

# AWARENESS, KNOWLEDGE, UNDERSTANDING AND READINESS TO ADOPT BIOACTIVE FOOD INGREDIENTS AS PART OF FUNCTIONAL FOOD CONSUMPTION BY HEALTH-CONSCIOUS CONSUMERS OF THE CITY OF CAPE TOWN

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## OPSOMMING

Suid-Afrikaanse verbruikers volg toenemend 'n gesonder lewenstyl. Dit dra by tot verbruikersbelangstelling in die bioaktiewe bestanddele in voedsel (en voedingaanvullings) wat gesondheid bevorder. Die doel van hierdie studie was daarom om die volgende vas te stel: (i) die bewustheid, kennis en insig tov tien bioaktiewe voedselbestanddele deur gesondheidsbewuste verbruikers in Kaapstad en (ii) die verband tussen die respondente se bewustheid, kennis en insig tov die bioaktiewe bestanddele en hul belangstelling in en kennis van voeding en gesondheid.

Een honderd nege-en-dertig respondente uit twee subrade het aan die opname deelgeneem. Hulle was lede van 'n gimnasium en/of gebruikers van voedingaanvullings. Die respondente verteenwoordig gesondheidsbewuste verbruikers en 'n middel-tot-hoër sosio-ekonomiese segment van die Metropolitaanse Raad van Kaapstad. 'n Getoetste vraelys is gebruik om inligting van die respondente te bekom tov hul demografiese profiel, gesondheid en lewenstyl, asook hul bewustheid en kennis van en insig in stimuluswoorde wat die tien geselekteerde bioaktiewe voedselbestanddele verteenwoordig het. Laasgenoemde is bepaal deur gebruik van die vryewoord-assosiasietegniek.

Om die woordassosiasieresponse op die bioak-

tiewe voedselbestanddele korrek te kategoriseer as bewustheid, kennis of insig, is die triangulasiemetode van data-analise gebruik, gegrond op die vakkennis van drie kategoriseerders. Om die verbruikersgereedheid om die bioaktiewe voedselbestanddele te aanvaar te bepaal, is die responsfrenkwensies van die bewustheid, kennis en insig klassifikasies daarvan gebruik. Dit is gekombineer met die Pearson  $\chi^2$ -analise om die verband/verskil te bepaal tussen die respondente se bewustheid en kennis en insig in die bioaktiewe voedselbestanddele en hul belangstelling in en kennis van voeding en gesondheid. Verbruikersbelangstelling en kennis verteenwoordig stappe in die aanvaardingsproses van nuwe produkte en verbruikers se gereedheid om bioaktiewe voedselbestanddele te aanvaar.

Die respondente se demografiese, gesondheid en lewenstyl profiel verteenwoordig 'n gesondheidsbewuste groep. Die meerderheid respondente het omega-3-vetsure (97,1%), antioksidante (87,1%), probiotika (84,9%), sojaproteïen (83,5%) en beta-karoteen (68,3%) onder die gelyste bioaktiewe voedselbestanddele herken. Ten spyte van die hoë herkenning van omega-3-vetsure, probiotika en sojaproteïen, het die respondente hoofsaaklik kennis (40,7%, 46,5% en 61,2% onderskeidelik) oor die voedselbestanddele gehad. 'n Onverwags lae persentasie (5,2%) respondente het sojaproteïen verstaan, hoewel die bestanddeel deur talle respondente herken is en reeds geruime tyd op

die mark is. Ongeveer 'n derde (32,6%) van die respondente van diegene wat omega-3-vetsure herken het, verstaan dit wel. Betekenisvolle verskille ( $p < 0,05$ ) is verder gevind tussen die respondente se bewustheid, kennis en insig van omega-3-vetsure en hul belangstelling in en kennis van voeding en gesondheid. Dit plaas omega-3-vetsure die naaste aan die verbruiker se gereedheid tot aanvaarding van die gelyste bioaktiewe voedselbestanddele. Dit het ook die respondente se gereedheid vir die aanvaarding van omega-3-vetsure onderskei van dié van sojaproteïen en beta-karoteen wat nie betekenisvol ( $p > 0,05$ ) deur enigeen van die faktore beïnvloed is nie.

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#### INTRODUCTION

The concept of functional food is based on the hypothesis that the risk of lifestyle-related diseases can be reduced through consumption of foods that support and transform various biological activities in the body and, in so doing, help sustain a state of health (Arai *et al*, 2002). This has resulted in an expanding interest in functional foods, or foods with bioactive ingredients, as people turn to food to provide both basic nutrition as well as disease-preventative benefits (National Institute of Nutrition, 2000:1). This also holds true for South African consumers. South African consumers are becoming more concerned about healthier lifestyles as well as acquiring an improved understanding of nutrition and self-medication for disease prevention (Agriculture and Agri-Food Canada, 2007:3). South Africa (SA) was identified as an emerging market for functional foods in a global online survey by AC Nielsen in 2005 (Nielsen, 2005:9).

Hawkins *et al* (2007:253) presents the new product adoption process of purchasing commodity items like food in five stages. New products, such as functional foods, will firstly require consumers to become aware of them (stage 1: awareness) and be interested in or about them (stage 2: interest). After becoming interested, consumers seek information and evaluate this gained information (stage 3: evaluation) for a trial purchase of the new product to occur (stage 4: trial) and it being adopted (stage 5: adoption) (Kotler & Armstrong, 2001:200; Hawkins *et al*, 2007:546). Such seeking of information results in the attainment of knowledge (Merriam-Webster's Online Dictionary, 2009).

Wansink *et al* (2005) proposed that the knowledge a consumer has of a bioactive food ingredient determines his or her readiness to consume and adopt it into their diets. Consumers who do not have knowledge of functional foods and their bioactive ingredients are not like-

ly to purchase or consume them. Although many factors influence the consumer decision making process in purchasing (Schiffman & Kanuk, 2000:443) the initial awareness and interest of consumers and resultant seeking of information and gaining in knowledge of a food and/or its ingredients are fundamental factors to successfully introduce new food products into the market. The resultant understanding of what benefits the consumed functional food and its bioactive ingredient(s) have advance the consumer readiness for consumption of the functional food and its bioactive ingredient(s) (Witwer, 1999; Wansink *et al*, 2005). It is therefore important to determine the consumer awareness, knowledge and understanding of bioactive food ingredients (refer Table 1) to ascertain the readiness of the consumer market to adopt foods (and dietary

supplements) containing these ingredients in SA. This is important when launching new products, such as functional foods, into the market to prevent product failures.

This study had two aims:

(i) To determine the awareness, knowledge and understanding (i.e., readiness for a trial purchase and possible adoption) of ten bioactive food ingredients by health-conscious consumers in the City of Cape Town.

(ii) To determine the associations between the awareness, knowledge and understanding of each bioactive food ingredient by the respondents and their perceived interest in, and knowledge about, food and nutrition and health and wellness.

**TABLE 1: CLARIFICATION OF RESEARCH TERMS AND CONCEPTS**

Term	Description*	Description within research method
Adopt (verb) Adoption (noun)	'To take up and practice or use' 'The state of being adopted'	Readiness of bioactive food ingredient to be adopted as represented by the awareness, knowledge and understanding of the ingredient (Witwer, 1999; Wansink <i>et al</i> , 2005)
Aware (adjective) Awareness (noun)	'Knowing that something exists' 'Having or showing realisation'	Respondents had heard of the bioactive food ingredient stimulus word, but indicated no knowledge / understanding of the bioactive food ingredient (in relation to the proposed 'hierarchy of nutritional knowledge' of Wansink <i>et al</i> (2005) as 'no knowledge')
Bioactive food ingredients	Ingredients in food or food components that deliver biological benefits to health when consumed (Witwer, 1999:50)	The bioactive ingredients chosen in alphabetical order are antioxidants, beta-carotene, flavonoids, glucosinolates, isoflavones, lycopene, omega-3 fatty acids (or omega-3 as they are usually referred to), plant sterols (or stanols), probiotics and soy protein.
Knowledge (noun)	'The fact or condition of having information'	Respondents correctly listed a food source and/or attribute of the bioactive food ingredient (in relation to the proposed 'hierarchy of nutritional knowledge' of Wansink <i>et al</i> (2005) as 'food-specific attribute knowledge')
Recognition (noun)	'Knowledge or feeling that something present has been encountered before'	Respondents had heard of the bioactive food ingredient stimulus word
Understanding (noun)	'A mental grasp / Comprehension'	Respondents correctly indicated a health connection or benefit of consuming the bioactive food ingredient in addition to a food source and/or attribute of that bioactive food ingredient (in relation to the proposed 'hierarchy of nutritional knowledge' of Wansink <i>et al</i> (2005) as 'consumption consequences knowledge' in addition to 'food-specific attribute knowledge')

\* Source: Merriam-Webster's Online Dictionary, except otherwise stated

## METHOD AND MATERIALS

### Ethical approval

This study was conducted after approval of the research proposal by the Faculty of Applied Sciences Research Committee at the Cape Peninsula University of Technology and ethical clearance by the Faculty of Applied Sciences Research Ethics Committee, had been obtained.

### Instrument and application

A cross-sectional descriptive study of a quantitative nature was used. The data was collected through a survey, using a pilot-tested questionnaire. Nine multiple-choice questions that gathered information from the respondents regarding their demographic, health and lifestyle characteristics were used for confirmation of the respondent group as a health-conscious consumer group. Four multiple-choice questions related to the respondent's own perceived interest (with the responses as 'very interested', 'little interest' and 'no interest') and knowledge (with the ratings as 'well informed', 'moderately informed' and 'not at all informed') of food and nutrition and health and wellness were used for ascertaining stages 2 ('interest') and 3 ('evaluation' or attainment of knowledge) of the new product adoption process. These four questions related to the respondent's perceived interest ( $n = 2$ ) and knowledge ( $n = 2$ ) represented the respondent's readiness to adopt the bioactive food ingredients investigated.

The awareness, knowledge and understanding of the ten bioactive food ingredients by the respondents were evaluated (refer Table 1) using a process of 'associated group analysis'. This followed the indication whether they had heard of the listed bioactive food ingredient ('recognition') ( $n = 10$  'yes'/'no' indications). The fundamental process on which associative group analysis is based, is to evaluate the re-

sults obtained across a diverse group of respondents through the process of free word association. In free word association the respondents write down as many associated free words as possible in response to the provided stimulus words (Grenard, 2003:9). Bioactive food ingredients ( $n = 10$  open-ended format questions) were used in this case. The process of free word association was used rather than providing responses linked to attribute and consumption consequences in the format of multiple-choice questions pertaining to each bioactive food ingredient. As no other method was incorporated to evaluate the awareness, knowledge and understanding of the bioactive food ingredients by the respondents the process of free word association was selected to provide a more objective and less subjective provision and evaluation of the information. As respondents are not openly asked about their opinions and values, nor guided to an answer, the associative group analysis is reasonably free of bias (Grenard, 2003:9). The ten bioactive ingredients chosen as stimulus words (Table 1) are 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 (McKevith *et al*, 2003:261).

To categorise the word association correctly (awareness, knowledge or understanding) more than one investigator was used to achieve inter-rater agreement in the information categorisation. The information gathered was categorised according to subject knowledge by the principal investigator. The information was also independently categorised by the research assistant of the programme Consumer Science: Food and Nutrition, after which any discrepancies were discussed and subsequently verified by the co-researcher. This qualitative method of using multiple investigators (observers or methods) is known as triangulation (Guion, 2002:1).

### Study sample and procedure

Consumers purchasing bioactive food ingredients or foods for medicine are typically in mid-life and are educated (Gilbert, 2000). It was, therefore, expected that the typical Cape Town consumer who is aware of, and may be informed about, bioactive ingredients is one who has higher disposable income, a higher level of education and lives in a broad middle-to-upper socio-economic urban area. Respondents for this study were consequently sought from such areas. For this reason, two sub-councils were selected with a higher percentage of the population economically active employed than the average for the City of Cape Town Metropolitan Municipality. In the City of Cape Town Metropolitan Municipality 70,8% of the population are economically active employed, while in the adjoining De Grendel and Blaauberg middle-to-upper socio-economic sub-councils 95,7% and 82,1% of the populations respectively, meet this criterion (City of Cape Town, 2009). Only respondents between 25 and 65 years of age who live in these urban areas were targeted because they represent the economically active sector of the sub-councils (City of Cape Town, 2009). These two adjoining sub-councils were also selected based on the locality of a gymnasium/fitness centre and a pharmacy that supplies a range of dietary supplements in these sub-councils, which would draw residents across the wards forming these sub-councils.

Health-conscious consumers, in addition to being better educated and higher income earners, are concerned with nutrition and fitness (Kraft & Goodell, 1993). Gymnasium/Fitness centre subscribers and/or dietary supplement users were chosen as respondents to represent health-conscious consumers. While partaking in exercise is associated with a healthy lifestyle (Divine & Lepisto, 2005), dietary supplement use is associated with persons conscious of their dietary intake and their health which corroborates their dietary supplement use (Connor *et al*, 2001).

Dietary supplement users are also usually found to be persons of a lower body mass index (BMI), who do not smoke or drink excessively, are physically active, consume nutrient dense diets (Lyle *et al*, 1998; Kirk *et al*, 1999; Fennel, 2004) and better educated and more affluent individuals than non-users (de Jong *et al*, 2003). 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 the gymnasium/fitness centre and pharmacy in the adjoining sub-councils, it was decided to target an equal number of visitors at each venue.

In free word association, using groups of respondents numbering more than 50 has 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 responses would have been listed more than twice (Korshuk, 2000:2). For the purpose of this study, 150 respondents from the two sub-councils representing health-conscious consumers were targeted to ensure a sufficiently representative and large enough sample size to efficiently access the process of free word association. Consumers were approached by the principal investigator at the entrances of the gymnasium and pharmacy and were asked to participate in the study. The reasons for conducting the study were explained to the consumers and those willing to participate asked to anonymously complete the questionnaire, which took place at different times of the day. The study period covered weekdays and week-ends and included public, school and tertiary education holidays, during April and May, 2009.

### Data analysis

Firstly, the data of the free word association was evaluated and categorised according to four possible responses. Firstly, it was determined whether the respondent indicated whether they

recognised ('had heard of') the stimulus word or not (as 'recognition' of the bioactive food ingredient). Secondly, if they recognised the word, the extent to which they were aware of it was determined. If respondents had heard of the word (recognised it), but indicated no additional knowledge or understanding, they displayed awareness. If respondents had heard of the word and correctly indicated a food source and/or attribute of the listed stimulus word, they displayed knowledge. If respondents additionally correctly indicated the health connection(s)/health benefit(s) for this word they reflected an understanding of the bioactive food ingredient (refer Table 1). To categorise the word association correctly, the triangulation method of data analysis was used.

Secondly, for those bioactive food ingredients recognised by at least half of the respondent group, the Pearson's chi-squared analysis was used to test for significant associations/differences between the respondents' readiness for adoption (i.e., awareness, knowledge and understanding) of the bioactive food ingredient and their perceived interest in and knowledge of food and nutrition, as well as health and wellness, in relation to other adults of similar age. A significance level of 5 percent ( $p < 0,05$ ) was used.

## RESULTS

### Demographic, health and lifestyle characteristics of the respondents

One hundred and forty-five respondents participated in the study. The data obtained from 139 respondents was used for the analysis. The questionnaires of six of the respondents had not fully been completed (as they were self-administered) and were discarded.

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 (28,8%) and Grade 12 plus some degree of tertiary education (23,7%). About a third of the respondents were married or living together with children (34,8%) and without children (31,2%). The majority 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. Just over half (52,5%) of the respondents were 'very interested' in food and nutrition and nearly three quarters (70,5%) of the respondents 'very interested' in health and wellness. About 20% of the respondents perceived their level of health and wellness knowledge and nutrition knowledge as being well informed (22,3% and 17,3% respectively) while the majority thought they were moderately informed (66,9% and 65,5% respectively) in relation to other adults of the same age. These characteristics (Table 2) are in agreement with those of health-conscious consumers.

### Awareness, knowledge and understanding of the bioactive food ingredients by the respondents

The recognition of the listed bioactive food ingredients by the respondents and their awareness, knowledge or understanding of ('readiness to adopt') these ingredients are summarised in Table 3. Omega-3 fatty acids had the highest overall recognition (97,1%) and also produced the highest percentage (32,6%) of respondents with understanding of this nutrient. Antioxidants had the second highest overall recognition (87,1%). Half (55,4%) of these respondents were only aware of antioxidants, just under a third (28,1%) had knowledge and less than a fifth (16,5%) an understanding of antioxidants. Probiotics (84,9%) and soy protein (83,5%) were the next highly recognised bioactive food ingredients. Slightly more than 60% (61,2%) of the

**TABLE 2: DEMOGRAPHIC, HEALTH AND LIFESTYLE CHARACTERISTICS OF RESPONDENT SAMPLE (n = 139)**

Demographic characteristics		%	n	Health and lifestyle characteristics		%	n
Gender	Male	28,1	39	Incidence of chronic disease	Yes	17,3	24
	Female	71,9	100		No	82,7	115
Age (years)	25-34	42,4	59	Regular physical activity participation	Yes	63,3	88 **
	35-44	20,1	28				
	45-54	18,7	26		No	36,7	51
	55-60	12,2	17				
	61-65	6,5	9				
Population group	Black	12,9	18	Frequency of consumption of dietary supplements	Daily	56,8	79
	Coloured	18,7	26		Weekly	12,2	17
	Indian	0,7	1		Monthly	5,8	8
	White	66,2	92		Seldom/Never	25,2	35
	Other	1,4	2				
Level of education	Grade 11 (Standard 9) or below	7,9	11	Perceived nutrition knowledge rating in relation to other adults of similar age	Well informed	22,3	31
	Grade 12 (Matric)	28,8	40				
	Grade 12 and certificate	10,8	15		Moderately informed	66,9	93
	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	7	Not at all informed	10,8	15		
Occupation*	Unemployed/retired	12,2	17	Perceived health and wellness knowledge rating in relation to other adults of similar age	Well informed	17,3	24
	Legislators, senior officials, managers	7,2	10				
	Professionals	12,9	18		Moderately informed	65,5	91
	Technicians and other associate professionals	35,3	49				
	Office clerks	28,1	39				
	Service workers, shop and market sales workers; Craft and related trade workers; Elementary occupations	4,3	6				
Annual income	R490 001 and above	7,2	10	Perceived interest in food and nutrition	Very interested	52,5	73
	R380 001-R490 000	5,8	8				
	R270 001-R380 000	10,8	15		Little interest	40,3	56
	R195 001-R270 000	15,1	21				
	R122 001-R195 000	23	32				
R0-R122 000	38,1	53	No interest	7,2	10		
Marital status **	Married/Living together without children	31,2	43	Perceived interest in health and wellness	Very interested	70,5	98
	Married/Living together with children	34,8	48				
	Single, living without children	26,8	37		Little interest	25,9	36
	Single, living with children	7,2	10				

\*Sub-group categorisation based on information from the International Standard Classification of Occupations as depicted by the International Labour Organisation (Bureau of Statistics, 2009)

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

**TABLE 3: BIOACTIVE FOOD INGREDIENT RECOGNITION, AWARENESS, KNOWLEDGE AND UNDERSTANDING OF RESPONDENT SAMPLE**

Bioactive food ingredient	Recognition (n = 139)				Readiness for adoption *					
	Yes*		No		Awareness		Knowledge		Understanding	
	%	n	%	n	%	n	%	n	%	n
Antioxidants	87,1	121	12,9	18	55,4	67	28,1	34	16,5	20
Beta-carotene	68,3	95	30,9	43	26,3	25	52,6	50	21,1	20
Flavonoids	32,4	45	67,6	94	68,9	31	24,4	11	6,7	3
Glucosinolates	15,1	21	84,9	118	66,7	14	33,3	7	0	0
Isoflavones	20,9	29	79,1	110	65,5	19	13,8	4	20,7	6
Lycopene	25,9	36	74,1	103	25	9	44,4	16	30,6	11
Omega-3 fatty acids	97,1	135	2,9	4	26,7	36	40,7	55	32,6	44
Plant sterols (or stanols)	26,6	37	73,4	102	70,3	26	13,5	5	16,2	6
Probiotics	84,9	118	15,1	21	28,8	34	47,5	56	23,7	28
Soy protein	83,5	116	16,5	23	33,6	39	61,2	71	5,2	6

\* Based on number of respondents who recognised each bioactive food ingredient

respondents who recognised soy protein were informed (had knowledge) about soy protein, while almost half (47,5%) of the respondents who recognised probiotics had knowledge of this ingredient. Just over two-thirds (68,3%) of the respondents recognised beta-carotene. Half (52,6%) of these respondents had knowledge of beta-carotene.

In contrast only a third (32,4%) of the respondents recognised flavonoids, a quarter plant sterols (or stanols) and lycopene (26,6% and 25,9% respectively) and a fifth and less isoflavones and glucosinolates (20,9% and 15,1% respectively). While most of the respondents who recognised flavonoids, plant sterols (or stanols), isoflavones and glucosinolates only had an awareness of these bioactive food ingredients (68,9%, 70,3%, 65,5% and 66,7% respectively), almost half (44,4%) of the respondents who recognised lycopene had knowledge and almost a third (30,6%) an understanding of lycopene. Among the respondents who recognised glucosinolates no respondent had an understanding of this bioactive food ingredient and only a few (n = 3) of the respondents who recognised flavonoids had an understanding of this bioactive food ingredient (Table 3).

Associations between the awareness, knowledge and understanding of the bioactive food ingredients by the respondents and their perceived interest in, and knowledge of, food and nutrition and health and wellness

Five bioactive food ingredients were recognised by at least half of the respondents (omega-3 fatty acids, antioxidants, probiotics, soy protein and beta-carotene). Associations/differences (Pearson's chi-squared analysis) between the bioactive food ingredient awareness, knowledge and understanding of the respondents (as reflection of the 'readiness to adopt') and their own perceived interest in and knowledge of food and nutrition, as well as health and wellness, were investigated to further describe and differentiate the consumer market for these bioactive food ingredients.

No associations or differences ( $p > 0,05$ ) were found between the respondents' readiness to adopt soy protein and beta-carotene as bioactive food ingredients and their own perceived interest in, and knowledge of, food and nutrition as well as health and wellness (Tables 4 and 5 respectively). Significant differences ( $p < 0,05$ ) were found between the awareness, knowledge and understanding of omega-3 fatty acids by the



**TABLE 4: BIOACTIVE FOOD INGREDIENT RECOGNITION BY THE RESPONDENTS AND ASSOCIATIONS BETWEEN THEIR ADOPTION READINESS AND THEIR PERCEIVED INTEREST IN FOOD AND NUTRITION AND HEALTH AND WELLNESS**

Perceived interest in food and nutrition and health and wellness		Recognition*		Readiness for adoption						P**
				Awareness		Knowledge		Understanding		
		%	n	%	n	%	n	%	n	
Soy protein (n = 116)										
Interest in food and nutrition	Very interested	87,7	64	26,6	17	70,3	45	3,1	2	0,074
	Little/No interest	78,8	52	42,3	22	50	26	7,7	4	
Interest in health and wellness	Very interested	84,7	83	28,9	24	66,3	55	4,8	4	0,201
	Little/No interest	80,5	33	45,5	15	48,5	16	6,1	2	
Beta-carotene (n = 95)										
Interest in food and nutrition	Very interested	74	54	22,2	12	55,6	30	22,2	12	0,582
	Little/No interest	62,1	41	31,7	13	48,8	20	19,5	8	
Interest in health and wellness	Very interested	72,4	71	25,4	18	53,5	38	21,1	15	0,931
	Little/No interest	58,5	24	29,2	7	50	12	20,8	5	
Omega-3 fatty acids (n = 135)										
Interest in food and nutrition	Very interested	98,6	72	18,1	13	38,9	28	43,1	31	0,008***
	Little/No interest	95,5	63	36,5	23	42,9	27	20,6	13	
Interest in health and wellness	Very interested	98	96	21,9	21	38,5	37	39,6	38	0,016***
	Little/No interest	95,1	39	38,5	15	46,1	18	15,4	6	
Probiotics (n = 118)										
Interest in food and nutrition	Very interested	90,4	66	21,2	14	53	35	25,8	17	0,119
	Little/No interest	78,8	52	38,5	20	40,4	21	21,1	11	
Interest in health and wellness	Very interested	87,8	86	20,9	18	52,3	45	26,7	23	0,008***
	Little/No interest	78,1	32	50	16	34,4	11	15,6	5	
Antioxidants (n = 121)										
Interest in food and nutrition	Very interested	89	65	52,3	34	20	13	27,7	18	0,001***
	Little/No interest	84,8	56	58,9	33	37,5	21	3,6	2	
Interest in health and wellness	Very interested	87,8	86	53,5	46	24,4	21	22,1	19	0,027***
	Little/No interest	85,4	35	60	21	37,1	13	2,9	1	

\* Respondent number and percentage of those who recognised the bioactive food ingredient within each of the interest responses (refer Table 2)

\*\* 'Little interest' and 'No interest' combined in the analysis due to the low cell numbers found

\*\*\* Significant difference ( $p < 0,05$ ) between variables

respondents and their perceived interest in food and nutrition and health and wellness (Table 4) and their perceived nutrition knowledge and health and wellness knowledge in relation to other adults of similar age (Table 5).

A significant difference ( $p < 0.05$ ) was also found between the awareness, knowledge and understanding of probiotics by the respondents and their perceived interest in health and wellness (Table 4). Significant differences ( $p < 0.05$ ) were in addition found between the awareness, knowledge and understanding of antioxidants by the respondents and their perceived interest in

food and nutrition and health and wellness (Table 4) as well as their perceived nutrition knowledge in relation to other adults of similar age (Table 5).

## DISCUSSION

Respondents in this study had high recognition of omega-3 fatty acids, antioxidants, probiotics and soy protein. The high recognition of omega-3 fatty acids, antioxidants and soy protein found is in line with the findings of other studies report-

ing on the consumer awareness of these bioactive food ingredients. In a global consumer survey carried out in 16 countries including SA, 80% of the respondents indicated that they had heard of omega-3 fatty acids. In the emerging

countries the highest recognition of omega-3 fatty acids was at 74% and in the developed countries at 89% (Diekman & Malcolm, 2009). The awareness of antioxidants was high among Australian consumers and residents of Trinidad,

**TABLE 5: BIOACTIVE FOOD INGREDIENT RECOGNITION BY THE RESPONDENTS AND ASSOCIATIONS BETWEEN THEIR ADOPTION READINESS AND THEIR PERCEIVED KNOWLEDGE RATING OF NUTRITION AND HEALTH AND WELLNESS**

Perceived knowledge rating of nutrition and health and wellness relative to other adults of similar age	Recognition*	Readiness for adoption								P**
		Awareness		Knowledge		Understanding				
		%	n	%	n	%	n	%	n	
Soy protein (n = 116)										
Nutrition knowledge Rating	Well informed	96,8	30	20	6	73,3	22	6,7	2	0,185
	Moderately/Not at all informed	79,6	86	38,4	33	57	49	4,6	4	
Health and wellness knowledge rating	Well informed	100	24	16,7	4	75	18	8,3	2	0,128
	Moderately/Not at all informed	80	92	38,1	35	57,6	53	4,3	4	
Beta-carotene (n = 95)										
Nutrition knowledge Rating	Well informed	83,9	26	23,1	6	57,7	15	19,2	5	0,829
	Moderately/Not at all informed	63,9	69	27,5	19	50,7	35	21,7	15	
Health and wellness knowledge rating	Well informed	83,3	20	20	4	60	12	20	4	0,719
	Moderately/Not at all informed	65,2	75	28	21	50,7	38	21,3	16	
Omega-3 fatty acids (n = 135)										
Nutrition knowledge Rating	Well informed	100	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	
Health and wellness knowledge rating	Well informed	100	24	20,8	5	29,2	7	50	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	
Probiotics (n = 118)										
Nutrition knowledge Rating	Well informed	90,3	28	25	7	46,4	13	28,6	8	0,757
	Moderately/Not at all informed	83,3	90	30	27	47,8	43	22,2	20	
Health and wellness knowledge rating	Well informed	100	24	20,8	5	50	12	29,2	7	0,582
	Moderately/Not at all informed	81,7	94	30,9	29	46,8	44	22,3	21	
Antioxidants (n = 121)										
Nutrition knowledge Rating	Well informed	96,8	30	53,3	16	16,7	5	30	9	0,044***
	Moderately/Not at all informed	84,3	91	56	51	31,9	29	12,1	11	
Health and wellness knowledge rating	Well informed	91,7	22	45,5	10	22,7	5	31,8	7	0,103
	Moderately/Not at all informed	86,1	99	57,6	57	29,3	29	13,1	13	

\*\* Respondent number and percentage of those who recognised the bioactive food ingredient within each of the knowledge ratings (refer Table 2)

\*\* 'Moderately informed' and 'Not at all informed' combined in the analysis where low cell numbers were found

\*\*\* Significant difference ( $p < 0,05$ ) between variables

West Indies, where 86% (Cox & Bastiaans, 2007) and 77,7% (Boodhu & Badrie, 2007) of the respondents respectively claimed to have heard of antioxidants. Eighty-one percent of the population selected from metropolitan and rural areas in a South African study were aware of or had heard of soy (Bosman *et al*, 2009).

The recognition of probiotics in this study though was far higher than the 14% previously found in SA with a 2005 Markinor survey in Metropolitan areas across all the provinces (Robertson, 2005) and among yoghurt buyers in four Pretoria suburbs as mainstream probiotic consumers (Venter & Hanekom, 2010). Respondents from this study had lower recognition of beta-carotene and isoflavones than those of the studies by Braun and Venter (2008) at 88,4% and 42,9% respectively for health food store customers in the Cape Town city bowl and Miller (2002:77) at 88,3% and 67,2% respectively for United States subscribers to a health promotion magazine. The recognition of lycopene of 25,9% in this study is very similar to the lycopene recognition of 22,3% in the study of Braun and Venter (2008) and 29,6% in the study of Miller (2002:77). The low recognition of flavonoids, plant sterols (or stanols) and isoflavones by the respondents in this study was also encountered by Verbeke (2010) among Belgian consumers. Verbeke (2010) found that polyphenols (represented by the subclass flavonoids in this current study), plant sterols and isoflavones were indicated as 'never heard of' by more than 80% of their sample of 255 Belgian consumers in 2001 and a similar sample of 230 consumers five years later (in 2006).

Among the respondents who recognised antioxidants, flavonoids, plant sterols, isoflavones and glucosinolates as bioactive food ingredients most were only aware of them. These findings should not be unexpected considering available literature. It had, for example, been indicated that consumer awareness of such ingredients as plant sterols had not reached its peak and that a

large market of consumers exist that are not only unfamiliar with plant sterols but even more so of what they are and what they can do in terms of heart health (St. Jean, 2008:16). Most of the respondents who recognised the other five bioactive ingredients investigated (beta-carotene, lycopene, omega-3 fatty acids, probiotics and soy protein) had knowledge rather than an understanding of the ingredient. These findings should also be anticipated considering the reported consumer knowledge and understanding of omega-3 fatty acids, probiotics and soy. Even though dietary fat consistently ranks at the top list of consumer nutrition concerns and 77% of the respondents in the global consumer survey that included SA knew that omega-3 fatty acids are 'good' for them, only a third knew they were essential fatty acids and about half did not realise they were fats (Diekman & Malcolm, 2009). In a survey conducted in Ireland by Bogue *et al* (2003:31), 70% of the respondents were not able to explain the term probiotics, while Wansink *et al* (2005) in a survey conducted among North Americans found that only 10,4% of the respondents had attribute-related and consumption-consequences-related knowledge of soy.

Many consumers recognise the link between nutrition and health and seem interested in the concepts of nutraceuticals and functional foods (Kalaitzandonakes, 2000); however, there are still many that do not (Reinhardt, 2005:21). In order for respondents to become informed, they need to show awareness of, and interest in, nutrition- and health-related aspects to the extent that they can at least be considered to be moderately informed. Respondents who were very interested in food and nutrition and health and wellness and those who viewed their level of nutrition and health and wellness knowledge as moderately informed exhibited greater readiness to adopt the studied bioactive food ingredients omega-3, probiotics and antioxidants (as represented by the respondents' knowledge and understanding of these ingredients).

Omega-3 fatty acids was the bioactive food ingredient influenced by all the factors studied to impact the readiness for adoption; that is perceived interest in food and nutrition, perceived interest in health and wellness, as well as perceived nutrition and health and wellness knowledge. The adoption readiness for probiotics was supported by perceived interest in health and wellness and the adoption readiness for antioxidants by perceived interest in food and nutrition and health and wellness, as well as perceived nutrition knowledge.

## CONCLUSIONS

Bioactive food ingredients that respondents are only aware of (as indicated in the 'stages in the new product adoption process' by Hawkins *et al*, 2007:253) and have no knowledge about (as indicated in the 'hierarchy of nutritional knowledge' by Wansink *et al*, 2005) are the furthest away from the product trial and adoption stages, according to Hawkins *et al* (2007:253), and consumption, according to Wansink *et al* (2005). Bioactive food ingredients for which consumers have knowledge and understanding of are closest to product trial and adoption or consumption. Omega-3 fatty acids, probiotics and soy protein all had high levels of recognition, with the respondents having knowledge of these bioactive food ingredients representing a higher percentage than respondents with either awareness or an understanding. These bioactive food ingredients were nearest to the adoption stage, as described by Hawkins *et al* (2007:253), compared to the other studied ingredients. Omega-3 fatty acids had the highest overall recognition as a bioactive food ingredient and also produced the highest percentage of respondents with understanding. This indicates that the impact activities for this ingredient, whether education or marketing efforts, are creating awareness and interest which efficiently support consumer

adoption.

The majority of the respondents did not have understanding of any of the studied bioactive food ingredients. An unexpectedly low number of respondents having an understanding thereof was found for soy protein despite the fact that this ingredient has been available on the market for some time. Antioxidants had the second highest overall recognition as a bioactive food ingredient, but most respondents had no knowledge and/or understanding of antioxidants, indicating that education and/or marketing efforts are required to create adoption of this ingredient.

There were eight significant differences between the bioactive food ingredient readiness for adoption and the respondents' own perceived interest in and knowledge of food and nutrition, as well as health and wellness (omega-3 and antioxidants with perceived interest in food and nutrition; omega-3, probiotics and antioxidants with perceived interest in health and wellness; omega-3 and antioxidants with perceived nutrition knowledge; omega-3 with perceived health and wellness knowledge). This indicates that the interest and evaluation stages should be considered and used to target the activities for bioactive food ingredient adoption as it differentiated omega-3 and antioxidants and to a lesser extent probiotics from the other highly recognised bioactive food ingredients, soy protein and beta-carotene.

## RECOMMENDATIONS

Hawkins *et al* (2007:253) described five stages in the new product adoption process that is suited to consumers purchasing commodity items like food. These stages highlight the fact that interest plays an important foundation role in product adoption by consumers. For the evaluation stage to occur consumers must have

awareness and interest, which for this study implied an awareness of, and an interest in, functional foods and/or bioactive food ingredients before a trial purchase is to follow and the purchase made. Interest in these bioactive ingredients and foods containing them allows consumers to gain knowledge, ultimately leading to consumption of these products, as described by Wansink *et al* (2005). These stages can be used to describe the movement of bioactive food ingredients from one stage of consumer adoption to the next. For more consumers to recognise and move from having awareness to knowledge and to understanding the consumers must exhibit an interest to gain knowledge. The consumers in this study had already shown that there was an interest in food and nutrition, and even more so for health and wellness, which manifests itself as an opportunity which should be capitalised on to educate consumers about bioactive food ingredients.

Marketing activities by food manufacturers could be channelled through the media, by supplying scientific evidence on food labels to consumers, or the education of consumers by health care providers regarding the health benefits of consuming bioactive food ingredients (Castellini *et al*, 2002:13). These efforts will raise consumer interest in food and nutrition as well as health and wellness and increase consumer awareness of bioactive food ingredients, and in particular their knowledge and understanding of these food components in health promotion and disease prevention. For any bioactive ingredient to move from the awareness stage to the adoption stage, the awareness of, and interest in, the ingredients needs to increase through activities, such as marketing activities and consumer education to provide knowledge and understanding to consumers. Food manufacturers or marketers need to intensively focus on bioactive food ingredient education of consumers so that they can become informed. Those proactive consumers 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 from the awareness stage to the adoption stage; however, the majority of the consumers will need a great deal of specific bioactive food ingredient education to increase their awareness together with their knowledge and understanding before ingredient adoption will be achieved (Witwer, 1999). In this study those bioactive food ingredients which were most strongly influenced by the factors studied to support consumer readiness for adoption (perceived interest in food and nutrition, perceived interest in health and wellness, perceived nutrition knowledge and perceived health and wellness knowledge) were the closest to consumer adoption.

The lack of readiness found to adopt soy protein should be studied to determine how activities could impart information to consumers to increase their knowledge and in particular their understanding of this ingredient which has been on the market for some time. Similarly, antioxidants had a very high overall recognition. Because more than half of the respondents only had awareness of antioxidants, this is an indication that the consumer activities relating to this ingredient needs to be adapted and/or improved. This would not only raise consumer awareness of antioxidants, but also improve consumer knowledge of antioxidants. Activities should furthermore be intensified for those bioactive food ingredients where interest in food and nutrition, as well as health and wellness, together with knowledge of nutrition and health and wellness, have as yet made no impact, like beta-carotene, and those bioactive food ingredients which had overall low recognition, such as isoflavones and glucosinolates, as well as lycopene and flavonoids.

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