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ABSTRACT

Objectives: Beliefs about what people think they ought to eat to be healthy ("healthy eating norms") may be important influences on food consumption. The purpose of this study was to examine the predictive roles of normative expectations and

demographics, personal values, substance use behaviours, and body weight on reported food consumption among middle-aged Australians.

Subjects: A questionnaire was administered by mail to a random sample of people aged 40 years and above, drawn from the Electoral Rolls in Victoria, Australia. Part of the questionnaire contained questions about the respondents' beliefs about what should they eat to be healthy, what actually they ate, their personal values, smoking and alcohol use, as well as self-reported heights and weights and demographic characteristics.

Results: Respondents' reported food consumption did not match their healthy eating norms (HEN). Demographics, smoking, BMI, and personal values, and HEN were associated with reported consumption but the relationships differed among men and women. Generally, high energy dense, nutrition poor food (EDNP) consumption was negatively associated with age. Fruit and vegetable HEN and consumption was positively linked to universalist values but negatively related to smoking status among men. In contrast in women, fruit and vegetable HEN were positively related to income and education while EDNP HEN was negatively associated with age and income but positively linked to body weight and power values.

Conclusion: Reported food consumption was associated with HEN, personal values, demographics, smoking, and BMI through different pathways among men and women. The implications for nutrition promotion are discussed.

Introduction

As a group, middle-aged people suffer from or are at high risk of, several chronic diseases such as type 2 diabetes, cardiovascular disease and various cancers (1, 2). For example, one fifth of Australians between 50 and 60 years either have type 2 diabetes or are pre-diabetic (3). This has major implications for future health service costs (4).

There is considerable knowledge about the population *moderators* of disease and risk factor prevalence (e.g., low socio economic position (SEP) (5)). However, less is known about modifiable *mediators* of disease risk and prevalence within various population groups. Although identification of at-risk population groups is essential, social demographic characteristics such as age, education, income, locality, and gender are not highly amenable to change. Much more needs to be known about the mediators of risk behaviours in these population groups if successful prevention programs are to be pursued.

One useful example of the mediation of a disease risk factor is to be found in the Western Australian community-wide Fruit and Vegetable program which was conducted during the 1990s. This program brought about an increase in fruit and vegetable consumption through a mix of social marketing and community strategies (6). The investigators hypothesised that consumers' *expectations* of the amounts of fruit and vegetables they should eat to be healthy would influence their consumption. So during the program, messages informed people about how many fruit and vegetables they should eat per day. As these expectations increased in the population, after a lag time, consumption increased. Similar findings have been found in a number of social marketing programs where information about behavioural norms has been provided to members of the public leading to increased performance of those behaviours (7, 8).

In this paper we will examine these expectations which we term healthy eating norms (HEN) in relation to particular groups of foods of nutritional significance – fruits and vegetables, dairy meat and fish and energy dense, nutrient poor (EDNP) foods. Fruit and vegetables have been shown to be essential components of a healthy diet (9) whereas EDNP foods appear implicated in the aetiology of the obesity epidemic (10, 11). We wanted to see if middle-aged people either exceed or fail to meet these norms

in their usual food consumption, and if mismatches are evident, in which social groups do they occur and how do food consumers explain them?

In the second part of this paper, we use structural equation modelling to identify the possible roles of health eating norms (HEN) as mediators of the relationships between demographic, personal and health characteristics (population moderators) and usual food consumption. These potential moderators include, in descending order of stability, demographics, body mass, personal values, and, smoking status and alcohol use. Whilst there is evidence that these variables are related to usual food consumption (8, 12-16) the order in which they interact to influence food consumption is largely unknown. Below, we briefly review the evidence for these associations.

Healthy Eating Norms (HEN)

Psycho-social aspects of food beliefs and expectations play an important role in food behaviours. The relationships between food beliefs and food behaviours are evident in many studies. For example, Povey, et al. (17) demonstrated that beliefs are the strongest associates of healthy eating behaviours. Furthermore, Wang, Worsley, and Cunningham (18) found that female baby boomers' negative food expectations positively impacted on their unhealthy food consumption. These expectations have a normative or "oughtness quality" so in this paper we call them 'healthy eating *norms*' (HEN).

We anticipated that HEN would be positively related to reported food consumption. Some evidence for this is found in the influence of nutrition knowledge and attitudes on consumption (19). However, discrepancies between these healthy eating expectations and reported food consumption appear to be commonplace but little studied; usually people complain they do not consume healthy food in the frequencies required for health, and vice versa with respect to unhealthy foods. The extent of such mismatches, and the reasons offered by consumers for them, have not been reported previously. Therefore, it is hypothesised that for healthy foods, people hold higher HEN but report relatively lower consumption; for EDNP foods, people have lower HEN but relatively higher consumption.

Demographics

A number of studies have shown that food consumption behaviours are related to age (e.g., 20, 21). Several studies also suggest that people from lower socio-economic position (SEP) backgrounds (as indicated by education and family income) tend to consume more EDNP foods (e.g., 5, 14, 15, 22). Therefore, we hypothesized that age, education and family income would be positively associated with healthy eating behaviours. Gender differences in food choice have been well studied. For example, women tend to be more aware of health issues, health recommendations, and choose more nutritious foods than men (23-25). Therefore, the present analyses will be conducted separately for men and women.

Body Mass Index (BMI),

People who are obese or overweight may spend less time in physical activity and care less about their eating behaviours than healthy weight people (26). As BMI can be regarded as a relatively stable body condition for adults, we treated it as a stable personal health variable in the present study along with demographics. We expected that BMI would be positively related to high EDNP food consumption but negatively associated with healthy food consumption.

Smoking

Smoking status is associated with dietary intake (27). For example, smokers appear to consume significantly fewer fruits and vegetables than non-smokers (28). Therefore, we hypothesised that non-smokers would have higher HEN, consume healthy foods more frequently, and EDNP foods less frequently.

Alcohol consumption

Alcohol consumption is also related to dietary patterns. Kesse, Clavel-Chapelon, Slimani, and van Liere (29) showed that alcohol consumption was positively related to total energy intake and inversely to consumption of vegetables and dairy products. Yeomans (30) confirmed this finding in relation to energy intake. Therefore, we hypothesized that the number of glasses of alcohol consumed per week would be negatively associated with HEN and healthy food consumption but positively related to EDNP consumption.

Personal values

Personal values and behaviours have been investigated in numerous empirical studies (e.g., 31). Feather (32) noted that personal values are at the centre of attitude-behaviour models. They have been shown to predict food consumption (17, 33), food choice (34, 35), the practice of vegetarian diets (34, 36), food concerns (23, 37), support for school food policies (38), and, to trust in sources of nutrition information (39), as well as to general purchasing decisions (40, 41).

However, relatively little work has been undertaken on the possible influence of personal values on the consumption of key food groups and none on healthy eating norms. We expected that communitarian values like universalism (42) would be negatively associated with EDNP food consumption (e.g., snacks), which are marketed on their hedonistic properties, but positively related to healthy food choices as universalists tend to show greater concern for the welfare of others (including the environment, animals and marginalised people) than self interests (42).

In contrast, we expected that social power values (e.g., dominance and material possession) that are located opposite to universalism on Schwartz' circumplex structure (42) would be negatively related to healthy eating because they tend to be related to self-indulgent and hedonistic behaviours (43).

In summary, there is evidence that several demographic variables, body weight, health behaviours, personal values, and healthy eating expectations may influence usual food consumption. Clearly, if specific mediators between them and food consumption can be identified, there may be feasible opportunities for behavioural interventions. The Baby boomers' Food and Health Survey of middle-aged Australians enabled the relationships between these variables to be examined.

Method

Procedure

The study was based on a random sample of 845 Victorians over 40 years of age, drawn from the Electoral Rolls from Victoria, Australia. Enrolment on the Rolls is compulsory for all persons over 18 years of age. The survey was administered by mail to 1470 adults. An introductory letter was sent followed by the questionnaire and

cover letter a week later. A reminder letter (or letter of thanks) was sent two weeks later, followed by a replacement questionnaire to non-respondents two weeks after. The formatting and administrative procedures were based on Dillman's recommendations (44). Ethics permission was granted by the Deakin University Human Ethics Committee.

The Questionnaire

The questionnaire was constructed in several sections including: the expectations of frequency of food consumption, frequency of food consumption, personal values, smoking and alcohol consumption, and demographic characteristics.

Healthy eating norms (HEN)) and frequency of usual food consumption. Information about healthy eating norms was elicited through the following question: *How often should you consume the following foods and drinks to have a healthy old age?* Then followed a list of 28 food groups and foods (e.g. fruit, green leafy vegetables, peas and beans), derived from our previous work on middle-aged Australians' food consumption (45). The frequency of usual food consumption was elicited through the question: *Think about what you have consumed over the past month and indicate how often you consumed the foods listed below*. This question was followed by the same list of 28 food groups and foods as in the previous section (Table 3). In these two sections, five point response scales were used: *rarely*/*never*, *once/twice a week*, *three/four times a week*, *once a day*, *more than once a day.* The respondents were also asked to give reasons why their actual consumption might not match their healthy eating expectations. Stated explanations were counted and categorised through the Leximancer qualitative data analysis package (46) (Table 4).

Personal values

Twenty-one personal values items were adopted from the Schwartz values inventory (42), similar to those used in the previous studies (8). In the present analysis, eight items were used to assess two personal values constructs, namely Universalism (five items, $\alpha = .75$, e.g., *Equality*) and Power (three items, $\alpha = .59$, e.g., *wealth, authority*). The response format was a 5-point scale ranging from 0 (*not important*) to 4 (*very important*).

Body Mass Index (BMI)

Respondents were asked to provide details of their height and weight. This information was converted into metric units (cm and kg) from which the body mass index of each respondent was calculated. Several studies have shown that self-reported weights and heights are valid indices in population studies (47, 48).

Drinking and Smoking

Current alcohol use was elicited by the question: *Do you currently drink alcohol?* Respondents answered either 'Yes' or 'No', if they answered 'Yes', they were asked: (a) *How many glasses of alcohol do you drink per week?* and (b) *How many times per week do you drink alcohol?* Responses to question (b) were used as a check on the answers to question (a) which was the variable used in the data analyses. Current smoking status was assessed by the question: *Do you currently smoke?*

BMI can be regarded as a fairly stable body condition; and drinking and smoking are addictive behaviours that are difficult to change in the short term, they were viewed as stable personal health background variables in the present study along with demographics. Figure 1 illustrates the conceptual framework for the present study.

Figure 1 here

Analytical procedure

SPSS 20 (49) and Mplus 6.12 (50) were used for the data analyses. Prior to the analyses, data were screened for accuracy of data entry, outliers and normality.

Structural equation modelling (SEM) was employed to test the hypotheses. The robust Maximum likelihood (MLR) estimation method was used in the current analyses, which is robust to non-normality of the data. Model evaluations were examined by chi-square statistics and accompanying significance tests. Goodness-of-fit indices reported are the Standardized Root Mean Square Residual (SRMR), Root Mean Square Error of Approximation (RMSEA), Tucker-Lewis index (TLI), and Comparative fit index (CFI) (51). When the models were considered to fit the data

well, the following criteria were met: χ^2 probability $p > .05$, SRMR< .05, RMESA< .05, TLI> .95, and CFI> .95.

The item parcelling method (52, 53) was used to form the scale scores for the personal values: universalism and power. Once composite variables had been computed through parcelling the items measuring the same construct, it was possible to fix both the regression coefficients, which reflect the regression of each composite variable on its latent variable, and the measurement error variances associated with each composite variable via the formulae proposed by Munck (54). Using Munck's formula, regression coefficients can be derived from $SD\sqrt{\alpha}$ and error variances from $SD^2 (1 - \alpha)$. Both fixed values were used for single indicator construct in the structural equation model.

Unlike the major principle of classical test theory that all of the items in a scale tap a single domain or construct such as beliefs or attitudes, there are a number of measures that do not follow this conventional test model. Measures falling into this type are referred to as formative indicators (55). These causal indicators would not be appropriate to be analysed based on the assumption of homogeneity of the items (56). Therefore, Cronbach's alpha, the mean inter-item correlation, and factor analysis are inadequate tools for formative measures including HEN and the frequencies of usual food consumption in the present study. Principal component analysis (PCA) was used for obtaining the composite scores of HEN and food consumption as PCA retains all of the variance in the measured variables (57).

The dependent variables were the four composite food consumption variables namely, EDNP food, fruits and vegetables, meat and fish, and dairy foods. Our conceptual framework was based on a concept of relative stability with predictors ranging from difficult to change moderators like demographics and BMI, through the less stable but enduring personal values and behavioural habits like alcohol and tobacco usage, to the more malleable healthy eating norms (see Figure 1). This structural model was estimated separately for male and female participants.

Results

The population sample was fairly representative of middle-aged Australians (58). However, inspection of Table 1 suggests that there were more women in the sample than the general population and tertiary educated people were over represented (25% in the general population versus 34% in the sample). Marital status and household income were similar to the general population (e.g., approximately 74% of adults were in married or de facto relationships (58) and Victorian median household income ranged between approximately $41,600 to $55,600 depending on region (59).

The prevalence of current smoking was similar to that of the over 50 year population of Victoria (11.9%; 60), the proportion of ex-smokers was high, 34% compared to 26% of the general population (61) as was the proportion of non-drinkers (31% nominated themselves as non-drinkers compared to 16% of the general population; 61) but this might be expected in this older group which is at greater risk of chronic disease than the younger population (3).

Table 1 here

Table 2 presents the mean comparisons and correlations between the HEN and consumption items. Inspection of Table 2 suggests that reported food consumption was moderately positively related to HEN for most items (the magnitudes of the correlations ranged from .35 to .63) but there were significant differences between reported consumption and HEN for most items, suggesting that the respondents' reported food consumption was not in line with their healthy eating norms.

Mean HEN were lower than reported consumption for potato chips or salty snacks, fizzy drinks or cordial, lollies or chocolate, baked sweet foods (e.g. cakes and biscuits). This indicates that the respondents ate more of these foods than they thought was desirable for health. Conversely, HEN were higher than usual intake for peas and beans, orange vegetables, green leafy vegetables, fruit, fish, yoghurt low fat milk and cheese. This indicates that the respondents did not eat these foods as often as they thought they should. One-sample *t* tests showed significant differences between HEN and reported consumption among most of the items except three groups of items

(sausages, patties, hamburgers; meat pies, sausage rolls, tarts or quiches; and cheese – any type) (see Table 2.1 for men and Table 2.2 for women).

Table 2.1 here

Table 2.2 here

Table 3 shows the comparisons of HEN and reported consumption between the genders. Inspection of Table 3 suggests that 11 out of 18 HEN items and 14 out of 18 consumption items with significant differences between men and women, suggesting those men and women's HEN and actual consumption behaviour were distinct.

Table 3 here

Respondents' explanations for the discrepancies between HEN and reported food consumption

Most of the respondents provided short explanations for the discrepancies between their HEN and their reported actual food consumption. These texts were subjected to thematic analysis through the Leximancer qualitative data analysis package. Seven broad themes were identified. They are summarised with indicative examples in Table 4. The themes were related in diverse ways to: Beverages (e.g., alcohol, milk), Time (lack of it), Aspects of food (e.g., dislikes, likes, prices), Freshness (e.g., availability), Barriers to healthy eating (e.g., cravings), Cooking (e.g., lack of skills) and 'Lack of things" (e.g., of discipline, planning).

Table 4 here

Structural Equation Modelling

As gender differences in food beliefs and consumption have been documented in the food literature (13, 62), separate SEM analyses were conducted for the genders. The fit statistics derived from the SEM analysis suggested that the proposed model fitted the data well, as indicated by non-significant chi-square statistics and other fit indices for men: $\chi 2$ (36) = 36.29, p = .46. CFI = 1.00, TLI = 1.00, RMSEA = .01 (.00, .03), and SRMR = .04 and for women: $\chi 2$ (54) = 65.70, p = .13. CFI = .99, TLI = .98, RMSEA = .02 (.00, .04), and SRMR = .04. Therefore, it can be concluded that the proposed model fitted the data well for both genders, with certain dissimilarities.

Figure 2 illustrates the path model with the standardized parameter estimates for men and women. It can be seen that for each sex there were quite different pathways between the antecedents and the consumption of each food category.

Figure 2 here

Men

EDNP food consumption was directly and negatively related to age, but positively associated with EDNP HEN, and fruit and vegetable HEN.

Fruit and vegetable consumption was positively related to universalism and to fruit and vegetable HEN but negatively linked to smoking. Fruit and vegetable HEN was positively related to universalism values and meat and fish HEN, but negatively associated with EDNP HEN, BMI, and smoking.

Meat and Fish consumption was positively related to meat and fish HEN but negatively linked to dairy HEN. Meat and fish HEN was negatively related to age. Dairy consumption was positively linked to dairy HEN. Dairy HEN was positively associated with fruit and vegetable HEN but negatively related to age.

Women

Women's food consumption was predicted by more factors than men's consumption and in more complex ways. Again however, the consumption variables were related to the HEN variables, as well as the demographic variables.

EDNP consumption was positively linked to EDNP HEN and BMI but negatively related to age. EDNP HEN was positively related to BMI and power values but negatively associated with age and income.

Fruit and vegetable consumption was directly and positively related to age and fruit and vegetable HEN. In turn, fruit and vegetable HEN was positively linked to age, income, and education.

Meat and fish consumption was positively related to meat and fish HEN which was positively associated with EDNP HEN, fruit and vegetable HEN, BMI, and power values but negatively linked to education and universalism values.

Dairy consumption was positively linked to age and dairy HEN which was positively related to meat and fish HEN, fruit and vegetable HEN, and education.

Discussion

The main findings from this study can be summarised as follows:
(1) There were mismatches between the respondents' HEN and their reported food consumption, and these varied significantly between the genders.
(2) Healthy eating norms were correlated with reported food consumption and also associated with demographics, smoking and alcohol consumption behaviour, body weight and values factors.
(3) There were distinct structural patterns between the genders, women's food consumption being affected by a larger number of factors than men's consumption.

(1) Mismatches between HEN and reported food consumption.

Although there were strong, significant, positive correlations between HEN and food consumption for genders, most men and women consumed more unhealthy foods than they considered desirable for health. Conversely they consumed healthy foods

(fruit/vegetable, meat/fish, and dairy) less often than they considered desirable (see Table 2 *t* statistics).

Whilst many of these findings are new they exhibit features which are consistent with the literature. For example, women have been shown generally to take better care of their health and consume healthier diets than men (13, 63, 64). This study confirms these earlier findings but also suggests that HEN differ between genders as well as their consumption behaviour.

Both men and women failed to consume fruit and vegetables as often as they considered desirable. Indeed the mean consumption of fruit and vegetables were 2.16 and 2.51 with standard deviations of .67 and .74 for men and women, respectively (on average, less than about once a day), which does not meet the recommended Australian Dietary Guidelines (65) of at least daily servings of fruit and vegetables. Further the findings suggest that many middle aged people know they should eat fruit and vegetables more frequently; the mean HEN for these foods appears to be close to the daily servings recommended in the Australian Dietary Guidelines (65) though a substantial proportion of the men and a minority of women sample had less than the mean intake of fruit and vegetables (mean HEN of fruit and vegetables were 2.75 and 3.06 with standard deviations of .67 and .63 for men and women, respectively). Similarly the finding that women reported consuming more low fat milk and cheese than they thought was healthy is cause for concern given recent research which shows substantial deficits of calcium among women (66). More needs to be done to communicate dietary recommendations to this population group.

The respondents offered a broad variety of explanations for the mismatches between HEN and consumption. Our content analysis provides only a basic outline of their complex answers. The seven themes exhibit perceived failures of personal responsibility (e.g. never learned to cook, lack of willpower, cravings) as well as situational factors such as the availability of food or the need to obey social norms about drinking and offers of food. In a sense they mirror current academic debates about the merits of altering situational cues to behaviour versus cognitive approaches to change attitudes and intentions (67). Both types of attributions might be modified through more targeted communications (e.g., about how to plan food shopping) or

through situational changes (e.g., SMS messages to avoid purchasing certain foods during shopping). Whichever approach is taken, these findings suggest that HEN are an important influence on food consumption and so need to be considered in behavioural change programs. Further investigation of these explanations is required.

(2) HEN and reported food consumption

The main finding from the structural equation modelling of the male and female data sets is that HENs are strong mediators of reported food consumption. Consistent with several cognitive behaviour theories such as the theory of planned behaviour (68), this finding suggests one possible approach to dietary change in the population. As the western Australian Fruit and Vegetable program suggested (69) communications which raise HENs increase consumption of targeted health foods like fruit and vegetables. So a useful nutrition promotion strategy would be to communicate the dietary guideline *recommendations* more strongly in order to raise norms and thus consumption.

(3) Different patterns of mediation between genders

Whilst healthy eating expectations were strong mediators of consumption in both genders, it is evident from the structural equation models (Figure 2) that fewer factors influenced both the mediators and outcome variables among men than was the case for women. We have observed this greater complexity in women's food behaviours in previous studies (62). The predictors of the HEN mediators and consumption outcomes in both genders, however, are quite consistent with the results of earlier studies, as is shown below.

The influence of Demographics

Women's fruit and vegetable HEN were positively related to their age, income and education and their EDNP HEN were negatively related to age and income. Again, this is consistent with findings from earlier studies which showed that healthy food consumption is positively related to socio economic position and age (14, 22) and EDNP food consumption is negatively related to these demographic factors (5).

Moreover, as men's age increased, they had lower dairy HEN. These findings are consistent with reports of inverse relationships between age and milk and EDNP food consumption (70, 71).

The influence of BMI

Similar findings as for demographics were observed: for women as BMI increased, EDNP HEN and consumption increased; for men, as BMI increased, fruit and vegetable HEN and consumption decreased. Again, these findings are consistent with earlier work, for example, Guo, Warden, Paeratakul, and Bray's (26) finding that low Healthy Eating Indices were associated with overweight and obesity and Field, Gillman, Rosner, Rockett, and Colditz's (72) finding of a negative relationship between BMI and fruit and vegetable consumption, and positive relationships between EDNP food consumption and BMI. The mediating role of EDNP HEN between BMI and EDNP consumption suggests that population weight reduction might be advanced through targeting of the healthy eating norms of overweight and obese people.

The influence of smoking and alcohol

Men's fruit and vegetable consumption was negatively linked to their fruit and vegetable HEN and then to their smoking status. This suggests that male smokers perceived fruit and vegetables to be less important than non-smokers did. In a previous study, we found that smoking status was positively related to unhealthy food behaviours (16). It may be that smokers are less aware of national recommendations about fruit and vegetable consumption (73). The present study did not find any effect of alcohol use on HEN and consumption among men and women. These findings require further confirmation and investigation.

The influence of personal values

Among men, universalist values had a direct positive relationship with fruit and vegetable HEN and reported consumption. Similar findings have been shown in our previous work on public support for fruit and vegetable policy (38, 74). However among women, power values were positively related to EDNP and meat and fish HEN and universalism was negatively linked to meat and fish HEN. This has not been reported before. The power-EDNP HEN link supports our hypothesis that power values may lead to less healthy eating because these values reflect indulgent and

hedonistic behaviours (43). The relationship between power and meat and fish HEN is partially consistent with the sociological literature on meat which has emphasized the symbolism of meat as male, power laden food (75).

The findings did not support our hypothesis that universalist values would be negatively related to EDNP HEN and consumption. However, the negative relationship with meat and fish HEN is highly consistent with previous studies which have shown universalism to be linked to vegetarianism (76, 77) and anti-meat attitudes (78).

Implications for nutrition promotion and policy

Whilst it is difficult or impossible to change people's demographic characteristics, communication programs may influence people's HEN and thus their consumption behaviours. Furthermore, men and women's food HEN and consumption may be related to power and universalist values. Thus, health communication which focuses on the promotion of communitarian values and HEN, may be an effective way to increase healthy eating, particularly among overweight and obese people and smokers.

The important roles of universalism and power values in our models have some significance for the acceptance or rejection of policies which promote food security, eco-nutrition and food based dietary guidelines (FBDGs) in communities. FBDGs are the internationally agreed basis for the promotion of healthy food choice (79). The inclusion of healthy eating norms in FBDG policies would enhance their validity and enable them to be more relevant to the specific needs of communities.

To the extent that Universalism represents the attribution of value to nature and ecosystems people who hold these values may be more likely to support food security and associated policies through their daily food choices (80). Indeed in our other recent work we have found that Universalist consumers know more about agriculture and environmental issues and support farming more than other people (81). Research on the acceptance or rejection of scientific findings (82) e.g. those relating to climate change) shows that 'world views' such as those indicated by values such as Universalism and its antithesis, Power, may have much to contribute to the

understanding of support for broad food policies. Further exploration and development of the ecosystem dimension of Universalism and related values, at both personal and societal levels, could make a broad contribution not only to healthy food choice, but also to food and human security in general.

Strengths and limitations

Several studies have demonstrated that self-reported food consumption measures are related to social desirability bias (83). In particular, intakes of healthy foods such as fruits and vegetables may be overstated and consumption of fats and sweets can be underreported by respondents who place an emphasis on social desirability (84). Respondents may be more likely to report dietary behaviours which are closer to the dietary guidelines (85). Although social desirability bias was not measured in the present study, the use of healthy eating norms essentially assesses respondents' views about the desirability of food albeit for a limited purpose: eating for a healthy old age. Nevertheless future studies should investigate the relationships between HEN and social desirability measures such as the Marlow Crowne index (86).

Whilst the present study has shown the importance of HEN, both the HEN and reported consumption were based on self reports from the same individuals which raises issues about the independence of these variables, for example, both HEN and reported consumption may be affected by a third intra-individual variable. In future work it is important that reported consumption measures are supported by more objective assessments, for example, by observational methods (87) or purchasing receipts (88). As causal attributions cannot be drawn from the cross-sectional design of this study, it is also important that future research is based on longitudinal or experimental designs. Moreover, the HEN and consumption scales require further validation.

Conclusion

Healthy eating norms vary among middle aged men and women. Together with demographics, smoking status, personal values, and body weight, they are significantly associated with reported food consumption. The findings suggest the need to better communicate healthy eating recommendations to several population groups based on their health status and values orientations.

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Conflict of interest

The authors declare that they have no conflicts of interest.

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Figure 1. Conceptual model

Figure 2. Standardized parameter estimates for food expectation and consumption models for men (upper panel) and women (lower panel)

Table 1

Socio-demographic characteristics across gender groups

Demographics		Male (n = 314)	Female (n = 528)	Total (n = 842)*
Age	Mean	57.29	57.08	57.16
	(SD)	(7.18)	(7.28)	(7.24)
Education (%)	Primary school or less	2.2	2.8	2.6
	Secondary school	36.0	36.0	35.8
	TAFE or college diploma	19.4	18.8	19.0
	Bachelors degree	15.6	14.3	14.7
	Tertiary education	9.9	14.1	12.5
	Masters degree or higher	8.0	5.5	6.4
Marital status (%)	Single/separated/divorced/ widowed	16.2	27.3	23.1
	Married/defacto	83.4	72.5	76.2
Family income (%)	< $10K	3.2	4.5	4.1
	$10K - $20K	7.6	8.5	8.2
	$20K - $35K	12.7	15.8	14.6
	$35K - $50K	15.6	17.5	16.8
	$50K - $100K	33.4	30.1	31.2
	> $100K	25.5	18.5	21.1
Smoke (%)	Yes	12.4	10.0	10.8
Ex-smoke (%)	Yes	41.1	29.8	33.8
Alcohol (%)	Yes	76.4	64.6	68.7
Number of glasses of alcohol a week	Mean	9.06	3.94	5.86
	(SD)	(11.02)	(4.97)	(8.20)

Note: SD=Standard deviation

*three missing values on gender

Table 2.1
Correlations and comparisons of means between healthy eating norms and consumption for each item in each food group among men

Men	HEN *M (SD)*	Consumption *M (SD)*	*t*	*r*
High energy dense foods				
1. sausages, patties, hamburgers	.40 (.56)	.48 (.66)	-2.62**	.51**
2. cooked meats (e.g., ham, salami etc.)	.67 (.73)	.82 (.89)	-3.56**	.46**
3. potato chips or other salty snacks	.22 (.52)	.40 (.67)	-6.27**	.54**
4. hot chips, wedges, roast or fried potatoes	.62 (.73)	.64 (.70)	-.57	.54**
5. fizzy soft drinks	.43 (.80)	.70 (1.02)	-5.74**	.49**
6. meat pies, sausage rolls, tarts or quiches	.26 (.47)	.28 (.56)	-.67	.47**
7. lollies or chocolate	.40 (.67)	.81 (.98)	10.68**	.42**
8. Baked sweet foods (e.g., cakes, biscuits)	.53 (.76)	.84 (.99)	-7.21**	.35**
Vegetable & fruit				
1. peas and beans	2.27 (.91)	1.73 (.83)	10.44**	.42**
2. orange red vegetables (e.g., pumpkin, carrots)	2.55 (.86)	2.08 (.80)	9.47**	.53**
3. green leafy vegetables	2.95 (.89)	2.23 (1.06)	14.23**	.45**
4. fruit (fresh, frozen canned)	3.22 (.91)	2.61 (1.27)	11.78**	.47**
Meat & fish				
1. Chicken fresh, pre-cooked	1.36 (.78)	1.17 (.71)	4.23**	.57**
2. lean red meat	1.83 (.82)	1.61 (.81)	4.78**	.63**
3. fish fresh, frozen or canned	1.50 (.73)	1.04 (.70)	11.03**	.38**
Dairy				
1. yoghurt	1.72 (1.11)	.98 (1.14)	11.80**	.47**
2. milk drinks (all types – low fat)	1.76 (1.33)	1.31 (1.46)	5.97**	.60**
3. Cheese – any type	1.40 (.92)	1.44 (1.03)	-.68	.60**

Note: ** $p < .01$. *M* = mean; *SD* = Standard deviation; *r* = correlation; HEN: Healthy Eating Norm.

Table 2.2
Correlations and comparisons of means between healthy eating norms and consumption for each item in each food group among women

Women	HEN *M (SD)*	Consumption *M (SD)*	*t*	*r*
High energy dense foods				
1. sausages, patties, hamburgers	.33 (.65)	.29 (.55)	1.45	.36**
2. cooked meats (e.g., ham, salami etc.)	.51 (.66)	.57 (.74)	-2.14*	.44**
3. potato chips or other salty snacks	.16 (.41)	.31 (.59)	-8.48**	.32**
4. hot chips, wedges, roast or fried potatoes	.45 (.59)	.55 (.68)	-4.01**	.41**
5. fizzy soft drinks	.26 (.71)	.48 (.95)	-6.92**	.49**
6. meat pies, sausage rolls, tarts or quiches	.23 (.47)	.19 (.47)	1.75	.30**
7. lollies or chocolate	.38 (.64)	.90 (.97)	-18.47**	.31**
8. Baked sweet foods (e.g., cakes, biscuits)	.54 (.76)	.88 (.97)	-10.20**	.37**
Vegetable & fruit				
1. peas and beans	2.54 (.89)	1.92 (.98)	15.99**	.49**
2. orange red vegetables (e.g., pumpkin, carrots)	2.88 (.79)	2.36 (.92)	15.07**	.48**
3. green leafy vegetables	3.27 (.81)	2.66 (1.09)	17.45**	.47**
4. fruit (fresh, frozen canned)	3.54 (.81)	3.11 (1.07)	12.25**	.51**
Meat & fish				
1. Chicken fresh, pre-cooked	1.44 (.78)	1.35 (.78)	2.72**	.64**
2. lean red meat	1.77 (.80)	1.58 (.82)	5.33**	.64**
3. fish fresh, frozen or canned	1.63 (.75)	1.22 (.77)	12.40**	.48**
Dairy				
1. yoghurt	2.30 (.95)	1.66 (1.25)	15.24**	.51**
2. milk drinks (all types – low fat)	2.40 (1.23)	1.65 (1.48)	13.76**	.55**
3. Cheese – any type	1.72 (.94)	1.60 (1.02)	2.91**	.57**

Note: * $p < .05$, ** $p < .01$. *M* = mean; *SD* = Standard deviation; *r* = correlation; HEN: Healthy Eating Norm.

Table 3
Mean comparisons of HEN and reported consumption between men and women for each food group item

	HEN			Consumption		
	Men	Women	*t*	Men	Women	*t*
High energy dense foods						
1. sausages, patties, hamburgers	.40	.33	1.44	.48	.29	4.09**
2. cooked meats (e.g., ham, salami etc.)	.67	.51	3.32**	.82	.57	4.16**
3. potato chips or other salty snacks	.22	.16	1.67	.40	.31	2.02*
4. hot chips, wedges, roast or fried potatoes	.62	.45	3.46**	.64	.55	1.92
5. fizzy soft drinks	.43	.26	3.01**	.70	.48	3.11**
6. meat pies, sausage rolls, tarts or quiches	.26	.23	1.06	.28	.19	2.30*
7. lollies or chocolate	.40	.38	.47	.81	.90	-1.18
8. Baked sweet foods (e.g., cakes, biscuits)	.53	.54	-.24	.84	.88	-.61
Vegetable & fruit						
1. peas and beans	2.27	2.54	-4.18**	1.73	1.92	-2.80**
2. orange red vegetables (e.g., pumpkin, carrots)	2.55	2.88	-5.56**	2.08	2.36	-4.70**
3. green leafy vegetables	2.95	3.27	-5.37**	2.23	2.61	-5.67**
4. fruit (fresh, frozen canned)	3.22	3.54	-5.23**	2.61	3.11	-5.82**
Meat & fish						
1. Chicken fresh, pre-cooked	1.36	1.44	-1.53	1.17	1.35	-3.46**
2. lean red meat	1.83	1.77	1.14	1.61	1.58	.53
3. fish fresh, frozen or canned	1.50	1.63	-2.46*	1.04	1.22	-3.55**
Dairy						
1. yoghurt	1.72	2.30	-7.62**	.98	1.66	-8.00**
2. milk drinks (all types – low fat)	1.76	2.40	-6.75**	1.31	1.65	-3.15**
3. Cheese – any type	1.40	1.72	-4.71**	1.44	1.60	-2.16*

Statistical significance indicated as: *p<.05; **p<.001.

Table 4
Reasons suggested by respondents for non compliance with their healthy eating norms: key themes identified by Leximancer analysis.

Theme		Quotes
1.	Beverage	"I think I should drink (alcohol) less often but is my one luxury" "I visited my friends and didn't want to refuse the drinks and food they offered" "I don't like milk - so rarely drink it"
2.	Time	"No time or lack of planning" "Because I ate what I felt like at the time" "Hadn't shopped at that time"
3.	Aspects of food	"Dislike of some food" "Higher prices of food" "Menu planning & quality of supermarket food"
4.	Freshness	"Don't work close to fresh food shops and often forget to eat or don't organise food from home" "Couldn't be bothered to cook fresh that day" "Availability of fresh fish"
5.	Barriers to Healthy Eating	"Sometimes difficult to stick to healthy routine when travelling or busy" "Know healthy foods but sometimes crave sweet things. Snack more often than should as live alone" "Don't like all foods that are healthy for you"
6.	Cooking	"Husband often does the cooking. He dislikes vegies so rarely cooks them" "Use more butter in cooking than should" "Never learned to cook"
7.	Lack of things	"Lack of discipline" "Lack of time to cook more elaborate meals" "Lack of planning"