FOOD ADDITIONS THAT CONSUMERS IN THE PROFESSIONAL SECTOR IN THE CITY OF CAPE TOWN ARE LIKELY TO CONSUME TO ENHANCE THEIR PHYTOCHEMICAL INTAKE

Shelley Mager & Irma Venter*

OPSOMMING

Die voorkoms van nie-oordraagbare chroniese siektes in Suid-Afrika wat onder meer deur ongewenste lewenstylfaktore veroorsaak word - soos hartvatsiektes, diabetes mellitus en kanker - is toenemend rede tot kommer. Die inname van groente, vrugte en tee verlaag die risiko om dié siektes te ontwikkel weens die fitochemikalieë wat onder andere daarin voorkom. Vele fitochemikalieë het anti-oksidant en anti-inflammatoriese eienskappe wat die risiko van siekte verminder. Die polifenole is een van die grootste groepe fitochemikalieë, met tee, verskeie vrugte en veral kruie ryk bronne daarvan. Die algemene Suid-Afrikaanse dieet bevat egter te min van hierdie voedselbronne. Die inname van fitochemikalieë moet daarom op ander maniere bewerkstellig word.

Groente word teenoor vrugte baie meer algemeen by geregte gevoeg met min wat bekend is oor die byvoeging van kruie en tee in geregte in Suid-Afrika. Die doelwit van hierdie studie was om te bepaal of verbruikers in die professionele sektor in Kaapstad:

i. gewillig sou wees om tuisbereide geregte te eet waarby groente, vrugte, kruie en rooibos kruietee gevoeg is om die inname van fitochemikalieë te bevorder; en indien wel,
ii. watter groente, vrugte en kruie hulle sou inneem as byvoegings en watter tipe geregte hulle sou eet vir die byvoeging van kruie (as ryker bron van polifenole) en rooibos kruietee (as minder algemene byvoeging); en
iii. wie gewillig sou wees om geregte waarby vrugte, kruie en rooibos kruietee gevoeg is, in te neem.

Etiese goedkeuring is vooraf vir die studie verkry. Elke respondent (n = 184) het skriftelik toegestem om deel te neem. 'n Getoetste vraelys is gebruik om die inligting in te samel. Die vraelys is vooraf deur vyf akademici in die voedsel- en voedingsveld vir inhoudsgeldigheid nagegaan en deur 17 mense wat die deelnemergroep verteenwoordig vir voorkomsgeldigheid. Die grootste gedeelte van die vraelys (n = 48 vrae) het die respondente se bereidwilligheid bepaal om geregte te eet wat die inname van fitochemikalieë bevorder met die gebruik van 'n skaal met grense vanaf '1' as 'uiters onwillig' tot '5' as 'uiters gewillig'.

Skaalresponse is gebruik om te bepaal watter groente, vrugte en kruie die respondente bereid was om as byvoeging te neem en watter geregte hul bereidwillig was om te eet waarby kruie en rooibos kruietee as bronne van fitochemikalieë gevoeg is (met 'n blinde skyn veranderlike wat aangedui het of die respondent betrokke was by voedselvoorbereiding tuis wat as onafhanklike veranderlike gedien het). Dit is ook gebruik om volgens die demografiese en lewenstyleienskappe van die respondente te bepaal watter van hulle bereidwillig was om geregte te eet met vrugte-, kruie- en rooibosbyvoeging. Herhaalde metings variansieontleding (ANOVA) is gebruik om te bepaal of betekenisvolle ($p < 0,05$) verskille voorkom. Dit is opgevolg met veelvuldige vergelykings met Bonferroni-regstellings om te bepaal waar betekenisvolle verskille in die gepaarde vergelykings voorkom.

Die studie het bevind dat die respondente minder waarskynlik uie as groentebyvoeging en kruisement as kruiebyvoeging in geregte sou geniet en dat dit meer waarskynlik was dat hulle vrugtebyvoeging en kruiebyvoeging in geregte teenoor rooibosbyvoeging sou geniet. Eier, hoender en aartappel geregte was ook meer waarskynlike bronne vir kruiebyvoeging, terwyl ander stylsel-gebaseerde geregte meer waarskynklik was vir rooibosbyvoeging. Die studie het ook gewys dat heelwat meer vroulike as manlike deelnemers voorbereide geregte met vrugtebyvoeging sou geniet ($p < 0,05$), dat meer ouer (55 tot 64 jaar) as jonger respondente vrugtebyvoeging ($p < 0,05$) en kruiebyvoeging ($p < 0,05$) sou geniet en dat dit meer waarskynlik was dat diegene betrokke by voedselvoorbereiding tuis voorbereide geregte met vrugtebyvoeging ($p < 0,05$), kruiebyvoeging ($p < 0,05$) en rooibosbyvoeging ($p < 0,05$) sou geniet teenoor diegene wat nie daarby betrokke is nie.

— ***Ms S Mager***
Department of Biotechnology and Consumer Science

Cape Peninsula University of Technology
Tel: +27 (21) 531 4735
Fax: +27 (86) 458 0226
e-mail: shelley.mager@live.co.za

— ***Dr I Venter****
Department of Biotechnology and Consumer Science
Cape Peninsula University of Technology
Tel: +27 (21) 460 3428
Fax: +27 (21) 460 3854
e-mail: venteri@cput.ac.za
*Corresponding author

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INTRODUCTION

Non-communicable diseases (NCDs) are one of the leading causes of death in South Africa (SA) (Mungal-Singh, 2011) and dietary behaviour is believed to be a major risk factor (Mbanya *et al*, 2010). A growing body of evidence has accumulated proposing that regular consumption of plant produce and plant-based products play an important preventative role in the development of these diseases, which include cardiovascular disease (CVD) (Wang *et al*, 2011), various cancers (Miller & Snyder, 2012) and type 2 diabetes mellitus (Leiherer *et al*, 2013). The accumulating evidence suggests that the health-promoting benefits of consuming plant produce and plant-based products are, in part, attributed to the interaction and/or enhanced effects brought about by the phytochemicals present within them (Lui, 2013a), with their mode of action comprising biological activities to more complex changes in cell signalling pathways (Traka & Mithen, 2011; Lui, 2013a).

Phytochemicals are bioactive, non-nutrient, health-promoting plant chemicals (Vincent *et al*, 2010; Miller & Snyder, 2012) of which the common groups include the polyphenols (with non-flavonoid phenolic compounds and flavonoids as its classes and flavonoids the major class), the carotenoids and the organosulfurs (González-Castejón & Rodriquez-Casado, 2011; Lui, 2013b). Beverages such as tea and red wine, fruits such as apples, berries, grapes and citrus fruits, vegetables such as onions and broccoli, as well as herbs are abundant in flavonoids (Yao *et al*, 2004; Miller & Snyder, 2012), with yellow, orange, red and deep-green vegetables and fruit abundant in carotenoids (Miller & Snyder, 2012). *Alliums* such as onions (Sengupta *et al*, 2004; González -Castejón & Rodriquez-Casado, 2011) and cruciferous vegetables such as broccoli (Miller & Snyder, 2012) are abundant in organosulfur compounds. Wheat bran and whole grains are abundant in flavonoids, the non-flavonoid phenolic acids (Lui, 2013b) and lignans (González-Castejón & Rodriquez-Casado, 2011; Miller & Snyder, 2012).

Numerous phytochemicals exhibit antioxidant properties that reduce oxidative stress in the body, while several phytochemicals stimulate anti-inflammatory responses in the body. Due to their antioxidant and anti-inflammatory actions among other, phytochemicals provide vascular health protection (Wang *et al*, 2011). The antioxidant and anti-inflammatory activities, along with numerous other plausible biological mechanisms link phytochemical consumption and cancer prevention (Miller & Snyder, 2012). Due to their anti-inflammatory properties, phytochemicals can interfere with the inflammation process in the adipose tissue and potentially provide protection against inflammatory conditions like diabetes (Leiherer *et al,* 2013). Several phytochemicals also possess cellular actions such as the induction of adipocyte apoptosis and the stimulation of lipolysis, which provides potential anti-obesity properties to these phytochemicals (González-Castejón & Rodriquez-Casado, 2011).

The widely endorsed recommendation for fruit and vegetable intake is an average of 400 grams (g) (five servings) per day. Nevertheless, the available data indicates that fruit and vegetable consumption by South Africans is exceedingly low (Naude, 2013). The data also indicates that South Africans consume refined grains more often than whole grains (Vorster & Nell, 2001), and consume less tea (Nel & Steyn, 2002:92) than the four and more cups daily that have been found to beneficially affect health (Yang & Hong, 2013). Limited data is available on the consumption of herbs by South Africans. A report by Nel and Steyn (2002:C37) that summarised South African food consumption studies based on dietary intake assessment via 24-hour recalls, indicated that only 0,02% of the South African population on one particular day consumed herbs (and spices). Although this suggests that the use of herbs and spices is not a common daily practice in many South African households, the use of

herbs among consumers in SA may have increased since the publication of Nel and Steyn due to increased global accessibility (Tapsell, 2008). Tapsell (2008) points out that, based on evidence which indicates that herb consumption can provide protection against oxidative and inflammatory mechanisms, herb incorporation into dishes deserves serious consideration as a separate inclusion in the dietary guidelines for health promotion and the prevention of NCDs. It consequently is envisaged that the phytochemical intake of South Africans is low due to their inadequate intake of plant produce and plant-based products rich in phytochemicals. Enhancing the phytochemical intake of South Africans to assist in alleviating the risk for NCD therefore may have to be supported in other ways.

In addition to genetic manipulation and molecular breeding as agricultural approaches to enhance phytochemical levels in plant produce (Traka & Mitchen, 2011), the use of plant by-products containing an abundance of phytochemicals (e.g. fruit and vegetable pomace, peel and skin) as novel ingredients in food product development as a further approach have also gained popularity (O'Shea *et al*, 2012). For phytochemicals to contribute to the health of the consumer, the food industry should be optimised in terms of pre-harvest factors, such as cultivar selection and maturity at harvest, and processing operations and product storage, as post-harvest factors, optimally applied to minimise losses (Tiwari & Cummins, 2013). Besides for industrial approaches, an added approach to consider is the incorporation of phytochemical-rich plant sources into home-cooked dishes.

Vegetables are added to dishes far more commonly than fruit (Krebs-Smith *et al*, 1995; O'Brien *et al*, 2003), while information on the addition of herbs and rooibos herbal tea to dishes in the South African context is scarce. The polyphenols are one of the largest groups of phytochemicals (Beecher, 2003) and are considered to be the significant family among the phytochemicals as they render several promising health benefits (González-Castejón & Rodriquez-Casado, 2011; Kasote *et al*, 2015). Beverages like tea and fruit represent the major sources of polyphenols (flavonoid class provision) in the diet (Manach *et al*, 2004) with exceptionally high concentrations found in herbs. At typical ingestion levels, herbs provide an antioxidant capacity similar to that of vegetables (Tapsell, 2008). This study consequently explored whether consumers in the professional sector in the City of Cape Town would (i) be likely to consume home-cooked dishes for enhanced phytochemical intake with the addition of vegetables, in particular with the addition of fruit, herbs and rooibos herbal tea, as phytochemical providers, and if so, (ii) which vegetables, fruit and herbs as phytochemical providers, and which dishes as food vehicles for herb addition (as herbs provide exceptionally high levels of polyphenols) and for rooibos herbal tea addition (as less typical food addition) they would be likely to consume, and (iii) who would be likely to consume fruit, herbs and rooibos herbal tea as phytochemical providers in home-cooked dishes. Whole-grain foods (whole-grain breads, cereals and crackers) as phytochemical provider were not investigated in the study as these products are typically purchased and not prepared at home.

METHODOLOGY

Permission to conduct the study

Ethical clearance (Ref 06/2012) to conduct this study was granted by the Research Ethics Committee of the Faculty of Applied Sciences of the Cape Peninsula University of Technology. Three of the seven medium-sized companies approached in the northern and the southern suburbs of the City of Cape Town were prepared to participate. Once authorisation was granted by the human resources manager of each company, written consent was obtained from the employees who were willing to participate.

Study design

A cross-sectional study utilising a survey was conducted to obtain quantitative data using a self-administered questionnaire as the research tool.

Study sample

The sampling method used was convenient purposive sampling, a form of non-probability sampling in which individuals are selected because of the ease of their availability or easy access, and because they have particular characteristics of interest for the purpose of the research (Zikmund & Babin, 2013:323). The characteristics of interest for this study were that the respondents should be employed within the International Standard Classification of Occupations (ISCO) occupational groups, as

compiled by the International Labour Organisation (ILO) (Bureau of Statistics, 2009), as professional (as Major Group 2 encompassing physical, mathematical and engineering science professionals, life science and health professionals, teaching professionals, and other professionals as business, legal, information, social science, etc.) and technicians and associate professionals (as Major Group 3 encompassing the associate professionals of the above groups), to represent the 'professional sector' as the study population and fall within the lifecycle grouping of 31 to 65 years. Occupations link education and income. Education credentials are attained that enable employment in certain jobs and a higher salary is earned (Barbeau *et al*, 2004). Income earned consequently reflects the availability of economic and material resources and may contribute to dietary quality by making healthy and nutritious food more affordable and readily available (Turrell *et al*, 2003).

There is strong evidence that adults acquire risk factors leading to the development of chronic diseases (Darnton-Hill *et al*, 2004). A report by the World Health Organization/Food and Agricultural Organization Expert Consultation on diet, nutrition and the prevention of chronic diseases demonstrated the importance of the adult phase in terms of life course, nutrition and chronic disease expression in addition to being a critical stage in the prevention of numerous chronic diseases (World Health Organization, 2003:5). The adult lifecycle grouping (31 to 65 years) selected for the study represented both the young (19 to 50 years) and middle (51 to 70 years) adulthood (Wardlaw, 2003:515) until the older life stage of 65 years (Wardlaw, 2003:518). The age group selection considered the adulthood groupings (31 to 50 years and 51 to 70 years) presented in the dietary reference intakes (Wardlaw, 2003:i) and that people of this age face a greater risk for the development of CVD (men over 45 years and women over 55 years) (Wardlaw, 2003:181) and type 2 diabetes (usually after the age of 40 years) (Wardlaw, 2003:141). Age (middle-aged and older) is also used to initiate examinations for the early detection of cancer, as recommended by the American Cancer Society (Wardlaw, 2003:288).

A minimum sample size of 169 respondents was calculated from a population of 186 456, representing 85 815 persons employed in the professional group and 100 641 in the technicians and associate professional group according to the ISCO classification for the City of Cape Town (City of Cape Town, 2001). The calculation used for the sample for this study was as follows:

$$n = \frac{Z^2\, p\, q\, N}{e^2\,(N-1) + Z^2\, p\, q}$$

where p (probability of success) = 0,5; q (probability of failure) = 0,5; Z (z-value for 95% confidence interval) = 1,96; e (precision) = 0,0755; and N (population size) = 186 456.

The respondents were approached individually at their place of work and asked whether they would be willing to participate in the survey. The willing participants were each handed a consent form (in duplicate) and a questionnaire to read and complete. In consultation with the respondents, completed copies were collected after two days. The questionnaire took approximately 20 minutes to complete.

The questionnaire

A self-administered questionnaire that had been pre-tested for content and face validity (by five academics in the field of food and nutrition and 17 individuals representing the sample respectively) was used to obtain quantitative data pertaining to the respondents' degree of 'likelihood' to consume home-cooked dishes for enhanced phytochemical intake (48 questions), as well as their demographic (gender, age, population group, home language, highest level of education, occupation, marital status and involvement in the preparation of food at home), health and lifestyle (smoking status, dietary supplement use, level of physical activity, obesity or NCD diagnosis and a family history of obesity or NCDs) information (13 questions). Possible unfamiliar dishes (compote, risotto, crêpe, pesto) were explained in the questionnaire, and non-specific terms (current and former smoker, dietary supplements, physical activity) were defined.

The major part of the questionnaire consisted of closed-ended Likert scale behavioural questions (n = 48) that required the respondents to mark their 'likelihood' to consume each of the included home-cooked dishes for enhanced phytochemical intake, ranging from 'extremely unlikely' (1) to 'extremely likely' (5). Although some home-prepared dishes (e.g. salads) were included, the term 'home-cooked' was used for continuity as the majority of the included dishes were home-cooked. Recipe books from SA, Australia and the United Kingdom were consulted for food-pairing ideas for

phytochemical-rich sources and associated food vehicles as recipe books, cookery programmes, food shows and demonstrations from abroad are very accessible to South African consumers. The focus of this study was the major groups of phytochemicals, which include the flavonoids (major polyphenol class), carotenoids and organosulfurs (*Allium* compounds). The incorporation of added rooibos herbal tea to dishes (seven questions) was selected for flavonoid provision (Joubert & Ferreira, 1996), as were herbs (16 questions) (Yao *et al*, 2004), while vegetables (13 questions) were selected for carotenoid (Palace *et al*, 1999), *Allium* compound (Sengupta *et al*, 2004) and flavonoid (Yao *et al*, 2004) provision. Fruit (12 questions) also were selected for flavonoid provision (Yao *et al*, 2004). These represented the phytochemical providers. The food vehicles represented clusters of the same or similar foods which for herb addition (having high concentrations of polyphenols/flavonoids as phytochemicals) were egg (two questions), chicken (two questions), potato (three questions), other starch (two questions) and vegetables (four questions). The food vehicles for rooibos herbal tea addition (a less typical addition to food) were vegetables (two questions), other starch (two questions) and fruit (three questions). The detail of the phytochemical providers and the food vehicles provided above are incorporated in the table representing the findings of the respondents' likelihood to consume home-cooked dishes for enhanced phytochemical intake.

Data analysis

Each respondent obtained a numerical score for each question to reflect how likely it was that he/she would consume each provided food pairing. Mean scores (and standard errors) were calculated for the respondent sample as a whole to represent the respondents' likelihood to consume the phytochemical providers and selected food vehicles (for rooibos herbal tea and herbs as phytochemical providers). The repeated measures analysis of variance (ANOVA) was used to determine significant differences ($p < 0,05$) for the means of the likeliness scale (with '1' as 'extremely unlikely' and '5' as 'extremely likely') of each of the phytochemical providers and selected food vehicle clusters. Where the ANOVA results showed significant differences ($p < 0,05$), the Bonferroni correction for multiple comparisons was applied and pairwise comparisons were used to identify the differences in the various phytochemical providers or food vehicles. A dummy variable (indicating whether the respondents were involved in the preparation of food at home or not) was used as an independent variable, while the phytochemical providers and food vehicles were the dependent variables. The ANOVA and the Bonferroni correction for multiple comparisons were also used to identify significant differences between the respondents' demographic and lifestyle characteristics and their likelihood to consume home-cooked dishes for enhanced phytochemical intake from fruit, herb and rooibos herbal tea additions as phytochemical providers. The data was analysed using the Statistical Package for Social Sciences® version 20.

RESULTS AND DISCUSSION

Sample size

A total of 230 questionnaires were distributed to allow for incomplete data and participant withdrawal from the study, and 184 questionnaires were captured and used for the results. The 184 respondents included employees that represented the professional sector occupations in the participating companies and who met the age criteria. Thirty respondents withdrew from the study (87% response rate), and 16 questionnaires had to be discarded as they were returned incomplete.

Demographic, health and lifestyle characteristics of the respondents

The respondents were predominantly female (58,7%), between the ages of 31 and 44 years (67,9%) and white (72,3%). The highest level of education attained by most of the respondents was grade 12 plus a diploma (29,4%) or a degree (32,1%). A large percentage (42,4%) of the respondents' occupations fell within the category 'other professionals', and included business professionals and legal professionals (Bureau of Statistics, 2009). Almost half of the respondents were married or living together with their children (48,9%), and spoke English (48,9%) or Afrikaans (47,3%). The majority (76,1%) of the respondents were involved in the preparation of food at home (see Table 1).

The majority of the respondents were non-smokers (69%) and a few (10,9%) were former smokers. Just over half of the respondents were regular supplement users (50,5%) and engaged in regular physical activity (59,2%). A small

TABLE 1: DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS

Respondent demographic characteristics (n = 184)		%	n
Gender	Male	41,3	76
	Female	58,7	108
Age (years)	31-44	67,9	125
	45-54	19	35
	55-64	13	24
Population group	White	72,3	133
	Black	3,8	7
	Coloured	22,3	41
	Asian	1,6	3
Home language	English	48,9	90
	Afrikaans	47,3	87
	Xhosa	1,6	3
	Other (African languages)	2,2	4
Level of education (Highest)	Grade 12 (matric)	8,7	16
	Grade 12 and certificate	11,4	21
	Grade 12 and diploma	29,4	54
	Grade 12 and degree	32,1	59
	Postgraduate (masters/doctorate)	18,5	34
Occupation[a]	Physicists, chemists and related professionals	16,3	30
	Life science and health professionals	1,6	3
	Teaching professionals	1,1	2
	Other professionals	42,4	78
	Technicians and associate professionals	4,4	8
	Life science and health associate professionals	1,1	2
	Teaching associate professionals	0,5	1
	Other associate professionals	32,6	60
Marital status	Married / living together with children	48,9	90
	Married / living together without children	21,7	40
	Single and living with children	9,8	18
	Single and living without children	19,6	36
Involved in home food preparation	Yes	76,1	140
	No	23,9	44

[a] International Standards Classification of Occupations as professionals and technician and associate professionals as sample groups

percentage of the respondents indicated that they had been diagnosed with a NCD (8,8%) or were obese (7,6%). The most prevalent NCD within the respondents' family history was cancer (36,4%), followed by diabetes mellitus (29,9%) (see Table 2).

The profile of the respondents in this study concurs with that of health-conscious consumers. In line with the respondents in this study, studies have indicated that health-conscious consumers tend to be female, older, more educated (Girois *et al*, 2001; Divine & Lepisto, 2005), higher income earners, physically active and have a more optimal body weight status (Robinson & Smith, 2003).

Respondents' likelihood to consume home-cooked dishes for enhanced phytochemical intake

Vegetables as phytochemical provider
Various vegetables were included as options for vegetables as phytochemical provider and various dishes were included as food vehicles (see Table 3). The majority of the respondents indicated that they would be likely (as response options 'very likely' and 'extremely likely') to consume pasta, meat and chicken as food vehicles with added vegetables, namely spaghetti tossed in tomato pesto (83,7%), meatballs cooked in tomato sauce (81%), chicken and broccoli bake (83,2%), pasta and broccoli bake (77,8%) and chicken breast stuffed with spinach (81,5%). Considering

TABLE 2: LIFESTYLE CHARACTERISTICS OF RESPONDENTS

Respondent lifestyle characteristics (n = 184)		%	n
Smoking status[a]	Non-smoker	69	127
	Current smoker	20,1	37
	Former smoker	10,9	20
Dietary supplement usage[b]	Never	19	35
	Seldom	16,9	31
	When remembered	13,6	25
	Fairly regularly	11,4	21
	Regularly	39,1	72
Level of physical activity	Physically active[c]	59,2	109
	Not physically active	40,8	75
Obesity or chronic disease diagnosis	Obesity	7,6	14
	Diabetes mellitus	4,4	8
	Cardiovascular disease	2,2	4
	Cancer (excluding melanoma and skin cancer)	2,2	4
Family history of obesity or chronic disease	Obesity	7,6	14
	Diabetes mellitus	29,9	55
	Cardiovascular disease	26,6	49
	Cancer (excluding melanoma and skin cancer)	36,4	67

[a] Current smoker included those who smoked any tobacco in the past 12 months and those who had quit within the past year. Former smoker included those who had quit more than a year ago (Yusuf *et al*, 2004)

[b] Dietary supplement was defined as "a product (other than tobacco) that is intended to supplement the diet and that bears or contains one or more of the following dietary ingredients: a vitamin, a mineral, a herb or other botanical, an amino acid, a dietary substance for use by man to supplement the diet by increasing the total daily intake, or a concentrate, metabolite, constituent, extract or combinations of these ingredients" (Halsted, 2003).

[c] Physically active was defined as regular involvement of moderate (walking, cycling or gardening) or strenuous (jogging, football and vigorous swimming) exercise for four hours or more a week (Yusuf *et al*, 2004)

quiche as food vehicle for vegetables as phytochemical provider, the respondents indicated that they would be equally likely to consume spinach quiche (74,4%) and roasted butternut quiche (72,8%) rather than onion quiche (56%). Considering soup as food vehicle for vegetable addition, the majority (86,4%) of the respondents indicated that they would be likely to consume roasted butternut soup, while about two thirds indicated that they would be likely to consume broccoli (60,3%) and tomato (63,1%) soups. Approximately half (53,3%) indicated that they would be likely to consume onion soup. A number of vegetables therefore were likely options for enhancing phytochemical intake, with the respondents likely to consume tomato, broccoli, spinach and butternut. Mixed dishes and soup contribute to the consumption of vegetables, particularly tomatoes and broccoli (Bachman *et al*, 2008).

Fruit as phytochemical provider When considering fruit as phytochemical provider (see Table 3), the majority of the respondents indicated that they would be likely to consume a green leafy salad with strawberries (72,8%) and crêpe with mixed berries (77,2%) as berry additions. Just over half of the respondents indicated that they would be likely to consume pear poached in red grape juice (53,8%) and rocket and pear salad (56%) as pome additions. The respondents also indicated that they would be likely to consume chicken as food vehicle with added apple, with just over three-quarters (78,3%) likely to consume chicken breast salad with apple pieces and two-thirds (66,3%) to consume chicken and apple casserole. Just over half (57,1%) of the respondents indicated that they would be likely to consume kingklip baked with naartjie segments (as added citrus fruit). Carrot dishes as food vehicle for fruit addition was a further likely option, with two-thirds (66,3%) of the respondents likely to consume carrot salad with raisins and carrots roasted in orange juice respectively. Consuming raw apple with its skin on was a likely option for the majority (90,8%) of the respondents. This is a favourable way to consume apples as flavonoids occur in higher amounts in the outer rather than inner parts of fruit, with the result that skinning fruit can greatly lower its flavonoid content (Manach *et al*, 2004).

South Africans are said to enjoy the taste of apples, which are a popular choice due to their

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TABLE 3: RESPONDENTS' LIKELIHOOD TO CONSUME HOME-COOKED DISHES FOR ENHANCED PHYTOCHEMICAL INTAKE

Phytochemical provider		Food vehicle	Dish	Respondent consumption likeliness (n = 184)									
				Extremely unlikely		Very unlikely		Unsure		Very likely		Extremely likely	
				%	n	%	n	%	n	%	n	%	n
Vegetables (n=13)	**Broccoli** (n = 3)	Soup	Broccoli soup	13	24	13,6	25	13	24	39,1	72	21,2	39
		Other starch	Pasta and broccoli bake	7,6	14	6	11	8,7	16	35,9	66	41,9	77
		Chicken	Chicken and broccoli bake	7,6	14	3,8	7	5,4	10	37,5	69	45,7	84
	Butternut (n = 2)	Soup	Roasted butternut soup	4,9	9	3,3	6	5,4	10	46,2	85	40,2	74
		Quiche	Roasted butternut quiche	7,6	14	7,6	14	12	22	37,5	69	35,3	65
	Onion (n = 2)	Soup	Onion soup	10,9	20	19	35	16,9	31	37	68	16,3	30
		Quiche	Onion quiche	12,5	23	12,5	23	19	35	37	68	19	35
	Spinach (n = 3)	Quiche	Spinach quiche	11,4	21	8,2	15	6	11	35,3	65	39,1	72
		Chicken	Chicken breast stuffed with spinach	6	11	4,9	9	7,6	14	34,8	64	46,7	86
		Other starch	Pancakes filled with cooked spinach	8,7	16	16,3	30	10,9	20	33,2	61	31	57
	Tomato (n = 3)	Soup	Tomato soup	14,7	27	13,6	25	8,7	16	43,5	80	19,6	36
		Meat	Meatballs cooked in tomato sauce	5,4	10	7,6	14	6	11	31	57	50	92
		Other starch	Spaghetti with tomato pesto[a]	0	0	9,8	18	6,5	12	40,2	74	43,5	80
Fruit (n=12)	**Berry** (n = 3)	Salad	Green leafy salad with strawberries	5,4	10	9,2	17	12,5	23	30,4	56	42,4	78
		Dessert	Crêpe[b] with mixed berries	5,4	10	8,2	15	9,2	17	33,2	61	44	81
		Dessert	Mixed berry compote	7,1	13	13,6	25	13	24	35,3	65	31	57
	Pome (n = 5)	Dessert	Pear poached in red grape juice	12,5	23	15,8	29	17,9	33	34,8	64	19	35
		Salad	Rocket and pear salad	8,2	15	13	24	22,8	42	29,4	54	26,6	49
		Chicken	Chicken breast salad with apple pieces	4,4	8	7,1	13	10,3	19	39,7	73	38,6	71
	Citrus (n = 3)	Chicken	Chicken and apple casserole	9,2	17	12	22	12,5	23	39,7	73	26,6	49
		-	Raw apple with skin	0	0	4,4	8	4,9	9	32,1	59	58,7	108
		Fish	Kingklip fish baked with naartjie segments	10,3	19	12	22	20,7	38	34,8	64	22,3	41
		Vegetables/Carrot	Carrots roasted in orange juice	7,6	14	8,7	16	17,4	32	35,9	66	30,4	56
		Vegetables/Butternut	Butternut and orange soup	7,6	14	14,7	27	15,8	29	33,7	62	28,3	52
	Dried (n = 1)	Salad	Carrot salad with raisins	9,2	17	13,6	25	10,9	20	34,8	64	31,5	58

[a] Tomato pesto means a paste of crushed sundried tomatoes, pine nuts and olive oil
[b] Crêpe means a very thin pancake
[c] Plum compote means plums cooked in syrup
[d] Risotto means rice cooked to a creamy and sticky consistency

TABLE 3: RESPONDENTS' LIKELIHOOD TO CONSUME HOME-COOKED DISHES FOR ENHANCED PHYTOCHEMICAL INTAKE - Continued

Phytochemical provider		Food vehicle	Dish	Respondent consumption likeliness (n = 184)									
				Extremely unlikely		Very unlikely		Unsure		Very likely		Extremely likely	
				%	n	%	n	%	n	%	n	%	n
Herbs (n = 16)	**Mint** (n = 3)	Legume	Split pea and mint soup	10,9	20	20,1	37	16,9	31	36,4	67	15,8	29
		Potato	Potato salad with mint	4,4	8	14,7	27	20,1	37	37,5	69	23,4	43
		Water	Water infused with mint	3,8	7	12	22	12	22	40,2	74	32,1	59
	Parsley (n = 4)	Potato	Boiled baby potatoes with parsley	0	0	4,4	8	4,4	8	45,7	84	45,7	84
		Egg	Scrambled egg with parsley	3,8	7	5,4	10	3,3	6	42,9	79	44,6	82
		Vegetables/Carrot	Carrot salad with raisins and parsley	9,8	18	14,1	26	16,9	31	34,8	64	24,5	45
		Chicken	Chicken soup with parsley	0	0	7,6	14	3,8	7	49,5	91	39,1	72
	Basil (n = 3)	Fruit	Spanspek balls with basil	10,3	19	14,1	26	21,2	39	31,5	58	22,8	42
		Vegetables/Tomato	Sliced tomato with basil	8,2	15	10,9	20	9,2	17	40,2	74	31,5	58
		Vegetables/Tomato	Tomato and basil soup	12	22	14,1	26	10,3	19	41,3	76	22,3	41
	Mixed herbs (n = 3)	Egg	Omelette with mixed herbs	3,3	6	3,8	7	6,5	12	45,1	83	41,3	76
		Other starch	Bread baked with mixed herbs	0	0	8,2	15	13,6	25	52,2	96	26,1	48
		Other starch	Rice with mixed herbs	0	0	7,1	13	9,8	18	54,9	101	28,3	52
	Rosemary (n = 3)	Potato	Roasted potatoes with rosemary	0	0	5,4	10	7,6	14	40,2	74	46,7	86
		Vegetables/Butternut	Butternut soup with rosemary	7,6	14	10,9	20	16,9	31	44	81	20,7	38
		Chicken	Roast chicken with rosemary stuffing	4,9	9	3,8	7	7,6	14	35,3	65	48,4	89
	Rooibos herbal tea (n = 7)	Fruit (dessert)	Prunes stewed in rooibos herbal tea	20,7	38	20,7	38	20,7	38	26,6	49	11,4	21
		Fruit (dessert)	Plum compote[c] prepared with rooibos herbal tea	19	35	16,3	30	28,3	52	23,9	44	12,5	23
		Fruit (dessert)	Pear poached in rooibos herbal tea	15,2	28	20,7	38	20,7	38	28,3	52	15,2	28
		Other starch	Risotto[d] prepared with rooibos herbal tea	14,7	27	16,3	30	25	46	29,9	55	14,1	26
		Other starch	Bread baked with rooibos herbal tea	9,8	18	13	24	23,9	44	37	68	16,3	30
		Vegetables	Vegetable soup prepared with rooibos herbal tea	14,1	26	23,4	43	21,7	40	32,1	59	8,7	16
		Vegetables/Tomato	Tomato soup prepared with rooibos herbal tea	19,6	36	23,9	44	21,7	40	27,7	51	7,1	13

[a] Tomato pesto means a paste of crushed sundried tomatoes, pine nuts and olive oil
[b] Crêpe means a very thin pancake
[c] Plum compote means plums cooked in syrup
[d] Risotto means rice cooked to a creamy and sticky consistency

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affordability (Temple & Steyn, 2011). It therefore can be assumed that the respondents found apple a likely option to utilise for enhanced phytochemical intake due to its familiarity and enjoyable taste. It further may be assumed that apple in its cooked form may have been a more likely choice if dishes incorporating cooked apple in a dessert were presented as options, as savoury dishes incorporating apple were provided most as options. The consumption of berries is increasing in SA (Farmer's Weekly, 2012), which may be a contributory factor to their likelihood of being consumed in a dessert and added to a salad for enhanced phytochemical intake.

Herbs as phytochemical provider Far more respondents indicated that they would be more likely than not to consume dishes with added herbs for enhanced phytochemical intake (see Table 3). The majority of the respondents indicated that they would be likely to consume both food vehicle options of chicken with added herbs, namely chicken soup with parsley (88,6%) and roast chicken with rosemary stuffing (83,7%). The majority of the respondents indicated that they also would be likely to consume egg as food vehicle with added herbs, such as scrambled egg with parsley (87,5%) and omelette with mixed herbs (86,4%). Potato and other starches were also likely food vehicles for added herbs. The majority of the respondents were likely to consume boiled baby potatoes with parsley (91,4%), roasted potatoes with rosemary (86,9%), rice with mixed herbs (83,2%) and bread baked with mixed herbs (78,3%). The majority of the respondents also were likely to consume water infused with mint (72,3%) and sliced tomato salad with shredded basil (71,1%).

Parsley, mixed herbs and rosemary as herb additions to foods were likely to be consumed by the respondents. The dishes with added herbs most likely to be consumed were boiled baby potatoes with parsley, chicken soup with parsley, scrambled egg with parsley, omelette with mixed herbs, rice with mixed herbs, bread baked with mixed herbs, roasted potatoes with rosemary and roast chicken with rosemary stuffing.

While parsley was a likely option for herbs added to dishes, the respondents were less likely to consume carrot salad with raisins and parsley than carrot salad with raisins (respondent consumption likelihood of 59,3% compared to 66,3%). When considering parsley, the food vehicles likely to be consumed by the respondents were potato, egg and chicken. Boiled baby potatoes with parsley was a more likely option than potato salad with mint (respondent consumption likelihood of 91,4% compared to 60,9%). The addition of herbs may be a more likely option when added to warm dishes rather than cold dishes such as salads, as carrot salad with added parsley was not as likely to be consumed by the respondents. Egg (as quiche) and other starch, namely bread and rice, were likely options when paired with mixed herbs. Mixed herbs can be a versatile way to enhance the phytochemical content of dishes, as they enhance the flavour of a dish without dominating it. Potato and chicken were likely options when paired with rosemary. As soups, vegetable soups were a less likely food vehicle option for the addition of herbs than chicken soup.

Rooibos herbal tea as phytochemical provider When considering the respondents' likelihood to consume home-cooked dishes with rooibos herbal tea (see Table 3), starch as food vehicle for the addition of rooibos herbal tea was a more likely option over fruit (as three desserts) and vegetables (as two soups). Just more than half (53,3%) of the respondents indicated that they would be likely to consume bread baked with rooibos herbal tea, and just less than half (44%) that they would be likely to consume risotto prepared with rooibos herbal tea.

Differences in the respondents' likelihood to consume home-cooked dishes for enhanced phytochemical intake considering phytochemical providers and food vehicles

A significant difference ($p < 0,05$) was found between the respondents' likelihood to consume broccoli, onion, spinach, butternut and tomato as vegetable phytochemical providers. The respondents were significantly ($p < 0,001$) more likely to consume broccoli, spinach, butternut and tomato in comparison to onion as vegetable additions, and significantly ($p < 0,05$) more likely to consume tomato as vegetable addition rather than broccoli (see Table 4). The North/South Ireland Food Consumption Survey undertaken by O'Brien *et al* (2003) found composite dishes to contribute to the mean daily intake of tomatoes. Tomatoes were also found to be consumed by far more consumers than broccoli. This corresponds to the finding of the current study and confirms that tomato is a likely vegetable added to dishes. Although composite foods comprise a large portion of the mean daily

TABLE 4: DIFFERENCES IN THE RESPONDENT LIKELIHOOD TO CONSUME HOME-COOKED DISHES FOR ENHANCED PHYTOCHEMICAL INTAKE

Respondent likelihood to consume home-cooked dishes for enhanced phytochemical intake[a]					Significant difference[d,e]
Vegetables as phytochemical provider					
Broccoli (1) (n = 3)[b]	Onion (2) (n = 2)	Spinach (3) (n = 3)	Butternut (4) (n = 2)	Tomato (5) (n = 3)	
3,72 (0,09)[c]	3,25 (0,10)	3,73 (0,09)	3,83 (0,08)	3,91 (0,08)	(2) – (1)[f](3)[f](4)[f](5)[f] (1) – (5)
Fruit as phytochemical provider					
Berries (1) (n = 3)	Citrus (2) (n = 2)[b1]	Pome (3) (n = 3)[b2]			
3,81 (0,08)	3,50 (0,09)	3,67 (0,08)			(1) – (2)[f](3) (2) – (3)
Herbs as phytochemical provider					
Mint (1) (n = 3)	Parsley (2) (n = 4)	Basil (3) (n = 3)	Mixed herbs (4) (n = 3)	Rosemary (5) (n = 3)	
3,24 (0,08)	4,01 (0,07)	3,47 (0,08)	4,01 (0,06)	3,92 (0,07)	(1) – (2)[f](3)(4)[f](5)[f] (2) – (3)[f] (3) – (4)[f](5)[f]
Food vehicle with added herbs as phytochemical provider					
Egg (1) (n = 2)	Chicken (2) (n = 2)	Potato (3) (n = 3)	Other starch (4) (n = 2)	Vegetable (5) (n = 4)	
4,19 (0,08)	4,14 (0,08)	4,01 (0,07)	3,93 (0,07)	3,49 (0,08)	(5) – (1)[f](2)[f](3)[f](4)[f] (4) – (1)(2)
Fruit, herbs and rooibos herbal tea as phytochemical providers					
Fruit (1) (n = 10)[b3]	Herbs (2) (n = 16)	Rooibos herbal tea (3) (n = 7)			
3,60 (0,07)	3,79 (0,06)	2,92 (0,09)			(3) – (1)[f](2)[f] (2) – (1)[f]
Food vehicle with added rooibos herbal tea as phytochemical provider					
Vegetables (1) (n = 2)	Starch (2) (n = 2)	Fruit (3) (n = 3)			
2,77 (0,10)	3,15 (0,10)	2,86 (0,10)			(2) – (1)[f](3)

[a] Mean of scale values, where 1 equals 'extremely unlikely' and 5 equals 'extremely likely'

[b] Number of set options within phytochemical provider or food vehicle (see Table 3: [b1] Butternut and orange soup (less pertinent citrus addition) excluded as citrus fruit; [b2] Raw apple with skin (as whole fruit) and pear poached in red grape juice (having a further fruit addition) excluded as pome fruit; [b3] Berries, citrus fruit and pome fruit, excluding raw apple with skin (as whole fruit), the fruit phytochemical providers)

[c] Values: Mean ± standard error presented as mean (standard error)

[d] Overall significant difference ($p < 0,05$) in the repeated measures analysis of variance (ANOVA)

[e] Bonferroni correction for multiple comparisons for identification of pair-wise contrasts on significance ($p < 0,05$) in the repeated measures (ANOVA). Pair-wise contrasts presented as phytochemical provider (or food vehicle) number in brackets, e.g. (1), different (-) to other phytochemical provider (or food vehicle) number(s) in brackets.

[f] Bonferroni correction for multiple comparisons for identification of pair-wise contrasts on significance ($p < 0,001$) in the repeated measures (ANOVA). Pair-wise contrasts presented as phytochemical provider (or food vehicle) number in brackets, e.g. (1), different (-) to other phytochemical provider (or food vehicle) number(s) in brackets.

onion intake (O'Brien *et al*, 2003), onions did not feature well in this study. Onions are typically added to enhance the taste and flavour of dishes (Marotti & Piccaglia, 2002) and do not represent the main ingredient that lends the name to the dish as was presented in this study (e.g. onion quiche).

The likelihood of the respondents to consume fruit as phytochemical provider added to various food vehicles was considered and a significant difference ($p < 0,05$) was found between the respondents' likelihood to consume berries, citrus fruit and pome fruit as fruit additions. The respondents were more likely to consume berries than pome fruit ($p < 0,05$) and citrus fruit

TABLE 5: DEMOGRAPHIC CHARACTERISTICS OF THE RESPONDENTS MOST LIKELY TO CONSUME HOME-COOKED DISHES FOR ENHANCED PHYTOCHEMICAL INTAKE WITH FRUIT, HERBS AND ROOIBOS HERBAL TEA AS PHYTOCHEMICAL PROVIDERS

Demographic characteristics	Demographic category	Respondent likelihood to consume phytochemical providers in home-cooked dishes[a]			
		Fruit (n = 10)[b]	Herbs (n = 16)	Rooibos herbal tea (n = 7)	Significant difference[d,e]
Gender	Male (1)	3,52 (0,10)[c]	3,76 (0,08)	2,96 (0,11)	Fruit: (1) – (2)
	Female (2)	3,81 (0,08)	3,93 (0,06)	3,07 (0,10)	
Age (years)	31 – 44 (1)	3,65 (0,08)	3,81 (0,06)	3,04 (0,09)	Fruit: (3) – (1)(2) Herbs: (1) – (3)
	45 – 54 (2)	3,52 (0,15)	3,79 (0,10)	2,76 (0,16)	
	55 – 64 (3)	4,16 (0,14)	4,18 (0,11)	3,32 (0,22)	
Population group	White (1)	3,68 (0,08)	3,86 (0,06)	3,00 (0,09)	
	Black (2)	3,81 (0,33)	3,96 (0,28)	3,16 (0,40)	
	Coloured (3)	3,77 (0,10)	3,87 (0,09)	3,14 (0,14)	
	Asian (4)	3,03 (0,46)	3,31 (0,16)	2,29 (0,38)	
Home language	English (1)	3,76 (0,09)	3,96 (0,07)	3,13 (0,11)	
	Afrikaans (2)	3,61 (0,09)	3,74 (0,07)	2,90 (0,11)	
	Xhosa (3)	3,33 (0,67)	3,73 (0,62)	2,33 (0,67)	
	Other (African languages) (4)	4,18 (0,22)	4,13 (0,24)	3,79 (0,17)	
Level of education (highest)	Grade 12 (1)	3,90 (0,20)	3,98 (0,20)	3,10 (0,25)	
	Grade 12 and certificate (2)	3,51 (0,18)	3,75 (0,12)	2,50 (0,22)	
	Grade 12 and diploma (3)	3,75 (0,10)	3,94 (0,07)	3,09 (0,15)	
	Grade 12 and degree (4)	3,67 (0,12)	3,76 (0,09)	3,12 (0,12)	
	Postgraduate (master's / doctorate) (5)	3,66 (0,17)	3,89 (0,13)	3,03 (0,18)	
Marital status	Married/living together with children (1)	3,73 (0,09)	3,89 (0,06)	3,07 (0,11)	
	Married/living together without children (2)	3,83 (0,14)	3,98 (0,12)	3,12 (0,17)	
	Single and living with children (3)	3,46 (0,17)	3,58 (0,13)	2,62 (0,24)	
	Single and living without children (4)	3,56 (0,15)	3,77 (0,13)	3,00 (0,15)	
Involved in the preparation of food at home	Yes (1)	3,77 (0,07)	3,91 (0,06)	3,12 (0,08)	Fruit: (1) – (2) Herbs: (1) – (2) Rooibos herbal tea: (1) – (2)
	No (2)	3,43 (0,13)	3,67 (0,10)	2,71 (0,16)	

[a] Mean of scale values where 1 equals 'extremely unlikely' and 5 equals 'extremely likely'

[b] Number of set options within phytochemical provider (see Table 3: Berries, citrus fruit and pome fruit, excluding raw apple with skin (as whole fruit), the fruit phytochemical providers)

[c] Values: Mean ± standard error presented as mean (standard error)

[d] Overall significant difference ($p < 0,05$) in the repeated measures analysis of variance (ANOVA)

[e] Bonferroni correction for multiple comparisons for identification of pair-wise contrasts on significance ($p < 0,05$) in the repeated measures analysis of variance (ANOVA). Pair-wise contrasts presented as demographic characteristic category number in brackets, e.g. (1), different (-) to other demographic characteristic category number(s) in brackets within each phytochemical provider.

($p < 0,001$), and pome fruit rather than citrus fruit ($p < 0,05$), as fruit additions (see Table 4). O'Brien *et al* (2003) found the contribution of citrus fruit in composite foods to be lower than that of apple, making the inclusion of apple a likely option for fruit addition to food.

Considering the likelihood of the respondents to consume home-cooked dishes with the addition of herbs, a significant difference ($p < 0,05$) was found between mint, parsley, basil, mixed herbs and rosemary as options. The respondents were significantly more likely to consume dishes with parsley ($p < 0,001$), mixed herbs ($p < 0,001$),

rosemary ($p < 0,001$) and basil ($p < 0,05$) than mint. The respondents also were more likely to consume parsley than basil ($p < 0,001$), and more likely to consume mixed herbs ($p < 0,001$) and rosemary ($p < 0,001$) than basil as herb addition to food (see Table 4). Parsley is a popular culinary herb, used in its fresh or dry form, in many dishes around the world (Kamel, 2013).

A significant difference ($p < 0,05$) was found between egg, chicken, potato, other starch and vegetables as food vehicles for the addition of herbs. The respondents were more likely to consume egg and chicken as respective food vehicles in comparison to other starch ($p < 0,05$) and vegetables ($p < 0,001$). The respondents also were more likely to consume potato than vegetables ($p < 0,001$), as well as other starch than vegetables ($p < 0,001$), as food vehicles (see Table 4).

Considering the likelihood of the respondents to consume home-cooked dishes for enhanced phytochemical intake, a significant difference ($p < 0,05$) was found in the respondents' likelihood to consume fruit, herbs and rooibos herbal tea as phytochemical providers. The respondents were significantly ($p < 0,001$) more likely to consume fruit and herb addition than rooibos herbal tea addition (see Table 4). While tea flavonoids have been utilised in a wide range of food and beverage applications in food trials (Wang *et al*, 2007), food products with tea/tea extract addition are not widely available in the South African market. Tea is also not a commonly used ingredient in recipe formulations. These could be among the reasons why rooibos herbal tea was found to be the least likely addition.

Furthermore, the respondents were more likely to consume herb addition to food than fruit addition ($p < 0,001$) (see Table 4). As herbs are added to many recipe formulations for enhanced flavour, aroma and colour (Balestra *et al*, 2011) this possibly makes them a familiar food addition for consumers. The respondents on the other hand may not be familiar with adding fruit to home-cooked dishes. When compared to vegetables, fruit is not commonly used as an ingredient in composite dishes (Krebs-Smith *et al*, 1995; O'Brien *et al*, 2003).

Although the addition of rooibos herbal tea to home-cooked dishes appeared to be a less likely option as phytochemical provider based on the above, a significant difference ($p < 0,05$) was found between the likelihood of vegetables, starch and fruit as respective food vehicles for the addition of rooibos herbal tea. The respondents were more likely to consume starch-based dishes than vegetable-based dishes ($p < 0,001$) and fruit-based dishes ($p < 0,05$) with the addition of rooibos herbal tea (see Table 4).

Demographic characteristics of the respondents most likely to consume home-cooked dishes with fruit, herbs and rooibos herbal tea as phytochemical providers

The respondents' gender, age and whether or not they were involved in the preparation of food at home were individually found to significantly ($p < 0,05$) influence their likelihood to consume the phytochemical-providing additions to home-cooked dishes (see Table 5). The female respondents were more likely to consume dishes with added fruit than the male respondents ($p < 0,05$). The older respondents (55 to 64 years) were more likely to consume dishes with fruit additions than the younger respondents aged 31 to 44 years ($p < 0,05$) and 45 to 54 years ($P < 0,05$). The older respondents (55 to 64 years) were also more likely to consume dishes with added herbs than the younger respondents (31 to 44 years) ($p < 0,05$). The respondents involved in the preparation of food at home were more likely to consume dishes with added fruit ($p < 0,05$), herbs ($p < 0,05$) and rooibos herbal tea ($p < 0,05$) respectively than those who were not. The respondents' population group, home language, level of education and marital status did not influence ($p > 0,05$) their likelihood to consume home-cooked dishes for enhancing their intake of any of the providers of phytochemicals.

According to Kiefer *et al* (2005) there are significant gender-specific differences in many areas of nutrition. Women have a greater awareness and better knowledge of nutrition and consume more fruit than men. The female respondents in this study were significantly more likely to consume dishes with added fruit than the male respondents. Furthermore, the older respondents were significantly more likely to consume dishes with added herbs and fruit than the younger respondents. The consumption of fruit increases with advancing age and is more prevalent amongst females (Li *et al*, 2000). The respondents involved in the preparation of food at home may have been more familiar with certain ingredients and flavour combinations than those not involved with food preparation, and as a result may be more open to consuming

dishes with the addition of fruit, herbs and rooibos herbal tea than those who were not.

Lifestyle characteristics of the respondents most likely to consume home-cooked dishes with fruit, herbs and rooibos herbal tea as phytochemical providers

The respondents' smoking status, dietary supplement use and level of physical activity did not influence ($p > 0,05$) their likelihood to consume home-cooked dishes for enhanced phytochemical intake for any of the phytochemical providers.

CONCLUSIONS

The respondents in this study were likely to consume home-cooked dishes with food additions for enhanced phytochemical intake. Adding vegetables, fruit, herbs and tea to dishes for enhanced phytochemical intake is a possible approach that could be used to increase the consumption of these phytochemical-rich sources. Although the respondents were likely to consume home-cooked dishes for enhanced phytochemical intake, some phytochemical providers and food vehicles were found to be more likely options than others that may be greatly influenced by the provided food-pairing options. The question that remains, however, is whether it is not more realistic to consume more vegetables, fruit and tea as is, rather than to incorporate them into dishes.

The respondents' gender, age and whether or not they were involved in the preparation of food at home influenced their likelihood to consume home-cooked dishes for enhanced phytochemical intake. More female than male respondents were likely to consume added fruit for enhanced phytochemical intake. The older respondents also were more likely to consume home-cooked dishes with added fruit and added herbs than the younger respondents. The respondents involved in the preparation of food at home were more likely to consume home-cooked dishes with fruit, herbs and rooibos herbal tea than those who were not involved in the preparation of food at home.

Online journal searches produced no similar studies pertaining to the likelihood of consumers in the professional sector, or other occupational groups, to make dietary adjustments to enhance phytochemical intake. The lack of available studies therefore limits the discussion of the results of this study. Even information on the types of food commonly consumed by adult South Africans is limited (Van Heerden & Schönfeldt, 2011) which further limits the discussion of the findings of this study.

The phytochemical provider and food vehicle pairing options provided in the study to represent the home-cooked dishes can be questioned, as they cannot be considered equally and fully representative. Although these pairings were evaluated for content and face validity, the selection may bias the findings due to a possible lack of equal and collective representation. The study nevertheless provides a platform from which to proceed for further research in the field.

The research was restricted to a limited population size ($n = 184$) of predominantly white -collar workers in occupations representing the occupational groups professional, technicians and associate professionals who were 31 to 65 years of age, working within the boundaries of the City of Cape Town. As convenience purposive sampling was used, it is possible that sampling bias occurred. The research furthermore was not extended to other occupational groups, geographical areas and age groups. The research also was restricted to vegetables, fruit, herbs and tea as phytochemical providers, and to commonly consumed and readily available foods as food vehicles (chicken, fish, egg, potato, other starch, etc.). Therefore the results do not represent all the options that could be utilised as home-cooked dishes.

RECOMMENDATIONS

Education is required to convey the importance of a phytochemical-rich diet to reduce the risk of the onset of NCDs. There is considerable evidence of the role played by vegetables, fruit and whole grains, and regular tea consumption, in the prevention of NCDs. The recommended and/or suggested dietary intakes of phytochemical-rich dietary sources should be promoted and emphasised as a minimum requirement, while caution should be exercised with herbs and teas, as no official dietary recommendations have been established to date and toxicity levels have not been established for herbs.

Dieticians, health-care practitioners and food-, nutrition- and health-related government departments can make use of the findings of this study to educate consumers on the vital role phytochemicals play in reducing the risk of the

development of NCDs. They first and foremost should educate consumers on responsible food choices, which then can be followed by education on the recommended and/or suggested intakes of fruit, vegetables, whole grains and tea for the prevention of disease. Suggestions can be made to enhance phytochemical intake by flavouring dishes with added herbs (instead of salt), adding a variety of vegetables to composite dishes such as soups, stews and casseroles in quantities that can contribute to the consumption of a vegetable serving, and using teas and herbal teas as a food preparation liquid. To date, no South African interventions have been aimed specifically at improving dietary phytochemical intake other than the promotion of the food-based dietary guidelines by the Nutrition Directorate of the National Department of Health in particular the dietary guideline of "Eat plenty of vegetables and fruit every day" (Naude, 2013). The education provided should assist consumers to understand the reasons for making the recommended dietary changes, as well as their importance. There is a need to raise consumer awareness of phytochemicals in order for dietary change to take place so that the escalating incidence of NCDs in SA is prevented. Strategies to create awareness of phytochemicals should be targeted at women, individuals between the ages of 55 and 64 years and those who are involved in the preparation of food at home. Women are considered more health conscious than men (Girois *et al*, 2001; Divine & Lepisto, 2005) and most often are responsible for the preparation of food at home (Smith *et al*, 2013) making them suitable candidates for such awareness-creation strategies. Although NCDs manifest in adulthood (Darnton-Hill *et al*, 2004), awareness-creation strategies are appropriate for older persons as individuals later in life, for example in their forties and even up to their sixties, still may benefit from adopting sound food choices to reduce their risk of age-associated chronic disease (Rivlin, 2007).

If a study of this nature was ever to be repeated or expanded upon, consideration should be given to the inclusion of soy and spices as providers of phytochemicals. A further consideration would be to use younger adults or children as the study sample. There is a growing body of evidence that adult diseases are influenced by various early-life exposures (Davey-Smith, 2003; Kuh & Ben-Shlomo, 2003).

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