of stimulus word associations correctly listed by respondents

Stimulus word	Examples of respondent word associations correctly listed	
	Knowledge [a]	Understanding [b]
	Food source and / or properties	Health connection
Soy protein	Soy milk; Soy mince; Alternative to animal protein; Meat alternative; Good non-animal source of protein	Prevents heart disease; Lowers cholesterol
Probiotics	Yoghurt; Good bacteria found in yoghurts; Healthy bacteria in yoghurts; Good bacteria which promotes healthy bowel movement; Acidophilus	Boosts microflora in intestine; Healthy gut bacteria; Used after antibiotics
Sterols	Found in plants; Found in nuts and seeds	Lowers cholesterol
Omega-3 fatty acids	Fish oil which is good for you; Fish; Healthy fish oils; Found in margarine	Good for brain functioning; Brain development and good for cardiovascular problems; Promotes central nervous system and neural network development in foetal stage; Prevents heart attacks/strokes
Isoflavones	Soy products; Common in soy protein	Helps menopause; Boosts estrogen levels; Protects against prostrate cancer and boosts estrogen levels; Similar in chemical composition to estrogen; Prevention and management of cancers, Heart disease and menopause; For menopause symptoms
Lycopene	Antioxidant in tomatoes; Found in tomato products; Tomato pigmentation	Reduces risk of cancer; Helps prevent cancer
Beta carotene	Carrots; Antioxidant in orange foods; Antioxidant in carrots; Carrots and orange foods	Reduce the risk of aging; Good for eye sight
Glucosinolates	Cabbage; Broccoli	- [c]
Flavonoids	Antioxidant in plants; Red wine; Found in vegetables	Protective effect against cardiovascular heart disease
Phytochemicals	Fresh produce; Spinach and green vegetables; Contains antioxidants; Plants and broccoli	Disease preventative properties to the body
Functional foods	Foods enriched with substances benefiting health; Vitamin enriched foods; Parmalat physical; Well B	Provides health benefits to body over and above the normal vitamins and minerals it usually provides; Helps prevent diseases

Table 3.1 (continued)

Stimulus word	Examples of respondent word associations correctly listed	
	Knowledge [a]	Understanding [b]
	Food source and / or properties	Health connection
Antioxidants	Rooibos; Green leafy vegetables; Green tea; Protects cells in the body; Fruit and vegetables	Helps with 'cleaning out' the body; Repairs and prevent cell damage from free radicals

[a] Food source and/or property identified

[b] Health benefit description in addition to food source and/or property identification [a]

[c] None indicated

CHAPTER FOUR
RESULTS

4.1 Respondent sample and their demographic, health and lifestyle characteristics

One hundred and forty five respondents participated in the study over the two weeks. A total of 139 respondents' data was used for the results, as six respondents questionnaires were not fully completed (as they were self administered) and therefore had to be discarded. This provided a final sample with a 95% confidence level and a 8.3 confidence interval (The Survey System). Approximately one in every three gym subscribers and dietary supplement users declined to take part in the study, providing for a response rate of approximately 67%. Those respondents who participated in the study appeared to be those with more spare time to answer the questionnaire and not those who were in a rush or who had less time to spare. This study also took place over school and tertiary education holidays, which would have allowed some mothers/fathers less time to participate in the study if they had their children with them.

The respondents' demographic characteristics are represented in Table 4.1. The majority of the respondents were female (71.9%), aged between 25 and 34 years (42.4%) and of white ethnic origin (66.2%). The educational levels achieved by most of the respondents were Grade 12 only (28.8%) or Grade 12 plus a diploma (23.7%). Most of the respondents' occupations fell within the technicians and associate professionals category (35.3%). This includes any profession from physical science or computer technicians to life science and business associate professionals (Bureau of Statistics, 2009). The majority of the respondents earned within the two lowest per annum income brackets (38.1% between nil and R122 000 per annum and 23% between R122 001 and R195 000 per annum) and were married or living together with children (34.8%) and married or living together without children (31.2%).

Table 4.1: Demographic characteristics of respondents (n = 139)

Respondent demographic characteristics		%	n
Gender	Male	28.1	39
	Female	71.9	100
Age (years)	25-34	42.4	59
	35-44	20.1	28
	45-54	18.7	26
	55-60	12.2	17
	61 and older	6.5	9
Population group	Black	12.9	18
	Coloured	18.7	26
	Indian	0.7	1
	White	66.2	92
	Other	1.4	2
Level of education	Grade 11 (Standard 9) or below	7.9	11
	Grade 12 (Matric)	28.8	40
	Grade 12 and certificate	10.8	15
	Grade 12 and diploma	23.7	33
	Grade 12 and degree	7.9	11
	Grade 12 and diploma and degree	15.8	22
	Post graduate (Masters or Doctorate)	5.0	7
Occupation	Unemployed/retired	12.2	17
	Legislators, senior officials, managers	7.2	10
	Professionals	12.9	18
	Technicians and other associate professionals	35.3	49
	Office clerks	28.1	39
	Service workers and shop and market sales workers; Craft and related trade workers; Elementary occupations	4.3	6
Annual income	R490 001 and above	7.2	10
	R380 001-R490 000	5.8	8
	R270 001-R380 000	10.8	15
	R195 001-R270 000	15.1	21
	R122 001-R195 000	23.0	32
	R0-R122 000	38.1	53
Marital status*	Married/Living together without children	31.2	43
	Married/Living together with children	34.8	48
	Single, living without children	26.8	37
	Single, living with children	7.2	10

* One respondent did not answer this question (n = 138)

The majority of the respondents did not suffer from any chronic diseases (82.7%) and participated in regular physical activities (63.3%). Most of the respondents participated in moderate physical activity two to four times a week (46.1%) followed by about once a week (22.5%), and/or hard physical activity two to four times a week (33.3%). These activity levels greatly represented their usual physical activity levels (68.6%). Just more than half (56.8%) of the respondents consumed dietary supplements daily.

The majority of the respondents viewed their level of health and wellness knowledge and nutrition knowledge as being well informed (22.3% and 17.3% respectively) and moderately informed (66.9% and 65.5% respectively). While just over half (52.5%) of the respondents were 'very interested' in food and nutrition, nearly three quarters (70.5%) of the respondents were 'very interested' in health and wellness. These health and lifestyle characteristics of the participants are represented in Table 4.2.

Table 4.2: Health and lifestyle characteristics of respondents (n = 139)

Respondent health and lifestyle characteristics		%	n
Incidence of chronic disease	Yes	17.3	24
	No	82.7	115
Regular physical activity participation	Yes	63.3	88**
	No	36.7	51
Frequency of moderate physical activity*	Rarely or never	11.8	12
	2-3 times over the month	8.8	9
	About once a week	22.5	23
	2-4 times a week	46.1	47
	More than 4 times a week	10.8	11
Frequency of hard physical activity*	Rarely or never	27.5	28
	2-3 times over the month	10.8	11
	About once a week	20.6	21
	2-4 times a week	33.3	34
	More than 4 times a week	7.8	8
Frequency of physical activity over last month compared to average activity*	More active	10.8	11
	Less active	20.6	21
	About the same	68.6	70
Frequency of consumption of dietary supplements	Daily	56.8	79
	Weekly	12.2	17
	Monthly	5.8	8
	Seldom/Never	25.2	35
Level of health and wellness knowledge rating in relation to other adults of similar age	Well informed	22.3	31
	Moderately informed	66.9	93
	Not at all informed	10.8	15
Level of nutrition knowledge rating in relation to other adults of similar age	Well informed	17.3	24
	Moderately informed	65.5	91
	Not at all informed	17.3	24
Degree of interest in food and nutrition	Very interested	52.5	73
	Little interest	40.3	56
	No interest	7.2	10
Degree of interest in health and wellness	Very interested	70.5	98
	Little interest	25.9	36
	No interest	3.6	5

* 102 respondents engaged in physical activity (moderate/hard) of whom 88 respondents did so regularly **

4.2 Respondent purchase intention of foods and beverages with added health benefits

An equal number of respondents purchased foods with added health benefits either 'often' (41%) or 'seldom/never' (41%), while more respondents (59.7%) 'seldom/never' purchased

beverages with added health benefits. Just more than half (55.4%) of the respondents were prepared to pay more for foods with added health benefits, while about half (48.9%) of the respondents were prepared to pay more for beverages with added health benefits. Although there was about an equal representation of respondents accepting to pay more for both foods and beverages with added health benefits, the majority of the respondents were not prepared to pay much more for these foods and beverages as most respondents (74% and 79.4% respectively) indicated a price premium reaching 15% at the most (refer Table 4.3).

Table 4.3: Respondent (n = 139) purchase behaviours and intentions of foods/beverages with added health benefits

Respondent purchase behaviours and intentions of foods/beverages with added health benefits		%	n
Purchase frequency of foods with added health benefits	Very often	18.0	25
	Often	41.0	57
	Seldom/never	41.0	57
Purchase frequency of beverages with added health benefits	Very often	10.8	15
	Often	29.5	41
	Seldom/never	59.7	83
Acceptance to paying more for foods with added health benefits	Yes	55.4	77
	No	44.6	62
Degree of price premium for foods with added health benefits (n = 77)*	1-15%	74.0	57
	16-25%	19.5	15
	26-50%	5.2	4
	51-75%	0.0	0
	76-100%	1.3	1
Acceptance to paying more for beverages with added health benefits	Yes	48.9	68
	No	51.1	71
Degree of price premium for beverages with added health benefits (n = 68)*	1-15%	79.4	54
	16-25%	13.2	9
	26-50%	5.9	4
	51-75%	0.0	0
	76-100%	1.5	1

* Number of respondents who responded affirmative to paying more for foods/beverages with added health benefits

4.3 Respondent bioactive food ingredient recognition

The recognition of the listed bioactive food ingredients by the respondents and their level of awareness, knowledge or understanding (i.e. acceptance) of these ingredients are summarised in Table 4.4. Of the listed bioactive food ingredients, the majority of the respondents recognised omega - 3 fatty acids (97.1%), after which antioxidants were highly recognised (87.1%), closely followed by probiotics (84.9%) and soy protein (83.5%) and then beta carotene (68.3%). Less than half (40.3%) of the respondents recognised functional foods, about a third (32.4%) recognised flavonoids and about a quarter (26.6% and 25.9% respectively) plant sterols (or stanols) and lycopene. The other bioactive food ingredients (i.e.

isoflavones, phytochemicals and glucosinolates) were recognised by about 20% of the respondents or less.

Table 4.4: Respondent bioactive food ingredient recognition and acceptance

Bioactive food ingredient	Respondent recognition (n = 139)				Respondent acceptance*					
	Yes*		No		Awareness		Knowledge		Understanding	
	%	n	%	n	%	n	%	n	%	n
Soy protein	83.5	116	16.5	23	33.6	39	61.2	71	5.2	6
Probiotics	84.9	118	15.1	21	28.8	34	47.5	56	23.7	28
Omega - 3 fatty acids	97.1	135	2.9	4	26.7	36	40.7	55	32.6	44
Isoflavones	20.9	29	79.1	110	65.5	19	13.8	4	20.7	6
Lycopene	25.9	36	74.1	103	25.0	9	44.4	16	30.6	11
Beta carotene	68.3	95	30.9	43	26.3	25	52.6	50	21.1	20
Glucosinolates	15.1	21	84.9	118	66.7	14	33.3	7	0	0
Flavonoids	32.4	45	67.6	94	68.9	31	24.4	11	6.7	3
Plant sterols (or stanols)	26.6	37	73.4	102	70.3	26	13.5	5	16.2	6
Antioxidants	87.1	121	12.9	18	55.4	67	28.1	34	16.5	20
Phytochemicals	20.9	29	79.1	110	55.2	16	34.5	10	10.3	3
Functional foods	40.3	56	59.7	83	69.3	39	21.4	12	8.9	5

*Number and percentage of respondents who recognised each bioactive food ingredient

4.4 Respondent bioactive food ingredient acceptance and the association with the respondent characteristics

The consumer acceptance of bioactive food ingredients is represented by their awareness, knowledge and understanding of it (Witwer, 1999:52). In this section the respondent recognition and acceptance results pertaining to the studied bioactive food ingredients are firstly indicated. This is followed by the associations/differences (Pearson's chi-squared analysis) between the respondent bioactive food ingredient acceptance and the respondent characteristic distributions (i.e. their demographic characteristics, their health and lifestyle characteristics and their food and beverage with added health benefits purchase behaviours and intentions) for the bioactive food ingredients. For those bioactive food ingredients, which were recognised by approximately 20% of the respondents and less, the recognition of that bioactive food ingredient (i.e. isoflavones, glucosinolates and phytochemicals) is indicated only per respondent characteristic. No associations/differences (or Pearson's chi-squared analysis) between the respondent acceptance and the respondent characteristics were

investigated for these bioactive food ingredients. The respondent recognition in the forthcoming tables is indicated as the number and the percentage of the respondents who recognised the bioactive food ingredient within each of the respondent characteristic distributions, while the acceptance results are indicated in terms of the percentage of the respondents who recognised and accepted the bioactive food ingredient across a characteristic distribution as row percentage. The respondent number per characteristic distribution as indicated in Table 4.1 for the demographic, Table 4.2 for the health and lifestyle and Table 4.3 for the food and beverage with added health benefits purchase behaviour and intention distributions were not repeated in the related forthcoming association/difference results tables. The demographic, health and lifestyle and other socio-cultural environmental influences affecting the consumer awareness, knowledge and understanding (i.e. acceptance) of bioactive ingredients and functional foods was used to determine the consumer market for functional foods and the bioactive food ingredients investigated, which was taken up in the next chapter (as discussion of the results).

4.4.1 Soy protein

4.4.1.1 Acceptance as bioactive food ingredient

The majority (83.5%) of the respondents recognised soy protein. Approximately 60% (61.2%) of those respondents who recognised soy protein were informed (had some knowledge) about it, whereas only a few (5.2%) had an understanding of it (refer Table 4.4).

4.4.1.2 Associations between the acceptance and the respondent characteristics

4.4.1.2.1 Demographic characteristics

Although it may seem that somewhat more female respondents than male respondents recognised soy protein (73.3% versus 26.7% of the 116 respondents who recognised it) nearly as many of the male respondents (79.5%) as of the female respondents (85%) recognised it. However, there was a significant difference ($p < 0.05$) in the awareness, knowledge and understanding of soy protein between the genders with more female than male respondents who recognised soy protein having either knowledge or an understanding (72.9% versus 48.4%) and more male than female respondents who recognised soy protein only having an awareness (51.6% versus 27.1%) of this bioactive food ingredient (refer Table 4.5).

Although a significant difference ($p < 0.05$) was found between the genders in the acceptance of soy protein as a bioactive food ingredient, no associations or differences ($p > 0.05$) were found for the acceptance of soy protein as a bioactive ingredient and the other demographic characteristics of the respondents (refer Table 4.5). The majority of the respondents in all the age categories recognised soy protein (from 71.4% to 100% of the respondents). All the respondents aged between 45 and 54 years recognised soy protein, with respondents aged between 35 and 44 years having the lowest recognition (71.4%). In most of the age categories, the number of respondents who recognised soy protein and had knowledge of it were about double that of the respondents having recognition and an awareness of it ($p > 0.05$) (i.e. in the age category 25 to 34 years, 59.6% compared to 34%; in the age category 35 to 44 years, 65% compared to 30%; in the age grouping 45 to 54 years, 65.4% compared to 34.6%; and in the age grouping 55 to 60 years, 66.7% to 33.3%) (refer Table 4.5).

The majority of the respondents across the population groups (from 73% of the coloured to all of the white respondents) recognised soy protein. While about half of the black and coloured population group respondents who recognised soy protein either had an awareness (50% and 42.1% respectively) or knowledge (50% and 52.6% respectively) of it, about double of the white population group respondents who recognised it had knowledge of soy protein (64.5%) compared to those who were aware of it (28.9%) ($p > 0.05$) (refer Table 4.5).

The majority of the respondents across all the education qualification levels also recognised soy protein (from 72.7% of those respondents having Grade 12 and a degree to 90.9% of those respondents having a Grade 11 or lower education level). Across all the education qualification levels, most of the respondents who recognised soy protein had knowledge of it (from as low as 47.4% of those having a Grade 12 along with a degree and diploma as qualification to as high as 83.3% of those having a post graduate qualification) ($p > 0.05$). The majority of the respondents across all the occupation groups also recognised soy protein (from 79.6% to 94.1%). Most of the respondents across all the occupation groups who recognised soy protein also had knowledge of it (from as low as 48.5% of those within the office clerk group to as high as 80% of those within the service workers group) ($p > 0.05$) (refer Table 4.5).

Three quarters to nearly all the respondents across the annual income brackets recognised soy protein (from 75% to 90.6%). Most of the respondents across all the annual income brackets who recognised soy protein also had knowledge of it (from as low as 44.8% of those within the R122 001 to R195 000 annual income bracket to as high as 88.9% of those within the highest income bracket) ($p > 0.05$). Most of the respondents who recognised soy

protein, not withstanding their marital status, also had knowledge of soy protein (from as low as 42.8% of those being single and living with children to as high as 70.7% of those married or living together with children) ($p > 0.05$). Across all the demographic distributions, very few respondents (mostly no one to a maximum of five persons) of those who recognised soy protein had an understanding of it (refer Table 4.5).

Table 4.5: Respondent soy protein recognition and acceptance associations with their demographic characteristics

Demographic characteristics		Recognition		Acceptance (n = 116)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Gender[b]	Male	79.5	31	51.6	16	45.2	14	3.2	1	0.046
	Female	85.0	85	27.1	23	67.1	57	5.9	5	
Age[c] (years)	25-34	79.7	47	34.0	16	59.6	28	6.4	3	0.309
	35-44	71.4	20	30.0	6	65.0	13	5.0	1	
	45-54	100	26	34.6	9	65.4	17	0.0	0	
	55-60	88.2	15	33.3	5	66.7	10	0.0	0	
	61 and older	88.9	8	37.5	3	37.5	3	25.0	2	
Population group[d]	Black	100	18	50.0	9	50.0	9	0.0	0	0.626
	Coloured	73.0	19	42.1	8	52.6	10	5.3	1	
	Indian	100	1	0.0	0	100.0	1	0.0	0	
	White	82.6	76	28.9	22	64.5	49	6.6	5	
	Other	100	2	0.0	0	100.0	2	0.0	0	
Level of education[e]	Grade 11 (Standard 9) or below	90.9	10	30.0	3	70.0	7	0.0	0	0.585
	Grade 12 (Matric)	82.5	33	42.4	14	51.5	17	6.1	2	
	Grade 12 and certificate	86.6	13	23.1	3	61.5	8	15.4	2	
	Grade 12 and diploma	81.8	27	22.2	6	74.1	20	3.7	1	
	Grade 12 and degree	72.7	8	37.5	3	62.5	5	0.0	0	
	Grade 12 and degree and diploma	86.3	19	47.4	9	47.4	9	5.3	1	
	Post graduate (Masters or Doctorate)	85.7	6	16.7	1	83.3	5	0.0	0	

Table 4.5 (continued)

Demographic characteristics		Recognition *		Acceptance (n = 116)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Occupation[f]	Unemployed/retired	94.1	16	18.8	3	68.8	11	12.5	2	0.608
	Legislators, senior officials, managers	80.0	8	25.0	2	75.0	6	0.0	0	
	Professionals	83.3	15	26.7	4	66.7	10	6.7	1	
	Technicians and other associate professionals	79.6	39	33.3	13	61.5	24	5.1	2	
	Office clerks	84.6	33	48.5	16	48.5	16	3.0	1	
	Service workers and shop and market sales workers; Craft and related trade workers; Elementary occupations	83.3	5	20.0	1	80.0	4	0.0	0	
Annual income[g]	R490 001 and above	90.0	9	11.1	1	88.9	8	0.0	0	0.572
	R380 001-R490 000	75.0	6	33.3	2	66.7	4	0.0	0	
	R270 001-R380 000	80.0	12	25.0	3	75.0	9	0.0	0	
	R195 001-R270 000	80.9	17	29.4	5	64.7	11	5.9	1	
	R122 001-R195 000	90.6	29	44.8	13	44.8	13	10.3	3	
	R0-R122 000	81.1	43	34.9	15	60.5	26	4.7	2	
Marital status[h]	Married/Living together without children	88.3	38	31.6	12	60.5	23	7.9	3	0.447
	Married/Living together with children	85.4	41	24.4	10	70.7	29	4.9	2	
	Single, living without children	78.3	29	44.8	13	51.7	15	3.5	1	
	Single, living with children	70.0	7	11.1	1	88.9	8	0.0	0	

* Respondent number and percentage of those who recognised soy protein within each of the respondent demographic characteristic distributions (refer Table 4.1)

[ab] Significant difference ($p < 0.05$)

[ac, ad, ae, af, ag, ah] Non-significant ($p > 0.05$)

4.4.1.2.2 Health and lifestyle characteristics

No associations or differences ($p > 0.05$) were found for the acceptance of soy protein as a bioactive food ingredient and the health and lifestyle characteristics of the respondents (refer Table 4.6). The majority of the respondents, whether they suffered from any chronic disease or not, recognised soy protein (87.5% and 82.6% respectively). Most of those respondents suffering and of those not suffering from any chronic disease who recognised soy protein were aware (42.8% and 31.6% respectively) or had knowledge (47.6% and 64.2%

respectively) of it, while very few (9.5% and 4.2% respectively) had an understanding of it ($p > 0.05$) (refer Table 4.6).

More than two thirds of the respondents who participated in moderate physical activity (from as low as 66.7% of those rarely or never participating to as high as 88.9% of those participating two to three times a month) or hard physical activity (from a low as 75% of those participating more than four times a week to all of those participating two to three times a month) recognised soy protein. Among these respondents who recognised soy protein and participated in moderate and / or hard physical activity on a weekly basis, i.e. about once a week, two to four times a week or more than four times a week, most had knowledge of it (63.2%, 62.5% and 88.9% respectively and 83.3%, 55.6% and 83.3% respectively ($p > 0.05$ for each). Most respondents whether consuming dietary supplements very regularly (i.e. daily) to seldom/never recognised soy protein (91.1% and 62.9% respectively). About two thirds (62.5%, 62.5% and 68.2% respectively) of these respondents, whether consuming dietary supplements either daily, monthly or seldom/never, had knowledge of soy protein ($p > 0.05$) (refer Table 4.6).

More than three quarters of those respondents who viewed their level of nutrition and health and wellness knowledge as well informed (100% and 77.4% respectively) and moderately informed (84.6% and 82.8% respectively) recognised soy protein. Of these respondents who viewed their level of nutrition and health and wellness knowledge as well informed, about three quarters (73.3% and 75% respectively) had knowledge of soy protein. Of these respondents who viewed their level of nutrition and health and wellness knowledge as moderately informed, about 60% (59.7% and 58.4% respectively) had knowledge of soy protein ($p > 0.05$ for each) (refer Table 4.6).

Less than half (40%) of the respondents who had no interest in health and wellness recognised soy protein, while more than three quarters of the respondents who had an interest in food and nutrition (from as low as 78.6% for little interest to as high as 87.7% for very interested) and health and wellness (from as low as 80.5% for little interest to as high as 88% for very interested) recognised soy protein. About two thirds of the respondents who recognised soy protein and were very interested in food and nutrition and health and wellness had knowledge of it (70.3% and 66.3% respectively), while half of the respondents who recognised soy protein and had little interest in food and nutrition and health and wellness had knowledge of it (50% and 51.7% respectively) ($p > 0.05$ for each) (refer Table 4.6). Again, very few respondents (mostly no one to a maximum of four persons) of those who recognised soy protein had an understanding of it across all the health and lifestyle characteristic distributions (refer Table 4.6).

Table 4.6: Respondent soy protein recognition and acceptance associations with their health and lifestyle characteristics

Health and lifestyle characteristics		Recognition *		Acceptance (n = 116)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Incidence of chronic disease [b]	Yes	87.5	21	42.9	9	47.6	10	9.5	2	0.307
	No	82.6	95	31.6	30	64.2	61	4.2	4	
Frequency of moderate physical activity **[c]	Rarely or never	66.7	8	50.0	4	50.0	4	0.0	0	0.517
	2-3 times over the month	88.9	8	62.5	5	37.5	3	0.0	0	
	About once a week	82.6	19	31.6	6	63.2	12	5.3	1	
	2-4 times a week	85.1	40	32.5	13	62.5	25	5.0	2	
	More than 4 times a week	81.8	9	11.1	1	88.9	8	0.0	0	
Frequency of hard physical activity **[d]	Rarely or never	78.6	22	40.9	9	54.5	12	4.5	1	0.469
	2-3 times over the month	100.0	11	45.5	5	45.5	5	9.1	1	
	About once a week	85.7	18	16.7	3	83.3	15	0.0	0	
	2-4 times a week	79.4	27	40.7	11	55.6	15	3.7	1	
	More than 4 times a week	75.0	6	16.7	1	83.3	5	0.0	0	
Frequency of consumption of dietary supplements[e]	Daily	91.1	72	31.9	23	62.5	45	5.6	4	0.618
	Weekly	82.4	14	50.0	7	42.9	6	7.1	1	
	Monthly	100.0	8	25.0	2	62.5	5	12.5	1	
	Seldom/Never	62.9	22	31.8	7	68.2	15	0.0	0	
Level of health and wellness knowledge rating in relation to other adults of similar age[f]	Well informed	100.0	30	20.0	6	73.3	22	6.7	2	0.266
	Moderately informed	84.6	77	35.1	27	59.7	46	5.2	4	
	Not at all informed	62.5	9	66.7	6	33.3	3	0.0	0	
Level of nutrition knowledge rating in relation to other adults of similar age[g]	Well informed	77.4	24	16.7	4	75.0	18	8.3	2	0.130
	Moderately informed	82.8	77	36.4	28	58.4	45	5.2	4	
	Not at all informed	100	15	46.7	7	53.3	8	0.0	0	
Degree of interest in food and nutrition[h]	Very interested	87.7	64	26.7	17	70.3	45	3.1	2	0.168
	Little interest	78.6	44	40.9	18	50.0	22	9.1	4	
	No interest	80.0	8	50.0	4	50.0	4	0.0	0	
Degree of interest in health and wellness[i]	Very interested	88.0	83	28.9	24	66.3	55	4.8	4	0.275
	Little interest	80.5	29	41.4	12	51.7	15	6.9	2	
	No interest	40.0	4	75.0	3	25.0	1	0.0	0	

* Respondent number and percentage of those who recognised soy protein within each of the respondent health and lifestyle characteristic distributions (refer Table 4.2)

** 84 of the respondents who engaged in physical activity (moderate/hard) recognised soy protein

ab, ac, ad, ae, af, ag, ah, ai Non-significant ($p > 0.05$)

4.4.1.2.3 Food and beverage with added health benefits purchase behaviours and intentions

There was a noticeable percentage of respondents who recognised soy protein even among those that seldom/never purchased foods (84.2%) or beverages (79.5%) with added health benefits. The largest percentages of these respondents to have knowledge of soy protein purchased foods and beverages with added health benefits seldom/never (68.8% and 66.7% respectively) and often (62.2% and 58.3% respectively). Of these respondents who recognised soy protein and purchased foods and beverages with added health benefits very often (92% and 93.3% respectively), the highest percentage of respondents had awareness of soy protein (52.2% and 57.1% respectively), that was closely followed by respondents having knowledge of it (43.5% and 42.9% respectively) ($p > 0.05$ for each) (refer Table 4.7).

There was no noticeable difference between the percentage of respondents who recognised soy protein and were prepared to pay more for foods and beverages with added health benefits (85.7% and 83.8% respectively) or those who were not prepared to pay more (80.6% and 83.1% respectively). Of those respondents who recognised soy protein and were not prepared to pay more, a slightly higher percentage had knowledge of soy protein (64% and 66.1% respectively) than those who were prepared to pay more (59.1% and 56.1% respectively) ($p > 0.05$ for each). As indicated, most respondents willing to pay more for foods and beverages with added health benefits indicated a price premium of up to 15%, followed by a few respondents willing to pay more and in particular only up to 25% more (refer Table 4.3). Among the respondents in these two food and beverage price premium levels who recognised soy protein most had knowledge of it (56.2% and 69.2% respectively and 51.1% and 75% respectively) with some having an awareness (37.5% and 30.8% respectively and 42.2% and 25% respectively) ($p > 0.05$ for each) (refer Table 4.7). Across all the purchase behaviour and intention distributions, very few respondents (mostly no one to a maximum of three persons) of those who recognised soy protein had an understanding of it (refer Table 4.7).

Table 4.7: Respondent soy protein recognition and acceptance associations with their food and beverage with added health benefits purchase behaviours and intentions

Purchase behaviours and intentions		Recognition *		Acceptance (n = 116)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Purchase frequency of foods with added health benefits[b]	Very often	92.0	23	52.2	12	43.5	10	4.3	1	0.287
	Often	78.9	45	31.1	14	62.2	28	6.7	3	
	Seldom/never	84.2	48	27.1	13	68.8	33	4.2	2	
Purchase frequency of beverages with added health benefits[c]	Very often	93.3	14	57.1	8	42.9	6	0.0	0	0.251
	Often	87.8	36	33.3	12	58.3	21	8.3	3	
	Seldom/never	79.5	66	28.8	19	66.7	44	4.5	3	
Acceptance to paying more for foods with added health benefits[d]	Yes	85.7	66	36.4	24	59.1	39	4.5	3	0.752
	No	80.6	50	30.0	15	64.0	32	6.0	3	
Degree of price premium for foods with added health benefits **[e]	1-15%	84.2	48	37.5	18	56.3	27	6.3	3	0.731
	16-25%	86.7	13	30.8	4	69.2	9	0.0	0	
	26-50%	75.0	3	66.7	2	33.3	1	0.0	0	
	51-75%	0.0	0	0.0	0	0.0	0	0.0	0	
	76-100%	100.0	1	0.0	0	100.0	1	0.0	0	
Acceptance to paying more for beverages with added health benefits[f]	Yes	83.8	57	38.6	22	56.1	32	5.3	3	0.523
	No	83.1	59	28.8	17	66.1	39	5.1	3	
Degree of price premium for beverages with added health benefits **[g]	1-15%	83.3	45	42.2	19	51.1	23	6.7	3	0.615
	16-25%	88.9	8	25.0	2	75.0	6	0.0	0	
	26-50%	75.0	3	33.3	1	66.7	2	0.0	0	
	51-75%	0.0	0	0.0	0	0.0	0	0.0	0	
	76-100%	100.0	1	0.0	0	100.0	1	0.0	0	

* Respondent number and percentage of those who recognised soy protein within each of the respondent food and beverage with added health benefits purchase behaviour and intention characteristic distributions (refer Table 4.3)

** Number of the respondents who responded affirmative to paying more for food/beverages with added health benefits; one respondent did not specify food price premium

[ab, ac, ad, ae, af, ag] Non-significant ($p > 0.05$)

4.4.2 Probiotics

4.4.2.1 Acceptance as bioactive food ingredient

The majority (84.9%) of the respondents recognised probiotics. Almost half (47.5%) of these respondents had knowledge of probiotics, while among the other half of the respondents a

near similar percentage were aware of or had an understanding (28.8% and 23.7% respectively) of it (refer Table 4.4).

4.4.2.2 Associations between the acceptance and the respondent characteristics

4.4.2.2.1 Demographic characteristics

Although a significant difference ($p < 0.05$) was found across the population groups in the acceptance of probiotics as a bioactive food ingredient, no associations or differences ($p > 0.05$) were found for the acceptance of probiotics as a bioactive ingredient and the other demographic characteristics of the respondents (refer Table 4.8).

The majority of the male and the female respondents (71.8% and 90% respectively) recognised probiotics. Approximately half of them (57.1% of the males and 44.4% of the females) had knowledge of probiotics, while slightly less than 30.0% of them (28.6% of the males and 28.9% of the females) were only aware of probiotics ($p > 0.05$) (refer Table 4.8).

Less than half (44.4%) of the respondents aged 61 years and older recognised probiotics, whereas the majority of the respondents in all the other age categories recognised it (i.e. in the age category 25 to 34 years 88.1% up to 92.4% in the age category 35 to 44 years). In each of the predominantly younger age categories a near equal number of the respondents who recognised probiotics were either aware of or had an understanding of it with somewhat more of the respondents having knowledge of it (i.e. in the age categories 35 to 44 years five respondents were aware of probiotics while four respondents had an understanding and 16 respondents had knowledge of it) ($p > 0.05$) (refer Table 4.8).

The majority of the respondents across all the population groups recognised probiotics (i.e. in the black population grouping 83.3% up to all in the Indian and other population groupings). Almost half of these respondents across the population groups had knowledge of probiotics (i.e. 44.9% among the white population grouping, 46.7% among the black population grouping and 54.5% among the coloured population grouping). However, while almost half of these respondents in the black and coloured population groups were also aware of probiotics (53.3% and 40.9% respectively) far more respondents in the white population had an understanding of probiotics (34.6%) compared to those who were aware of it (20.5%) ($p < 0.05$) (refer Table 4.8).

In each of the education qualification levels about three quarters (72.7% in the level Grade 11 or below) up to all (in the levels Grade 12 and degree and post graduate) of the

respondents recognised probiotics. In most of the education qualification levels a near equal percentage of the respondents who recognised probiotics were either aware of or had an understanding of it with more respondents having knowledge of it (i.e. among those having Grade 12 and a diploma as a qualification, 21.4% were aware of it, 25% understood it and 53.6% had knowledge of it) ($p > 0.05$) (refer Table 4.8).

In all of the occupation groups two thirds (66.7% for service and sales workers) up to the majority (89.8% for technicians and associate professionals) recognised probiotics. In most of the occupation groups a near equal percentage of the respondents who recognised probiotics were either aware of or had an understanding of it with more respondents having knowledge of it (i.e. among those either unemployed or retired or those from the professionals group, 21.4% were aware of it, 28.6% understood it and 50% had knowledge of it) ($p > 0.05$) (refer Table 4.8).

Almost three quarters to nearly all of the respondents across the annual income brackets recognised probiotics (i.e. from 70% in the R490 001 and above bracket up to 96.9% in the R122 001 to R195 000 bracket). In most of the annual income brackets a near equal percentage of the respondents who recognised probiotics were again either aware of or had an understanding of it with more respondents having knowledge of it (i.e. among those earning R195 001 to R270 000 per annum, 21.1% were aware of it, 26.3% understood it and 52.6% had knowledge of it). In the annual income bracket of R122 001 to R195 000, however, a near equal percentage of the respondents who recognised probiotics were aware (38.7%) or had an understanding (35.5%) of it, while fewer respondents had knowledge of it (25.8%) ($p > 0.05$) (refer Table 4.8).

Respondents who were married or living together with children had the highest recognition of probiotics (89.6%), while single respondents who were living with children had the lowest recognition of probiotics (70%). Almost double the percentage of respondents who recognised probiotics and were married or living together with or without children had an understanding of probiotics (27.9% and 27% respectively) than those who were single and living with or without children (14.3% and 16.7% respectively). Among those respondents who were married or living together with children that formed the marital status group that most highly recognised soy protein, more respondents had an understanding of probiotics (27.9%) compared to those who were aware of it (18.6%). Slightly more than half (53.5%) of these respondents had knowledge of probiotics ($p > 0.05$) (refer Table 4.8).

Table 4.8: Respondent probiotics recognition and acceptance associations with their demographic characteristics

Demographic characteristics		Recognition		Acceptance (n = 118)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Gender[b]	Male	71.8	28	28.6	8	57.1	16	14.3	4	0.349
	Female	90.0	90	28.9	26	44.4	40	26.7	24	
Age[c] (years)	25-34	88.1	52	32.7	17	46.2	24	21.2	11	0.619
	35-44	92.4	25	20.0	5	64.0	16	16.0	4	
	45-54	92.3	24	29.2	7	37.5	9	33.3	8	
	55-60	76.5	13	30.8	4	46.2	6	23.1	3	
	61 and older	44.4	4	25.0	1	25.0	1	50.0	2	
Population group[d]	Black	83.3	15	53.3	8	46.7	7	0.0	0	0.014
	Coloured	84.6	22	40.9	9	54.5	12	4.5	1	
	Indian	100.0	1	0.0	0	100.0	1	0.0	0	
	White	84.8	78	20.5	16	44.9	35	34.6	27	
	Other	100.0	2	50.0	1	50.0	1	0.0	0	
Level of education[e]	Grade 11 (Standard 9) or below	72.7	8	62.5	5	25.0	2	12.5	1	0.521
	Grade 12 (Matric)	87.5	32	31.3	10	43.8	14	25.0	8	
	Grade 12 and certificate	80.0	12	25.0	3	50.0	6	25.0	3	
	Grade 12 and diploma	84.8	28	21.4	6	53.6	15	25.0	7	
	Grade 12 and degree	100.0	11	18.2	2	63.6	7	18.2	2	
	Grade 12 and degree and diploma	90.9	20	40.0	8	40.0	8	20.0	4	
	Post graduate (Masters or Doctorate)	100.0	7	0.0	0	57.1	4	42.9	3	
Occupation[f]	Unemployed/retired	82.4	14	21.4	3	50.0	7	28.6	4	0.322
	Legislators, senior officials, managers	70.0	7	0.0	0	100.0	7	0.0	0	
	Professionals	77.8	14	21.4	3	50.0	7	28.6	4	
	Technicians and other associate professionals	89.8	44	31.8	14	40.9	18	27.3	12	
	Office clerks	89.7	35	34.3	12	42.9	15	22.9	8	
	Service workers and shop and market sales workers; Craft and related trade workers; Elementary occupations	66.7	4	50.0	2	50.0	2	0.0	0	
Annual income[g]	R490 001 and above	70.0	7	28.6	2	71.4	5	0.0	0	0.111
	R380 001-R490 000	75.0	6	16.7	1	66.7	4	16.7	1	
	R270 001-R380 000	93.3	14	14.3	2	78.6	11	7.1	1	
	R195 001-R270 000	90.5	19	21.1	4	52.6	10	26.3	5	
	R122 001-R195 000	96.9	31	38.7	12	25.8	8	35.5	11	
	R0-R122 000	77.4	41	31.7	13	43.9	18	24.4	10	

Table 4.8 (continued)

Demographic characteristics		Recognition *		Acceptance (n = 118)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Marital status[h]	Married/Living together without children	86.0	37	29.7	11	43.2	16	27.0	10	0.403
	Married/Living together with children	89.6	43	18.6	8	53.5	23	27.9	12	
	Single, living without children	81.1	30	33.3	10	50.0	15	16.7	5	
	Single, living with children	70.0	7	57.1	4	28.6	2	14.3	1	

* Respondent number and percentage of those who recognised probiotics within each of the respondent demographic characteristic distributions (refer Table 4.1)

[ad] Significant difference ($p < 0.05$)

[ab, ac, ae, af, ag, ah] Non-significant ($p > 0.05$)

4.4.2.2.2 Health and lifestyle characteristics

A significant difference ($p < 0.05$ for each) was found between the participant frequency of moderate physical activity, frequency of dietary supplement consumption, perceived levels of nutrition and health and wellness knowledge in relation to other adults of their age, as well as their interest in health and wellness and the acceptance of probiotics as a bioactive food ingredient (refer Table 4.9).

Among those respondents who suffered from chronic disease and those who did not, most recognised probiotics (75% and 87% respectively). Among these respondents who recognised probiotics approximately a quarter to a third of those suffering and not suffering from chronic disease either had an awareness (33.3% and 28% respectively) or understanding (27.8% and 23% respectively) of probiotics with somewhat more respondents having knowledge of it (38.9% and 49% respectively) ($p > 0.05$) (refer Table 4.9).

Two thirds (66.7%) of the respondents who rarely or never participated in moderate physical activity recognised probiotics, while more than three quarters of those respondents who participated in moderate physical activity recognised it (from 77.8% for participating two to three times a month to 87.2% for those who participated two to four times a week). While three quarters of the respondents who recognised probiotics and rarely or never participated in moderate physical activity had awareness of probiotics with very little knowledge or understanding (12.5% respectively), nearly three quarters of those respondents who recognised probiotics and participated two to three times a month or once a week had knowledge of it (71.4% and 70% respectively). Those respondents who recognised probiotics and participated in moderately physical activity two to four times a week had the

highest respondent percentage probiotics understanding (36.6%), followed by those respondents who recognised probiotics and participated in moderate physical activity more than four times a week (22.2%) ($p < 0.05$) (refer Table 4.9).

About three quarters to nearly all of the respondents who participated in hard physical activity at different levels recognised probiotics (from 72.7% to 90.5%). Those respondents who recognised probiotics and rarely or never participated in hard physical activity mostly had awareness and knowledge of probiotics (39.1% respectively). Of those respondents who recognised probiotics and participated in hard physical activity two to three times over a month, the majority (87.5%) had knowledge of probiotics, while of those respondents who recognised probiotics and participated two to four times a week, about one third (34.5%) had an understanding of it with slightly more (41.4%) of them having knowledge of it ($p > 0.05$) (refer Table 4.9).

Of those respondents who recognised probiotics and consumed dietary supplements weekly, monthly or seldom/never, a near equal percentage of them had awareness and knowledge of probiotics (i.e. of those who consumed dietary supplements seldom/never, 45.8% were aware of it and 37.5% had knowledge of it). However, among those respondents who recognised probiotics and consumed dietary supplements daily, most had knowledge followed by an understanding of it (50.7% and 31.9% respectively) ($p < 0.05$) (refer Table 4.9).

About three quarters to all the respondents who viewed their level of nutrition knowledge as well, moderately or not at all informed recognised probiotics (from 73.3% to 100%). Among these respondents who viewed their level of nutrition knowledge as well or moderately informed, half had knowledge (50% and 49.4% respectively) with a near equal percentage of respondents having awareness and an understanding of it (20.8% and 25.3% respectively for awareness and 29.2% and 25.3% respectively for an understanding). Of these respondents who viewed their level of nutrition as not at all informed, none had an understanding of probiotics, while most (72.7%) were only aware of it ($p < 0.05$) (refer Table 4.9).

The majority of the respondents who viewed their level of health and wellness knowledge as well or moderately informed recognised probiotics (90.3% and 89.2 respectively), while of those respondents who viewed their level of health and wellness knowledge as not at all informed, less than half (46.7%) recognised it. Among these respondents who viewed their level of health and wellness as well or moderately informed, about half again had knowledge (46.4% and 50.6% respectively) with a near equal percentage of respondents having awareness and an understanding of it (25% and 25.3% respectively for awareness and

28.6% and 24.1% respectively for understanding). Of these respondents who viewed their level of health and wellness knowledge as not at all informed, again none had an understanding of probiotics, while most (85.7%) were only aware of it ($p < 0.05$) (refer Table 4.9).

The majority of the respondents who were very interested or had little interest in food and nutrition recognised probiotics (90.4% and 83.9% respectively), while of those respondents who had no interest in food and nutrition, only half recognised it. Of these respondents who were interested in food and nutrition, about half had knowledge of probiotics (53% for very interested and 42.6% for little interest), while the remainder of these respondents either had awareness or an understanding of it (i.e. 21.2% and 25.8% for very interested) ($p > 0.05$) (refer Table 4.9).

Respondents who were very interested in health and wellness had the highest recognition of probiotics, while those who had no interest, had the lowest recognition of it (i.e. 87.8% for very interested, 80.6% for little interest and 60% for no interest). Of these respondents who were very interested, approximately one quarter (26.7%) had an understanding of probiotics, while about half (52.3%) had knowledge. Of these respondents who had little interest, a near equal percentage had awareness and knowledge (44.8% and 37.9% respectively) of probiotics, while of these respondents who were not interested in health and wellness, all only had an awareness of it ($p < 0.05$) (refer Table 4.9).

Table 4.9: Respondent probiotics recognition and acceptance associations with their health and lifestyle characteristics

Health and lifestyle characteristics		Recognition		Acceptance (n = 118)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Incidence of chronic disease[b]	Yes	75.0	18	33.3	6	38.9	7	27.8	5	0.731
	No	87.0	100	28.0	28	49.0	49	23.0	23	
Frequency of moderate physical activity**[c]	Rarely or never	66.7	8	75.0	6	12.5	1	12.5	1	0.013
	2-3 times over the month	77.8	7	28.6	2	71.4	5	0.0	0	
	About once a week	87.0	20	15.0	3	70.0	14	15.0	3	
	2-4 times a week	87.2	41	29.3	12	34.1	14	36.6	15	
	More than 4 times a week	81.2	9	22.2	2	55.6	5	22.2	2	

Table 4.9 (continued)

Health and lifestyle characteristics		Recognition *		Acceptance (n = 118)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Frequency of hard physical activity[**d]	Rarely or never	82.1	23	39.1	9	39.1	9	21.7	5	0.279
	2-3 times over the month	72.7	8	0.0	0	87.5	7	12.5	1	
	About once a week	90.5	19	31.6	6	47.4	9	21.1	4	
	2-4 times a week	85.3	29	24.1	7	41.4	12	34.5	10	
	More than 4 times a week	75.0	6	50.0	3	33.3	2	16.7	1	
Frequency of consumption of dietary supplements[e]	Daily	87.3	69	17.4	12	50.7	35	31.9	22	0.035
	Weekly	100.0	17	47.1	8	47.1	8	5.9	1	
	Monthly	100.0	8	37.5	3	50.0	4	12.5	1	
	Seldom/Never	68.6	24	45.8	11	37.5	9	16.7	4	
Level of health and wellness knowledge rating in relation to other adults of similar age[f]	Well informed	100.0	24	20.8	5	50.0	12	29.2	7	0.015
	Moderately informed	89.2	83	25.3	21	49.4	41	25.3	21	
	Not at all informed	73.3	11	72.7	8	27.3	3	0.0	0	
Level of nutrition knowledge rating in relation to other adults of similar age[g]	Well informed	90.3	28	25.0	7	46.4	13	28.6	8	0.017
	Moderately informed	89.2	83	25.3	21	50.6	42	24.1	20	
	Not at all informed	46.7	7	85.7	6	14.3	1	0.0	0	
Degree of interest in food and nutrition[h]	Very interested	90.4	66	21.2	14	53.0	35	25.8	17	0.059
	Little interest	83.9	47	34.0	16	42.6	20	23.4	11	
	No interest	50.0	5	80.0	4	20.0	1	0.0	0	
Degree of interest in health and wellness[i]	Very interested	87.8	86	20.9	18	52.3	45	26.7	23	0.008
	Little interest	80.6	29	44.8	13	37.9	11	17.2	5	
	No interest	60.0	3	100.0	3	0.0	0	0.0	0	

* Respondent number and percentage of those who recognised probiotics within each of the respondent health and lifestyle characteristic distributions (refer Table 4.2)

** 85 of the respondents who engaged in physical activity (moderate/hard) recognised probiotics

[ac, ae, af, ag, ai] Significant difference ($p < 0.05$)

[ab, ad, ah] Non-significant ($p > 0.05$)

4.4.2.2.3 Food and beverage with added health benefits purchase behaviours and intentions

Although there was no significant association or difference ($p > 0.05$) between the respondents who purchased food and beverages with added health benefits and their acceptance of probiotics as bioactive food ingredient, the respondents who recognised probiotics the least were those who seldom/never purchased foods (78.9% recognition) and beverages (81.9% recognition) with added health benefits (refer Table 4.10). About half of these respondents, irrelevant of their purchase frequency of foods with added health benefits, had knowledge of probiotics (i.e. 48% for purchasing very often, 41.7% for purchasing often and 53.3% for seldom/never purchasing foods with added health benefits). Those respondents who recognised probiotics and purchased foods with added health benefits very often had the lowest respondent percentage probiotics understanding (16%), compared to the one third (29.2%) of those who recognised probiotics and purchased foods with added health benefits only often ($p > 0.05$) (refer Table 4.10).

The majority of those respondents who purchased beverages with added health benefits recognised probiotics (i.e. 93.3% for very often, 87.8% for often and 81.9% for seldom/never). While about half of the respondents who recognised probiotics and purchased beverages with added health benefits had knowledge of probiotics (57.1% for very often, 41.7% for often and 48.5% for seldom/never), respondents who recognised probiotics and very often purchased beverages with added health benefits had the lowest respondent percentage probiotics understanding (7.1%) ($p > 0.05$) (refer Table 4.10).

The majority of the respondents who were prepared and not prepared to pay more for foods or beverages with added health benefits recognised probiotics (from 75.8% to 92.2%). About half of these respondents who were prepared to pay more for foods and/or beverages with added health benefits had knowledge of probiotics (45.1% and 50% respectively), while about half of these respondents who were not prepared to pay more for such foods and beverages also had knowledge of it (51.1% and 44.8% respectively) ($p > 0.05$ for each) (refer Table 4.10).

Those respondents who recognised probiotics and were prepared to pay 16% to 25% more for foods (93.3%) and beverages (100%), had a near equal percentage of respondents who had knowledge or an understanding of probiotics (for foods, 35.7% respectively and for beverages, 33.3% respectively). Among those respondents who recognised probiotics and were prepared to pay up to 15% more for such foods and beverages most had knowledge (47.1% and 52.2% respectively), which were followed by about half having either an

awareness (27.5% and 19.6% respectively) or an understanding (25.5% and 28.3% respectively) of probiotics ($p > 0.05$ for each) (refer Table 4.10).

Table 4.10: Respondent probiotics recognition and acceptance associations with their food and beverage with added health benefits purchase behaviours and intentions

Purchase behaviours and intentions		Recognition*		Acceptance (n = 118)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Purchase frequency of foods with added health benefits[b]	Very often	100.0	25	36.0	9	48.0	12	16.0	4	0.611
	Often	84.2	48	29.2	14	41.7	20	29.2	14	
	Seldom/never	78.9	45	24.4	11	53.3	24	22.2	10	
Purchase frequency of beverages with added health benefits[c]	Very often	93.3	14	35.7	5	57.1	8	7.1	1	0.581
	Often	87.8	36	30.6	11	41.7	15	27.8	10	
	Seldom/never	81.9	68	26.5	18	48.5	33	25.0	17	
Acceptance to paying more for foods with added health benefits[d]	Yes	92.2	71	29.6	21	45.1	32	25.4	18	0.799
	No	75.8	47	27.7	13	51.1	24	21.3	10	
Degree of price premium of foods with added health benefits**[e]	1-15%	89.5	51	27.5	14	47.1	24	25.5	13	0.574
	16-25%	93.3	14	28.6	4	35.7	5	35.7	5	
	26-50%	100.0	4	50.0	2	50.0	2	0.0	0	
	51-75%	0.0	0	0.0	0	0.0	0	0.0	0	
	76-100%	100.0	1	0.0	0	100.0	1	0.0	0	
Acceptance to paying more for beverages with added health benefits[f]	Yes	88.2	60	23.3	14	50.0	30	26.7	16	0.390
	No	81.7	58	34.5	20	44.8	26	20.7	12	
Degree of price premium of beverages with added health benefits**[g]	1-15%	85.2	46	19.6	9	52.2	24	28.3	13	0.369
	16-25%	100.0	9	33.3	3	33.3	3	33.3	3	
	26-50%	100.0	4	50.0	2	50.0	2	0.0	0	
	51-75%	0.0	0	0.0	0	0.0	0	0.0	0	
	76-100%	100.0	1	0.0	0	100.0	1	0.0	0	

* Respondent number and percentage of those who recognised probiotics within each of the respondent food and beverage with added health benefits purchase behaviour and intention characteristic distributions (refer Table 4.3)

** Number of the respondents who responded affirmative to paying more for food/beverages with added health benefits; one respondent did not specify food price premium

[ab, ac, ad, ae, af, ag] Non-significant ($p > 0.05$)

4.4.3 Omega-3 fatty acids

4.4.3.1 Acceptance as bioactive food ingredient

Almost all the respondents (97.1%) recognised omega-3 fatty acids, in short referred to as omega-3. While more than one third (40.7%) of these respondents had knowledge of omega-3, a third (32.6%) of the respondents had an understanding of omega-3 (refer Table 4.4).

4.4.3.2 Associations between the acceptance and the respondent characteristics

4.4.3.2.1 Demographic characteristics

The majority of both the male and the female respondents (94.5% and 98% respectively) recognised omega-3. Most (40.5%) of these male respondents had awareness of omega-3 which was followed by an equal percentage of them having knowledge and an understanding of it (29.7% respectively). Most of these female respondents had knowledge (44.9%) of omega-3 which was followed by one third (33.7%) having an understanding of it ($p > 0.05$) (refer Table 4.11).

Almost all to all of the respondents across the age categories recognised omega-3 (from 88.2% to 100.0%). Respondents who recognised omega-3 in the age category of 61 years and older had the highest respondent percentage with omega-3 awareness (66.7%) with no one having knowledge of it. One third (33.3%) of these respondents had an understanding of omega-3. Within the age categories 25 to 34 years, 45 to 54 years and 55 to 60 years, about half of the respondents that recognised omega-3 had knowledge of it (49.1%, 42.3% and 53.3% respectively), while about one third had an understanding of it (28.1%, 38.5% and 26.7%). In the age category 35 to 44 years, most of the respondents who recognised omega-3 either had awareness or an understanding (32.1% and 39.3% respectively) of it ($p > 0.05$) (refer Table 4.11).

The majority to all of the respondents across the population groups (from 94.4% to 100%) recognised omega-3. While about a near equal percentage of the coloured population group respondents who recognised omega-3 had awareness and knowledge of it (38.5% and 42.3% respectively), about double of the white and the black population group respondents who recognised it had knowledge of omega - 3 (38.2% and 52.9% respectively), compared to those who were aware of it (22.5% and 29.4% respectively) ($p > 0.05$) (refer Table 4.11).
The majority of the respondents to all of them across all the education qualification levels recognised omega-3 (from 92.5% to 100%). About one third of the respondents who

recognised omega-3 across the education qualification levels had an understanding of omega-3 (from 27.3% for Grade 11 or below to 38.1% for Grade 12 and diploma and degree) ($p > 0.05$). The majority of the respondents (from 90% to 100%) across the occupation groups also recognised omega-3. About one third of these respondents across most of the occupational groups (i.e. 35.3%, 33.3%, 27.7%, 39.5% and 33.3% respectively from the retired or unemployed, professionals, technicians and other associate professionals, office clerks and service and sales workers groups) also had an understanding of omega-3 ($p > 0.05$) (refer Table 4.11).

Almost all to all of the respondents across the annual income brackets (from 93.3% to 100 respectively) recognised omega-3. Those respondents who recognised omega-3 and earned R380 001 to R490 000 per annum had the highest respondent percentage awareness of it (50%), while those respondents who earned R270 001 to R380 000 per annum had the highest respondent percentage knowledge of it (71.4%). Those respondents who recognised omega-3 and earned R122 000 and less, R122 001 to R195 000 and R195 001 to R270 000 per annum had the highest respondent percentage understanding of it (36.5%, 35.5% and 35% respectively) ($p > 0.05$) (refer Table 4.11).

The majority of the respondents (from 93% to 100%), independent of their marital status recognised omega-3. About half of the respondents who recognised omega-3 and were either married or living together without children and single, living without children had knowledge (45% and 55.6% respectively) of omega-3, while half of those respondents who recognised omega-3 and were married or living together with children had an understanding (50%) of it ($p < 0.05$) (refer Table 4.11). This was the only significant ($p < 0.05$) finding for the acceptance of omega-3 as bioactive food ingredient across the demographic characteristics of the respondents (refer Table 4.11).

Table 4.11: Respondent omega-3 fatty acid recognition and acceptance associations with their demographic characteristics

Demographic characteristics		Recognition		Acceptance (n = 135)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Gender[b]	Male	94.5	37	40.5	15	29.7	11	29.7	11	0.070
	Female	98.0	98	21.4	21	44.9	44	33.7	33	
Age[c] (years)	25-34	96.6	57	22.8	13	49.1	28	28.1	16	0.075
	35-44	100.0	28	32.1	9	28.6	8	39.3	11	
	45-54	100.0	26	19.2	5	42.3	11	38.5	10	
	55-60	88.2	15	20.0	3	53.3	8	26.7	4	
	61 and older	100.0	9	66.7	6	0.0	0	33.3	3	
Population group[d]	Black	94.4	17	29.4	5	52.9	9	17.6	3	0.305
	Coloured	100.0	26	38.5	10	42.3	11	19.2	5	
	Indian	100.0	1	0.0	0	100.0	1	0.0	0	
	White	96.7	89	22.5	20	38.2	34	39.3	35	
	Other	100.0	2	50.0	1	0.0	0	50.0	1	
Level of education[e]	Grade 11 (Standard 9) or below	100.0	11	36.4	4	36.4	4	27.3	3	0.999
	Grade 12 (Matric)	92.5	37	27.0	10	37.8	14	35.1	13	
	Grade 12 and certificate	100.0	15	26.7	4	40.0	6	33.3	5	
	Grade 12 and diploma	100.0	33	27.3	9	42.4	14	30.3	10	
	Grade 12 and degree	100.0	11	27.3	3	45.5	5	27.3	3	
	Grade 12 and degree and diploma	95.5	21	23.8	5	38.1	8	38.1	8	
	Post graduate (Masters or Doctorate)	100.0	7	14.3	1	57.1	4	28.6	2	
Occupation[f]	Unemployed/retired	100.0	17	35.3	6	29.4	5	35.3	6	0.888
	Legislators, senior officials, managers	90.0	9	44.4	4	33.3	3	22.2	2	
	Professionals	100.0	18	27.8	5	38.9	7	33.3	6	
	Technicians and other associate professionals	95.9	47	23.4	11	48.9	23	27.7	13	
	Office clerks	97.4	38	23.7	9	36.8	14	39.5	15	
	Service workers and shop and market sales workers; Craft and related trade workers; Elementary occupations	100.0	6	16.7	1	50.0	3	33.3	2	

Table 4.11 (continued)

Demographic characteristics		Recognition*		Acceptance (n = 135)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Annual income[g]	R490 001 and above	100.0	10	40.0	4	30.0	3	30.0	3	0.134
	R380 001-R490 000	100.0	8	50.0	4	37.5	3	12.5	1	
	R270 001-R380 000	93.3	14	7.1	1	71.4	10	21.4	3	
	R195 001-R270 000	95.2	20	20.0	4	45.0	9	35.0	7	
	R122 001-R195 000	96.9	31	16.1	5	48.4	15	35.5	11	
	R0-R122 000	98.1	52	34.6	18	28.8	15	36.5	19	
Marital status[h]	Married/Living together without children	93.0	40	20.0	8	45.0	18	35.0	14	0.006
	Married/Living together with children	100.0	48	25.0	12	25.0	12	50.0	24	
	Single, living without children	97.3	36	36.1	13	55.6	20	8.3	3	
	Single, living with children	100.0	10	30.0	3	40.0	4	30.0	3	

* Respondent number and percentage of those who recognised omega-3 fatty acids within each of the respondent demographic characteristic distributions (refer Table 4.1)

[ah] Significant difference ($p < 0.05$)

[ab, ac, ad, ae, af, ag] Non-significant ($p > 0.05$)

4.4.3.2.2 Health and lifestyle characteristics

Regardless of whether respondents suffered from chronic disease or not, the majority of the respondents recognised omega-3 (91.7% and 98.3% respectively). There was no significant difference ($p > 0.05$) between the respondents who recognised omega-3 and suffered from chronic disease and those not and their acceptance of omega-3 (i.e. approximately one third of the respondents who did (27.3%) and did not (33.6%) suffer from chronic disease had an understanding of omega-3) ($p > 0.05$) (refer Table 4.12).

The majority of the respondents who participated in regular moderate or hard physical activity had recognition of omega-3 (from as low as 87.5% of those participating in hard physical activity more than four times a week to all of those participating less in moderate or hard physical activity). Respondents who recognised omega-3 and rarely or never participated in moderate physical activity had the highest respondent percentage with omega-3 knowledge (58.3%), while more than one third of those respondents who recognised omega-3 and participated in moderate physical activity about once a week or more had the highest respondent percentage with omega-3 understanding (39.1% for

participating about once a week, 34.8% for participating two to four times a week and 40% for those participating more than four times a week). While those respondents who recognised omega-3 and participated in hard physical activity about once a week had the highest respondent percentage with omega-3 knowledge (57.1%), a near equal percentage of respondents who recognised omega-3 and either rarely or never participated and those who recognised omega-3 and participated two to four times a week in hard physical activity had the highest respondent percentage with omega-3 understanding (35.7% and 36.4% respectively) ($p > 0.05$) (refer Table 4.12).

The majority to all of the respondents, independent of their frequency of consumption of dietary supplements, recognised omega-3 (from as low as 87.5% for the monthly consumers to all of the daily consumers). Those respondents who recognised omega-3 and seldom or never consumed dietary supplements had the lowest respondent percentage with omega-3 understanding (15.2%). Two thirds to a half of those respondents who recognised omega-3 and consumed dietary supplements daily, weekly or monthly had an understanding (36.7%, 43.8%, 42.9% respectively) of omega-3 ($p > 0.05$) (refer Table 4.12).

Almost all of the respondents who viewed their level of nutrition knowledge as moderately informed or not at all informed recognised omega-3 (97.8% and 91.7% respectively), while all of those respondents who viewed their level of nutrition knowledge as well informed recognised it. Almost double the percentage of respondents who recognised omega-3 and viewed their level of nutrition knowledge as not at all informed had awareness of omega-3 (54.5%) compared to those who recognised omega-3 and viewed their level of nutrition knowledge as well or moderately informed (20.8% and 21.3% respectively). Of those respondents who recognised omega-3 and viewed their level of nutrition knowledge as well informed, half had an understanding of omega-3, while few respondents (18.2%) who recognised omega-3 and viewed their level of nutrition knowledge as not at all informed had an understanding ($p < 0.05$) (refer Table 4.12).

All to nearly all of the respondents who viewed their level of health and wellness knowledge as well or moderately informed or not at all informed recognised omega-3 (100%, 96.8% and 93.3% respectively). Among those respondents who recognised omega-3 and viewed their level of health and wellness as well or moderately informed, about one third to half had knowledge or an understanding of omega-3 (32.3% and 45.2% respectively for well informed and 46.7% and 31.1% for moderately informed respectively). Of those respondents who recognised omega-3 and viewed their level of health and wellness knowledge as not at all informed, few (14.3%) had an understanding of omega-3, while most (64.3%) were only aware of it ($p < 0.05$) (refer Table 4.12).

While most of the respondents who were interested in nutrition or not recognised omega-3 (from 90% for not interested to 98.6% for very interested), about double the percentage of respondents who recognised omega-3 and were very interested compared to those that had little interest had an understanding of it (43.1% and 24.1% respectively). Among those respondents who recognised omega-3 and indicated having no interest in nutrition, none had an understanding of omega-3. The highest percentage of the respondents (44.4%) who was only aware of omega-3 occurred among these respondents ($p < 0.05$) (refer Table 4.12).

Respondents who indicated that they were very interested or had little interest in health and wellness had the highest recognition of omega - 3 (98% and 97.2% respectively), while those that indicated no interest, had somewhat lower omega-3 recognition (80%). Of these respondents very interested in health and wellness, just more than one third had knowledge or an understanding (38.5% and 39.6% respectively) of omega-3. Of these respondents who indicated little interest in health and wellness, a near equal percentage had awareness and knowledge (40% and 42.9% respectively) of omega-3, while of these respondents who indicated not being interested in health and wellness, three quarters had knowledge and none an understanding of omega-3 ($p < 0.05$) (refer Table 4.9).

Table 4.12: Respondent omega-3 fatty acid recognition and acceptance associations with their health and lifestyle characteristics

Health and lifestyle characteristics		Recognition		Acceptance (n = 135)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Incidence of chronic disease[b]	Yes	91.7	22	27.3	6	45.5	10	27.3	6	0.829
	No	98.3	113	26.5	30	39.8	45	33.6	38	
Frequency of moderate physical activity**[c]	Rarely or never	100.0	12	33.3	4	58.3	7	8.3	1	0.417
	2-3 times over the month	100.0	9	44.4	4	44.4	4	11.1	1	
	About once a week	100.0	23	30.4	7	30.4	7	39.1	9	
	2-4 times a week	97.9	46	19.6	9	45.7	21	34.8	16	
	More than 4 times a week	90.1	10	20.0	2	40.0	4	40.0	4	
Frequency of hard physical activity**[d]	Rarely or never	100.0	28	25.0	7	39.3	11	35.7	10	0.644
	2-3 times over the month	100.0	11	45.5	5	36.4	4	18.2	2	
	About once a week	100.0	21	19.0	4	57.1	12	23.8	5	
	2-4 times a week	97.1	33	21.2	7	42.4	14	36.4	12	
	More than 4 times a week	87.5	7	42.9	3	28.6	2	28.6	2	

Table 4.12 (continued)

Health and lifestyle characteristics		Recognition *		Acceptance (n = 135)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Frequency of consumption of dietary supplements[e]	Daily	100.0	79	24.1	19	39.2	31	36.7	29	0.140
	Weekly	99.3	16	31.3	5	25.0	4	43.8	7	
	Monthly	87.5	7	0.0	0	57.1	4	42.9	3	
	Seldom/Never	94.3	33	36.4	12	48.5	16	15.2	5	
Level of health and wellness knowledge rating in relation to other adults of similar age[f]	Well informed	100.0	24	20.8	5	29.2	7	50.0	12	0.007
	Moderately informed	97.8	89	21.3	19	47.2	42	31.5	28	
	Not at all informed	91.7	22	54.5	12	27.3	6	18.2	4	
Level of nutrition knowledge rating in relation to other adults of similar age[g]	Well informed	100.0	31	22.6	7	32.3	10	45.2	14	0.008
	Moderately informed	96.8	90	22.2	20	46.7	42	31.1	28	
	Not at all informed	93.3	14	64.3	9	21.4	3	14.3	2	
Degree of interest in food and nutrition[h]	Very interested	98.6	72	18.1	13	38.9	28	43.1	31	0.020
	Little interest	96.4	54	35.2	19	40.7	22	24.1	13	
	No interest	90.0	9	44.4	4	55.6	5	0.0	0	
Degree of interest in health and wellness[i]	Very interested	98.0	96	21.9	21	38.5	37	39.6	38	0.044
	Little interest	97.2	35	40.0	14	42.9	15	17.1	6	
	No interest	80.0	4	25.0	1	75.0	3	0.0	0	

* Respondent number and percentage of those who recognised omega-3 fatty acids within each of the respondent health and lifestyle characteristic distributions (refer Table 4.2)

** 100 of the respondents who engaged in physical activity (moderate/hard) recognised omega – 3 fatty acids

af, ag, ah, ai Significant difference ($p < 0.05$)

ab, ac, ad, ae Non-significant ($p > 0.05$)

4.4.3.2.3 Food and beverage with added health benefits purchase behaviours and intentions

No significant ($p > 0.05$) associations or differences were found between the respondent omega-3 fatty acid acceptance and their purchase behaviour and intent of food and beverages with added health benefits (refer Table 4.13). Nearly all to all respondents who purchased foods and beverages with added health benefits or not recognised omega-3 (from as low as 94.7% for seldom/never purchasing such foods to as high as 100% for very often purchasing such foods and beverages). Respondents who recognised omega-3 and purchased foods and beverages with added health benefits very often had the highest respondent percentage with omega-3 knowledge (48% and 60% respectively), while

approximately a third of the respondents who recognised omega-3 and purchased foods or beverages with added health benefits often or seldom/never had an understanding of omega-3 (35.7% and 33.3% respectively for foods and 34.1% and 34.2% respectively for beverages) ($p > 0.05$) (refer Table 4.13).

- There was no noticeable difference between the respondent omega-3 recognition among those who were prepared to pay more (100% and 98.5% respectively) and those that were not prepared to pay more (93.5% and 95.8% respectively) for foods and beverages with added health benefits. Of those respondents who recognised omega-3 and were not prepared to pay more for foods or beverages with added health benefits and those who were prepared to pay more, a near equal percentage had knowledge of omega-3 (39.7% and 38.2% respectively and 41.6% and 43.3% respectively) ($p > 0.05$).

As indicated, most respondents willing to pay more for foods and beverages with added health benefits indicated a price premium of up to 15%, followed by a few respondents willing to pay more and in particular only up to 25% more (refer Table 4.3). Among the respondents who recognised omega-3 in these two price premium levels for purchasing such foods and beverages most had knowledge (39.3% and 53.3% respectively and 39.6% and 55.6% respectively) of omega-3 with some respondents having an understanding of it (12.5% and 20% respectively and 32.1% and 22.2%) ($p > 0.05$) (refer Table 4.13).

Table 4.13: Respondent omega-3 fatty acid recognition and acceptance associations with their food and beverage with added health benefits purchase behaviours and intentions

Purchase behaviours and intentions		Recognition		Acceptance (n = 135)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Purchase frequency of foods with added health benefits[b]	Very often	100.0	25	28.0	7	48.0	12	24.0	6	0.792
	Often	98.2	56	23.2	13	41.1	23	35.7	20	
	Seldom/never	94.7	54	29.6	16	37.0	20	33.3	18	
Purchase frequency of beverages with added health benefits[c]	Very often	100.0	15	20.0	3	60.0	9	20.0	3	0.506
	Often	100.0	41	31.7	13	34.1	14	34.1	14	
	Seldom/never	95.2	79	25.3	20	40.5	32	34.2	27	
Acceptance to paying more for foods with added health benefits[d]	Yes	100.0	77	28.6	22	41.6	32	29.9	23	0.711
	No	93.5	58	24.1	14	39.7	23	36.2	21	

Table 4.13 (continued)

Purchase behaviours and intentions		Recognition*		Acceptance (n = 135)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Degree of price premium of foods with added health benefits**[e]	1-15%	98.2	56	28.6	16	39.3	22	12.5	7	0.623
	16-25%	100.0	15	26.7	4	53.3	8	20.0	3	
	26-50%	100.0	4	25.0	1	25.0	1	50.0	2	
	51-75%	100.0	0	0.0	0	0.0	0	0.0	0	
	76-100%	100.0	1	0.0	0	100.0	1	0.0	0	
Acceptance to paying more for beverages with added health benefits[f]	Yes	98.5	67	26.9	18	43.3	29	29.9	20	0.771
	No	95.8	68	26.5	18	38.2	26	35.3	24	
Degree of price premium of foods with added health benfits**[g]	1-15%	98.1	53	28.3	15	39.6	21	32.1	17	0.970
	16-25%	100.0	9	22.2	2	55.6	5	22.2	2	
	26-50%	100.0	4	25.0	1	50.0	2	25.0	1	
	51-75%	100.0	0	0.0	0	0.0	0	0.0	0	
	76-100%	100.0	1	0.0	0	100.0	1	0.0	0	

* Respondent number and percentage of those who recognised omega-3 fatty acids within each of the respondent food and beverage with added health benefits purchase behaviour and intention characteristic distributions (refer Table 4.3)

** Number of the respondents who responded affirmative to paying more for food/beverages with added health benefits; one respondent did not specify food price premium

ab, ac, ad, ae, af, ag Non-significant ($p > 0.05$)

4.4.4 Lycopene

4.4.4.1 Acceptance as bioactive food ingredient

Only one quarter (25.9%) of the respondents recognised lycopene. However, of these respondents almost half (44.4%) had knowledge and almost one third (30.6%) an understanding of it (refer Table 4.4).

4.4.4.2 Associations between the acceptance and the respondent characteristics

4.4.4.2.1 Demographic characteristics

Double the percentage of the female respondents (30%) compared to the male respondents (15.4%) recognised lycopene. However, between the male and the female respondents who recognised lycopene half to nearly half had knowledge (50% and 43.3% respectively) and about one third an understanding (33.3% and 30% respectively) of it ($p > 0.05$) (refer Table 4.14).

While respondents in the age category 35 to 44 years had the lowest (17.9%) lycopene recognition, respondents in the 45 to 54 year age category had the highest (38.5%) recognition of it. The majority (80%) of respondents from the age category 35 to 44 years who recognised lycopene had knowledge of it, while respondents from the age categories 45 to 54 years and 61 years and older who recognised lycopene had the highest respondent percentage (50% and 66.7% respectively) lycopene understanding ($p > 0.05$) (Refer Table 4.14).

While black respondents had the highest (55.5%) recognition of lycopene, none of these respondents had an understanding of it. The majority (80%) of them had knowledge of lycopene. The highest respondent percentage (35.7%) lycopene understanding occurred among the white respondents who recognised it (30.4%) ($p > 0.05$) (refer Table 4.14).

Respondents with a post graduate qualification had the highest (57.1%) recognition of lycopene, while few respondents (9.1%) with Grade 12 and a degree recognised it. Those who recognised lycopene and had a Grade 12 and diploma qualification, had the highest respondent percentage (71.4%) lycopene awareness, while those respondents who recognised lycopene and had a Grade 12 or a Grade 12 with a degree qualification had the highest respondent percentage (50% and 100% respectively) lycopene knowledge. Half of the respondents who recognised lycopene and had an education level of Grade 11 and below, Grade 12 or Grade 12 and a certificate (50% respectively) and one quarter of the respondents who recognised lycopene and had an education level of Grade 12 along with a diploma and degree or post graduate qualification (25% respectively) had an understanding of it ($p > 0.05$) (refer Table 4.14).

While respondents from the unemployed/retired occupational group had the highest (41.2%) recognition of lycopene, respondents from the technicians and other associate professionals and service worker groups had the lowest (16.3% and 16.7% respectively) recognition. Almost two thirds of the respondents who recognised lycopene and fell into the legislator, senior official and managers, professionals and office clerks groups had knowledge of it (66.7%, 60% and 58.3% respectively), while just over two thirds (71.4%) of the retired/unemployed respondents who recognised lycopene had an understanding of it ($p > 0.05$) (refer Table 4.14).

Respondents from the annual income brackets of R490 001 and above, R380 000 to R490 000 and R122 000 to R195 000 had the highest recognition (40%, 37.5% and 37.5% respectively) of lycopene. One third to all of the respondents across the annual income

brackets who recognised lycopene had knowledge of it (from as little as 33.3% for the R122 000 and less and R122 001 to R195 000 income brackets to as high as all the respondents earning R380 001 to R490 000). The respondents who recognised lycopene and had an understanding of it were mostly centred in the three lower annual income brackets (33.3% for R122 000 and less, 41.7% for R122 001 to R195 000 and 33.3% for R195 001 to R270 000) ($p > 0.05$) (refer Table 4.14).

One third of those respondents who were married or living together with or without children recognised lycopene (32.6% and 31.3% respectively), while few of those respondents who were single and living with or without children recognised it (13.5% and 20% respectively). Of these respondents who were married or living together without or with children, more had an understanding (35.7% and 33.3% respectively) of lycopene than those who were single and living without or with children (20% and nil respectively) ($p > 0.05$) (refer Table 4.14). No significant ($p > 0.05$) associations or differences were therefore found between the respondent acceptance of lycopene and their demographic characteristics (refer Table 4.14).

Table 4.14: Respondent lycopene recognition and acceptance associations with their demographic characteristics

Demographic characteristics		Recognition		Acceptance (n = 36)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Gender[b]	Male	15.4	6	16.7	1	50.0	3	33.3	2	0.875
	Female	30.0	30	26.7	8	43.3	13	30.0	9	
Age[c] (years)	25-34	23.7	14	28.6	4	57.1	8	14.3	2	0.259
	35-44	17.9	5	0.0	0	80.0	4	20.0	1	
	45-54	38.5	10	30.0	3	20.0	2	50.0	5	
	55-60	23.5	4	25.0	1	50.0	2	25.0	1	
	61 and older	33.3	3	33.3	1	0.0	0	66.7	2	
Population group[d]	Black	55.5	5	20.0	1	80.0	4	0.0	0	0.465
	Coloured	11.5	3	33.3	1	33.3	1	33.3	1	
	Indian	0.0	0	0.0	0	0.0	0	0.0	0	
	White	30.4	28	25.0	7	39.3	11	35.7	10	
	Other	0.0	0	0.0	0	0.0	0	0.0	0	

Table 4.14 (continued)

Demographic characteristics		Recognition*		Acceptance (n = 36)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Level of education[e]	Grade 11 (Standard 9) or below	18.2	2	50.0	1	0.0	0	50.0	1	0.112
	Grade 12 (Matric)	25.0	10	0.0	0	50.0	5	50.0	5	
	Grade 12 and certificate	26.7	4	25.0	1	25.0	1	50.0	2	
	Grade 12 and diploma	21.2	7	71.4	5	28.6	2	0.0	0	
	Grade 12 and degree	9.1	1	0.0	0	100.0	1	0.0	0	
	Grade 12 and degree and diploma	36.4	8	25.0	2	50.0	4	25.0	2	
	Post graduate (Masters or Doctorate)	57.1	4	0.0	0	75.0	3	25.0	1	
Occupation[f]	Unemployed/retired	41.2	7	28.6	2	0.0	0	71.4	5	0.175
	Legislators, senior officials, managers	30.0	3	0.0	0	66.7	2	33.3	1	
	Professionals	27.8	5	20.0	1	60.0	3	20.0	1	
	Technicians and other associate professionals	16.3	8	37.5	3	50.0	4	12.5	1	
	Office clerks	24.5	12	16.7	2	58.3	7	25.0	3	
	Service workers and shop and market sales workers; Craft and related trade workers; Elementary occupations	16.7	1	100.0	1	0.0	0	0.0	0	
Annual income[g]	R490 001 and above	40.0	4	25.0	1	50.0	2	25.0	1	0.673
	R380 001-R490 000	37.5	3	0.0	0	100.0	3	0.0	0	
	R270 001-R380 000	13.3	2	50.0	1	50.0	1	0.0	0	
	R195 001-R270 000	14.3	3	0.0	0	66.7	2	33.3	1	
	R122 001-R195 000	37.5	12	25.0	3	33.3	4	41.7	5	
	R0-R122 000	22.6	12	33.3	4	33.3	4	33.3	4	
Marital status[h]	Married/Living together without children	32.6	14	28.6	4	35.7	5	35.7	5	0.766
	Married/Living together with children	31.3	15	13.3	2	53.3	8	33.3	5	
	Single, living without children	13.5	5	40.0	2	40.0	2	20.0	1	
	Single, living with children	20.0	2	50.0	1	50.0	1	0.0	0	

* Respondent number and percentage of those who recognised lycopene within each of the respondent demographic characteristic distributions (refer Table 4.1)

[ab, ac, ad, ae, af, ag, ah] Non-significant ($p > 0.05$)

4.4.4.2.2 Health and lifestyle characteristics

No significant ($p > 0.05$) associations or differences were also found between the respondent lycopene acceptance and their health and lifestyle characteristics (refer Table 4.15). While almost double the percentage of respondents who did not suffer from chronic disease than those who did suffer recognised lycopene (27.8% versus 16.7%), a higher percentage of these respondents who did suffer from chronic disease had knowledge and an understanding (50% respectively) of lycopene than those who did not suffer from chronic disease (43.8% and 28.1% respectively) ($p > 0.05$) (refer Table 4.15).

Of those respondents who participated in moderate physical activity less than once a week ($n = 21$, refer Table 4.2), none recognised lycopene. Double the percentage of respondents who participated more than four times a week (54.2%) than those who participated about once a week (26.1%) recognised lycopene, while three quarters (78.3%) of the respondents who participated two to four times a week recognised it. One third of the respondents who recognised lycopene and participated in moderate physical activity about once a week or two to four times a week either had an awareness, knowledge or an understanding of it (33.3% respectively), while two thirds (66.7%) of the respondents who recognised lycopene and participated in moderate physical activity more than four times a week had knowledge of it ($p > 0.05$) (refer Table 4.15).

Less than half of the respondents who participated in hard physical activity recognised lycopene (from as low as 14.3% of the participants rarely or never participating in such activity to as high as 42.9% of the participants participating in such activity about once a week). While respondents who rarely or never participated in such activity had the lowest (14.3%) recognition of lycopene, the highest percentage (75%) respondent lycopene understanding was centered in this activity frequency grouping. Those respondents who participated in hard physical activity about once a week had the lowest percentage (11.1%) respondent lycopene understanding ($p > 0.05$) (refer Table 4.15).

Those respondents who seldom/never consumed dietary supplements had the highest (40%) recognition of lycopene; however, none of these respondents had an understanding of it. The majority (75%) of the respondents who recognised lycopene and consumed dietary supplements weekly had knowledge of it, while one third of those respondents who recognised lycopene and consumed dietary supplement daily or monthly (36% and 33.3% respectively) had an understanding of it ($p > 0.05$) (refer Table 4.15).

Approximately half of the respondents who viewed their level of nutrition and health and wellness knowledge as well informed recognised lycopene (58.3% and 45.2% respectively). Half of these respondents (50% respectively) had knowledge of lycopene, while approximately one quarter (21.4% and 28.6% respectively) had an understanding of it. The highest respondent percentage understanding of lycopene occurred among those who recognised lycopene and viewed their level of nutrition and health and wellness knowledge as moderately informed (38.1% and 33.3% respectively). None of those respondents who recognised lycopene and viewed their level of nutrition and health and wellness knowledge as not at all informed (4.2% and 6.7% respectively) had knowledge or an understanding of it ($p > 0.05$) (refer Table 4.15).

While approximately 40% (39.7%) of the respondents very interested in food and nutrition recognised lycopene, about half (48.3%) of them had knowledge and just less than one third (27.6%) an understanding of it. Of those few (8.9%) respondents who had little interest in food and nutrition and recognised lycopene, more than half (60%) had an understanding of it, while of those respondents who had no interest in food and nutrition and recognised lycopene (20%), none had an understanding of it ($p > 0.05$) (refer Table 4.15).

About one third (36.7%) of the respondents who were very interested in health and wellness recognised lycopene, of which almost half (44.4%) had knowledge and just less than one third (30.6%) an understanding of it. None of the respondents who had little or no interest in health and wellness recognised lycopene (refer Table 4.15).

Table 4.15: Respondent lycopene recognition and acceptance associations with their health and lifestyle characteristics

Health and lifestyle characteristics		Recognition		Acceptance (n = 36)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Incidence of chronic disease[b]	Yes	16.7	4	0.0	0	50.0	2	50.0	2	0.425
	No	27.8	32	28.1	9	43.8	14	28.1	9	
Frequency of moderate physical activity[**c]	Rarely or never	0.0	0	0.0	0	0.0	0	0.0	0	0.695
	2-3 times over the month	0.0	0	0.0	0	0.0	0	0.0	0	
	About once a week	26.1	6	33.3	2	33.3	2	33.3	2	
	2-4 times a week	78.3	18	33.3	6	33.3	6	33.3	6	
	More than 4 times a week	54.5	6	16.7	1	66.7	4	16.7	1	

Table 4.15 (continued)

Health and lifestyle characteristics		Recognition*		Acceptance (n = 36)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Frequency of hard physical activity**[d]	Rarely or never	14.3	4	25.0	1	0.0	0	75.0	3	0.270
	2-3 times over the month	27.3	3	66.7	2	0.0	0	33.3	1	
	About once a week	42.9	9	22.2	2	66.7	6	11.1	1	
	2-4 times a week	32.4	11	27.3	3	45.5	5	27.3	3	
	More than 4 times a week	37.5	3	33.3	1	33.3	1	33.3	1	
Frequency of consumption of dietary supplements[e]	Daily	31.6	25	24.0	6	40.0	10	36.0	9	0.587
	Weekly	23.5	4	0.0	0	75.0	3	25.0	1	
	Monthly	37.5	3	33.3	1	33.3	1	33.3	1	
	Seldom/Never	40.0	4	50.0	2	50.0	2	0.0	0	
Level of health and wellness knowledge rating in relation to other adults of similar age[f]	Well informed	58.3	14	28.6	4	50.0	7	21.4	3	0.373
	Moderately informed	23.1	21	19.0	4	42.9	9	38.1	8	
	Not at all informed	4.2	1	100.0	1	0.0	0	0.0	0	
Level of nutrition knowledge rating in relation to other adults of similar age[g]	Well informed	45.2	14	21.4	3	50.0	7	28.6	4	0.515
	Moderately informed	22.6	21	23.8	5	42.9	9	33.3	7	
	Not at all informed	6.7	1	100.0	1	0.0	0	0.0	0	
Degree of interest in food and nutrition[h]	Very interested	39.7	29	24.1	7	48.3	14	27.6	8	0.485
	Little interest	8.9	5	20.0	1	20.0	1	60.0	3	
	No interest	20.0	2	50.0	1	50.0	1	0.0	0	
Degree of interest in health and wellness[i]	Very interested	36.7	36	25.0	9	44.4	16	30.6	11	[j]
	Little interest	0.0	0	0.0	0	0.0	0	0.0	0	
	No interest	0.0	0	0.0	0	0.0	0	0.0	0	

* Respondent number and percentage of those who recognised lycopene within each of the respondent health and lifestyle characteristic distributions (refer Table 4.2)

** 30 of the respondents who engaged in physical activity (moderate/hard) recognised lycopene

[j] No statistics were completed as the degree of interest in health and wellness is a constant

[ab, ac, ad, ae, af, ag, ah, ai] Non-significant ($p > 0.05$)

4.4.4.2.3 Food and beverage with added health benefits purchase behaviours and intentions

Less than one third of the respondents who purchased foods with added health benefits very often, often or seldom/never recognised lycopene (32%, 28.1% and 21.1% respectively).

Most of the respondents who very often purchased foods with added health benefits and recognised lycopene either had awareness (50%) or knowledge (37.5%) of it, while most (62.5%) of the respondents who often purchased such foods and recognised lycopene had knowledge of it. Among the respondents who seldom/never purchased foods with added health benefits and recognised lycopene most (50%) had an understanding of lycopene ($p > 0.05$) (refer Table 4.16).

One fifth to one third of the respondents who seldom/never, often and very often purchased beverages with added health benefits recognised lycopene (20.5%, 36.6% and 26.7% respectively). Among those respondents who very often purchased beverages with added health benefits and recognised lycopene most (75%) had awareness of lycopene. While among those respondents who often purchased these beverages and recognised lycopene most (60%) had knowledge of it, most (47.1%) of the respondents who seldom/never purchased these beverages and recognised lycopene had an understanding of it ($p < 0.05$) (refer Table 4.16).

About 30% of the respondents who were prepared to pay more for foods or beverages with added health benefits recognised lycopene (29.9% and 29.4% respectively). Of these respondents who recognised lycopene and accepted to pay more, approximately half (47.8% and 55% respectively) had knowledge of it, while just less than one third (30.4% and 30% respectively) had an understanding of it. Among those respondents who were not prepared to pay more for foods or beverages with added health benefits and recognised lycopene (21% and 22.5% respectively), an almost equal percentage had awareness, knowledge and an understanding of it (30.8%, 38.5% and 30.8% respectively and 37.5%, 31.3% and 31.3% respectively) ($p > 0.05$) (refer Table 4.15).

None of the respondents who were prepared to pay more than 50% for foods or beverages with added health benefits recognised lycopene. The majority of the respondents who were prepared to pay 16 to 25% more for foods and beverages with added health benefits and recognised lycopene (33.3% respectively) had knowledge of it (80% and 100% respectively). Of those respondents who were prepared to pay one to fifteen percent more for foods or beverages with added health benefits and recognised lycopene (24.6% and 29.6% respectively), approximately one third had knowledge (35.3% and 43.8% respectively) or an understanding (35.3% and 37.5% respectively) of it ($p > 0.05$) (refer Table 4.15).

Table 4.16: Respondent lycopene recognition and acceptance associations with their food and beverage with added health benefits purchase behaviours and intentions

Purchase behaviours and intentions		Recognition *		Acceptance (n = 36)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Purchase frequency of foods with added health benefits[b]	Very often	32.0	8	50.0	4	37.5	3	12.5	1	0.100
	Often	28.1	16	12.5	2	62.5	10	25.0	4	
	Seldom/never	21.1	12	25.0	3	25.0	3	50.0	6	
Purchase frequency of beverages with added health benefits[c]	Very often	26.7	4	75.0	3	0.0	0	25.0	1	0.028
	Often	36.6	15	26.7	4	60.0	9	13.3	2	
	Seldom/never	20.5	17	11.8	2	41.2	7	47.1	8	
Acceptance to paying more for foods with added health benefits[d]	Yes	29.9	23	21.7	5	47.8	11	30.4	7	0.804
	No	21.0	13	30.8	4	38.5	5	30.8	4	
Degree of price premium of foods with added health benefits**[e]	1-15%	24.6	17	29.4	5	35.3	6	35.3	6	0.333
	16-25%	33.3	5	0.0	0	80.0	4	20.0	1	
	26-50%	25.0	1	0.0	0	100.0	1	0.0	0	
	51-75%	0.0	0	0.0	0	0.0	0	0.0	0	
	76-100%	0.0	0	0.0	0	0.0	0	0.0	0	
Acceptance to paying more for beverages with added health benefits[f]	Yes	29.4	20	15.0	3	55.0	11	30.0	6	0.231
	No	22.5	16	37.5	6	31.3	5	31.3	5	
Degree of price premium of beverages with added health benefits**[g]	1-15%	29.6	16	18.8	3	43.8	7	37.5	6	0.421
	16-25%	33.3	3	0.0	0	100.0	3	0.0	0	
	26-50%	25.0	1	0.0	0	100.0	1	0.0	0	
	51-75%	0.0	0	0.0	0	0.0	0	0.0	0	
	76-100%	0.0	0	0.0	0	0.0	0	0.0	0	

* Respondent number and percentage of those who recognised lycopene within each of the respondent food and beverage with added health benefits purchase behaviour and intention characteristic distributions (refer Table 4.3)

** Number of the respondents who responded affirmative to paying more for food/beverages with added health benefits

[ac] Significant difference ($p < 0.05$)

[ab, ad, ae, af, ag] Non-significant ($p > 0.05$)

4.4.5 Plant sterols or stanols

4.4.5.1 Acceptance as bioactive food ingredient

Just over one quarter (26.6%) of the respondents recognised plant sterols (or stanols). The majority (70.3%) of these respondents had awareness of it, while the remaining respondents

had a near equal respondent percentage with knowledge (13.5%) or understanding (16.2%) of it (refer Table 4.4).

4.4.5.2 Associations between the acceptance and the respondent characteristics

4.4.5.2.1 Demographic characteristics

No significant ($p > 0.05$) associations or differences occurred between the respondent acceptance of plant sterols and their demographic characteristics as indicated in Table 4.17. Almost double the percentage of the female respondents had recognition of plant sterols compared to the male respondents (30% versus 17.9%). The majority of these male and female respondents (85.7% and 66.7% respectively) had awareness of plant sterols. While a near equal percentage of these male and female respondents (14.3% and 16.7% respectively) had an understanding of it, five female respondents compared to one male respondent understood it ($p > 0.05$) (refer Table 4.17).

One third and less of the respondents in the 60 years and younger age category recognised plant sterols (from 10.7% to 34.6%), while two thirds (66.7%) of the respondents 61 years and older recognised it. While two thirds to most (from 66.7% to 88.9%) of the respondents across the age category who recognised plant sterols were aware of it, only one third (33.3%) of these respondents from the age category 55 to 60 years were aware of it. In this age category only three respondents recognised plant sterols of whom one respectively was aware, had knowledge or an understanding of it ($p > 0.05$) (refer Table 4.17).

While only the black, coloured and white respondents recognised plant sterols, less than one third (16.7%, 19.2% and 31.5% respectively) of them did so. No black respondents had an understanding of plant sterols, while two of the three (66.7%) had awareness of it. The majority (80%) of the coloured respondents were also only aware of plant sterols with one respondent having an understanding of it. Similarly, most (69%) of the white respondents had awareness of it with a few (17.2%) having an understanding of it ($p > 0.05$) (refer Table 4.17).

About one third or less of the respondents across all the education qualification levels up to and excluding respondents with a post graduate qualification recognised plant sterols (from 36.4% to 13.3%). More than half (57.1%) of the respondents with a post graduate qualification recognised it. Half to just over three quarters of respondents who recognised plant sterols across the education qualification levels were aware of it (from 50% for Grade 12 and a certificate or a degree and diploma to 81.8% for Grade 12 and diploma).

Respondents who recognised plant sterols with a Grade 12 and a degree with out or with a diploma had the highest respondent percentage knowledge (33.3% respectively) of it, although this relates to one and two respondents respectively ($p > 0.05$) (refer Table 4.17).

Less than half to very few of the respondents (from 47.1% to 15.4%) across the occupation groups also recognised plant sterols. Half to all of these respondents across the occupation groups (i.e. 50%, 75%, 87.5%, 70%, 66.7% and 100% respectively from the retired or unemployed, legislators, professionals, technicians and other associate professionals, office clerks and service and sales workers groups) were aware of plant sterols. About one quarter of these respondents who recognised plant sterols and fell into the legislators, senior officials and managers (25%) or the technicians and other associate professionals (20%) occupation groups had knowledge of it, while one third or more of these respondents who recognised plant sterols and fell into the unemployed or retired (37.5%) or the office clerks (33.3%) occupation groups had an understanding of it. However, this relates to one and two respondents respectively having knowledge of it and three and two respondents respectively having understanding of it ($p > 0.05$) (refer Table 4.17).

Twenty percent to approximately two thirds (62.5%) of the respondents across the annual income brackets recognised plant sterols. All of these respondents who earned between R270 001 and R490 000 per annum had awareness of it. These respondents who earned R490 001 and above had the highest respondent percentage (40%) knowledge of plant sterols, while the respondents who earned R122 001 to R195 000 per annum had the highest respondent percentage (37.5%) understanding of it. However, this also relates to one and two respondents respectively having knowledge or an understanding of it ($p > 0.05$) (refer Table 4.17).

Few to less than half (from 14.6% to 40%) of the respondents, independent of their marital status recognised plant sterols. Most of these respondents (from 68.8% to 77.8%) had awareness of plant sterols, independent of their marital status. These respondents who were married or living together with children had the highest respondent percentage (14.3%) knowledge of plant sterols, while these respondents who were single, living with children had the highest respondent percentage (25%) understanding of it although reference is again made to only one respondent in each case ($p > 0.05$) (refer Table 4.17).

Table 4.17: Respondent plant sterol or stanol recognition and acceptance associations with their demographic characteristics

Demographic characteristics		Recognition		Acceptance (n = 37)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Gender[b]	Male	17.9	7	85.7	6	0.0	0	14.3	1	0.477
	Female	30.0	30	66.7	20	16.7	5	16.7	5	
Age[c] (years)	25-34	27.1	16	68.8	11	18.8	3	12.5	2	0.480
	35-44	10.7	3	66.7	2	33.3	1	0.0	0	
	45-54	34.6	9	88.9	8	0.0	0	11.1	1	
	55-60	17.6	3	33.3	1	33.3	1	33.3	1	
	61 and older	66.7	6	66.7	4	0.0	0	33.3	2	
Population group[d]	Black	16.7	3	66.7	2	33.3	1	0.0	0	0.703
	Coloured	19.2	5	80.0	4	0.0	0	20.0	1	
	Indian	0.0	0	0.0	0	0.0	0	0.0	0	
	White	31.5	29	69.0	20	13.8	4	17.2	5	
	Other	0.0	0	0.0	0	0.0	0	0.0	0	
Level of education[e]	Grade 11 (Standard 9) or below	36.4	4	75.0	3	25.0	1	0.0	0	0.556
	Grade 12 (Matric)	17.5	7	71.4	5	0.0	0	28.6	2	
	Grade 12 and certificate	13.3	2	50.0	1	0.0	0	50.0	1	
	Grade 12 and diploma	33.3	11	81.8	9	0.0	0	18.2	2	
	Grade 12 and degree	27.3	3	66.7	2	33.3	1	0.0	0	
	Grade 12 and degree and diploma	27.3	6	50.0	3	33.3	2	16.7	1	
	Post graduate (Masters or Doctorate)	57.1	4	75.0	3	25.0	1	0.0	0	
Occupation[f]	Unemployed/retired	47.1	8	50.0	4	12.5	1	37.5	3	0.601
	Legislators, senior officials, managers	40.0	4	75.0	3	25.0	1	0.0	0	
	Professionals	44.4	8	87.5	7	12.5	1	0.0	0	
	Technicians and other associate professionals	20.4	10	70.0	7	20.0	2	10.0	1	
	Office clerks	15.4	6	66.7	4	0.0	0	33.3	2	
	Service workers and shop and market sales workers; Craft and related trade workers; Elementary occupations	16.7	1	100.0	1	0.0	0	0.0	0	
Annual income[g]	R490 001 and above	50.0	5	60.0	3	40.0	2	0.0	0	0.153
	R380 001-R490 000	62.5	5	100.0	5	0.0	0	0.0	0	
	R270 001-R380 000	20.0	3	100.0	3	0.0	0	0.0	0	
	R195 001-R270 000	23.8	5	80.0	4	20.0	1	0.0	0	
	R122 001-R195 000	25.0	8	37.5	3	25.0	2	37.5	3	
	R0-R122 000	20.8	11	72.7	8	0.0	0	27.3	3	

Table 4.17 (continued)

Demographic characteristics		Recognition*		Acceptance (n = 37)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Marital status[h]	Married/Living together without children	37.2	16	68.8	11	12.5	2	18.8	3	0.985
	Married/Living together with children	14.6	7	71.4	5	14.3	1	14.3	1	
	Single, living without children	24.3	9	77.8	7	11.1	1	11.1	1	
	Single, living with children	40.0	4	75.0	3	0.0	0	25.0	1	

* Respondent number and percentage of those who recognised plant sterol or stanols within each of the respondent demographic characteristic distributions (refer Table 4.1)

[ab, ac, ad, ae, af, ag, ah] Non-significant ($p > 0.05$)

4.4.5.2.2 Health and lifestyle characteristics

A significant difference ($p < 0.05$) was found between those respondents who did or did not suffer from chronic disease and the acceptance of plant sterols as a bioactive food ingredient, but no significant associations or difference ($p > 0.05$) were found for the other health and lifestyle characteristics (refer Table 4.18). Among those respondents who suffered from chronic disease and those who did not, about one quarter (25% and 27% respectively) recognised plant sterols. Among the respondents who recognised plant sterols, more than double of those respondents who did not suffer from chronic disease had awareness (77.4%) than those who did suffer from chronic disease (33.3%). While half (50%) of these respondents who suffered from chronic disease had an understanding of plant sterols, very few (9.7%) of those who did not suffer from chronic disease understood it. However, in both instances this relates to three respondents having an understanding of it ($p < 0.05$) (refer Table 4.18).

None of the respondents who rarely or never participated in moderate physical activity (n = 12, refer Table 4.2) recognised plant sterols, while approximately one third of those respondents who participated in moderate physical activity to some regular level recognised it (from 31.9% of those who participated in physical activity two to four times a week to 36.4% for those who participated more than four times a week), with the exception of those few (8.7%) respondents who participated about once a week. Some respondents who recognised plant sterols and participated two to four times a week or more than four times a week had knowledge of it (three and one respondent respectively). The only respondents that understood plant sterols occurred among those respondents who recognised plant sterols and participated in moderate physical activity once a week or two to four times a week (one and two respondents respectively) ($p > 0.05$) (refer Table 4.18).

One quarter to half (from 23.5 % to 45.5%) of the respondents who participated in hard physical activity at different levels recognised plant sterols. Those respondents who recognised plant sterols and rarely or never participated in hard physical activity, participated two to three times a month or more than four times a week only had awareness of plant sterols (100% respectively). Of those respondents who recognised plant sterols and participated in hard physical activity about once a week or two to four times a week, half had awareness of plant sterols. Of these respondents who participated in hard physical activity two to four times a week approximately one third (37.5%) had knowledge of it ($p > 0.05$) (refer Table 4.18).

Those respondents who consumed dietary supplements monthly had the highest respondent percentage (50%) recognition of plant sterols with most (75%) of them having an awareness of it. The majority of those respondents who recognised plant sterols and whether consuming dietary supplements seldom/never or even daily also were only aware of it (85.7% and 66.7% respectively) ($p > 0.05$) (refer Table 4.18).

Approximately half of the respondents who viewed their level of nutrition and health and wellness knowledge as well informed recognised plant sterols (50% and 54.8% respectively). About one quarter of these respondents (25% and 17.6% respectively) had knowledge of plant sterols, while few (16.7% and 5.9% or two and one respondent respectively) had an understanding of it. The highest percentage of respondents who had an understanding of plant sterols occurred among those respondents who viewed their level of nutrition and health and wellness as moderately informed and recognised plant sterols (19% and 26.3% respectively). None of those respondents who recognised plant sterols and viewed their level of nutrition and health and wellness as not at all informed (16.7% and 6.7% respectively) had an understanding of it ($p > 0.05$) (refer Table 4.18).

While approximately one third (34.2%) of those respondents who were very interested in food and nutrition recognised plant sterols, few of them had knowledge (20%) or an understanding (16%) of it. Of those few respondents who had little interest in food and nutrition and recognised plant sterols (19.6%), most (81.8%) also only had awareness of it with few (18.2% or two respondents) having an understanding. The respondent who had no interest in food and nutrition and recognised plant sterols only had awareness of it ($p > 0.05$) (refer Table 4.18).

About one third (33.7%) of the respondents who were very interested in health and wellness recognised plant sterols, of whom two thirds (66.7%) had awareness and a similar

percentage or respondents knowledge (15.2%) or an understanding (18.2%) of it. All the respondents who indicated having little interest in health and wellness and recognised plant sterols (11.1%) were only aware of it. Of those respondents who had no interest in health and wellness (n = 5, refer Table 4.2) none recognised plant sterols ($p > 0.05$) (refer Table 4.18).

Table 4.18: Respondent plant sterol or stanol recognition and acceptance associations with their health and lifestyle characteristics

Health and lifestyle characteristics		Recognition		Acceptance (n = 37)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Incidence of chronic disease[b]	Yes	25.0	6	33.3	2	16.7	1	50.0	3	0.039
	No	27.0	31	77.4	24	12.9	4	9.7	3	
Frequency of moderate physical activity[**c]	Rarely or never	0.0	0	0.0	0	0.0	0	0.0	0	0.575
	2-3 times over the month	33.3	3	100.0	3	0.0	0	0.0	0	
	About once a week	8.7	2	50.0	1	0.0	0	50.0	1	
	2-4 times a week	31.9	15	66.7	10	20.0	3	13.3	2	
	More than 4 times a week	36.4	4	75.0	3	25.0	1	0.0	0	
Frequency of hard physical activity[**d]	Rarely or never	10.7	3	100.0	3	0.0	0	0.0	0	0.330
	2-3 times over the month	45.5	5	100.0	5	0.0	0	0.0	0	
	About once a week	28.6	6	50.0	3	16.7	1	33.3	2	
	2-4 times a week	23.5	8	50.0	4	37.5	3	12.5	1	
	More than 4 times a week	25.0	2	100.0	2	0.0	0	0.0	0	
Frequency of consumption of dietary supplements[e]	Daily	30.4	24	66.7	16	16.7	4	16.7	4	0.658
	Weekly	11.8	2	50.0	1	0.0	0	50.0	1	
	Monthly	50.0	4	75.0	3	0.0	0	25.0	1	
	Seldom/Never	20.0	7	85.7	6	14.3	1	0.0	0	
Level of health and wellness knowledge rating in relation to other adults of similar age[f]	Well informed	50.0	12	58.3	7	25.0	3	16.7	2	0.424
	Moderately informed	23.1	21	76.2	16	4.8	1	19.0	4	
	Not at all informed	16.7	4	75.0	3	25.0	1	0.0	0	
Level of nutrition knowledge rating in relation to other adults of similar age[g]	Well informed	54.8	17	76.5	13	17.6	3	5.9	1	0.508
	Moderately informed	20.4	19	63.2	12	10.5	2	26.3	5	
	Not at all informed	6.7	1	100.0	1	0.0	0	0.0	0	
Degree of interest in food and nutrition[h]	Very interested	34.2	25	64.0	16	20.0	5	16.0	4	0.547
	Little interest	19.6	11	81.8	9	0.0	0	18.2	2	
	No interest	10.0	1	100.0	1	0.0	0	0.0	0	

Table 4.18 (continued)

Health and lifestyle characteristics		Recognition *		Acceptance (n = 37)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Degree of interest in health and wellness[i]	Very interested	33.7	33	66.7	22	15.2	5	18.2	6	0.387
	Little interest	11.1	4	100.0	4	0.0	0	0.0	0	
	No interest	0.0	0	0.0	0	0.0	0	0.0	0	

* Respondent number and percentage of those who recognised plant sterols or stanols within each of the respondent health and lifestyle characteristic distributions (refer Table 4.2)

** 24 of the respondents who engaged in physical activity (moderate/hard) recognised plant sterols (or stanols)

[ab] Significant difference ($p < 0.05$)

[ac, ad, ae, af, ag, ah, ai] Non-significant ($p > 0.05$)

4.4.5.2.3 Food and beverage with added health benefits purchase behaviours and intentions

None of the respondent foods and beverages with added health benefits purchase behaviours or intent were associated ($p > 0.05$) with their acceptance of plant sterols as bioactive ingredient (refer Table 4.19). Double the percentage of respondents (40%) who very often purchased foods with added health benefits recognised plant sterols than those who seldom/never (19.3%) purchased these foods. While a similar percentage of the respondents who very often, often or seldom/never purchased foods with added health benefits had awareness (70%, 68.8% and 72.7%), those respondents who purchased these foods very often had the highest respondent percentage (20%) understanding of it. However, reference is made to only two respondents. Among those respondents who recognised plant sterols and purchased foods with added health benefits often or seldom/never, two respondents respectively understood plant sterols ($p > 0.05$) (refer Table 4.19).

One quarter of the respondents across the various frequencies of purchasing beverages with added health benefits recognised plant sterols (26.7% for very often, 26.8% for often and 26.5% for seldom/never) with most of them only being aware of plant sterols (75% for very often, 72.7% for often and 68.2% for seldom/never). While no respondents who very often purchased beverages with added health benefits had knowledge of plant sterols, double the percentage of respondents who recognised plant sterols and seldom/never purchased these beverages had knowledge of it compared to those who recognised plant sterols and often purchased such beverages (18.2% versus 9.1% or four versus one respondent). The highest respondent percentage (25%) understanding occurred among those who very often

purchased these beverages although reference is made to only one respondent ($p > 0.05$) (refer Table 4.19).

Less than one third of the respondents who were or were not prepared to pay more for foods (31.2% and 21% respectively) and beverages (29.4% and 23.9% respectively) with added health benefits recognised plant sterols. More than two thirds of these respondents who were prepared to pay more for foods or beverages had awareness (66.7% and 75% respectively), while a near equal percentage had knowledge (16.7% and 15% respectively) or an understanding (16.7% and 10% respectively) ($p > 0.05$) (refer Table 4.19).

Of those respondents who were prepared to pay one to fifteen percent more for foods with added health benefits, less than one third (28.1%) recognised plant sterols, of whom two thirds (68.8%) had awareness with slightly more respondents having an understanding than knowledge of it (three versus two respondents). Of those respondents who recognised plant sterols and were prepared to pay 16 to 25% more (46.7%), approximately half (57.1%) were only aware of it and approximately one quarter (28.6%) had knowledge of it. The majority (80%) of the respondents who recognised plant sterols and were prepared to pay one to fifteen percent more for beverages with added health benefits (27.8%) were aware of it. Three of the other five respondents who recognised plant sterols and were prepared to pay more for such beverages were only aware of plant sterols ($p > 0.05$) (refer Table 4.17).

Table 4.19: Respondent plant sterol or stanol recognition and acceptance associations with their food and beverage with added health benefits purchase behaviours and intentions

Purchase behaviours and intentions		Recognition		Acceptance (n = 37)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Purchase frequency of foods with added health benefits[b]	Very often	40.0	10	70.0	7	10.0	1	20.0	2	0.933
	Often	28.1	16	68.8	11	18.8	3	12.5	2	
	Seldom/never	19.3	11	72.7	8	9.1	1	18.2	2	
Purchase frequency of beverages with added health benefits[c]	Very often	26.7	4	75.0	3	0.0	0	25.0	1	0.845
	Often	26.8	11	72.7	8	9.1	1	18.2	2	
	Seldom/never	26.5	22	68.2	15	18.2	4	13.6	3	
Acceptance to paying more for foods with added health benefits[d]	Yes	31.2	24	66.7	16	16.7	4	16.7	4	0.727
	No	21.0	13	76.9	10	7.7	1	15.4	2	

Table 4.19 (continued)

Purchase behaviours and intentions		Recognition *		Acceptance (n = 37)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Degree of price premium of foods with added health benefits[**e]	1-15%	28.1	16	68.8	11	12.5	2	18.8	3	0.722
	16-25%	46.7	7	57.1	4	28.6	2	14.3	1	
	26-50%	0.0	0	0.0	0	0.0	0	0.0	0	
	51-75%	0.0	0	0.0	0	0.0	0	0.0	0	
	76-100%	100.0	1	100.0	1	0.0	0	0.0	0	
Acceptance to paying more for beverages with added health benefits[f]	Yes	29.4	20	75.0	15	15.0	3	10.0	2	0.348
	No	23.9	17	64.7	11	11.8	2	23.5	4	
Degree of price premium of beverages with added health benefits[**g]	1-15%	27.8	15	80.0	12	6.7	1	13.3	2	0.440
	16-25%	33.3	3	33.3	1	66.7	2	0.0	0	
	26-50%	25.0	1	100.0	1	0.0	0	0.0	0	
	51-75%	0.0	0	0.0	0	0.0	0	0.0	0	
	76-100%	100.0	1	100.0	1	0.0	0	0.0	0	

* Respondent number and percentage of those who recognised plant sterols or stanols within each of the respondent food and beverage with added health benefits purchase behaviour and intention characteristic distributions (refer Table 4.3)

** Number of the respondents who responded affirmative to paying more for food/beverages with added health benefits

ab, ac, ad, ae, af, ag Non-significant ($p > 0.05$)

4.4.6 Beta carotene

4.4.6.1 Acceptance as bioactive food ingredient

Just over two thirds (68.3%) of the respondents recognised beta carotene. Half (52.6%) of these respondents had knowledge of beta carotene and approximately one quarter of the respondents each an awareness or understanding (25% and 21.1% respectively) of it (refer Table 4.4).

4.4.6.2 Associations between the acceptance and the respondent characteristics

4.4.6.2.1 Demographic characteristics

No significant ($p > 0.05$) associations or differences were found between the respondent beta carotene acceptance and their demographic characteristics (refer Table 4.20). The majority

of both the male and the female respondents (60% and 72% respectively) recognised beta carotene. Most of these male or female respondents had knowledge (60.9% and 50% respectively) of beta carotene, with more female than male respondents having an understanding (23.6% and 13% respectively) of it ($p > 0.05$) (refer Table 4.20).

Most of the respondents across the age categories recognised beta carotene (from 64.3% to 77.8%). Across all the age categories, about half of the respondents who recognised beta carotene had knowledge of it (from 42.9% to 55.6%), with the exception of the respondents from the age category of 55 to 60 years where 75% of the respondents had knowledge of it. Respondents who recognised beta carotene in the age category of 61 years and older had the highest respondent percentage (28.6%) beta carotene understanding, closely followed by respondents from the age category of 25 to 34 years (26.3%) and 45 to 54 years (25%) ($p > 0.05$) (refer Table 4.20).

Half to all of the respondents across the population groups recognised beta carotene. While the majority (75%) of the black respondents had knowledge of beta carotene, with none having an understanding of it, nearly two thirds (61.5%) of the coloured respondents had knowledge of beta carotene with almost one third (30.8%) having an understanding of it. While about a near equal percentage of the white population group respondents who recognised beta carotene had awareness and an understanding of it (29.9% and 22.4% respectively), about half (47.8%) of them had knowledge of beta carotene ($p > 0.05$) (refer Table 4.20).

All the respondents with a post graduate degree recognised beta carotene, while only half (54.5%) of the respondents with Grade 12 and a degree recognised it. The majority of the respondents who recognised beta carotene and had an education level of Grade 11 or below, Grade 12 and a certificate or a post graduate qualification had knowledge (75%, 70% and 71.4% respectively) of it. While a few respondents (mostly one up to three respondents) across all the education qualification levels had an understanding of beta carotene, those respondents who had an education qualification level of Grade 12 with a degree and diploma had the highest respondent percentage (35.7%) understanding of it ($p > 0.05$) (refer Table 4.12).

Approximately two thirds to three quarter (from 60% to 76.5%) of the respondents across the occupation groups also recognised beta carotene. Those respondents who recognised beta carotene and fell in the professional occupation group had the highest respondent percentage (41.7%) awareness, while those respondents in the technicians and other associate professionals group had the highest respondent percentage (50%) knowledge of it.

Those respondents who had the highest respondent percentage (30.8%) understanding of beta carotene fell into the unemployed or retired occupation group ($p > 0.05$) (refer Table 4.20).

Half to the majority (from 53.3% to 78.1%) of the respondents across the annual income brackets recognised beta carotene. Those respondents who recognised beta carotene and earned R380 001 to R490 000 per annum had the highest respondent percentage (50%) awareness of it, while those respondents who earned R270 001 to R380 000 and R122 001 to R195 000 per annum had the highest respondent percentage (62.5% and 68% respectively) knowledge of it. Those respondents who recognised beta carotene and earned R195 001 to R270 000 and R380 001 to R490 000 per annum had the highest respondent percentage (38.5% and 33.3% respectively) understanding of it ($p > 0.05$) (refer Table 4.20).

Half of those respondents who were single, living without or with children (54.1% and 50% respectively) recognised beta carotene, while most of those respondents who were married or living together without or with children (79.1% and 75% respectively) recognised beta carotene. Approximately half of the respondents who recognised beta carotene, independent of their marital status, had knowledge of it (from 45% to 60%). About one quarter of those respondents who recognised beta carotene and were married or living together without or with children (26.5% and 22.2% respectively) had an understanding of it ($p < 0.05$) (refer Table 4.20).

Table 4.20: Respondent beta carotene recognition and acceptance associations with their demographic characteristics

Demographic characteristics		Recognition		Acceptance (n = 95)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Gender[b]	Male	60.0	23	26.1	6	60.9	14	13.0	3	0.518
	Female	72.0	72	26.4	19	50.0	36	23.6	17	
Age[c] (years)	25-34	64.4	38	28.9	11	44.7	17	26.3	10	0.459
	35-44	64.3	18	38.9	7	55.6	10	5.6	1	
	45-54	76.9	20	20.0	4	55.0	11	25.0	5	
	55-60	70.6	12	8.3	1	75.0	9	16.7	2	
	61 and older	77.8	7	28.6	2	42.9	3	28.6	2	
Population group[d]	Black	66.7	12	25.0	3	75.0	9	0.0	0	0.264
	Coloured	50.0	13	7.7	1	61.5	8	30.8	4	
	Indian	100.0	1	0.0	0	100.0	1	0.0	0	
	White	72.8	67	29.9	20	47.8	32	22.4	15	
	Other	100.0	2	50.0	1	0.0	0	50.0	1	

Table 4.20 (continued)

Demographic characteristics		Recognition*		Acceptance (n = 95)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Level of education[e]	Grade 11 (Standard 9) or below	72.7	8	12.5	1	75.0	6	12.5	1	0.662
	Grade 12 (Matric)	72.5	29	27.6	8	48.3	14	24.1	7	
	Grade 12 and certificate	66.7	10	10.0	1	70.0	7	20.0	2	
	Grade 12 and diploma	63.6	21	42.9	9	42.9	9	14.3	3	
	Grade 12 and degree	54.5	6	33.3	2	50.0	3	16.7	1	
	Grade 12 and degree and diploma	63.6	14	21.4	3	42.9	6	35.7	5	
	Post graduate (Masters or Doctorate)	100.0	7	14.3	1	71.4	5	14.3	1	
Occupation[f]	Unemployed/retired	76.5	13	23.1	3	46.2	6	30.8	4	0.648
	Legislators, senior officials, managers	60.0	6	33.3	2	50.0	3	16.7	1	
	Professionals	66.7	12	41.7	5	33.3	4	25.0	3	
	Technicians and other associate professionals	65.3	32	25.0	8	50.0	16	25.0	8	
	Office clerks	71.8	28	25.0	7	60.7	17	14.3	4	
	Service workers and shop and market sales workers; Craft and related trade workers; Elementary occupations	66.7	4	0.0	0	100.0	4	0.0	0	
Annual income[g]	R490 001 and above	70.0	7	28.6	2	57.1	4	14.3	1	0.502
	R380 001-R490 000	75.0	6	50.0	3	16.7	1	33.3	2	
	R270 001-R380 000	53.3	8	25.0	2	62.5	5	12.5	1	
	R195 001-R270 000	61.9	13	15.4	2	46.2	6	38.5	5	
	R122 001-R195 000	78.1	25	20.0	5	68.0	17	12.0	3	
	R0-R122 000	67.9	36	30.6	11	47.2	17	22.2	8	
Marital status[h]	Married/Living together without children	79.1	34	23.5	8	50.0	17	26.5	9	0.549
	Married/Living together with children	75.0	36	19.4	7	58.3	21	22.2	8	
	Single, living without children	54.1	20	40.0	8	45.0	9	15.0	3	
	Single, living with children	50.0	5	40.0	2	60.0	3	0.0	0	

* Respondent number and percentage of those who recognised beta carotene within each of the respondent demographic characteristic distributions (refer Table 4.1)

[ab, ac, ad, ae, af, ag, ah] Non-significant ($p > 0.05$)

4.4.6.2.2 Health and lifestyle characteristics

No significant ($p > 0.05$) associations or differences were found between the respondent beta carotene acceptance and their health and lifestyle characteristics (refer Table 4.21). While

more respondents who did not suffer from chronic disease than those who did suffer recognised beta carotene (71.3% versus 54.2%), a higher percentage of these respondents who did suffer from chronic disease had knowledge (69.2%) of beta carotene than these who did not suffer from chronic disease (50%). However, quite a few (23.2%) respondents who recognised beta carotene and did not suffer from chronic disease had an understanding of it ($p > 0.05$) (refer Table 4.21).

While those respondents who participated in moderate or hard physical activity two to three times a month had the lowest recognition (22.2% and 45.5% respectively) of beta carotene, those respondents who participated in moderate physical activity more than four times a week or hard physical activity about once a week had the highest recognition (81.2% and 81% respectively) of it. Those respondents who recognised beta carotene and participated in moderate or hard physical activity about once a week had the highest respondent percentage (64.7% respectively) knowledge of it followed closely by those who rarely or never participated in moderate or hard physical activity (62.5% respectively). Those respondents who recognised beta carotene and had the highest respondent percentage understanding (33.3% and 40% respectively) of it participated in moderate physical activity more than four times a week and hard physical activity two to three times a week ($p > 0.05$) (refer Table 4.21).

Those respondents who consumed dietary supplements on a daily basis had the highest (75.9%) recognition of beta carotene, while those respondents who rarely or never consumed dietary supplements had the lowest (57.1%) recognition of it. While those respondents who recognised beta carotene and consumed dietary supplements weekly had the highest respondent percentage (80%) knowledge of beta carotene, no one had an understanding of it. There was a similar respondent percentage understanding among those who recognised beta carotene and consumed dietary supplements on a daily basis, monthly or seldom/never (25%, 20% and 20% respectively) ($p > 0.05$) (refer Table 4.21).

Half to two thirds of those respondents who viewed their level of nutrition and health and wellness knowledge as moderate or not at all informed recognised beta carotene (68.1% and 54.2% respectively and 63.4% and 66.7% respectively). Of these respondents, about half had knowledge (50% and 53.8% respectively and 49.2% and 60% respectively), while one quarter of these respondents who viewed themselves as moderately informed had an understanding (24.2% and 23.7% respectively) of beta carotene. Only one respondent who viewed their level of nutrition and health and wellness as not at all informed had an understanding of beta carotene. The majority of those respondents who viewed their level of nutrition and health and wellness knowledge as well informed recognised (83.3% and 83.9%

respectively) beta carotene. Of these respondents, more than half (60% and 57.7% respectively) had knowledge of it, with about one fifth an understanding (20% and 19.2% respectively) ($p > 0.05$) (refer Table 4.21)

Those respondents who had little interest in food and nutrition and health and wellness had the lowest (60.7% and 55.6% respectively) recognition of beta carotene, while those who indicated being very interested or having no interest in food and nutrition or health and wellness had the highest (70% to 80%) beta carotene recognition. Approximately half of these respondents being very interested, interested or not interested in food and nutrition had knowledge (55.6%, 47.1% and 57.1% respectively) of beta carotene, while most of these respondents being very interested, interested and not interested in health and wellness also had knowledge (53.5%, 45% and 75% respectively) of it ($p > 0.05$) (refer Table 4.21).

Table 4.21: Respondent beta carotene recognition and acceptance associations with their health and lifestyle characteristics

Health and lifestyle characteristics		Recognition		Acceptance (n = 95)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Incidence of chronic disease[b]	Yes	54.2	13	23.1	3	69.2	9	7.7	1	0.346
	No	71.3	82	26.8	22	50.0	41	23.2	19	
Frequency of moderate physical activity**[c]	Rarely or never	66.7	8	12.5	1	62.5	5	25.0	2	0.313
	2-3 times over the month	22.2	2	100.0	2	0.0	0	0.0	0	
	About once a week	73.9	17	23.5	4	64.7	11	11.8	2	
	2-4 times a week	70.2	33	21.2	7	51.5	17	27.3	9	
	More than 4 times a week	81.2	9	22.2	2	44.4	4	33.3	3	
Frequency of hard physical activity**[d]	Rarely or never	57.1	16	18.8	3	62.5	10	18.8	3	0.895
	2-3 times over the month	45.5	5	20.0	1	40.0	2	40.0	2	
	About once a week	81.0	17	17.6	3	64.7	11	17.6	3	
	2-4 times a week	73.5	25	28.0	7	48.0	12	24.0	6	
	More than 4 times a week	75.0	6	33.3	2	33.3	2	33.3	2	
Frequency of consumption of dietary supplements[e]	Daily	75.9	60	26.7	16	48.3	29	25.0	15	0.558
	Weekly	58.8	10	20.0	2	80.0	8	0.0	0	
	Monthly	62.5	5	40.0	2	40.0	2	20.0	1	
	Seldom/Never	57.1	20	25.0	5	55.0	11	20.0	4	

Table 4.21 (continued)

Health and lifestyle characteristics		Recognition *		Acceptance (n = 95)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Level of health and wellness knowledge rating in relation to other adults of similar age[f]	Well informed	83.3	20	20.0	4	60.0	12	20.0	4	0.603
	Moderately informed	68.1	62	25.8	16	50.0	31	24.2	15	
	Not at all informed	54.2	13	38.5	5	53.8	7	7.7	1	
Level of nutrition knowledge rating in relation to other adults of similar age[g]	Well informed	83.9	26	23.1	6	57.7	15	19.2	5	0.852
	Moderately informed	63.4	59	27.1	16	49.2	29	23.7	14	
	Not at all informed	66.7	10	30.0	3	60.0	6	10.0	1	
Degree of interest in food and nutrition[h]	Very interested	74.0	54	22.2	12	55.6	30	22.2	12	0.158
	Little interest	60.7	34	38.2	13	47.1	16	14.7	5	
	No interest	70.0	7	0.0	0	57.1	4	42.9	3	
Degree of interest in health and wellness[i]	Very interested	72.4	71	25.4	18	53.5	38	21.1	15	0.680
	Little interest	55.6	20	35.0	7	45.0	9	20.0	4	
	No interest	80.0	4	0.0	0	75.0	3	25.0	1	

* Respondent number and percentage of those who recognised beta carotene within each of the respondent health and lifestyle characteristic distributions (refer Table 4.2)

** 69 of the respondents who engaged in physical activity (moderate/hard) recognised beta carotene

[ab, ac, ad, ae, af, ag, ah, ai] Non-significant ($p > 0.05$)

4.4.6.2.3 Food and beverage with added health benefits purchase behaviours and intentions

Although there was no significant associations or differences ($p > 0.05$) between the respondents who purchased food and beverages with added health benefits and their acceptance of beta carotene as bioactive food ingredient, the respondents who recognised beta carotene the least were those who seldom/never purchased foods (64.9% recognition) and beverages (62.7% recognition) with added health benefits (refer Table 4.22). About half of these respondents, irrelevant of their purchase frequency of foods with added health benefits, had knowledge of beta carotene (i.e. 44.4% for purchasing very often, 55% for purchasing often and 54.1% for seldom/never purchasing foods with added health benefits). Those respondents who recognised beta carotene and purchased foods with added health benefits very often had the lowest respondent percentage (11.1%) beta carotene understanding, compared to the one quarter (27%) of those who recognised beta carotene and purchased foods with added health benefits seldom/never ($p > 0.05$) (refer Table 4.21).

The majority of those respondents who purchased beverages with added health benefits very often or often recognised beta carotene (73.3% and 78% respectively). While those respondents who recognised beta carotene and often purchased beverages with added health benefits had the highest respondent percentage (59.4%) knowledge of it, those respondents who recognised beta carotene and seldom/never purchased beverages with added health benefits had the highest respondent percentage (25%) understanding of it ($p > 0.05$) (refer Table 4.21).

The majority of those respondents who were prepared to pay more for food or beverages with added health benefits recognised beta carotene (75.3% and 80.9% respectively). About half (53.4% and 52.7% respectively) of these respondents had knowledge of beta carotene while about one fifth and one quarter (19% and 25.5% respectively) had an understanding of it. While just over half of those respondents who were not prepared to pay more for foods or beverages with added health benefits recognised (59.7% and 56.3% respectively) beta carotene, about half of these respondents also had knowledge (51.4% and 52.5% respectively) of it ($p > 0.05$ for each) (refer Table 4.21).

Those respondents who recognised beta carotene and were prepared to pay one to fifteen percent more for foods (71.9%) and beverages (77.8%), had a near equal percentage of respondents who had knowledge (48.8% and 47.6% respectively) or an understanding (22% and 28.6% respectively) of beta carotene. Among those respondents who recognised beta carotene and were prepared to pay 16 to 25% more for such foods and beverages most had knowledge (66.7% and 75% respectively), with one respondent respectively having an understanding of beta carotene ($p > 0.05$ for each) (refer Table 4.21).

Table 4.22: Respondent beta carotene recognition and acceptance associations with their food and beverage with added health benefits purchase behaviours and intentions

Purchase behaviours and intentions		Recognition		Acceptance (n = 95)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Purchase frequency of foods with added health benefits[b]	Very often	72.0	18	44.4	8	44.4	8	11.1	2	0.306
	Often	70.2	40	25.0	10	55.0	22	20.0	8	
	Seldom/never	64.9	37	18.9	7	54.1	20	27.0	10	
Purchase frequency of beverages with added health benefits[c]	Very often	73.3	11	54.5	6	36.4	4	9.1	1	0.213
	Often	78.0	32	21.9	7	59.4	19	18.8	6	
	Seldom/never	62.7	52	23.1	12	51.9	27	25.0	13	

Table 4.22 (continued)

Purchase behaviours and intentions		Recognition*		Acceptance (n = 95)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Acceptance to paying more for foods with added health benefits[d]	Yes	75.3	58	27.6	16	53.4	31	19.0	11	0.811
	No	59.7	37	24.3	9	51.4	19	24.3	9	
Degree of price premium of foods with added health benefits**[e]	1-15%	71.9	41	29.3	12	48.8	20	22.0	9	0.263
	16-25%	80.0	12	25.0	3	66.7	8	8.3	1	
	26-50%	75.0	3	0.0	0	66.7	2	33.3	1	
	51-75%	0.0	0	0.0	0	0.0	0	0.0	0	
	76-100%	100.0	1	0.0	0	100.0	1	0.0	0	
Acceptance to paying more for beverages with added health benefits[f]	Yes	80.9	55	21.8	12	52.7	29	25.5	14	0.332
	No	56.3	40	32.5	13	52.5	21	15.0	6	
Degree of price premium of beverages with added health benefits**[g]	1-15%	77.8	42	23.8	10	47.6	20	28.6	12	0.217
	16-25%	88.9	8	12.5	1	75.0	6	12.5	1	
	26-50%	100.0	4	25.0	1	50.0	2	25.0	1	
	51-75%	0.0	0	0.0	0	0.0	0	0.0	0	
	76-100%	100.0	1	0.0	0	100.0	1	0.0	0	

* Respondent number and percentage of those who recognised beta carotene within each of the respondent food and beverage with added health benefits purchase behaviour and intention characteristic distributions (refer Table 4.3)

** Number of the respondents who responded affirmative to paying more for food/beverages with added health benefits; one respondent did not specify food price premium

[ab, ac, ad, ae, af, ag] Non-significant ($p > 0.05$)

4.4.7 Flavonoids

4.4.7.1 Acceptance as bioactive food ingredient

One third (32.4%) or 45 of the respondents recognised flavonoids. Two thirds (68.9%) of these respondents were aware of flavonoids, while one quarter (24.4%) had knowledge and a few (6.7%) an understanding of it (refer Table 4.4).

4.4.7.2 Associations between the acceptance and the respondent characteristics

4.4.7.2.1 Demographic characteristics

A significant association ($p < 0.05$) was found between the respondent gender and the acceptance of flavonoids as a bioactive food ingredient, but no significant associations or

differences ($p > 0.05$) were found for the other demographic characteristics (refer Table 4.23). Although more than double the percentage of female respondents had recognition of flavonoids compared to the male respondents (39% versus 15.4%) about one third of these female and male respondents had knowledge of flavonoids compared to these female and male respondents who had awareness of it (25.6% and 16.7% respectively versus 71.8% and 50% respectively) ($p < 0.05$) (refer Table 4.23).

About one quarter (23.5%) to one third (34.6%) of the respondents in the 60 years and younger age category recognised flavonoids, while two thirds (66.7%) of the respondents 61 years and older recognised it. While half to most (from 50% to 88.9%) of the respondents across the age categories who recognised flavonoids were aware of it, less than one third (28.6%) of these respondents from the age category 35 to 44 years were aware of it. Most (57.1%) of the respondents in this age category who recognised flavonoids had knowledge of it. Four respondents and less across all the age categories had knowledge of flavonoids, while one respondent each from the age categories 35 to 44 years, 55 to 60 years and older than 60 years had an understanding of flavonoids ($p > 0.05$) (refer Table 4.23).

No respondent from the Indian population group ($n = 1$, refer Table 4.1) up to approximately one third (37%) of the white population group had recognition of flavonoids. Half of the respondents from the population group listed as 'other' had recognition of flavonoids, but this only related to one respondent. Most of the respondents from the black, coloured and white population groups who recognised flavonoids only had awareness of it (60%, 60% and 73.5% respectively) ($p > 0.05$) (refer Table 4.23).

Respondents with an education level of Grade 11 or below had the highest (45.5%) recognition of flavonoids, while less than one fifth (18.2%) of the respondents with Grade 12 and a degree recognised it. The majority of the respondents who had an education level of Grade 11 or below, Grade 12, Grade 12 with a diploma or Grade 12 with a degree and diploma and recognised flavonoids had awareness (80%, 66.7%, 76.9% and 75% respectively) of it. While all the respondents who had an education level of Grade 12 and a degree and recognised flavonoids had awareness, this equates to two respondents only. Some respondents who had education levels of Grade 12, Grade 12 with a certificate or a post graduate qualification and recognised flavonoids had an understanding of it (11.1%, 33.3% and 20% respectively); however, this only amounted to one respondent in each of these educational levels ($p > 0.05$) (refer Table 4.23).

About one quarter (23.1%) to 60% (58.8%) of the respondents across the occupation groups also recognised flavonoids. Just more than half to all of these respondents across all the

occupation groups (i.e. 60%, 60%, 100%, 58.3%, 66.7% and 100% respectively from the retired or unemployed, legislators and senior officials, professionals, technicians and other associate professionals, office clerks and service and sales workers groups) were aware of flavonoids. One fifth to about half of the respondents who recognised flavonoids and fell into the retired or unemployed or legislators, senior officials and managers (20% respectively) or the technicians and office clerks (41.7% and 33.3% respectively) occupation groups had knowledge of it ($p > 0.05$) (refer Table 4.23).

Nearly one quarter (23.8%) to half of the respondents across the income brackets recognised flavonoids. The majority of the respondents who recognised flavonoids and earned R0 to R122 000, R122 001 to R195 000, R195 001 to R270 000, R270 001 to R380 000 and R380 001 to R490 000 only had awareness (64.7%, 72.7%, 60%, 80% and 100% respectively) of it. While one third of the respondents who recognised flavonoids and fell into the R490 001 and above income bracket had awareness, knowledge and understanding (33.3% respectively) of it. However, this only related to one respondent ($p > 0.05$) (refer Table 4.23).

One fifth (20%) to just over one third (39.5%) of the respondents, independent of their marital status, recognised flavonoids. The majority to all of the respondents who were married or living together without children or single and living without or with children (76.5%, 75% and 100% respectively) were aware of flavonoids, while only half of the respondents who were married or living together with children had awareness. However, almost half (42.9%) of the respondents who recognised flavonoids and were married or living together with children had knowledge of it ($p > 0.05$) (refer Table 4.23). Across all the demographic distributions, very few respondents (none to 2 persons) of those who recognised flavonoids had understanding of it (refer Table 4.23).

Table 4.23: Respondent flavonoid recognition and acceptance associations with their demographic characteristics

Demographic characteristics		Recognition		Acceptance (n = 45)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Gender[b]	Male	15.4	6	50.0	3	16.7	1	33.3	2	0.019
	Female	39.0	39	71.8	28	25.6	10	2.6	1	
Age[c] (years)	25-34	32.2	19	78.9	15	21.1	4	0.0	0	0.151
	35-44	25.0	7	28.6	2	57.1	4	14.3	1	
	45-54	34.6	9	88.9	8	11.1	1	0.0	0	
	55-60	23.5	4	50.0	2	25.0	1	25.0	1	
	61 and older	66.7	6	66.7	4	16.7	1	16.7	1	
Population group[d]	Black	27.8	5	60.0	3	40.0	2	0.0	0	0.452
	Coloured	19.2	5	60.0	3	20.0	1	20.0	1	
	Indian	0.0	0	0.0	0	0.0	0	0.0	0	
	White	37.0	34	73.5	25	20.6	7	5.9	2	
	Other	50.0	1	0.0	0	100.0	1	0.0	0	
Level of education[e]	Grade 11 (Standard 9) or below	45.5	5	80.0	4	20.0	1	0.0	0	0.658
	Grade 12 (Matric)	22.5	9	66.7	6	22.2	2	11.1	1	
	Grade 12 and certificate	20.0	3	33.3	1	33.3	1	33.3	1	
	Grade 12 and diploma	39.4	13	76.9	10	23.1	3	0.0	0	
	Grade 12 and degree	18.2	2	100.0	2	0.0	0	0.0	0	
	Grade 12 and degree and diploma	36.4	8	75.0	6	25.0	2	0.0	0	
	Post graduate (Masters or Doctorate)	71.4	5	40.0	2	40.0	2	20.0	1	
Occupation[f]	Unemployed/retired	58.8	10	60.0	6	20.0	2	20.0	2	0.305
	Legislators, senior officials, managers	50.0	5	60.0	3	20.0	1	20.0	1	
	Professionals	38.9	7	100.0	7	0.0	0	0.0	0	
	Technicians and other associate professionals	24.5	12	58.3	7	41.7	5	0.0	0	
	Office clerks	23.1	9	66.7	6	33.3	3	0.0	0	
	Service workers, shop and market sales workers; Craft and related trade workers; Elementary occupations	33.3	2	100.0	2	0.0	0	0.0	0	

Table 4.23 (continued)

Demographic characteristics		Recognition *		Acceptance (n = 45)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Annual income[g]	R490 001 and above	30.0	3	33.3	1	33.3	1	33.3	1	0.675
	R380 001-R490 000	50.0	4	100.0	4	0.0	0	0.0	0	
	R270 001-R380 000	33.3	5	80.0	4	20.0	1	0.0	0	
	R195 001-R270 000	23.8	5	60.0	3	40.0	2	0.0	0	
	R122 001-R195 000	34.4	11	72.7	8	18.2	2	9.1	1	
	R0-R122 000	32.1	17	64.7	11	29.4	5	5.9	1	
Marital status[h]	Married/Living together without children	39.5	17	76.5	13	11.8	2	11.8	2	0.384
	Married/Living together with children	29.2	14	50.0	7	42.9	6	7.1	1	
	Single, living without children	32.4	12	75.0	9	25.0	3	0.0	0	
	Single, living with children	20.0	2	100.0	2	0.0	0	0.0	0	

* Respondent number and percentage of those who recognised flavonoids within each of the respondent demographic characteristic distributions (refer Table 4.1)

[ab] Significant association ($p < 0.05$)

[ac, ad, ae, af, ag, ah] Non-significant ($p > 0.05$)

4.4.7.2.2 Health and lifestyle characteristics

No significant associations or differences ($p > 0.05$) were found for the health and lifestyle characteristics and the respondent acceptance of flavonoids as a bioactive food ingredient (refer Table 4.24). Among those respondents who suffered from chronic disease and those who did not, about one third (33.3% and 32.2% respectively) recognised flavonoids. Among these respondents who recognised flavonoids, half of the respondents who did suffer from chronic disease had awareness, while about three quarters (73%) of those who did not suffer from chronic disease had awareness ($p > 0.05$) (refer Table 4.24).

About one fifth (18.2%) to just over one third (36.2%) of the respondents who participated in moderate physical activity at different levels recognised flavonoids. Half to all of the respondents who recognised flavonoids and rarely or never participated in moderate physical activity, participated two to three times a month, about once a week, two to four times a week or more than four times a week only had awareness of flavonoids (75%, 100%, 66.7%, 70.6% and 50% respectively) ($p > 0.05$) (refer Table 4.24).

None of the respondents who participated in hard physical activity more than four times a week (n = 8, refer Table 4.2) recognised flavonoids, while approximately one quarter to one

third of the respondents who rarely or never participated in hard physical activity or participated to some regular level recognised it (from 27.3% recognition for those who participated two to three times a month to 39.3% recognition for those who participated rarely or never). While two thirds (63.6%) of the respondents who recognised flavonoids and rarely or never participated in hard physical activity had awareness or it, one third (36.4%) had knowledge of it. Most to all of the respondents who recognised flavonoids and participated in hard physical activity had awareness of it (i.e. hard physical activity two to three times over the month 100%, about once a week 66.7% and two to four times a week 75%). A few of those respondents who recognised flavonoids and participated in hard physical activity about once a week or two to four times a week had knowledge (16.7% respectively or one and two respondents respectively) of it ($p > 0.05$) (refer Table 4.24).

While one quarter of the respondents who seldom/never consumed dietary supplements recognised flavonoids, all of them had awareness of it. One quarter to two thirds (25%, 66.7% and 40% respectively) of the respondents who consumed dietary supplements daily, weekly or monthly and recognised flavonoids (35.4%, 17.6% and 62.5% respectively) had knowledge of it ($p > 0.05$) (refer Table 4.24).

The majority of the respondents who viewed their level of nutrition and health and wellness knowledge as well informed, moderately informed or not at all informed and recognised flavonoids (50%, 32.3% and 12.5% respectively and 58.1%, 28% and 6.7% respectively) had awareness (75%, 63.3% and 100% respectively and 72.2%, 65.4% and 100% respectively) of it. One quarter of the respondents who recognised flavonoids and viewed their level of nutrition and health and wellness knowledge as well or moderately informed (25% and 26.7% respectively and 22.2% and 26.9% respectively) had knowledge of it ($p > 0.05$) (refer Table 4.24).

Those respondents who had no interest in food and nutrition and health and wellness had the lowest (20% and nil respectively) recognition of flavonoids, while those who indicated being very interested in food and nutrition or health and wellness had the highest (39.7% to 38.8%) flavonoid recognition. Among the respondents who recognised flavonoids and were very interested in food and nutrition and health and wellness about double of them had awareness of flavonoids (62.1% and 65.8% respectively) compared to those having knowledge of it (31% and 26.3% respectively). Of the respondents who recognised flavonoids and had little interest in food and nutrition and health and wellness most (78.6% and 85.7% respectively) had awareness of it with few (14.3% respectively) having knowledge of it ($p > 0.05$) (refer Table 4.24). Again, very few respondents (mostly no one to a maximum

of three persons) of those who recognised flavonoids had an understanding of it across all the health and lifestyle characteristic distributions (refer Table 4.24).

Table 4.24: Respondent flavonoid recognition and acceptance associations with their health and lifestyle characteristics

Health and lifestyle characteristics		Recognition		Acceptance (n = 45)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Incidence of chronic disease[b]	Yes	33.3	8	50.0	4	37.5	3	12.5	1	0.432
	No	32.2	37	73.0	27	21.6	8	5.4	2	
Frequency of moderate physical activity[**c]	Rarely or never	33.3	4	75.0	3	25.0	1	0.0	0	0.843
	2-3 times over the month	33.3	3	100.0	3	0.0	0	0.0	0	
	About once a week	26.1	6	66.7	4	33.3	2	0.0	0	
	2-4 times a week	36.2	17	70.6	12	17.6	3	11.8	2	
	More than 4 times a week	18.2	2	50.0	1	50.0	1	0.0	0	
Frequency of hard physical activity[**d]	Rarely or never	39.3	11	63.6	7	36.4	4	0.0	0	0.622
	2-3 times over the month	27.3	3	100.0	3	0.0	0	0.0	0	
	About once a week	28.6	6	66.7	4	16.7	1	16.7	1	
	2-4 times a week	35.3	12	75.0	9	16.7	2	8.3	1	
	More than 4 times a week	0.0	0	0.0	0	0.0	0	0.0	0	
Frequency of consumption of dietary supplements[e]	Daily	35.4	28	67.9	19	25.0	7	7.1	2	0.053
	Weekly	17.6	3	0.0	0	66.7	2	33.3	1	
	Monthly	62.5	5	60.0	3	40.0	2	0.0	0	
	Seldom/Never	25.7	9	100.0	9	0.0	0	0.0	0	
Level of health and wellness knowledge rating in relation to other adults of similar age[f]	Well informed	50.0	12	75.0	9	25.0	3	0.0	0	0.572
	Moderately informed	32.3	30	63.3	19	26.7	8	10.0	3	
	Not at all informed	12.5	3	100.0	3	0.0	0	0.0	0	
Level of nutrition knowledge rating in relation to other adults of similar age[g]	Well informed	58.1	18	72.2	13	22.2	4	5.5	1	0.951
	Moderately informed	28.0	26	65.4	17	26.9	7	7.7	2	
	Not at all informed	6.7	1	100.0	1	0.0	0	0.0	0	
Degree of interest in food and nutrition[h]	Very interested	39.7	29	62.1	18	31.0	9	6.9	2	0.662
	Little interest	25.0	14	78.6	11	14.3	2	7.1	1	
	No interest	20.0	2	100.0	2	0.0	0	0.0	0	

Table 4.24 (continued)

Health and lifestyle characteristics		Recognition*		Acceptance (n = 45)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Degree of interest in health and wellness[i]	Very interested	38.8	38	65.8	25	26.3	10	7.9	3	0.537
	Little interest	19.4	7	85.7	6	14.3	1	0.0	0	
	No interest	0.0	0	0.0	0	0.0	0	0.0	0	

* Respondent number and percentage of those who recognised flavonoids within each of the respondent health and lifestyle characteristic distributions (refer Table 4.2)

** 32 of the respondents who engaged in physical activity (moderate/hard) recognised flavonoids

[ab, ac, ad, ae, af, ag, ah, ai] Non-significant ($p > 0.05$)

4.4.7.2.3 Food and beverage with added health benefits purchase behaviours and intentions

No significant associations or differences ($p > 0.05$) between the respondent purchase behaviours and intentions of food and beverages with added health benefits and their acceptance of flavonoids as bioactive food ingredient was found. The respondent recognition of flavonoids in relation to their purchase frequency of foods and beverages with added health benefits was approximately one third or less for those who viewed their purchase frequency as very often, often or seldom/never (28%, 29.8% and 36.8% respectively for foods and 20%, 31.7% and 15.7% respectively for beverages). Half to the majority of these respondents (85.7%, 52.9% and 76.2% respectively for foods and 66.7%, 53.8% and 75.9% respectively for beverages) had awareness of flavonoids ($p > 0.05$) (refer Table 4.25).

Just more than one third of those respondents who were prepared to pay more for foods or beverages with added health benefits recognised flavonoids (36.4% and 36.8% respectively). About one third (35.7% and 32% respectively) of these respondents had knowledge of flavonoids while nearly double the percentage (60.7% and 64% respectively) had awareness of it. While just over one quarter of those respondents who were not prepared to pay more for foods or beverages with added health benefits recognised flavonoids (27.4% and 28.2% respectively), the majority of these respondents had awareness (82.4% and 75% respectively) with very few of these respondents (one and three respondents respectively) having knowledge of it ($p > 0.05$ for each) (refer Table 4.25).

The majority of those respondents who recognised flavonoids and were prepared to pay one to fifteen percent more for foods (38.6%) and beverages (37%), had awareness (72.7% and

75% respectively) with approximately one quarter having knowledge (27.3% and 20% respectively) of flavonoids ($p > 0.05$ for each) (refer Table 4.25). Across all the respondent purchase behaviours and intentions for foods and beverages with added health benefits very few respondents (none to 2 persons) of those who recognised flavonoids had an understanding of it (refer Table 4.25).

Table 4.25: Respondent flavonoid recognition and acceptance associations with their food and beverage with added health benefits purchase behaviours and intentions

Purchase behaviours and intentions		Recognition*		Acceptance (n = 45)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Purchase frequency of foods with added health benefits[b]	Very often	28.0	7	85.7	6	14.3	1	0.0	0	0.293
	Often	29.8	17	52.9	9	41.2	7	5.9	1	
	Seldom/never	36.8	21	76.2	16	14.3	3	9.5	2	
Purchase frequency of beverages with added health benefits[c]	Very often	20.0	3	66.7	2	0.0	0	33.3	1	0.073
	Often	31.7	13	53.8	7	46.2	6	0.0	0	
	Seldom/never	15.7	29	75.9	22	17.2	5	6.9	2	
Acceptance to paying more for foods with added health benefits[d]	Yes	36.4	28	60.7	17	35.7	10	3.6	1	0.060
	No	27.4	17	82.4	14	5.9	1	11.8	2	
Degree of price premium for foods with added health benefits**[e]	1-15%	38.6	22	72.7	16	27.3	6	0.0	0	0.204
	16-25%	33.3	5	20.0	1	60.0	3	20.0	1	
	26-50%	25.0	1	0.0	0	100.0	1	0.0	0	
	51-75%	0.0	0	0.0	0	0.0	0	0.0	0	
	76-100%	0.0	0	0.0	0	0.0	0	0.0	0	
Acceptance to paying more for beverages with added health benefits[f]	Yes	36.8	25	64.0	16	32.0	8	4.0	1	0.348
	No	28.2	20	75.0	15	15.0	3	10.0	2	
Degree of price premium of beverages with added health benefits**[g]	1-15%	37.0	20	75.0	15	20.0	4	5.0	1	0.347
	16-25%	44.4	4	25.0	1	75.0	3	0.0	0	
	26-50%	25.0	1	0.0	0	100.0	1	0.0	0	
	51-75%	0.0	0	0.0	0	0.0	0	0.0	0	
	76-100%	0.0	0	0.0	0	0.0	0	0.0	0	

* Respondent number and percentage of those who recognised flavonoids within each of the respondent food and beverage with added health benefits purchase behaviour and intention characteristic distributions (refer Table 4.3)

** Number of the respondents who responded affirmative to paying more for food/beverages with added health benefits

[ab, ac, ad, ae, af, ag] Non-significant ($p > 0.05$)

4.4.8 Antioxidants

4.4.8.1 Acceptance as bioactive food ingredient

The majority (87.1%) of the respondents or 121 of them recognised antioxidants. Half (55.4%) of these respondents were only aware of antioxidants. While just under one third (28.1%) of the respondents had knowledge, less than one fifth (16.5%) had an understanding of it (refer Table 4.4).

4.4.8.2 Associations between the acceptance and the respondent characteristics

4.4.8.2.1 Demographic characteristics

No significant associations or differences ($p > 0.05$) were found for the respondent acceptance of antioxidants as a bioactive ingredient and their demographic characteristics (refer Table 4.26). The majority of the male and the female respondents (71.8% and 93% respectively) recognised antioxidants, with more than half of them (60.7% of the males and 53.8% of the females) having an awareness of it. While nearly 30% of them had knowledge (28.6% of the males and 28% of the females), less than 20% of them (10.7% of the males and 18.3% of the females) had an understanding of it ($p > 0.05$) (refer Table 4.26).

Two thirds of the respondents aged 61 years and older recognised antioxidants, whereas one third of less of the respondents in all the other age categories recognised it (i.e. in the age category 35 to 44 years 10.7% up to 34.6% in the age category 45 to 54 years). While no respondents who were 61 years and older who recognised antioxidants had knowledge of it, one respondent understood it. One quarter to one third of the younger respondents who recognised antioxidants had knowledge of it (i.e. from 25% in the 35 to 44 year age category to 35.3% in the 25 to 34 year age category). However, more of them were only aware of antioxidants (i.e. from 48% in the 45 to 54 year age group to 54.2% in the 35 to 44 year old age group). The highest percentage of respondents who recognised antioxidants and had an understanding of it fell in the younger age groups (i.e. 25 to 34 year age category 13.7%, 35 to 44 year old age group 20.8% and 45 to 54 year old age group 24% or seven, five and six respondents respectively) ($p > 0.05$) (refer Table 4.26).

About three quarters to all the respondents across the population groups recognised antioxidants (i.e. in the black population group 72.2% up to all in the Indian and 'other' population groups). Half to all these respondents across the population groups had awareness of antioxidants (i.e. 50% in the 'other' population group, 53% among the white

population group, 59.1% among the coloured population group, 61.5% among the black population group and all of the Indian respondents). Approximately one quarter to just over one third of the respondents who recognised antioxidants and who fell into the white, coloured or black population groups (26.5%, 31.8% and 38.5% respectively) had knowledge of it. While respondents from the 'other' population group had the highest percentage (50%) respondents with understanding, this only amounted to one respondent. However, 17 respondents (20.5%) from the white population group who recognised antioxidants had an understanding of it ($p < 0.05$) (refer Table 4.26).

In each of the education qualification levels about three quarters (72.7% in the level Grade 12 with a degree) up to all (in the levels Grade 11 or below and post graduate) of the respondents recognised antioxidants. In most of the education levels, approximately half (i.e. Grade 12 along with a certificate 58.3%, diploma 42.9%, degree 50% and degree and diploma 59.2%, a post graduate qualification 42.9% and up to Grade 12 61.8%) of the respondents who recognised antioxidants were aware of it with three quarters (72.7%) of the respondents with Grade 11 or below education level being aware of it. While respondents who had education levels of Grade 12 and diploma or Grade 12 and a degree and recognised antioxidants had the highest respondent percentage (42.9% and 37.5% respectively) with knowledge of antioxidants this amounted to twelve and three respondents respectively. Four or less respondents across the education qualification levels who recognised antioxidants had an understanding of it ($p > 0.05$) (refer Table 4.26).

The majority to all of the respondents across the occupation groups (from as low as 70% for the legislators, senior officials and managers group to all service and sales workers) recognised antioxidants. While the respondents who recognised antioxidants and fell into the service and sales workers occupation group had the highest respondent percentage (66.7%) with knowledge of antioxidants, an equal percentage of the remaining respondents in this occupation group were aware of or had an understanding (16.7% respectively) of it. Twenty percent (i.e. in the professionals group) and less (to as low as 11.1% among the office clerks) of the respondents across the occupation groups who recognised antioxidants had understanding of it; however, respondents from the technicians and other associate professionals had the highest number ($n = 8$) of respondents (at 19.5%) who had an understanding of it ($p > 0.05$) (refer Table 4.26).

Three quarters to nearly all the respondents across the annual income brackets recognised antioxidants (i.e. from 75% in the R380 001 to R490 000 up to 93.8% in the R122 001 to R195 000 bracket). While respondents who recognised antioxidants and who earned R380 001 to R490 000 per annum had the highest respondent percentage (50%) with knowledge

of it, none of these respondents had an understanding of antioxidants. Of the remaining respondents across the annual income brackets who recognised antioxidants, one quarter to one third mostly had knowledge (from 22.2% for those earning R490 001 and above to 33.3% for those earning R122 001 to R195 000 per annum). One fifth of the respondents who recognised antioxidants and earned R0 to R122 000 or R122 001 to R195 000 (19.6% and 20% respectively) per annum had an understanding of it ($p > 0.05$) (refer Table 4.26).

The majority of the respondents, independent of their marital status recognised antioxidants (i.e. from 83.8% for those who were single and living without children to 90% for those who were single and living with children). While approximately half of the respondents who were married or living together without or with children and recognised antioxidants (56.8% and 46.5% respectively) had awareness of it, approximately two thirds of those respondents who were single and living without or with children (61.3% and 66.7% respectively) had awareness of it. Double the percentage respondents who were married or living together without or with children and recognised antioxidants had an understanding (21.6% and 20.9% respectively) of antioxidants than those who were single and living without or with children (6.5% and 11.1% respectively) ($p > 0.05$) (refer Table 4.26).

Table 4.26: Respondent antioxidant recognition and acceptance associations with their demographic characteristics

Demographic characteristics		Recognition		Acceptance (n = 121)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Gender[b]	Male	71.8	28	60.7	17	28.6	8	10.7	3	0.626
	Female	93.0	93	53.8	50	28.0	26	18.3	17	
Age[c] (years)	25-34	27.1	51	51.0	26	35.3	18	13.7	7	0.453
	35-44	10.7	24	54.2	13	25.0	6	20.8	5	
	45-54	34.6	25	48.0	12	28.0	7	24.0	6	
	55-60	17.6	13	69.2	9	23.1	3	7.7	1	
	61 and older	66.7	8	87.5	7	0.0	0	12.5	1	
Population group[d]	Black	72.2	13	61.5	8	38.5	5	0.0	0	0.503
	Coloured	84.6	22	59.1	13	31.8	7	9.1	2	
	Indian	100.0	1	100.0	1	0.0	0	0.0	0	
	White	90.2	83	53.0	44	26.5	22	20.5	17	
	Other	100.0	2	50.0	1	0.0	0	50.0	1	

Table 4.26 (continued)

Demographic characteristics		Recognition*		Acceptance (n = 121)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Level of education[e]	Grade 11 (Standard 9) or below	100.0	11	72.7	8	18.2	2	9.1	1	0.311
	Grade 12 (Matric)	85.0	34	61.8	21	29.4	10	8.8	3	
	Grade 12 and certificate	80.0	12	58.3	7	8.3	1	33.3	4	
	Grade 12 and diploma	84.8	28	42.9	12	42.9	12	14.3	4	
	Grade 12 and degree	72.7	8	50.0	4	37.5	3	12.5	1	
	Grade 12 and degree and diploma	95.5	21	57.1	12	23.8	5	19.0	4	
	Post graduate (Masters or Doctorate)	100.0	7	42.9	3	14.3	1	42.9	3	
Occupation[f]	Unemployed/retired	94.1	16	62.5	10	18.8	3	18.8	3	0.592
	Legislators, senior officials, managers	70.0	7	42.9	3	42.9	3	14.3	1	
	Professionals	83.3	15	60.0	9	20.0	3	20.0	3	
	Technicians and other associate professionals	83.7	41	51.2	21	29.3	12	19.5	8	
	Office clerks	92.3	36	63.9	23	25.0	9	11.1	4	
	Service workers, shop and market sales workers; Craft and related trade workers; Elementary occupations	100.0	6	16.7	1	66.7	4	16.7	1	
Annual income[g]	R490 001 and above	90.0	9	66.7	6	22.2	2	11.1	1	0.922
	R380 001-R490 000	75.0	6	50.0	3	50.0	3	0.0	0	
	R270 001-R380 000	86.7	13	61.5	8	23.1	3	15.4	2	
	R195 001-R270 000	81.0	17	58.8	10	29.4	5	11.8	2	
	R122 001-R195 000	93.8	30	46.7	14	33.3	10	20.0	6	
	R0-R122 000	86.8	46	56.5	26	23.9	11	19.6	9	
Marital status[h]	Married/Living together without children	86.0	37	56.8	21	21.6	8	21.6	8	0.506
	Married/Living together with children	89.6	43	46.5	20	32.6	14	20.9	9	
	Single, living without children	83.8	31	61.3	19	32.3	10	6.5	2	
	Single, living with children	90.0	9	66.7	6	22.2	2	11.1	1	

* Respondent number and percentage of those who recognised antioxidants within each of the respondent demographic characteristic distributions (refer Table 4.1)

[ab, ac, ad, ae, af, ag, ah] Non-significant ($p > 0.05$)

4.4.8.2.2 Health and lifestyle characteristics

A significant difference ($p < 0.05$) was found between the participant perception of their nutrition knowledge relative to other adults of the same age, interest in food and nutrition and

health and wellness and their acceptance of antioxidants as a bioactive food ingredient (refer Table 4.27). Among those respondents who suffered from chronic disease and those that did not, most recognised antioxidants (79.2% and 88.7% respectively). Among these respondents who recognised antioxidants approximately half to two thirds of those suffering and not suffering from chronic disease had awareness of it (68.4% and 52.9% respectively). Respondents who did not suffer from chronic disease and recognised antioxidants had a higher respondent percentage with knowledge and with understanding (29.4% and 17.6% respectively) than those who did not suffer from chronic disease (21.1% and 10.5% respectively) ($p > 0.05$) (refer Table 4.27).

The majority of the respondents who participated in regular moderate or hard physical activity had recognition of antioxidants (from as low as 75% of those participating in hard physical activity more than four times a week to all of those participating about once a week in hard physical activity). Respondents who recognised antioxidants and rarely or never participated in moderate physical activity had the highest respondent percentage (45.5%) with antioxidant knowledge, while of those respondents who recognised antioxidants and participated in moderate physical activity two to four times a week had the highest respondent percentage (26.8%) with antioxidant understanding. While those respondents who recognised antioxidants and participated in hard physical activity about once a week had the highest respondent percentage (52.4%) with antioxidant knowledge, those respondents who recognised antioxidants and participated two to four times a week in hard physical activity had the highest respondent percentage (33.3%) with antioxidant understanding ($p > 0.05$) (refer Table 4.27).

The majority of the respondents, independent of their frequency of consumption of dietary supplements, recognised antioxidants (from as low as 80% for the seldom/never consumers to 89.9% of the daily consumers). While the respondents who recognised antioxidants and seldom/never consumed dietary supplements had the highest respondent percentage (35.7%) knowledge of it, double the number of respondents who recognised antioxidants and consumed dietary supplements daily had knowledge of it than those who seldom/never consumed it (21 versus 10 respondents). The respondents who recognised antioxidants and seldom or never consumed dietary supplements had the lowest respondent percentage (7.1%) with antioxidant understanding ($p > 0.05$) (refer Table 4.27).

The majority of the respondents who viewed their level of health and wellness knowledge as well or moderately informed recognised antioxidants (91.7% and 92.1% respectively), while of those respondents who viewed their level of nutrition knowledge as not at all informed, two thirds (66.7%) recognised it. Among these respondents who viewed their level of nutrition

knowledge as well or moderately informed, about half had awareness (45.5% and 51.8% respectively) with one quarter to one third of the respondents having knowledge of it (22.7% and 32.5% respectively). Half of the percentage of the respondents who recognised antioxidants and viewed their level of health and wellness knowledge as moderately informed had an understanding compared to those who viewed their level of nutrition knowledge as well informed (15.7% versus 31.8%). Of these respondents who viewed their level of nutrition knowledge as not at all informed, again, none had an understanding of antioxidants, while most (87.5%) were only aware of it ($p < 0.05$) (refer Table 4.27).

About two thirds to the majority of the respondents who viewed their level of nutrition knowledge as well, moderately or not at all informed recognised antioxidants (from 66.7% to 96.8%). Among these respondents who viewed their level of health and wellness knowledge as well or moderately informed, half had awareness (53.3% and 53.1% respectively) with a higher percentage respondents who viewed their level of health and wellness knowledge as well informed having an understanding than those who viewed their level of knowledge as moderately informed (30% and 13.6% respectively). Of these respondents who viewed their level of health and wellness as not at all informed, none had an understanding of antioxidants, while most (80%) were only aware of it ($p > 0.05$) (refer Table 4.27).

The majority of the respondents who were very interested or had little interest in food and nutrition recognised antioxidants (89% and 87.5% respectively), while of those respondents who had no interest in food and nutrition, less than three quarters (70%) recognised it. Half to two thirds of these respondents who were interested in food and nutrition and recognised antioxidants were aware (52.3% for very interested and 63.3% for little interest) of antioxidants. While a near equal number of respondents who were interested in food and nutrition and recognised antioxidants had knowledge (13 for very interested and 16 for little interest), far more respondents who were very interested in food and nutrition had an understanding than those who had little interest (27.7% and 4.1% respectively or 18 respondents and 2 respondents respectively). No respondent who indicated not being interested in food and nutrition had an understanding of antioxidants ($p < 0.05$) (refer Table 4.27).

The majority of the respondents who were very interested or had little or no interest in health and wellness recognised antioxidants (87.8%, 86.1% and 80% respectively). While the majority (75%) of the respondents who recognised antioxidants and had no interest in health and wellness had knowledge of it, none had an understanding of it. One quarter to one third of the respondents who had interest in health and wellness and who recognised antioxidants had knowledge (24.4% for very interested and 32.3% for little interest) of it. Again, far more

respondents who were very interested in health and wellness had an understanding of antioxidants than those who had little interest (22.1% and 3.2% respectively or 19 respondents and one respondent respectively). Again no respondent who indicated not being interested in health and wellness had an understanding of antioxidants ($p < 0.05$) (refer Table 4.27).

Table 4.27: Respondent antioxidant recognition and acceptance associations with their health and lifestyle characteristics

Health and lifestyle characteristics		Recognition		Acceptance (n = 121)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Incidence of chronic disease[b]	Yes	79.2	19	68.4	13	21.1	4	10.5	2	0.453
	No	88.7	102	52.9	54	29.4	30	17.6	18	
Frequency of moderate physical activity**[c]	Rarely or never	91.7	11	54.5	6	45.5	5	0.0	0	0.385
	2-3 times over the month	77.8	7	71.4	5	14.3	1	14.3	1	
	About once a week	91.3	21	52.4	11	38.1	8	9.5	2	
	2-4 times a week	87.2	41	43.9	18	29.3	12	26.8	11	
	More than 4 times a week	81.2	9	66.7	6	22.2	2	11.1	1	
Frequency of hard physical activity**[d]	Rarely or never	92.9	26	50.0	13	34.6	9	15.4	4	0.065
	2-3 times over the month	81.8	9	55.6	5	33.3	3	11.1	1	
	About once a week	100.0	21	42.9	9	52.4	11	4.8	1	
	2-4 times a week	79.4	27	51.9	14	14.8	4	33.3	9	
	More than 4 times a week	75.0	6	83.3	5	16.7	1	0.0	0	
Frequency of consumption of dietary supplements[e]	Daily	89.9	71	54.9	39	29.6	21	15.5	11	0.242
	Weekly	88.2	15	60.0	9	13.3	2	26.7	4	
	Monthly	87.5	7	42.9	3	14.3	1	42.9	3	
	Seldom/Never	80.0	28	57.1	16	35.7	10	7.1	2	
Level of health and wellness knowledge rating in relation to other adults of similar age[f]	Well informed	91.7	22	45.5	10	22.7	5	31.8	7	0.021
	Moderately informed	91.2	83	51.8	43	32.5	27	15.7	13	
	Not at all informed	66.7	16	87.5	14	12.5	2	0.0	0	
Level of nutrition knowledge rating in relation to other adults of similar age[g]	Well informed	96.8	30	53.3	16	16.7	5	30.0	9	0.061
	Moderately informed	87.1	81	53.1	43	33.3	27	13.6	11	
	Not at all informed	66.7	10	80.0	8	20.0	2	0.0	0	
Degree of interest in food and nutrition[h]	Very interested	89.0	65	52.3	34	20.0	13	27.7	18	0.001
	Little interest	87.5	49	63.3	31	32.7	16	4.1	2	
	No interest	70.0	7	28.6	2	71.4	5	0.0	0	

Table 4.27 (continued)

Health and lifestyle characteristics		Recognition*		Acceptance (n = 121)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Degree of interest in health and wellness[i]	Very interested	87.8	86	53.5	46	24.4	21	22.1	19	0.033
	Little interest	86.1	31	64.5	20	32.3	10	3.2	1	
	No interest	80.0	4	25.0	1	75.0	3	0.0	0	

* Respondent number and percentage of those who recognised antioxidants within each of the respondent health and lifestyle characteristic distributions (refer Table 4.2)

** 89 of the respondents who engaged in physical activity (moderate/hard) recognised antioxidants

[af, ah, ai] Significant difference ($p < 0.05$)

[ab, ac, ad, ae, ag] Non-significant ($p > 0.05$)

4.4.8.2.3 Food and beverage with added health benefits purchase behaviours and intentions

No significant ($p > 0.05$) associations or differences were found between the respondent antioxidant acceptance and their purchase behaviour and intent of food and beverages with added health benefits (refer Table 4.28). Nearly all to all respondents who purchased foods and beverages with added health benefits or not recognised antioxidants (from as low as 80.7% for seldom/never purchasing such foods to as high as 100% for very often purchasing such foods and beverages). Respondents who recognised antioxidants and purchased foods and beverages with added health benefits often had the highest respondent percentage with antioxidant knowledge (34% and 32.4% respectively), while the respondents who recognised antioxidants and purchased foods or beverages with added health benefits seldom/never had the highest respondent understanding of antioxidants (21.7% and 20.3% respectively) ($p > 0.05$) (refer Table 4.28).

While the majority of the respondents who were prepared to pay more food foods and beverages with added health benefits recognised antioxidants (96.1% and 92.6% respectively), as many of the respondents who were not prepared to pay more for foods and beverages with added health benefits also recognised antioxidants (75.8% and 81.7% respectively). A near equal percentage respondents who were or were not willing to pay more for foods or beverages with added health benefits and recognised antioxidants had knowledge (25.7% and 31.9% respectively for foods and 28.6% ad 27.6% respectively for beverages) or an understanding (16.2% and 17% respectively for foods and 15.9% and 17.2% respectively for beverages) of it ($p > 0.05$) (refer Table 4.28).

As indicated, most respondents willing to pay more for foods and beverages with added health benefits indicated a price premium of up to 15%, followed by a few respondents willing to pay more and in particular only up to 25% more (refer Table 4.3). Among the respondents who recognised antioxidants in these two price premium levels for purchasing such foods and beverages most had awareness of antioxidants (60.4% and 46.7% respectively and 55.1% and 44.4% respectively) with one quarter to one third of the respondents having knowledge of it (22.6% and 33.3% respectively and 28.6% and 33.3% respectively). Approximately 20% of the respondents who recognised antioxidants and where willing to pay up to 15% or up to 25% more for such foods and beverages had an understanding of it (17% and 20% respectively and 16.3% and 22.2% respectively) ($p > 0.05$) (refer Table 4.28).

Table 4.28: Respondent antioxidant recognition and acceptance associations with their food and beverage with added health benefits purchase behaviours and intentions

Purchase behaviours and intentions		Recognition		Acceptance (n = 121)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Purchase frequency of foods with added health benefits[b]	Very often	100.0	25	68.0	17	16.0	4	16.0	4	0.370
	Often	87.7	50	54.0	27	34.0	17	12.0	6	
	Seldom/never	80.7	46	50.0	23	28.3	13	21.7	10	
Purchase frequency of beverages with added health benefits[c]	Very often	100.0	15	66.7	10	20.0	3	13.3	2	0.644
	Often	90.2	37	56.8	21	32.4	12	10.8	4	
	Seldom/never	93.1	69	52.2	36	27.5	19	20.3	14	
Acceptance to paying more for foods with added health benefits[d]	Yes	96.1	74	58.1	43	25.7	19	16.2	12	0.716
	No	75.8	47	51.1	24	31.9	15	17.0	8	
Degree of price premium of foods with added health benefits[**e]	1-15%	93.0	53	60.4	32	22.6	12	17.0	9	0.811
	16-25%	100.0	15	46.7	7	33.3	5	20.0	3	
	26-50%	100.0	4	50.0	2	50.0	2	0.0	0	
	51-75%	0.0	0	0.0	0	0.0	0	0.0	0	
	76-100%	100.0	1	100.0	1	0.0	0	0.0	0	
Acceptance to paying more for beverages with added health benefits[f]	Yes	92.6	63	55.5	35	28.6	18	15.9	10	0.978
	No	81.7	58	55.2	32	27.6	16	17.2	10	
Degree of price premium of beverages with added health benefits[**g]	1-15%	90.7	49	55.1	27	28.6	14	16.3	8	0.956
	16-25%	100.0	9	44.4	4	33.3	3	22.2	2	
	26-50%	100.0	4	75.0	3	25.0	1	0.0	0	
	51-75%	0.0	0	0.0	0	0.0	0	0.0	0	
	76-100%	100.0	1	100.0	1	0.0	0	0.0	0	

* Respondent number and percentage of those who recognised antioxidants within each of the respondent food and beverage with added health benefits purchase behaviour and intention characteristic distributions (refer Table 4.3)

** Number of the respondents who responded affirmative to paying more for food/beverages with added health benefits; one respondent did not specify food price premium

ab, ac, ad, ae, af, ag Non-significant ($p > 0.05$)

4.4.9 Functional foods

4.4.9.1 Acceptance as bioactive food ingredient

Forty percent (40.3%) or 56 of the respondents recognised functional foods. The majority (69.3%) of these respondents were only aware of functional foods. While about one fifth (21.4%) of the respondents had knowledge, few (8.9%) had an understanding of it (refer Table 4.4).

4.4.9.2 Associations between the acceptance and the respondent characteristics

4.4.9.2.1 Demographic characteristics

No associations or differences ($p > 0.05$) were found between the acceptance of functional foods as a bioactive ingredient and the demographic characteristics of the respondents (refer Table 4.29). More than double the percentage of the female respondents had recognition of functional foods compared to the male respondents (50% versus 15.4%). However, the majority of these male and female respondents (50% and 72% respectively) only had awareness of functional foods. While a higher percentage of the male than the female respondents (50% and 18% respectively) had knowledge of it, in essence, only three male respondents compared to nine female respondents had knowledge of it. Similarly, five female respondents compared to nil male respondents had an understanding of functional foods ($p > 0.05$) (refer Table 4.29).

Half and less of the respondents in the 60 years and younger age categories recognised functional foods (from 50% of the respondents aged 45 to 54 years to as low as 32.1% of the respondents aged 35 to 44 years), while the majority (77.8%) of the respondents 61 years and older recognised it. A maximum of three respondents in the age categories of 25 to 34 years, 35 to 44 years and 55 to 60 years had knowledge of functional foods while a maximum of two respondents across the age categories 25 to 34 years and 35 to 44 years had an understanding of it ($p > 0.05$) (refer Table 4.29).

While approximately one quarter to less than half of the black, coloured and white respondents recognised functional foods (27.8%, 34.6% and 43.5% respectively) all of the 'other' respondents did so. All the black respondents who recognised functional foods only had an awareness of it. The majority (72.5%) of the white respondents were also only aware of functional foods with only three respondents having an understanding of it. Similarly, about half (44.4%) of the coloured respondents had awareness of it with a few having knowledge or an understanding (three and two respondents respectively) of it ($p > 0.05$) (refer Table 4.29).

Just over half to only a few of the respondents across the education qualification levels recognised functional foods (from 54.5% respectively for Grade 11 or below and Grade 12 and diploma to as low as 9.1% for Grade 12 and degree). Half to all the respondents who recognised functional foods across the education qualification levels were aware of it (from 50% for Grade 12 and a certificate or a post graduate qualification to all for Grade 12 and degree). Respondents who recognised functional foods and had a Grade 12 education level had the highest number of respondents ($n = 5$) who had knowledge of it, while respondents who recognised functional foods and had an education level of Grade 12 and a diploma had the most respondents ($n = 3$) with an understanding of it ($p > 0.05$) (refer Table 4.29).

Nearly one third to two thirds (from 30.6% to 64.7%) of the respondents across the occupation groups recognised functional foods. Half to all of these respondents across the occupation groups (i.e. 54.5%, 100%, 83.3%, 60%, 76.5% and 66.7% respectively from the retired or unemployed, legislators, professionals, technicians and other associate professionals, office clerks and service and sales workers groups) were aware of functional foods. Those respondents who fell into the unemployed or retired occupation group and recognised functional foods had the highest respondent percentage (45.5%) with knowledge of it, while those respondents who fell into the technicians and other associate professionals occupation group had the highest respondent percentage (26.7%) with understanding of it ($p > 0.05$) (refer Table 4.29).

Approximately one third to a half of the respondents who earned R490 000 and above, R270 001 to R380 000, R122 001 to R195 000 or R122 000 and below per annum (30%, 38.1%, 37.5% and 49.1% respectively) recognised functional foods. Two thirds (62.5%) of those respondents who earned R380 001 to R490 000 per annum recognised functional foods, while few (13.3%) of those respondents who earned R270 001 to R380 000 per annum recognised it. All of these respondents who earned R380 001 and above per annum had awareness of functional foods. Nearly one fifth (19.2%) of these respondents who earned R0 to R122 000 per annum had knowledge of functional foods, while respondents from this

annual income bracket had the highest number of respondents (n = 3) who had an understanding of it ($p > 0.05$) (refer Table 4.29).

About one third to half of those respondents who were married or living together without or with children or who were single and living without children (48.8%, 31.3% and 29.7% respectively) recognised functional foods, while the majority (80%) of those respondents who were single and living with children recognised functional foods. Those respondents who were married or living together with children and recognised functional foods had the highest respondent percentage (40%) with knowledge and the highest respondent percentage (20%) with understanding of it ($p > 0.05$) (refer Table 4.29).

Table 4.29: Respondents functional foods recognition and acceptance associations with their demographic characteristics

Demographic characteristics		Recognition		Acceptance (n = 56)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Gender[b]	Male	15.4	6	50.0	3	50.0	3	0.0	0	0.171
	Female	50.0	50	72.0	36	18.0	9	10.0	5	
Age[c] (years)	25-34	33.9	20	75.0	15	15.0	3	10.0	2	0.400
	35-44	32.1	9	44.4	4	33.3	3	22.2	2	
	45-54	50.0	13	84.6	11	7.7	1	7.7	1	
	55-60	41.2	7	57.1	4	42.9	3	0.0	0	
	61 and older	77.8	7	71.4	5	28.6	2	0.0	0	
Population group[d]	Black	27.8	5	100.0	5	0.0	0	0.0	0	0.359
	Coloured	34.6	9	44.4	4	33.3	3	22.2	2	
	Indian	0.0	0	0.0	0	0.0	0	0.0	0	
	White	43.5	40	72.5	29	20.0	8	7.5	3	
	Other	100.0	2	50.0	1	50.0	1	0.0	0	
Level of education[e]	Grade 11 (Standard 9) or below	54.5	6	83.3	5	16.7	1	0.0	0	0.728
	Grade 12 (Matric)	42.5	17	64.7	11	29.4	5	5.9	1	
	Grade 12 and certificate	26.7	4	50.0	2	50.0	2	0.0	0	
	Grade 12 and diploma	54.5	18	66.7	12	16.7	3	16.7	3	
	Grade 12 and degree	9.1	1	100.0	1	0.0	0	0.0	0	
	Grade 12 and degree and diploma	36.4	8	87.5	7	0.0	0	12.5	1	
	Post graduate (Masters or Doctorate)	28.6	2	50.0	1	50.0	1	0.0	0	

Table 4.29 (continued)

Demographic characteristics		Recognition *		Acceptance (n = 56)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Occupation[f]	Unemployed/retired	64.7	11	54.5	6	45.5	5	0.0	0	0.191
	Legislators, senior officials, managers	40.0	4	100.0	4	0.0	0	0.0	0	
	Professionals	33.3	6	83.3	5	16.7	1	0.0	0	
	Technicians and other associate professionals	30.6	15	60.0	9	13.3	2	26.7	4	
	Office clerks	43.6	17	76.5	13	17.6	3	5.9	1	
	Service workers, shop and market sales workers; Craft and related trade workers; Elementary occupations	50.0	3	66.7	2	33.3	1	0.0	0	
Annual income[g]	R490 001 and above	30.0	3	100.0	3	0.0	0	0.0	0	0.812
	R380 001-R490 000	62.5	5	100.0	5	0.0	0	0.0	0	
	R270 001-R380 000	13.3	2	50.0	1	50.0	1	0.0	0	
	R195 001-R270 000	38.1	8	62.5	5	25.0	2	12.5	1	
	R122 001-R195 000	37.5	12	58.3	7	33.3	4	8.3	1	
	R0-R122 000	49.1	26	69.2	18	19.2	5	11.5	3	
Marital status[h]	Married/Living together without children	48.8	21	71.4	15	23.8	5	4.8	1	0.082
	Married/Living together with children	31.3	15	40.0	6	40.0	6	20.0	3	
	Single, living without children	29.7	11	81.8	9	9.1	1	9.1	1	
	Single, living with children	80.0	8	100.0	8	0.0	0	0.0	0	

* Respondent number and percentage of those who recognised antioxidants within each of the respondent demographic characteristic distributions (refer Table 4.1)

[ab, ac, ad, ae, af, ag, ah] Non-significant ($p > 0.05$)

4.4.9.2.2 Health and lifestyle characteristics

No significant ($p > 0.05$) associations or differences were also found between the respondent functional food acceptance and their health and lifestyle characteristics (refer Table 4.30). While the majority of those respondents who did or did not suffer from chronic disease and recognised functional foods (45.8% and 39.1% respectively) had awareness of it (72.7% and 68.9% respectively), approximately 20% of them had knowledge of it (18.2% and 22.2% respectively). Few of these respondents had an understanding of it (9.1% and 8.9% or one and four respondents respectively) ($p > 0.05$) (refer Table 4.30).

Less than half of the respondents who participated in regular moderate or hard physical activity had recognition of antioxidants (from as low as 12.5% of those participating in hard physical activity more than four times a week to 47.6% of those participating about once a week in hard physical activity). All of those respondents who recognised antioxidants and rarely or never participated in moderate physical activity or participated two to three times a week had awareness of it. While those respondents who recognised functional foods and participated in moderate physical activity two to fours times a week or hard physical activity rarely or never, two to three times over a month or two to four times a week had the highest awareness of it (77.3%, 81.8% 80% and 76.9% respectively), few respondents who recognised functional foods and participated in moderate physical activity about one a week or two to four times a week had knowledge or an understanding of it (five respondents respectively) or hard physical activity about once a week or two to four times a week (four and three respondents respectively) ($p > 0.05$ in each case) (refer Table 4.30).

Those respondents who seldom/never consumed dietary supplements and recognised functional foods (34.3%) had the highest (83.3%) awareness of them; however, none of these respondents had an understanding of it. Those respondents who consumed dietary supplements weekly and recognised functional foods (29.4%) had the highest respondent percentage (60%) with knowledge of functional foods. Although one fifth (20%) and one quarter (25%) of those respondents who respectively consumed dietary supplements weekly and monthly and recognised functional foods had an understanding if it, this only amounted to one respondent in each case ($p > 0.05$) (refer Table 4.30).

One third to one half of those respondents who viewed their level of nutrition and health and wellness knowledge as well informed (45.8% and 51.6% respectively), moderately informed (39.6% and 37.6% respectively) or not at all informed (42.9% and 33.3% respectively) recognised functional foods. Of these respondents who viewed their level of nutrition and health and wellness knowledge as moderately informed, about one quarter (25% and 22.9% respectively) had knowledge of functional foods. Of these respondents who viewed their level of nutrition and health and wellness knowledge as well or moderately informed, few (18.2% and 8.3% respectively and 12.5% and 8.6% respectively) had an understanding of functional foods. This amounted to two and three respondents respectively for both nutrition and health and wellness knowledge ($p > 0.05$ for each) (refer Table 4.30).

While approximately half of the respondents who were very interested in food and nutrition and health and wellness (47.9% and 43.9% respectively) recognised functional foods, about 20% of them (20% and 23.3% respectively) had knowledge and few (11.4% and 9.3% respectively) an understanding of it. Of the approximately one third of the respondents who

had little interest in food and nutrition and health and wellness and recognised functional foods (33.9% and 36.1% respectively), few had knowledge of it (26.3% and 15.4% or five and two respondents respectively) with one respondent having an understanding of it. Of the two respondents who had no interest in food and nutrition and recognised functional foods both were only aware of it. None of the five respondents who indicated no interest in health and wellness (refer Table 4.2) recognised functional foods ($p > 0.05$) (refer Table 4.30).

Table 4.30: Respondent functional food recognition and acceptance associations with their health and lifestyle characteristics

Health and lifestyle characteristics		Recognition		Acceptance (n = 56)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Incidence of chronic disease[b]	Yes	45.8	11	72.7	8	18.2	2	9.1	1	0.958
	No	39.1	45	68.9	31	22.2	10	8.9	4	
Frequency of moderate physical activity**[c]	Rarely or never	33.3	4	100.0	4	0.0	0	0.0	0	0.494
	2-3 times over the month	33.3	3	100.0	3	0.0	0	0.0	0	
	About once a week	39.1	9	44.4	4	44.4	4	11.1	1	
	2-4 times a week	46.8	22	77.3	17	18.2	4	4.5	1	
	More than 4 times a week	18.2	2	50.0	1	50.0	1	0.0	0	
Frequency of hard physical activity**[d]	Rarely or never	39.3	11	81.8	9	9.1	1	9.1	1	0.461
	2-3 times over the month	45.5	5	80.0	4	20.0	1	0.0	0	
	About once a week	47.6	10	60.0	6	40.0	4	0.0	0	
	2-4 times a week	38.2	13	76.9	10	15.4	2	7.7	1	
	More than 4 times a week	12.5	1	0.0	0	100.0	1	0.0	0	
Frequency of consumption of dietary supplements[e]	Daily	44.3	35	74.3	26	17.1	6	8.6	3	0.159
	Weekly	29.4	5	20.0	1	60.0	3	20.0	1	
	Monthly	23.5	4	50.0	2	25.0	1	25.0	1	
	Seldom/Never	34.3	12	83.3	10	16.7	2	0.0	0	
Level of health and wellness knowledge rating in relation to other adults of similar age[f]	Well informed	45.8	11	72.7	8	9.1	1	18.2	2	0.555
	Moderately informed	39.6	36	66.7	24	25.0	9	8.3	3	
	Not at all informed	42.9	9	77.8	7	22.2	2	0.0	0	
Level of nutrition knowledge rating in relation to other adults of similar age[g]	Well informed	51.6	16	68.8	11	18.8	3	12.5	2	0.931
	Moderately informed	37.6	35	68.6	24	22.9	8	8.6	3	
	Not at all informed	33.3	5	80.0	4	20.0	1	0.0	0	

Table 4.30 (continued)

Health and lifestyle characteristics		Recognition *		Acceptance (n = 56)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Degree of interest in food and nutrition[h]	Very interested	47.9	35	68.6	24	20.0	7	11.4	4	0.798
	Little interest	33.9	19	68.4	13	26.3	5	5.3	1	
	No interest	20.0	2	100.0	2	0.0	0	0.0	0	
Degree of interest in health and wellness[i]	Very interested	43.9	43	67.4	29	23.3	10	9.3	4	0.800
	Little interest	36.1	13	76.9	10	15.4	2	7.7	1	
	No interest	0.0	0	0.0	0	0.0	0	0.0	0	

* Respondent number and percentage of those who recognised functional foods within each of the respondent health and lifestyle characteristic distributions (refer Table 4.2)

** 40 of the respondents who engaged in physical activity (moderate/hard) recognised functional foods

ab, ac ad, ae, af, ag, ah, ai Non-significant ($p > 0.05$)

4.4.9.2.3 Food and beverage with added health benefits purchase behaviours and intentions

One third to less than a half of the respondents who purchased foods and beverages with added health benefits very often, often or seldom/never recognised functional foods (44%, 42.1% and 36.8% respectively for foods and 33.3%, 43.9% and 39.8% respectively for beverages). The majority of the respondents who very often purchased foods with added health benefits and recognised functional foods had awareness (81.8%), while an equal respondent percentage had knowledge or an understanding (9.1% or one respondent) of it. Of those respondents who very often purchased beverages with added health benefits and recognised functional foods, and equal percentage had awareness and knowledge (40% respectively), while half (20%) of these respondents had an understanding of it. While two thirds to three quarters of the respondents who often or seldom/never purchased such foods and beverages and recognised functional foods had awareness (66.7% respectively for foods and 77.8% and 69.7% respectively for beverages) of it, some respondents had knowledge (20.8% and 28.6% respectively for foods and 11.1% and 24.2% respectively for beverages) and a few respondents understanding (12.5% and 4.8% or three and one respondents respectively for foods and 11.1% and 6.1% or two respondents respectively for beverages) of it ($p > 0.05$) (refer Table 4.31).

Nearly half of the respondents who were prepared to pay more for foods or beverages with added health benefits recognised functional foods (49.4% and 47.1% respectively), while about one third of those respondents who were not prepared to pay more for foods or

beverages with added health benefits recognised functional foods (29% and 33.8% respectively). Of these respondents who recognised functional foods and accepted to pay more for such foods and beverages, approximately 20% (21.1% and 21.9% respectively) had knowledge of it, while few (13.2% and 15.6% respectively) had an understanding of it. Among those respondents who were not prepared to pay more for foods or beverages with added health benefits and recognised functional foods, approximately 20% (22.2% and 20.8% respectively) had knowledge of it, while none had an understanding of it ($p > 0.05$) (refer Table 4.31).

None of the respondents who were prepared to pay more than 50% for foods or beverages with added health benefits recognised functional foods. The majority of the respondents who were prepared to pay 16 to 25% more for foods and beverages with added health benefits and recognised functional foods (73.3% and 77.8% respectively) had awareness of it (63.6% and 85.7% respectively). Of those respondents who were prepared to pay one to fifteen percent more for foods or beverages with added health benefits and recognised functional foods (42.1% and 40.7% respectively) most (66.7% and 59.1% respectively) had awareness of functional foods with approximately one quarter (20.8% and 27.3% respectively) of the respondents knowledge and few an understanding (12.5% and 13.6% or three respondents respectively) of it ($p > 0.05$) (refer Table 4.31).

Table 4.31: Respondent functional food recognition and acceptance associations with their food and beverage with added health benefits purchase behaviours and intentions

Purchase behaviours and intentions		Recognition		Acceptance (n = 56)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Purchase frequency of foods with added health benefits[b]	Very often	44.0	11	81.8	9	9.1	1	9.1	1	0.676
	Often	42.1	24	66.7	16	20.8	5	12.5	3	
	Seldom/never	36.8	21	66.7	14	28.6	6	4.8	1	
Purchase frequency of beverages with added health benefits[c]	Very often	33.3	5	40.0	2	40.0	2	20.0	1	0.447
	Often	43.9	18	77.8	14	11.1	2	11.1	2	
	Seldom/never	39.8	33	69.7	23	24.2	8	6.1	2	
Acceptance to paying more for foods with added health benefits[d]	Yes	49.4	38	65.8	25	21.1	8	13.2	5	0.269
	No	29.0	18	77.8	14	22.2	4	0.0	0	
Degree of price premium of foods with added health benefits[**e]	1-15%	42.1	24	66.7	16	20.8	5	12.5	3	0.807
	16-25%	73.3	11	63.6	7	18.2	2	18.2	2	
	26-50%	50.0	2	50.0	1	50.0	1	0.0	0	
	51-75%	0.0	0	0.0	0	0.0	0	0.0	0	
	76-100%	0.0	0	0.0	0	0.0	0	0.0	0	

Table 4.31 (continued)

Purchase behaviours and intentions		Recognition *		Acceptance (n = 56)[a]						P
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Acceptance to paying more for beverages with added health benefits[f]	Yes	47.1	32	62.5	20	21.9	7	15.6	5	0.116
	No	33.8	24	79.2	19	20.8	5	0.0	0	
Degree of price premium of beverages with added health benefits **[g]	1-15%	40.7	22	59.1	13	27.3	6	13.6	3	0.405
	16-25%	77.8	7	85.7	6	0.0	0	14.3	1	
	26-50%	75.0	3	33.3	1	33.3	1	33.3	1	
	51-75%	0.0	0	0.0	0	0.0	0	0.0	0	
	76-100%	0.0	0	0.0	0	0.0	0	0.0	0	

* Respondent number and percentage of those who recognised functional foods within each of the respondent food and beverage with added health benefits purchase behaviour and intention characteristic distributions (refer Table 4.3)

** Number of the respondents who responded affirmative to paying more for food/beverages with added health benefit; one respondent did not specify food price premium

[ab, ac, ad, ae, af, ag] Non-significant ($p > 0.05$)

4.4.10 Isoflavones

4.4.10.1 Acceptance as bioactive food ingredient

Only 20.9% or 29 of the respondents recognised isoflavones. The majority (65.5%) of these respondents had awareness of it. Approximately 20% and less of the respondents had knowledge and understanding (13.8% and 20.7% respectively) of it (refer Table 4.4).

4.4.10.2 Respondent recognition per respondent characteristics

4.4.10.2.1 Demographic characteristics

A quarter (25%) of the female respondents recognised isoflavones, while only few (10.3%) of the male respondents recognised it. Approximately half (55.5%) of the respondents 61 years and older recognised isoflavones, whereas respondents aged 35 to 44 years had the lowest respondent percentage (10.7%) with recognition of it. Respondents from the white population group had the highest (26.1%) recognition of isoflavones, while no respondents from the Indian or 'other' population groups recognised it (refer Table 4.32).

Almost half (42.9%) of those respondents who had a post graduate qualification recognised isoflavones. However, no respondents who had an education level of Grade 12 and a degree

recognised it. While those respondents who fell into the unemployed or retired occupational groups had the highest (35.3%) recognition of isoflavones, a near equal percentage of those respondents who fell in the technicians and other associates, office clerks or service and shop sales workers occupation groups (16.3%, 17.9% and 16.7% respectively) recognised it. About one third of those respondents who earned R380 001 to R490 000 and R490 000 and above per annum (37.5% and 30% respectively) or were married or living together without children or single living with children (32.6% and 30% respectively) recognised isoflavones. Respondents within the other income brackets and marital status groups had a lower respondent percentage recognition of isoflavones than the above annual income brackets and marital status groups (up to 21.9% and 14.6% respectively) (refer Table 4.32).

Table 4.32: Respondent isoflavone recognition per demographic characteristic

Demographic characteristics		n	Recognition (n = 29)	
			%	n
Gender	Male	39	10.3	4
	Female	100	25.0	25
Age (years)	25-34	59	16.9	10
	35-44	28	10.7	3
	45-54	26	30.8	8
	55-60	17	17.6	3
	61 and older	9	55.5	5
Population group	Black	18	11.1	2
	Coloured	26	11.5	3
	Indian	1	0.0	0
	White	92	26.1	24
	Other	2	0.0	0
Level of education	Grade 11 (Standard 9) or below	11	36.4	4
	Grade 12 (Matric)	40	7.5	3
	Grade 12 and certificate	15	20.0	3
	Grade 12 and diploma	33	33.3	11
	Grade 12 and degree	11	0.0	0
	Grade 12 and degree and diploma	22	22.7	5
	Post graduate (Masters or Doctorate)	7	42.9	3

Table 4.32 (continued)

Demographic characteristics		n*	Recognition (n = 29)	
			%	n
Occupation	Unemployed/retired	17	35.3	6
	Legislators, senior officials, managers	10	30.0	3
	Professionals	18	22.2	4
	Technicians and other associate professionals	49	16.3	8
	Office clerks	39	17.9	7
	Service workers, shop and market sales workers; Craft and related trade workers; Elementary occupations	6	16.7	1
Annual income	R490 001 and above	10	30.0	3
	R380 001-R490 000	8	37.5	3
	R270 001-R380 000	15	20.0	3
	R195 001-R270 000	21	14.3	3
	R122 001-R195 000	32	21.9	7
	R0-R122 000	53	18.9	10
Marital status	Married/Living together without children	43	32.6	14
	Married/Living together with children	48	14.6	7
	Single, living without children	37	13.5	5
	Single, living with children	10	30.0	3

* Respondent numbers within each demographic characteristic distribution obtained from Table 4.1

4.4.10.2.2 Health and lifestyle characteristics

One quarter (25%) of those respondents who suffered from chronic disease recognised isoflavones, while 20% of those who did not suffer from chronic disease recognised it. Those respondents who participated in moderate physical activity more than four times a week had the highest (27.3%) recognition of isoflavones while those respondents who participated in hard physical activity two to three times a month had the highest and a very similar respondent percentage (27.3%) recognition of it. One quarter (25%) of those respondents who consumed dietary supplements monthly had recognition of isoflavones, followed by those respondents who consumed them daily (22.8%) (refer Table 4.33).

Those respondents who viewed their level of nutrition or health and wellness knowledge as well informed had the highest recognition (35.5% and 41.7% respectively) of isoflavones, while those respondents who viewed their degree of interest in food and nutrition and health and wellness as very interested had the highest (30.1% and 29.6% respectively) recognition of it. No respondents who considered themselves not informed about nutrition or health and

wellness and indicated having no interest in health and wellness recognised isoflavones. No respondents who participated in moderate physical activity monthly or less also recognised isoflavones (refer Table 4.33).

Table 4.33: Respondent isoflavone recognition per health and lifestyle characteristic

Health and lifestyle characteristics		n*	Recognition (n = 29)	
			%	n
Incidence of chronic disease	Yes	24	25.0	6
	No	115	20.0	23
Frequency of moderate physical activity**	Rarely or never	12	0.0	0
	2-3 times over the month	9	0.0	0
	About once a week	23	17.4	4
	2-4 times a week	47	27.7	13
	More than 4 times a week	11	27.3	3
Frequency of hard physical activity**	Rarely or never	28	10.7	3
	2-3 times over the month	11	27.3	3
	About once a week	21	23.8	5
	2-4 times a week	34	20.6	7
	More than 4 times a week	8	25.0	2
Frequency of consumption of dietary supplements	Daily	79	22.8	18
	Weekly	17	11.8	2
	Monthly	8	25.0	2
	Seldom/Never	35	20.0	7
Level of health and wellness knowledge rating in relation to other adults of similar age	Well informed	24	41.7	10
	Moderately informed	91	20.9	19
	Not at all informed	24	0.0	0
Level of nutrition knowledge rating in relation to other adults of similar age	Well informed	31	35.5	11
	Moderately informed	93	19.4	18
	Not at all informed	15	0.0	0
Degree of interest in food and nutrition	Very interested	73	30.1	22
	Little interest	56	10.7	6
	No interest	10	10.0	1
Degree of interest in health and wellness	Very interested	98	29.6	29
	Little interest	36	0.0	0
	No interest	5	0.0	0

* Respondent numbers within each health and lifestyle characteristic distribution obtained from Table 4.2

** 20 of the respondents who engaged in physical activity (moderate/hard) recognised isoflavones

4.4.10.2.3 Food and beverage with added health benefits purchase behaviours and intentions

About one fifth (20%) of the respondents who very often, often or seldom/never purchased foods and beverages with added health benefits (20%, 21.1% and 21.1% for foods and 20%, 22% and 20.5% for beverages) recognised isoflavones. A slightly higher percentage of the respondents who were prepared to pay more for foods with added health benefits (22.1%) recognised isoflavones than those who were not prepared to pay more (19.4%) for it, while a slightly lower percentage of respondents who were prepared to pay more for beverages with added health benefits (20.6%) recognised isoflavones than those who were not prepared to pay more (21.1%) for it. This, however, also equated to about one fifth or 20% of the respondents in each case. One quarter of those respondents who were prepared to pay 26 to 50% more for both foods and beverages (25% respectively) recognised isoflavones. Those respondents willing to pay 50% or more for such foods and beverages did not recognise isoflavones (refer Table 4.34).

Table 4.34: Respondent isoflavone recognition per food and beverage with added health benefits purchase behaviour and intention characteristics

Purchase behaviours and intentions		n*	Recognition (n = 29)	
			%	n
Purchase frequency of foods with added health benefits	Very often	25	20.0	5
	Often	57	21.1	12
	Seldom/never	57	21.1	12
Purchase frequency of beverages with added health benefits	Very often	15	20.0	3
	Often	41	22.0	9
	Seldom/never	83	20.5	17
Acceptance to paying more for foods with added health benefits	Yes	77	22.1	17
	No	62	19.4	12
Degree of price premium of foods with added health benefits**	1-15%	57	24.6	14
	16-25%	15	13.3	2
	26-50%	4	25.0	1
	51-75%	0	0.0	0
	76-100%	1	0.0	0
Acceptance to paying more for beverages with added health benefits	Yes	68	20.6	14
	No	71	21.1	15

Table 4.34 (continued)

Purchase behaviours and intentions		n*	Recognition (n = 29)	
			%	n
Degree of price premium of beverages with added health benefits**	1-15%	54	22.2	12
	16-25%	9	11.1	1
	26-50%	4	25.0	1
	51-75%	0	0.0	0
	76-100%	1	0.0	0

* Respondent numbers within each purchase behaviour and intention characteristic distribution obtained from Table 4.3

** Number of the respondents who responded affirmative to paying more for food/beverages with added health benefits

4.4.11 Glucosinolates

4.4.11.1 Acceptance as bioactive food ingredient

Less than twenty percent (15.1%) of the respondents recognised glucosinolates. Two thirds (66.7%) had awareness, while one third (33.3%) had knowledge of it. No respondents had an understanding of it (refer Table 4.4).

4.4.11.2 Respondent recognition per respondent characteristic

4.4.11.2.1 Demographic characteristics

Less than 20% (18%) of the female respondents recognised glucosinolates, while only few (7.7% or three) of the male respondents recognised it. Nearly half (44.4%) of the respondents 61 years and older recognised glucosinolates, whereas no respondent aged 55 to 60 years had recognition of it. In the other age groups about 14% (13.6%) to 19% (19.2%) had recognition of glucosinolates. Respondents from the white population group had the highest respondent (18.5%) recognition of glucosinolates, while no respondents from the Indian or 'other' population group recognised it and some recognition occurred among the coloured (11.5% or 3 respondents) and black (5.6% or one respondent) populations groups (refer Table 4.35).

Almost half (42.9%) of those respondents who had a post graduate qualification recognised glucosinolates. However, only one respondent who had an education level of Grade 12 and a certificate recognised it. One fifth to about one quarter of the respondents with Grade 12 and

a degree, Grade 12 and diploma and Grade 11 or below recognised glucosinolates (18.2%, 21.2% and 27.3% respectively). While those respondents in the unemployed or retired occupational groups had the highest (41.2%) recognition of glucosinolates, very few (4.1% or two repondents) of those respondents in the technicians and other associates occupational groups recognised it. In the other occupational groups between 15% (15.4%) to 20% had recognition of glucosinolates. One quarter of those respondents who earned R380 001 to R490 000 per annum or were married or living together without children (25% and 23.3% respectively) recognised glucosinolates. This also formed the highest respondent percentage recognition over the annual income brackets and the marital status groups (refer Table 4.35).

Table 4.35: Respondent glucosinolate recognition per demographic characteristic

Demographic characteristics		n	Recognition (n = 21)	
			%	n
Gender	Male	39	7.7	3
	Female	100	18.0	18
Age (years)	25-34	59	13.6	8
	35-44	28	14.3	4
	45-54	26	19.2	5
	55-60	17	0.0	0
	61 and older	9	44.4	4
Population group	Black	18	5.6	1
	Coloured	26	11.5	3
	Indian	1	0.0	0
	White	92	18.5	17
	Other	2	0.0	0
Level of education	Grade 11 (Standard 9) or below	11	27.3	3
	Grade 12 (Matric)	40	7.5	3
	Grade 12 and certificate	15	6.7	1
	Grade 12 and diploma	33	21.2	7
	Grade 12 and degree	11	18.2	2
	Grade 12 and degree and diploma	22	9.1	2
	Post graduate (Masters or Doctorate)	7	42.9	3
Occupation	Unemployed/retired	17	41.2	7
	Legislators, senior officials, managers	10	20.0	2
	Professionals	18	16.7	3
	Technicians and other associate professionals	49	4.1	2
	Office clerks	39	15.4	6
	Service workers, shop and market sales workers; Craft and related trade workers; Elementary occupations	6	16.7	1

Table 4.35 (continued)

Demographic characteristics		n*	Recognition (n = 21)	
			%	n
Annual income	R490 001 and above	10	20.0	2
	R380 001-R490 000	8	25.0	2
	R270 001-R380 000	15	6.7	1
	R195 001-R270 000	21	9.5	2
	R122 001-R195 000	32	15.6	5
	R0-R122 000	53	17.0	9
Marital status	Married/Living together without children	43	23.3	10
	Married/Living together with children	48	12.5	6
	Single, living without children	37	13.5	5
	Single, living with children	10	0.0	0

* Respondent numbers within each demographic characteristic distribution obtained from Table 4.1

4.4.11.2.2 Health and lifestyle characteristics

Twenty percent (20.8%) of those respondents who suffered from chronic disease recognised glucosinolates, while few (13.9%) of those who did not suffer from chronic disease recognised it. About one quarter of those respondents who participated in moderate physical activity two to four times a week or more than four times a week recognised glucosinolates (21.3% and 27.3%respectively), while the majority (87.5%) of those respondents who participated in hard physical activity more than four times a week recognised it. A low respondent glucosinolate recognition occurred across the other moderate and hard physical activity frequencies (from no respondent to 14.3% or four respondents). Those respondents who consumed dietary supplements daily had the highest (19%) recognition of glucosinolates, followed by those respondents who consumed them weekly (17.6%) (refer Table 4.36).

Those respondents who viewed their level of health and wellness or nutrition knowledge as moderately informed had the highest recognition (18.7% and 17.2% respectively) of glucosinolates, while 20% of those respondents who viewed their degree of interest in food and nutrition and health and wellness as very interested recognised it (20.5% and 19.4% respectively). No respondents who indicated being not at all informed about nutrition or health and wellness and indicated no interest in food and nutrition or health and wellness recognised glucosinolates (refer Table 4.36).

Table 4.36: Respondent glucosinolate recognition per health and lifestyle characteristic

Health and lifestyle characteristics		n*	Recognition (n = 21)	
			%	n
Incidence of chronic disease	Yes	24	20.8	5
	No	115	13.9	16
Frequency of moderate physical activity**	Rarely or never	12	8.3	1
	2-3 times over the month	9	0.0	0
	About once a week	23	8.7	2
	2-4 times a week	47	21.3	10
	More than 4 times a week	11	27.3	3
Frequency of hard physical activity**	Rarely or never	28	14.3	4
	2-3 times over the month	11	0.0	0
	About once a week	21	4.8	1
	2-4 times a week	34	11.8	4
	More than 4 times a week	8	87.5	7
Frequency of consumption of dietary supplements	Daily	79	19.0	15
	Weekly	17	17.6	3
	Monthly	8	12.5	1
	Seldom/Never	35	5.7	2
Level of health and wellness knowledge rating in relation to other adults of similar age	Well informed	24	16.7	4
	Moderately informed	91	18.7	17
	Not at all informed	24	0.0	0
Level of nutrition knowledge rating in relation to other adults of similar age	Well informed	31	16.1	5
	Moderately informed	93	17.2	16
	Not at all informed	15	0.0	0
Degree of interest in food and nutrition	Very interested	73	20.5	15
	Little interest	56	10.7	6
	No interest	10	0.0	0
Degree of interest in health and wellness	Very interested	98	19.4	19
	Little interest	36	5.6	2
	No interest	5	0.0	0

* Respondent numbers within each health and lifestyle characteristic distribution obtained from Table 4.2

** 16 of the respondents who engaged in physical activity (moderate/hard) recognised glucosinolates

4.4.11.2.3 Food and beverage with added health benefits purchase behaviours and intentions

Those respondents who seldom/never purchased foods with added health benefits had the highest (17.5%) recognition of glucosinolates, while almost one quarter (22%) of those respondents who often purchased beverages with added health benefits recognised it. A near equal percentage of the respondents who were and those who were not prepared to pay more for foods and beverages with added health benefits recognised glucosinolates (15.6% and 16.2% respectively and 14.5% and 14.1% respectively). Those respondents who were prepared to pay 16 to 25% more for both such foods and beverages had a higher (20% and 33.3% respectively) recognition of glucosinolates than those who were prepared to pay one to fifteen percent more for such foods and beverages (15.8% and 14.8% respectively). No respondents willing to pay above 25% more for such foods and beverages recognised glucosinolates (refer Table 4.37).

Table 4.37: Respondent glucosinolates recognition per food and beverage with added health benefits purchase behaviour and intention characterisitcs

Purchase behaviours and intentions		n	Recognition (n = 21)	
			%	n
Purchase frequency of foods with added health benefits	Very often	25	8.0	2
	Often	57	15.8	9
	Seldom/never	57	17.5	10
Purchase frequency of beverages with added health benefits	Very often	15	6.7	1
	Often	41	22.0	9
	Seldom/never	83	13.3	11
Acceptance to paying more for foods with added health benefits	Yes	77	15.6	12
	No	62	14.5	9
Degree of price premium of foods with added health benefits**	1-15%	57	15.8	9
	16-25%	15	20.0	3
	26-50%	4	0.0	0
	51-75%	0	0.0	0
	76-100%	1	0.0	0
Acceptance to paying more for beverages with added health benefits	Yes	68	16.2	11
	No	71	14.1	10
Degree of price premium of beverages with added health benefits**	1-15%	54	14.8	8
	16-25%	9	33.3	3
	26-50%	4	0.0	0
	51-75%	0	0.0	0
	76-100%	1	0.0	0

* Respondent numbers within each purchase behaviour and intention characteristic distribution obtained from Table 4.3

** Number of the respondents who responded affirmative to paying more for food/beverages with added health benefits

4.4.12 Phytochemicals

4.4.12 .1 Acceptance as bioactive food ingredient

Only 29 or about one fifth (20.9%) of the respondents recognised phytochemicals. Half (55.2%) of these respondents had awareness of it. While approximately one third (34.5%) of the respondents had knowledge of it, few (10.3%) had an understanding of it (refer Table 4.4).

4.4.12.2 Respondent recognition per respondent characteristic

4.4.12.2.1 Demographic characteristics

One quarter (26%) of the female respondents recognised phytochemicals, while only few (7.7%) of the male respondents recognised it. One third (33.3%) of the respondents 61 years and older recognised phytochemicals, followed closely by those respondents aged 45 to 54 years (30.8%). One quarter of the respondents from the white population group recognised phytochemicals, while no respondent from the Indian or 'other' population groups recognised it with equally few respondents from the black (11.1% or two respondents) and coloured (11.5% or 3 respondents) population groups (refer Table 4.38).

The majority (71.4%) of those respondents who had a post graduate qualification recognised phytochemicals; however, very few respondents who had an education level of Grade 12 (matric) (5% or two respondents) or Grade 12 and a degree (9.1% or one respondent) recognised it. Almost half (47.1%) of those respondents in the unemployed or retired occupation group recognised phytochemicals followed by just over one quarter (27.8%) of the professionals group. About one fifth (20.4%) and less of the respondents in the other occupation groups recognised phytochemicals with the lowest recognition (7.7%) in the office clerks grouping. Half of those respondents who earned R380 001 to R490 000 per annum and about one quarter (25.6%) of those who were married or living together without children recognised phytochemicals with the lowest recognition among those who earned R270 001 to R380 000 per annum (13.3% or two respondents) and those single living with children (10% or one respondent) (refer Table 4.38).

Table 4.38: Respondents phytochemical recognition per demographic characteristic

Demographic characteristics		n	Recognition (n = 29)	
			%	n
Gender	Male	39	7.7	3
	Female	100	26.0	26
Age (years)	25-34	59	22.0	13
	35-44	28	10.7	3
	45-54	26	30.8	8
	55-60	17	11.8	2
	61 and older	9	33.3	3
Population group	Black	18	11.1	2
	Coloured	26	11.5	3
	Indian	1	0.0	0
	White	92	25.0	23
	Other	2	0.0	0
Level of education	Grade 11 (Standard 9) or below	11	36.4	4
	Grade 12 (Matric)	40	5.0	2
	Grade 12 and certificate	15	13.3	2
	Grade 12 and diploma	33	27.3	9
	Grade 12 and degree	11	9.1	1
	Grade 12 and degree and diploma	22	22.7	5
	Post graduate (Masters or Doctorate)	7	71.4	5
Occupation	Unemployed/retired	17	47.1	8
	Legislators, senior officials, managers	10	20.0	2
	Professionals	18	27.8	5
	Technicians and other associate professionals	49	20.4	10
	Office clerks	39	7.7	3
	Service workers, shop and market sales workers; Craft and related trade workers; Elementary occupations	6	16.7	1
Annual income	R490 001 and above	10	20.0	2
	R380 001-R490 000	8	50.0	4
	R270 001-R380 000	15	13.3	2
	R195 001-R270 000	21	19.0	4
	R122 001-R195 000	32	25.0	8
	R0-R122 000	53	17.0	9
Marital status	Married/Living together without children	43	25.6	11
	Married/Living together with children	48	18.8	9
	Single, living without children	37	18.9	7
	Single, living with children	10	10.0	1

* Respondent numbers within each demographic characteristic distribution obtained from Table 4.1

4.4.12.2.2 Health and lifestyle characteristics

One quarter* of those respondents who suffered from chronic disease recognised phytochemicals while one fifth of those who did not suffer from chronic disease recognised it. About one quarter of those respondents who participated in moderate physical activity two to four times a week (25.5%) and more than four times a week (27.3%) recognised phytochemcals, while nearly 30% (29.4%) of those respondents who participated in hard physical activity two to four times a week recognised it. No respondents participating in moderate or hard physical activity two to three times a month recognised phytochemicals. Those respondents who consumed dietary supplements monthly had the highest (37.5%) recognition of phytochemicals, followed by those respondents who consumed them daily (25.3%) with a near equal recognition among those respondents who consumed dietary supplements weekly or seldom/never (11.8% and 11.4% respectively) (refer Table 4.39).

Just less than half and a near equal percentage of those respondents who viewed their level of health and wellness or nutrition knowledge as well informed (45.8% and 45.2% respectively) recognised phytochemicals. This was followed by less than one fifth of the respondents being moderately informed about nutrition and health and wellness who recognised it (18.7% and 16.1% respectively). Just less than one third of those respondents who viewed their degree of interest in food and nutrition and health and wellness as very interested recognised it (31.5% and 29.6% respectively). Only a few respondents (n = 6) having little and no interest in food and nutrition recognised phytochemicals with no respondent having little or no interest in health and wellness who recognised phytochemicals (refer Table 4.39).

Table 4.39: Respondent phytochemical recognition per health and lifestyle characteristic

Health and lifestyle characteristics		n*	Recognition (n = 29)	
			%	n
Incidence of chronic disease	Yes	24	25.0	6
	No	115	20.0	23
Frequency of moderate physical activity**	Rarely or never	12	16.7	2
	2-3 times over the month	9	0.0	0
	About once a week	23	8.7	2
	2-4 times a week	47	25.5	12
	More than 4 times a week	11	27.3	3
Frequency of hard physical activity**	Rarely or never	28	14.3	4
	2-3 times over the month	11	0.0	0
	About once a week	21	19.0	4
	2-4 times a week	34	29.4	10
	More than 4 times a week	8	12.5	1
Frequency of consumption of dietary supplements	Daily	79	25.3	20
	Weekly	17	11.8	2
	Monthly	8	37.5	3
	Seldom/Never	35	11.4	4
Level of health and wellness knowledge rating in relation to other adults of similar age	Well informed	24	45.8	11
	Moderately informed	91	18.7	17
	Not at all informed	24	4.2	1
Level of nutrition knowledge rating in relation to other adults of similar age	Well informed	31	45.2	14
	Moderately informed	93	16.1	15
	Not at all informed	15	0.0	0
Degree of interest in food and nutrition	Very interested	73	31.5	23
	Little interest	56	8.9	5
	No interest	10	10.0	1
Degree of interest in health and wellness	Very interested	98	29.6	29
	Little interest	36	0.0	0
	No interest	5	0.0	0

* Respondent numbers within each health and lifestyle characteristic distribution obtained from Table 4.2

** 19 of the respondents who engaged in physical activity (moderate/hard) recognised phytochemicals

4.4.12.2.3 Food and beverage with added health benefits purchase behaviours and intentions

Approximately 20% of those respondents who very often, often or seldom/never purchased foods with added health benefits (20%, 19.3% and 22.8% respectively) recognised phytochemicals, while nearly one quarter of those respondents who seldom/never purchased beverages with added health benefits (24.1%) recognised it. About one quarter of those respondents who were prepared to pay more for foods or beverages with added health benefits (24.7% and 23.5% respectively) recognised phytochemicals compared to the less than one fifth of those who were not prepared to pay more (16.1% and 18.3% respectively) for it. Those respondents who were prepared to pay up to 15% more among the price premium categories for both foods and beverages had a higher (28.1% and 25.9% respectively) recognition of phytochemicals. No respondents willing to pay more than 50% for such foods and beverages recognised pytochemcials (refer Table 4.40).

Table 4.40: Respondent phytochemical recognition per food and beverage with added health benefits purchase behaviour and intention characteristics

Purchase behaviours and intentions		n	Recognition (n = 29)	
			%	n
Purchase frequency of foods with added health benefits	Very often	25	20.0	5
	Often	57	19.3	11
	Seldom/never	57	22.8	13
Purchase frequency of beverages with added health benefits	Very often	15	20.0	3
	Often	41	14.6	6
	Seldom/never	83	24.1	20
Acceptance to paying more for foods with added health benefits[c]	Yes	77	24.7	19
	No	62	16.1	10
Degree of price premium of foods with added health benefits[**]	1-15%	57	28.1	16
	16-25%	15	13.3	2
	26-50%	4	25.0	1
	51-75%	0	0.0	0
	76-100%	1	0.0	0
Acceptance to paying more for beverages with added health benefits	Yes	68	23.5	16
	No	71	18.3	13
Degree of price premium of beverages with added health benefits[**]	1-15%	54	25.9	14
	16-25%	9	11.1	1
	26-50%	4	25.0	1
	51-75%	0	0.0	0
	76-100%	1	0.0	0

* Respondent numbers within each purchase behaviour and intention characteristic distribution obtained from Table 4.3

** Number of the respondents who responded affirmative to paying more for food/beverages with added health benefits

CHAPTER FIVE
DISCUSSION

Numerous studies have indentified characteristics of health conscious consumers. The studies articulated by Robinson and Smith (2003:177) and Frewer, Scholderer and Lambert (2003:723) indicated that health conscious consumers were more likely to be more active, more affluent and better educated with women generally more health conscious than men. De Jong *et al.* (2003:280) and Kirk *et al.* (1999:72) also indicated that earlier studies have found that supplement users were more likely to be better educated females who are also non smokers, light drinkers and tend to have an adequate nutritional intake (de Jong *et al.,* 2003:280) and were more likely to perform other behaviours associated with health, including participating in exercise and adopting a healthy lifestyle (Kirk *et al.,* 1999:72). A study by Braun and Venter (2008:329) previously conducted in the Cape Town city bowl that focused on health food store customers, confirmed that the majority of these customers were dietary supplement users, also being predominately white females with a higher level of education who were between the ages of 20 to 39, while the profile of functional food users has emerged as being female, educated, of a higher age and who are in the presence of young children (Binkley, 2003:1; Verbecke, 2005:48).

The characteristics of the study respondents from the two adjoining subcouncils of the City of Cape Town are in agreement with the characteristics of the studies above pertaining to the health conscious consumer. The majority of the respondents of this study were female, younger, white, better educated with most having matriculation and a higher education qualification, were married or living together with children, participating in regular physical activity, were daily dietary supplement users and did not suffer from a chronic disease. These respondents also viewed their levels of nutrition knowledge and health and wellness knowledge as moderately informed and were also very interested in food and nutrition and health and wellness.

5.1 Consumer acceptance of bioactive food ingredients

As previously described (Chapter three), the bioactive food ingredients which the majority of the respondents were only aware of, were positioned in the emerging stage of the evolution of consumer acceptance of bioactive food ingredients and those bioactive food ingredients which the majority of respondents had knowledge or an understanding of, in the growth or mature stages respectively. Some consumers might recognise some bioactive food ingredients and only have awareness of these, while some pro-active consumers might have knowledge or even understanding of these bioactive food ingredients. However, the

surveyed ingredients were positioned according to the acceptance of the majority of the respondents.

Of those bioactive food ingredients studied, more than half (58.3%) were placed in the emerging stage of the evolution of consumer acceptance (refer Figure 5.1). Of those ingredients placed in the emerging stage of consumer acceptance, phytochemicals, plant stanols, flavonoids and isoflavones all had a low overall respondent recognition, of which the majority of the respondents also only had awareness. Glucosinolates had the lowest respondent recognition of all the ingredients, of which the majority of those respondents who recognised it, also only had awareness of it. Although functional foods had a higher overall level of respondent recognition than the mentioned ingredients, the majority of the respondents who recognised it were still only aware of it. Similarly, antioxidants had a very high level of overall respondent recognition. However, more than half of these respondents only had awareness of antioxidants and it was therefore placed in the emerging stage of consumer acceptance (refer Table 4.4). These results are similar to a previous 2005 study where a high level of recognition of antioxidants was found among randomly selected U.S. consumers, representative of the American population. However, where 72% of the consumers were aware of antioxidants only half were already incorporating them into their diet (International Food and Information Council, 2007b:10).

When comparing the consumer acceptance of the bioactive food ingredients from the current study which fell into the emerging stage to that of past studies, phytonutrients, which is commonly referred to as phytochemicals, was recognised by only one third (36.6%) of the health food store respondents in the study conducted by Braun and Venter (2008:35), while less than half (43.2%) of the health conscious respondents from a U.S. study (Miller, 2002:77) had heard of it. A higher percentage of the respondents in the above studies recognised phytochemicals compared to the current study. Fewer respondents in the study by Braun and Venter (2008:35) had heard of the individual flavonoid compounds quercetin, anthocyanidins and limonoids (10.7%, 8.9% and 7.1% respectively), than the respondents from this study who recognised the compound grouping flavonoids (32.4%). While few respondents from this study recognised isoflavones, almost half (42.9%) of the respondents from the study by Braun and Venter (2008:35) had heard of it, while two thirds (67.2%) of the respondents in the U.S. study had heard of it (Miller, 2002:77). The respondents in the studies by Braun and Venter (2008:35) and Miller (2002:77) had less than one third (32.1% and 30.9% respectively) recognition of phytoestrogens, which was still higher than the recognition of isoflavones by respondents in this study.

The remainder of the bioactive food ingredients in this study (41.6%) were placed in the growth stage of consumer acceptance (refer Figure 5.1) as the majority of the study respondents had knowledge of these ingredients. Interestingly, lycopene had a similarly low overall level of respondent recognition as plant sterols, of whom the majority of the respondents only had awareness. However, of those respondents who recognised lycopene, the majority had knowledge of it. The respondents had a high recognition of beta carotene, with more than half of them who recognised it having knowledge of this ingredient. Soy protein, probiotics and omega-3 fatty acids had the highest levels of recognition by the respondents from the studied bioactive food ingredients, of whom the majority of these respondents for all three of these ingredients had knowledge related to them (refer Table 4.4).

In the above mentioned previous studies conducted by Braun and Venter (2008:35) and Miller (2002:77) respondents from these studies had noticeably higher recognition of beta carotene (88.4% and 88.3% respectively) when compared to the respondents from the current study. The recognition of lycopene was fairly similar across the current study and the studies by Braun and Venter and Miller, with about one quarter of all respondents having recognition of this bioactive food ingredient - 25.9% for this study, 22.3% for Braun and Venter (2008:35) and 29.6% for Miller (2002:77).

No bioactive food ingredients from this study were placed in the mature stage of consumer acceptance (refer Figure 5.1) as an overall low level of respondent understanding was found across all the ingredients (refer Table 4.4). By determining the consumer awareness, knowledge and understanding of the studied bioactive ingredients, the objective of identifying the acceptance stages, represented by Witwer (1999:52), the studied ingredients fit into was achieved (refer Figure 5.1).

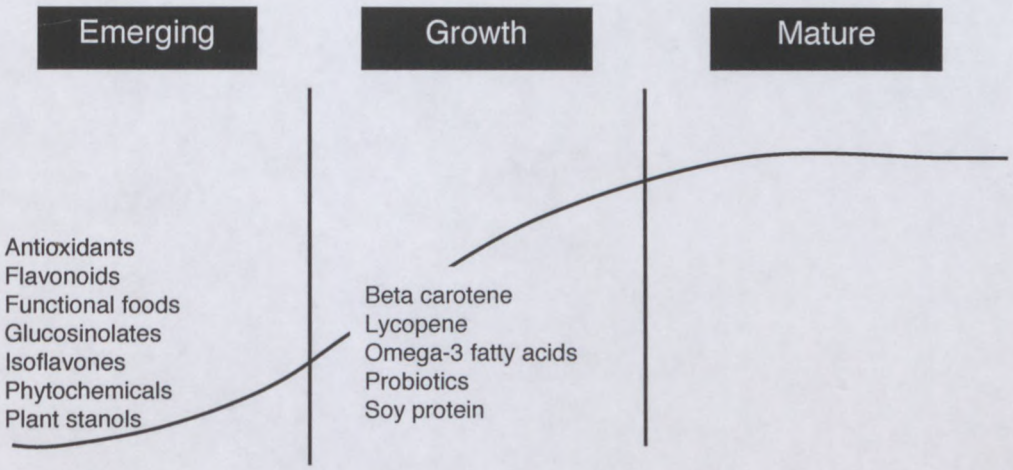

Figure 5.1: Evolution of consumer acceptance of bioactive ingredients among health conscious consumers in two adjoining subcouncils of the City of Cape Town (based on Witwer, 1999:52)

5.2 Consumer market for bioactive food ingredients

Research conducted by Witwer (1999:52) indicated that bioactive ingredients, like omega-3 fatty acids and probiotic cultures in yoghurts, and their health benefits are understood by some educated and up-to-date consumers (Witwer, 1999:52). In this study, both the acceptance of probiotics and omega-3 fatty acids were significantly influenced by three (of which two were similar, namely respondents who viewed their level of nutrition and health and wellness as moderately informed) respondent health and lifestyle characteristics and one respondent demographic characteristic each, whereas the acceptance of isoflavones, beta carotene, glucosinolates, phytochemicals and functional foods were not significantly influenced by any of the studied respondent demographic characteristics, health and lifestyle characteristics or foods/beverages with added health benefits purchase intention behaviours.

Gender, population group and marital status were the only respondent demographic factors to significantly impact the respondent acceptance of bioactive food ingredients. Gender significantly influenced the acceptance of soy protein and flavonoids with more female respondents having knowledge of soy protein than the male respondents whereas more females had awareness of flavonoids than the males. These results are in line with studies where Blandon, Cranfield and Henson (2007:2) indicated that some evidence exists that suggests that women have a greater tendency to accept functional foods and natural health products than men, while Bogue, Coleman and Sorenson (2003:8) referred to numerous dietary studies of gender that have also consistently shown that women were far more likely to conform to dietary recommendations. In the current study, age and the socio-economic factors related to educational level, occupation and annual income, did not impact the

respondent acceptance of any of the bioactive food ingredients studied. There does not seem to be a distinct age group that seems more interested in functional foods (Canada. National Institute of Nutrition, 2000:8). However, a higher socio-economic status, with reference to either educational level, occupation or annual income, have been found to impact on eating behaviour positively (Turrell *et al.,* 2004:209), reading of food labels (EdComs, 2007:13) and dietary supplement use (Agriculture and Agri-Food Canada, 2007a:4).

Significantly more respondents of the white population group had an acceptance of probiotics with more having knowledge of probiotics than the other population groups. A significant percentage of respondents who were married and living together with children also had an acceptance of omega-3 fatty acids with more having understanding of omega-3 fatty acids than those respondents who were married and living without children or who were single and living without or with children. Consumers from a U.K. study seemed to spend more time preparing fruit and vegetables when there were children living in the household (Pollard *et al.*, 2002:378), while children who eat meals together with their family also have healthier food consumption patterns (Patrick & Nicklas, 2005:85).

Respondent health and lifestyle characteristics had the greatest impact on the acceptance of the bioactive food ingredients. Of those respondents who recognised plant stanols, more respondents who did not suffer from chronic disease had awareness than those who did suffer from such disease, while more of those respondents who did suffer from chronic disease had an understanding of it than those who did not suffer from chronic disease, indicating that these respondents must know that plant stanols reduces serum cholesterol levels (shown to reduce cholesterol absorption in the intestine) (Katan *et al.,* 2003:966). The FDA has provided permission to display claims regarding the ability of plant stanols to lower the risk of heart disease (Pearl, 2001:3). Similarly to plant stanols, of those respondents who recognised probiotics and who participated in regular weekly moderate physical activity (i.e. two to four times a week) a higher percentage had understanding than those respondents who participated in moderate physical activity extensively per week (i.e. more than four times a week) or not regularly (i.e. less than twice a week).

Of those respondents who viewed their level of nutrition knowledge as moderately informed significantly more accepted probiotics, omega-3 fatty acids and antioxidants than those respondents who recognised these ingredients and viewed their level of nutrition knowledge as well or not at all informed. Similarly, of those respondents who viewed their level of health and wellness knowledge as moderately informed significantly more accepted probiotics and

omega-3 fatty acids than those who viewed their level of health and wellness knowledge as well or not at all informed.

A higher percentage of respondents who either recognised omega-3 fatty acids or antioxidants and who were very interested in food and nutrition had an understanding of these bioactive food ingredients than those who had little or no interest in food and nutrition. Among the respondents who were very interested in health and wellness and recognised these ingredients more had an understanding of these ingredients than of those respondents who had little or no interest in health and wellness and recognised these ingredients. Of those respondents who recognised lycopene and seldom or never purchased beverages with added health benefits more had understanding of lycopene than those respondents who recognised it, yet very often or often purchased these beverages.

Although those respondents who regularly participated in physical activity or who consumed dietary supplements on a daily basis had a higher overall recognition of the studied bioactive food ingredients these health and lifestyle factors did not influence the acceptance of any of the studied bioactive food ingredients. There also did not appear to be differences between the bioactive food ingredient acceptance of those respondents who were prepared to pay more for foods or beverages with added health benefits and those respondents who were not prepared to pay more for these foods or beverages. Unexpectedly, few of those respondents who purchased foods or beverages with added health benefits recognised the studied bioactive food ingredients compared to those who purchased these foods and beverages often or seldom/never. By determining the demographic, health and lifestyle characteristics and other socio-environmental influences affecting consumer awareness, knowledge and understanding of the studied bioactive ingredients, the objective of describing the consumer market for functional foods and the studied ingredients was achieved.

5.3 Study strengths and limitations

A limited number of overseas studies were found that investigated the consumer acceptance, i.e. the awareness, knowledge and understanding, of bioactive food ingredients, however, such studies were lacking locally. This limits the discussion of the results found in this study, in particular regarding a South African perspective, as it cannot be compared to a wide range of findings. Therefore these results cannot be compared to too many previous studies to determine consistency in findings. However, these findings are new and can at least be used to describe the present status of the studied bioactive food ingredients within the studied market. This addition of information to a field of food and nutrition for which limited information exists can be considered a strength of this study. These findings can also be

used by food manufacturers utilising such bioactive food ingredients and marketers of such products to determine whether their previous marketing efforts have been targeted appropriately or can indicate to them where they should be directing their efforts to increase the acceptance of these ingredients by consumers. Furthermore, as only health conscious consumers in two adjoining subcouncils of the City of Cape Town was used as respondents, the results cannot be generalised across respondents from the whole of the City of Cape Town. However, it can be assumed that if this health conscious group of respondents representing the two adjoining subcouncils were aware of most of the studied bioactive food ingredients (i.e. those ingredients in the emerging stage) and being informed of some of the studied ingredients (i.e. those ingredients in the growth stage), it can be expected that the general population could only be less aware of those ingredients in the emerging stage and not informed about those ingredients in the growth stage, besides possibly for a few pro-active consumers.

CHAPTER SIX
CONCLUSIONS

None of the studied bioactive food ingredients fell into the mature stage of consumer acceptance. This indicates that the majority of the respondents did not have an understanding of any of the studied bioactive food ingredients. Soy protein, probiotics and omega-3 fatty acids all had high levels of respondent recognition, with the majority of these respondents having knowledge of these bioactive food ingredients. This placed these ingredients in the growth stage of consumer acceptance. Soy protein, however, had an unexpected low respondent percentage understanding of it, despite this ingredient being on the market for a length of time. Respondent understanding of this ingredient was in actual fact the second lowest across all the bioactive food ingredients studied. Omega-3 fatty acids had the highest overall respondent recognition as a bioactive food ingredient and also had the highest percentage respondents with understanding. This indicates that the impact activities for this ingredient, whether education and/or marketing efforts, are efficiently supporting consumer acceptance. This ingredient, at this stage, is also the ingredient closest to move into the mature stage of consumer acceptance. Antioxidants had the second highest overall respondent recognition as a bioactive food ingredient, however it was placed in the emerging stage, indicating that education and/or marketing efforts were still required to move it across to the growth stage of consumer acceptance. Although isoflavones had an equal level of respondent recognition as phytochemicals and both had high respondent awareness, the respondents understanding isoflavones was double to that of phytochemicals. This indicates that of those few respondents who recognised isoflavones or phytochemicals, far more respondents had already obtained an understanding of isoflavones compared to those who recognised and were aware of phytochemicals. As a result it could be postulated that impact activities for isoflavones appear to be stronger and portraying clearer messages to consumers than that of phytochemicals or that activities relating to phytochemicals may be limited or even absent. Glucosinolates had the lowest respondent recognition and was the only ingredient to have no respondent understanding of it.

The results pertaining to the respondent acceptance of the bioactive food ingredients in this study are not in complete agreement of those found in other studies. Respondents in this study had a higher recognition of probiotics, omega-3 fatty acids and plant stanols than those found in the survey conducted in the U.S. by the International Food Information Council (IFIC) (International Food Information Council, 2009). The respondent level of understanding of probiotics in this study was, however, in line with a survey conducted in Ireland where 70% of the respondents were also not able to explain the term probiotics (Bogue *et al.*, 2003:31). Respondents from the current study also had a higher recognition of flavonoids as a group than the individual flavonoids studied by Braun and Venter (2008:35). Respondents from this

study furthermore had similar recognition of antioxidants than those respondents from the U.S. IFIC survey and similar recognition of lycopene than those respondents from the studies by both Braun and Venter (2008:35) and Miller (2002:77). Respondents from this study had lower recognition of isoflavones, beta carotene and phyotchemicals than those respondents from the studies by Braun and Venter (2008:35) and Miller (2002:77). Unfortunately, no clear results were reported in previous studies that reviewed the consumer acceptance of soy protein, glucosinolates and functional foods as bioactive food ingredients or foods.

While only four significant associations/differences were evident between the bioactive food ingredient acceptance and the respondent demographic characteristics (soy protein and flavonoids with gender, probiotics with population groups and omega-3 fatty acids with marital status) and only two associations/differences evident between the respondent food/beverage with added health benefits purchase behaviour and intention characteristics (probiotics and lycopene each with purchase frequency of beverages with added health benefits), there were ten significant associations/differences between the bioactive food ingredient acceptance and the respondent health and lifestyle characteristics (probiotics with frequency of moderate physical activity; probiotics, omega-3 fatty acids and antioxidants with level of nutrition knowledge; probiotics and omega-3 fatty acids with health and wellness knowledge; antioxidants with degree of interest in health and wellness; omega-3 fatty acids and antioxidants with degree of interest in food and nutrition and plant stanols with incidence of chronic disease). This indicates that consumer health and lifestyle characteristics should be greatly considered and used to target the activities for bioactive food ingredients acceptance.

While respondent food/beverage with added health benefits purchase behaviour and intention characteristics were found to have little significance on the respondent acceptance of bioactive food ingredients (except for probiotics and lycopene each with purchase frequency of beverages with added health benefits), this study indicated that women had acceptance of some bioactive food ingredients (i.e. soy protein and flavonoids) along with white respondents (i.e. probiotics) and respondents who were married and living together with children (i.e. omega-3 fatty acids). Respondents who did not suffer from chronic disease or those who participated in regular moderate physical activity each week (i.e. two to four times a week) also had acceptance of some studied bioactive food ingredients (i.e. plant stanols and probiotics respectively). Respondents who viewed their level of nutrition and health and wellness knowledge as moderately informed or those who were very interested in food and nutrition and health and wellness also had greater acceptance of some studied bioactive food ingredients (i.e. probiotics, omega – 3 fatty acids and antioxidants).

Omega-3 fatty acids is the bioactive food ingredient studied that is closest to moving into the mature stage of the consumer acceptance evolution of bioactive food ingredients. In the current study it was the bioactive food ingredient influenced by the most consumer acceptance impact factors studied (i.e. as demographic factor, gender and the health and lifestyle characteristics, perceived nutrition knowledge, health and wellness knowledge and interest in food and nutrition). The acceptance of probiotics was also driven by more acceptance influence factors than soy protein. While soy protein was only influenced by gender as a demographic consumer acceptance impact factor, probiotics was influenced by population as a demographic factor and health and lifestyle characteristics relating to frequency of physical activity and perceived nutrition and health and wellness knowledge. The lack of acceptance factors for soy protein may support the fact that it could not be placed in the mature stage of consumer acceptance despite this ingredient being on the market for a length of time. Even though antioxidants had a high overall consumer recognition, it still fell into the emerging stage of consumer acceptance as most consumers were only aware of this ingredient. Antioxidants did however have various consumer acceptance impact factors relating to health and wellness. Consumers who recognised antioxidants were shown to have greater interest in nutrition and health and wellness as well as greater perceived nutrition knowledge. These consumer acceptance impact factors highlight the fact that consumers have interest in this ingredient and if this interest is supported by marketing activities to capitalise on their interest and ultimately cultivate their knowledge, antioxidants could move into the growth stage of consumer acceptance rather sooner than later.

The overall respondent characteristics to drive the consumer acceptance evolution of bioactive food ingredients identified in this study were the health and lifestyle characteristics, particularly consumers' perceived knowledge of nutrition and health and wellness and their degree of interest in nutrition. In order for respondents to become informed, they need to show some degree of awareness of and interest in these ingredients to the extent that they can at least be considered to be moderately informed. Many consumers recognise the link between nutrition and health and seem interested in the concepts of neutraceuticals and functional foods (Kalaitzandonakes, 2000:2), however there are still many that do not (Reinhardt, 2005:21). Marketers need to awaken this interest in consumers in order to sway their acceptance of the bioactive food ingredients, in particular of those bioactive food ingredients where the health and lifestyle characteristics that have as yet made no impact on consumer acceptance, including isoflavones, beta carotene, glucosinolates, phytochemicals and functional foods.

Plant stanols had an unexpected association between acceptance as a bioactive food ingredient and the respondent's incidence of chronic disease. Those respondents who

suffered from chronic disease had a higher understanding of plant stanols compared to those respondents who did not suffer from chronic disease. This finding could indicate that the marketing activities for this ingredient are effective in increasing the knowledge and understanding of the effect of plant stanols on health for respondents with chronic disease.

Although nearly all the respondents were interested in food and nutrition and health and wellness, these results should be seen in context of a health conscious consumer group. Many respondents were purchasing foods with added health benefits but less where purchasing beverages with health benefits, while approximately half of these respondents were prepared to pay more or somewhat more (most respondents were only prepared to pay between one to fifteen percent more) for foods and beverages with added health benefits. The purchase frequency of beverages with added health benefits as an impact factor for lycopene on its acceptance as a bioactive food ingredient differed to that of the other ingredients in that of those respondents who seldom/never purchased beverages with added health benefits and recognised lycopene more had an understanding of lycopene than of those respondents who very often or often purchased these beverages.

Hawkins *et al.* (2007:253) described steps in the new product adoption process that is suited to consumers purchasing commodity items like food. These steps highlights the fact that interest plays an important foundation role in product adoption by consumers. For the evaluation stage to occur it must tag on consumer awareness and interest (refer Figure 2.3 in the Literature study), which for this study implicates an awareness of and an interest in functional foods and/or bioactive food ingredients before a trial purchase is to follow and such purchasing adopted. This can be used to describe the movement of bioactive food ingredients from one stage of consumer acceptance to the next. In order for more consumers to recognise and move from having awareness to knowledge to understanding, there is a degree of interest by the consumers that is required. The consumers from this study have already shown that there is a degree of interest in health and wellness, which presents itself as an opportunity for marketers to capitalise on in order to educate consumers about bioactive food ingredients.

Those marketers who want a quick win in targeting the consumer market who have the greatest interest in and acceptance of bioactive food ingredients should target females, those respondents from the white population groups, who are married or living together with children and have a greater interest in food and nutrition and health and wellness. COI Communications who conducted research on behalf of the FSA in 2007, gathered information from reports from English speaking countries. It was found that consumers who read food labels are typically those wanting to lead a healthy, balanced lifestyle (Edcoms,

2007:15). Generally, women, particularly mothers, with higher education levels and higher incomes are most likely to read food labels and packaging. The reasons for reading food labels and packaging also include children being present in the household (EdComs, 2007:11). However, in order to grow the market, marketers need to spend extra effort on targeting males and consumers who are older or come from population groups other than the white population or consumers from single households without children, those who do not participate in regular physical activity or do not show an interest in food and nutrition or health and wellness or perceive their level of food and nutrition and health and wellness knowledge as uninformed. By capturing the consumers from these markets, food industries and marketers can make the biggest impact in increasing the awareness, knowledge and understanding of bioactive food ingredients and an ultimate purchase.

CHAPTER SEVEN
RECOMMENDATIONS

In order for any ingredient to move from the emerging stage to the growth stage or the growth stage to the mature stage of consumer awareness, the awareness of and interest in these ingredients needs to increase through impact activities, such as consumer education and advertising. For those ingredients in the emerging stage of consumer acceptance, food manufacturers or marketers still need to focus on the bioactive food ingredient education of the consumers for them to become informed. Those proactive consumers in each stage who actively seek out information to learn more about the ingredients and thereby increase their awareness, knowledge or understanding are the first consumers to move into the growth stage from the emerging stage or from the growth stage to the mature stage. However, the majority of the consumers will need a lot of bioactive food ingredient education to increase their awareness, along with their knowledge and understanding before the respective ingredients can each move into the next consumer acceptance stage. Before an ingredient is ready to be included as part of a functional food, the health benefits of this ingredient needs to reach substantial levels of interest and understanding by more consumers than just those proactive consumers (Braun & Venter, 2008:31). A basic list of possible ways to communicate the benefits of health promoting foods to consumers was compiled after surveys were conducted among American adults between 1998 and 2000. This included the importance of the education of health professionals and marketers to equal the consumer knowledge; focussing on the positive aspects of eating and not focussing on what not to eat; allowing consumers to better understand functional foods by placing them in the perspective of conventional foods and backing up claims on functional foods with scientific evidence and ensuring the communication given is accurate (Schmidt, 2000:17).

Marketing activities by food manufacturers or the education regarding the health benefits of consuming bioactive food ingredients by healthcare providers or through the media will raise interest in food and nutrition and health and wellness along with increasing consumer's awareness of these ingredients and in particular their knowledge of nutrition and health and wellness. Only those proactive consumers who have an interest in bioactive food ingredients independently actively seek out more information about them and thus increase their knowledge and furthermore, understanding of these ingredients. Most consumers are only just becoming aware of the benefits of some bioactive food ingredients and food companies and marketers need to continue to conduct research, market these ingredients and educate consumers in order to promote these bioactive food ingredients (Witwer, 1999:52).

Charlton and co-authors (2004:802) found that 41.4% of the respondents from a study in S.A. across black urban women had received nutritional information through the radio and television once a month or more, while 35.1% responded that they had gathered nutritional information from magazines and 32.3% from food labels (Charlton *et al.,* 2004:804). Gilbert (2000:24) suggested that health claims and product information should be available to the consumer in various formats including product labels and the media (Gilbert, 2000:24). The acceptance of functional foods by consumers is affected by their access to, use and understanding of information regarding these foods, generally accessible through product labels (Blandon *et al.*, 2007:2). Food manufacturers and marketers should therefore focus on the print media as well as the audio-visual media, such as television and radio, in order to capture the majority of their target market and not just a segment of it for their impact activities. Information regarding health claims is conveyed to consumers primarily through product labels, as well as point-of-purchase displays, friends, family, fitness-professionals and educational campaigns (Wansink & Cheney, 2005:387). Nutrition labels are often perceived as unclear or misleading by consumers and it has become the responsibility of other sources of information (government, health professionals, medical practitioners) to provide integrity to health claims (Wansink & Cheney, 2005:388). Consumers are more likely to understand health claims that are short and simple, with clear, understandable use of language (Edcoms, 2007:39). They are also more likely to notice, understand and believe a health claim when a short claim is represented on the front of label/pack and a longer explanation on the back of the product (Wansink & Cheney, 2005:393).

The respondent bioactive food ingredient understanding finding between plant stanols and respondents who suffered from chronic disease should be further investigated and the impact activities used in the past for this ingredient considered. The indication that more respondents who did suffer from chronic disease had understanding than those who did not shows that the impact activities for this ingredient has worked and increased the level of knowledge and understanding for the market at which this product would have been targeted.

The lack of progression of consumer acceptance of soy protein by respondents should be studied to determine how impact activities could sufficiently get information across to consumers in order to increase their knowledge of this ingredient as it has been on the market for some time already. Similarly, antioxidants had a very high overall respondent acceptance. However, with more than half of these respondents only having awareness of it, there is an indication that impact activities targeted towards consumers for the improvement of knowledge about this ingredient in the market needs to be considered for adaptation

and/or improvement to not only raise the consumer awareness of antioxidants but also to provide for consumers becoming informed about antioxidants.

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APPENDIX A:

Reduction of disease risk claims

APPENDIX A: REDUCTION OF DISEASE RISK CLAIMS (South Africa. Department of Health, 2007:112-114)

	FOOD CHARACTERISTICS	PERMITTED WORDING OF CLAIM
1.	Calcium and osteoporosis • 'High' in calcium and 'source of' magnesium; • Phosphorus content may not exceed calcium content	Regular exercise and a healthy diet with enough calcium may help susceptible individuals maintain good bone health and may reduce their risk of osteoporosis later on life.
2.	Sodium and hypertension • Low sodium	Diets low in sodium may reduce the risk of high blood pressure, a disease associated with many risk factors, in some individuals
3.	Dietary saturated fat and cholesterol and the risk of coronary heart disease • Low saturated fat; • Low cholesterol; • Low total fat	While many factors affect heart disease, diets low in total fat, saturated fat and cholesterol may reduce the risk of heart disease.
4.	Fibre-containing grain products, fruit and vegetables a and cancer • grain products, fruits or vegetable that are a source of dietary; • Trans fatty acid free; • With total fat profile in line with the WHO's Dietary Goals as referred to in the Guidelines	Low fat diets, rich in fibre-containing grin products, fruits and vegetables may reduce the risk of some types of cancer, a disease associated with many factors.
5.	Fruit, vegetables and grain products that contain fibre, particularly soluble fibre, and the risk of coronary heart disease • Fruit, vegetable or grain products that are a source of dietary fibre that has an effect on glucose and lipid absorption; • Low saturated fat;low cholesterol; • Trans fat free; • Contain no fat that has been onterestified and • With a total fat profile in line with the WHO's Dietaey goals as referred to in the Guidelines	Diets low in saturated fat and cholesterol and rich in fruit, vegetables and grain products that contain dietary fibre that has effects on glucose and lipid absorption may reduce the risk of heart disease
6.	Fruit and vegetables and cancer • Fruit or vegetables; • Low total fat; • High in vitamins A or C or dietary fibre	Low fat diets rich in fruit and vegetables and which contain dietary fibre, vitamins A and C may reduce the risk of some types of cancer, a disease associated with many risk factors
7.	Folate and neural tube defects • High in folic acid	Women who consume adequate amounts of folate or folic acid, a B vitamin, daily throughout their childbearing years may reduce their risk of having a child with a birth defect of the brain ad spinal cord or cleft palate. Such birth defects, while not widespread are very serious. They can have many causes. Adequate amounts of folate can be obtained from diets rich in fruits, dark green leafy vegetables, legumes, fortified grain products, fortified foods a nutritional supplement
8.	Plant sterol esters and plant stanol esters and coronary heart disease • Foodstuffs that contain at least 0.65g plant sterols or 1.7g plant stanol esters per serving; • Low in saturated fat; and • Low in cholesterol • Foodstuffs shall bear a statement on the main panel in capital letter at least 3mm in height to indicate that the particular foodstuff is suitable for the intended target group only	Diets low in saturated fat and diets low in saturated fat and cholesterol that include two servings of food that provide a daily total of at least 1.3g plant sterols or 3.4g of plant stanol esters in two meals may reduce the risk of heart disease by lowering cholesterol

9.	Oats and coronary heart disease At least 60g whole oats (rolled oats), oatmeal or 40g oat bran, without enrichment, that provides 3g or more beta glucan fibre per single serving. The amount of beta glucan fibre per recommended serving shall be indicated in the table with nutritional information	3g beta glucan fibre from 60g whole oats daily, or 40g oat fibre, as part of a diet low in saturated fat and cholesterol, may reduce the risk of coronary heart disease.
10.	Sugar alcohols and dental caries The sugar alcohol should be the main sweetener in the foodstuff and should be a permitted sugar alcohol in terms of the Sweetener Regulations promulgated under Act No. 54 of 1972	Frequent eating of foods high sugars and starches that are retained in the teeth between meals can promote tooth decay. The sugar alcohol(s) [name sugar alcohol(s)] used as a sweetener in (name the product) does(do) not promote tooth decay/dental caries
11.	Psyllium fibre and coronary heart disease • 1.7 fibre that has effects on glucose and lipid absorption per • low saturated fat; • low cholesterol • and low total fat	Diets rich in fibre, such a psyllium, part of a diet low in saturated fat, cholesterol, and total fat, may reduce the risk of heart disease
12.	Whole grain and coronary heart disease and cancer • foodstuffs that contain at least 51% whole grains by weight as the main ingredient; • that provide a minimum of 16f of whole grains per serving; • 2.8g fibre per 50g serving; • are low in total fat; • low in saturated fat; and • low in cholesterol	Diets rich in whole-grain foods and other plant foods and low in fat and cholesterol may reduce the risk of heart disease and certain cancers
13.	Soy protein and heart disease • foodstuffs that contain at least 6.25g of soy protein per serving; • and are low in saturated fat; and • low in cholesterol	Diets which contain at least 25g soy protein (4 servings) daily and which are low in saturated fat and cholesterol, may reduce the risk of heart disease by lowering cholesterol levels
14.	Walnuts and heart disease • 45g serving of raw walnuts	Eating 45g walnuts per day as part of a diet low saturate fat and cholesterol may reduce the risk of coronary heart disease
15.	Folate, vitamin B_6 and B_{12} and coronary heart disease • at least 50% of the MDR for persons 4 years and older for folic acid, vitamin B_6 and vitamin B_{12} per single serving	The daily intake of at least 400mcg folic acid, 1.7mg vitamin B_6 and 2.4mcg vitamin B_{12} will assist in reducing plasma homocysteine levels. Elevated plasma homocysteine levels are associated with an increased risk of heart disease. X will provide at least half of the required amounts all these vitamins per serving.
16.	Omega-3 fatty acids and coronary heart disease 850mg of EPA and DHA per single serving	A daily intake of 850mg EPA and DHA omega-3 fatty acids from fish oil or fatty fish may protect against and reduce the risk of coronary heart disease
17.	Olive oil and coronary heart disease 100% pure extra virgin and virgin olive oil	Eating about 2 tablespoons (23g) of olive oil daily may reduce the risk of coronary heart disease due to the monounsaturated fat in olive oil. To achieve this possible benefit, olive oil is to replace a similar amount of saturated fat and not increase the total number of kilojoules you eat in a day.
18.	Potassium, blood pressure and stroke Foods that naturally contains at least 350mg potassium per serving and which are low in sodium	Diets containing foods that naturally contain at least 350mg potassium and which are low in sodium may reduce the risk of high blood pressure and stroke

APPENDIX B:

Research questionnaire

Cape Peninsula
University of Technology

FACULTY OF APPLIED SCIENCES

DEPARTMENT OF FOOD AND AGRICULTURAL SCIENCES

PROGRAMME: CONSUMER SCIENCE: FOOD AND NUTRITION

Confidential

SURVEY QUESTIONNIRE

No studies have investigated the awareness, knowledge and understanding of certain foods and food components by consumers in the Cape Town area. Such information is important for food product developers and marketers when considering the development and marketing of such foods or foods containing these components as ingredients.

Thank you for agreeing to participate in this survey on *Bioactive food ingredient acceptance of health conscious consumers in two adjoining subcouncils of the City of Cape Town*. Your questionnaire is of importance to this study.

- The questionnaire should take about 10 minutes of your time to complete.
- All information is treated as confidential and the researcher undertakes not to reveal any individual information that appears in this questionnaire. Your name is not asked anywhere and we are only interested in your honest answers.

INSTRUCTIONS:

Encircle the number in the block next to the response category that corresponds best with your answer, or where there is a line, please write the appropriate answer.

Example:

Office use

1) Your gender?

Male	(1)
Female	2

☐ 1

6.1) Calcium

Yes	1
No	(2)

Associated aspects: Stronger bones; dairy products; milk; osteoporosis

☐ 2

Date: April 2009

☐☐☐

Section A: Response data collection sheet

Please read the 12 words/terms listed below and indicate for each whether you have heard of it or not.
If you indicate yes, list anything, if any, that you associate with the provided word/term. Write down as much as you can think of about the provided word/term. There are no incorrect answers. Please write clearly.

For example:
A) Calcium

Yes	1
No	2

Associated aspects: Stronger bones; dairy products; milk; osteoporosis

Office use

1 Soy protein

Yes	1
No	2

Associated aspects:

Office use: 1, 2

2 Probiotics

Yes	1
No	2

Associated aspects:

Office use: 3, 4

3 Omega 3 fatty acids

Yes	1
No	2

Associated aspects:

Office use: 5, 6

4 Isoflavones

Yes	1
No	2

Associated aspects:

Office use: 7, 8

5 Lycopene

Yes	1
No	2

Associated aspects:

Office use: 9, 10

6 Beta carotene

Yes	1
No	2

11
12

Associated aspects:

7 Glucosinolates

Yes	1
No	2

13
14

Associated aspects:

8 Flavonoids

Yes	1
No	2

15
16

Associated aspects:

9 Sterols

Yes	1
No	2

17
18

Associated aspects:

10 Antioxidants

Yes	1
No	2

19
20

Associated aspects:

11 Phytochemicals

Yes	1
No	2

21
22

Associated aspects:

12 Functional foods

Yes	1
No	2

23
24

Associated aspects:

Section B: Lifestyle data collection

Do you suffer from any chronic diseases? (Chronic diseases include cardiovascular disease, cancer, diabetes, arthritis and obesity which are premanent or persisting that require long term supervision, observation and care.)

Yes	1	
No	2	1

Do you participate in regular physical activity? If yes, continue with Question 2.1 to 2.3 below.

Yes	1	
No	2	2

2.1 Over the last month, how often have you taken part in moderate physical activity (e.g. golf, light sports or physical exercise, gardening, taking long walks)?

Rarely or never	1	
2 - 3 times over the month	2	
About once a week	3	
2 - 4 times a week	4	
More than 4 times a week	5	3

2.2 Over the last month, how often have you taken part in hard or very hard physical activity (e.g. jogging, running, swimming, aerobics, strenuous sports)?

Rarely or never	1	
2 - 3 times over the month	2	
About once a week	3	
2 - 4 times a week	4	
More than 4 times a week	5	4

2.3 How does the amount of activity you have done over the last month compare with your average / usual physical activity during a 'normal month'?

More active	1	
Less active	2	
About the same	3	5

How often do you consume any dietary supplements such as amino acids, vitamins, minerals, botanicals and/or plant substances?

Daily	1	
Weekly	2	
Monthly	3	
Seldom/Never	4	6

How often do you purchase foods with added health benefits (e.g. foods enriched with vitamins and minerals or other such components)?

Very often	1	
Often	2	
Seldom/Never	3	7

How often do you purchase beverages with added health benefits (e.g. beverages enriched with vitamins and minerals or other such components)?

Very often	1	
Often	2	
Seldom/Never	3	8

Are you prepared to pay more for foods with added health benefits? If yes, answer question 6.1.

Yes	1	
No	2	9

6.1 What percentage more are you prepared to pay for foods with added health benefits? (Please indicate)

_____ % 10

Are you prepared to pay more for beverages with added health benefits? If yes, answer question 7.1.

Yes	1	
No	2	11

7.1 What percentage more are you prepared to pay for beverages with added health benefits? (Please indicate)

_____ % 12

How informed do you view your level of nutrition knowledge?

Well informed	1	
Moderately informed	2	
Not at all informed	3	13

How informed do you view your level of health and wellness knowledge?

Well informed	1	
Moderately informed	2	
Not at all informed	3	14

APPENDIX C:

Letter of ethical clearance

Cape Peninsula
University of Technology

Ms K O'Connor
7 Birkenhead Drive
Plattekloof Glen
7460

25 March 2009

Dear Ms O'Connor

Bioactive food ingredient acceptance of health conscious consumers in two adjoining sub councils of the City of Cape Town.

Thank you for addressing the issues raised by the Ethics Committee regarding the above research project.

Final ethical approved is hereby granted to proceed with the project. The committee wishes you success with your research.

Yours sincerely,

Prof AJS Benade
Chairperson .
Research Ethics Committee
Faculty of Applied Sciences