Appetite (2001) **36**, 127–136
doi:10.1006/appe.2000.0386, available online at http://www.idealibrary.com on IDEAL®

Original Article

Influences on meat consumption in Australia

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(Received 2 May 2000, final revision 19 October 2000, accepted in revised form 1 November 2000, published electronically 16 January 2001)

In a study of influences on meat consumption, over 700 South Australians answered questions on frequency of meat consumption, beliefs about meat and nutrition, perceived difficulties with and benefits of vegetarian diets, personal values, number of vegetarian significant others, use in and trust of health/nutrition/food information sources, and demography. Perceived difficulties with vegetarian diets, the number of vegetarian significant others and beliefs about meat were important predictors of meat consumption. There were differences between men and women and members of different age groups, which should be taken into account when attempts are made to influence meat consumption. For example, health promotion campaigns that focus on whether or not meat is necessary in the diet may influence meat consumption, but would be most successful if directed predominantly at older people and men. In contrast, the meat consumption of women and younger people was strongly associated with more specific concerns about lack of iron and protein in the vegetarian diet. Some of the difficulties people find with vegetarian diets will also apply to plant-based diets generally, and such diets are becoming more widely acknowledged as providing health benefits. Therefore, the findings have important implications for public health.

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Introduction

Many studies have been conducted on the health of people who choose not to eat meat (American Dietetic Association, 1997; Appleby *et al*., 1999; Beilin, 1994; Bingham, 1999; Dwyer, 1988, 1991; Janelle & Barr, 1995; Key *et al*., 1996, 1998, 1999a,b; Knutsen, 1994; Sanders & Reddy, 1994; Thorogood *et al*., 1994; White & Frank, 1994). Vegetarians have a lower mean body-mass index and plasma total cholesterol concentration, and mortality from ischaemic heart disease is decreased by 24% (Key *et al*., 1999a,b). All-cause mortality rates are also lower. For example, the Oxford Vegetarian Study found that the death-rate ratio for all cause mortality for non-meat-eaters compared with meat eaters was 0·80, after adjusting for smoking, body mass index and social class (Appleby *et al*., 1999).

Compared to conventional diets, plant-based diets in general (which may or may not contain some meat) contain less saturated fat, cholesterol and animal protein, are higher in folate, antioxidants, fibre, carotenoids and phytochemicals, and conform more closely to public health recommendations (American Dietetic Association, 1997; Bingham, 1999; National Health and Medical Research Council, 1992; US Department of Health and Human Services, 2000; World Cancer Research Fund/American Institute for Cancer Research, 1997).

Health is not the only reason given by consumers for reducing or avoiding meat consumption. Animal welfare and environmental issues are also important, with other reasons usually being less prevalent in Western societies (Beardsworth & Keil, 1991; Richardson, 1994; Rozin *et al*., 1997). For example, it is argued that reduced meat consumption would have a positive effect on the environment by decreasing water usage, soil erosion and methane production (Fieldhouse, 1986; Lewis, 1994; Pimental *et al*., 1997).

The number of people who avoid meat is increasing. In Britain, for example, the number of self-identified vegetarians[1] increased from 2·1% of the population in

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[1]It should be noted that it is likely that when vegetarianism is self-reported, rather than measured more objectively, an over-estimate of the prevalence of vegetarianism is obtained. There has been an increase in the numbers of people who

0195–6663/01/020127 + 10 $35.00/0

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1984 to 5·4% in 1997 (Gallup, 1997). In Australia, 3·7% of adults are self-identified vegetarians (Australian Bureau of Statistics, 1995). Many more people are choosing to eat some meatless main meals. For example, in a 1999 random poll of the general American population, 57% of the population sometimes, often or always ordered a vegetarian dish when eating out (Vegetarian Resource Group, 1999). The factors that may further enhance the popularity of low-meat diets and assist people to decrease their meat consumption are the topic of this paper.

Influences on meat consumption

The reasons for particular food choices are complex and diverse (Furst *et al*., 1996; Lindeman & Stark, 1999; Norman & Conner, 1996). Factors that may influence meat consumption include beliefs about meat and nutrition, difficulties with and benefits of vegetarianism, demography, personal values, use of and trust in information sources, and number of vegetarian friends and family.

Worsley and Skrzypiec (1998) found that meat appreciation (the enjoyment of meat eating) was a positive predictor of meat eating among people 18 to 32 years of age. In addition, Richardson *et al*. (1993) found that the healthiness of meat was a positive predictor of red meat consumption. Zey and McIntosh (1992) observed similar relationships. Thus, we hypothesized that meat appreciation and the healthiness (or necessity) of meat would be positive predictors of meat consumption (hypothesis 1 and hypothesis 2, respectively).

People may face barriers to changing their behaviour, such as when changing to a healthier diet (Cox *et al*., 1998; Lappalainen *et al*., 1997). It has been argued that a change in behaviour occurs only when the benefits of change outweigh the barriers or difficulties (McIntosh *et al*., 1996; Rosenstock, 1974; Wolinsky, 1980). The influence of these factors on meat consumption was therefore examined, as this is likely to have wider implications for the adoption of plant-based diets generally. We hypothesized that perceived difficulties with vegetarian diets would be positive predictors of meat consumption (hypothesis 3) but the perceived benefits of vegetarian diets would be negative predictors (hypothesis 4).

Sources of health information, such as those communicated via the mass media, have strong effects on health behaviours and attitudes (Goldberg & Hellwig, 1997), particularly when the source is strongly trusted (Heesacker *et al*., 1983; McGinniess, 1968). Interviews conducted by one of the authors (Lea) with vegetarians suggested that low or non-meat-eaters rarely use or trust the mass media, advertising or orthodox health sources. Vegetarians are more likely to be receptive to unorthodox sources of health information (Freeland-Graves *et al*., 1986; Furnham & Forey, 1994; Hamilton, 1993). Therefore we hypothesized that the use of and trust in the mass media, advertising and orthodox health sources would be positive predictors of meat consumption (hypothesis 5).

Sapp and Harrod (1989) and Zey and McIntosh (1992) found that significant others were a strong influence on intention to eat beef. Therefore, we hypothesized that the presence of vegetarian friends and family would be negative predictors of meat consumption (hypothesis 6).

Women are generally more health conscious than men (Fagerli & Wandel, 1999; Kemmer *et al*., 1998; Warde & Hetherington, 1994), as are members of older age groups (Lester, 1994). We predicted that women and members of older age groups would focus more on health factors than men and younger people (hypothesis 7).

Personal values may influence food consumption (Feather *et al*., 1998; Lindeman & Stark, 1999), such as vegetarianism and meat eating (Dietz *et al*., 1995; Sims, 1978; Worsley *et al*., 1995). We hypothesized that values would be weak predictors only however as they do not influence behaviour directly, being more likely to influence beliefs and attitudes (Grunert *et al*., 1994; Pollay & Gallagher, 1990) (hypothesis 8). We expected that power and tradition were likely to be positive predictors, after Adams (1990) and Dietz *et al*. (1995) (hypothesis 9). Teenage vegetarians are more likely to hold universal values such as concern about environmental issues and gender equity than non-vegetarians (Worsley *et al*., 1995). Therefore, we predicted that universalism would be a negative predictor (hypothesis 10).

Methods

Procedure and response

One thousand people were selected at random from the South Australian population by using the software package Marketing Pro (April 1999 version), containing a comprehensive list of residences from telephone directories. A 12-page booklet entitled *Food Choice, Information and Your Attitudes* was mailed to each person in the sample, together with a cover letter and

identify themselves as "vegetarian" despite including some animal flesh (particularly fish and fowl) in their diet (Adams, 1990; Fiddes, 1994). Therefore, there are usually some respondents who will answer in the affirmative to the question "*Are you a vegetarian*?" yet eat some fish or meat (e.g. Dietz *et al*., 1995). However, they usually avoid red meat.

reply-paid envelope. The design and administration of the questionnaire was based on Dillman's (1978) recommended methods for mail surveys.

Reminder postcards were sent to non-respondents 2 weeks after the initial mailing; after a further 2 weeks non-respondents were sent a follow-up letter and replacement questionnaire. After 6 weeks, the remaining non-respondents were contacted by telephone. Finally, questionnaires and letters were sent by registered post to a random selection of the 69 (43%) non-respondents who were unable to be contacted by telephone in order to ascertain if they were actually living at that address or not. The percentage of potential respondents who had moved from their last address was therefore able to be estimated.

In addition to the randomly-selected sample, a small non-random sample ($N = 106$) of vegetarians and semi-vegetarians was included in the survey. This was because the number of vegetarians in the random sample was very low ($N = 9$). Participants were selected by placing advertisements in vegetarian cafés and restaurants, health food stores and at Adelaide University; by distributing questionnaires at an environmental event; and by word-of-mouth.

About 71% of the randomly-selected subjects who could be contacted filled out the questionnaire ($N = 603$), with two questionnaires being unusable. Approximately 15% of the sample could not be contacted because their addresses were incomplete or had changed since the Marketing Pro data were collected, or they were unable to be contacted by telephone. One hundred and six non-randomly selected vegetarians and semi-vegetarians also participated, yielding a total of 707 usable questionnaires.

The questionnaire

The initial questionnaire was developed from interviews with 15 vegetarians about their food choices, information use and lifestyle; from the literature (e.g. Fiddes, 1991; Freeland-Graves *et al*., 1986; McIntosh *et al*., 1995; Richardson *et al*., 1993; Schwartz, 1992); and from three existing food choice questionnaires. The latter were the Institute of European Food Studies (IEFS) European Union survey on attitudes to food, nutrition and health (Kearney *et al*., 1997), an Australian survey on meat consumption and attitudes (Worsley *et al*., 1995) and Australian and New Zealand surveys of food concerns (Worsley & Scott, 2000).

The final questionnaire was developed from the results of pre-tests conducted among people of varying demographic characteristics. Sections included in the questionnaire are outlined below.

(1) Four items about *nutritional beliefs* (three of which were based on the IEFS European Union survey (Kearney *et al*., 1997)) and 20 items on beliefs about meat (some of which were based on Worsley *et al*., 1995 questionnaire). Respondents answered by indicating their level of agreement with each belief on a five-category scale, ranging between strongly disagree and strongly agree. (2) *Personal difficulties with vegetarian diets* (27 items) were assessed, parts of which were modelled on the IEFS survey (Kearney *et al*., 1997). Respondents indicated their level of agreement or disagreement with each difficulty on a 5-point scale. (3) *Frequency of consumption of animal products* was gauged by asking participants to indicate how often they consumed red meat, white meat, fish and seafood, eggs and dairy: never, rarely, one to three times a month, one to four times a week or almost daily/daily. (4) A total of 13 *demographic variables* were measured, including sex, age, occupation, marital status, education level, nature of household, income, postcode, ethnicity and religion.

The remaining sections were about respondents' concerns about particular food supply issues; the frequency of use of and trust in sources of information about food, nutrition and health; recall of promotion of meat and vegetarianism by these information sources; items about vegetarianism in general, including number of vegetarian friends and family and likelihood of becoming vegetarian; perceived benefits of vegetarian diets, including personal benefits and those with wider implications; and personal values. Analyses of these sections will be reported in depth elsewhere.

Data analysis

Principal components analyses with varimax rotation were performed on the responses to the various sections of the questionnaire, namely use of information sources, trust in information sources, beliefs about meat, difficulties with vegetarian diets, benefits of vegetarian diets, and personal values. However, only the results of difficulties with vegetarianism and beliefs about meat items will be reported here as they were the most important factors in the results of the regression analyses, discussed below.

Step-wise multiple regression analyses of the Meat Consumption Score (the sum of the responses to frequency of consumption of red and white meat, excluding fish and seafood) were run with factor scores derived from the above principal component analyses, the demographic variables and the respondents' recall of promotion of meat and vegetarianism by information sources, beliefs about nutrition, and numbers of vegetarian family and friends. Because small numbers of

respondents were missing on key variables, analyses using both pairwise and listwise methods of managing missing cases were run to ensure the results were not methodological artifacts. Results of the pairwise analyses are given here. Regression analyses were also conducted within each sex and age group. Age groups were formed by splitting respondents' ages into tertiles: 15–37, 38–53 and 54–91 years. Only 13 respondents (1·9% of the total sample) were aged 15 to 19 years. As the teenage group was too small to examine separately, adults and teenagers were considered together. All analyses were conducted with SPSS statistical software (version 10).

Results

Difficulties with vegetarian diets

Vegetarianism health concerns and appreciates meat (Factor 1; Table 1) included concern over lack of iron and protein in vegetarian diets and the enjoyment of eating meat, while *Lack of knowledge and convenience re vegetarianism* (Factor 2) included items such as not knowing what to eat instead of meat and lacking appropriate cooking skills. The other components were *Social concerns about vegetarianism* (Factor 3) and *Social influences against vegetarianism* (Factor 4).

Measures of internal reliability (Cronbach's alpha) indicated that all of the difficulties factors had high internal consistency (Table 1).

Beliefs about meat

The first two components (Table 2) consisted of positive beliefs about meat, specifically considering it to be necessary in human diets and an important strength-giver (Factor 1, *Meat is a necessary dietary component*) and enjoying eating meat (Factor 2, *Red meat appreciation*). The remaining factor (Table 2) predominantly consisted of beliefs that meat causes disease and other health problems (Factor 3, *Meat is unhealthy*).

Internal consistency was moderate to high (Table 2) except for *Meat is a necessary dietary component*.

Prediction of frequency of meat consumption

Almost three-quarters of the variance of the frequency of meat consumption was predicted by difficulties with vegetarian diets, number of vegetarian friends and beliefs about meat (Table 3). The perceived difficulties with vegetarianism factor *Vegetarianism health concerns and appreciates meat* (positive predictor accounting for 45·4% of the total variance, the latter not reported in the table) was the most important.

Sex differences were important. Difficulties with vegetarianism, particularly *Vegetarianism health concerns and appreciates meat* (positive predictor that explained 44·7% of the total variance, the latter not reported), were the most important for women, with *number of vegetarian friends* (negative predictor that explained 47·8% of the total variance, the latter not reported) most important for men. Women were therefore more concerned with health than men.

Some age group differences were apparent, particularly between the oldest group and the two youngest. Beliefs about meat were the main predictors for older people, with *Meat is a necessary dietary component* and *Meat is unhealthy* explaining (although not reported in the table) 19·2% and 17·8% of the total variance respectively. *Vegetarianism health concerns and appreciates meat* was most important for the younger two groups, explaining 57·2% of the total variance among young people and 38·1% among the middle-aged group (the figures are not reported). Health concerns were important for all of the age groups, however. Over 80% of the variance of meat consumption was predicted for young people, which decreased to about 70% for the middle-aged group and about 55% for the oldest group.

Discussion

Overall, difficulties with vegetarianism were the most important predictors of frequency of meat consumption. However, their relative contributions differed according to sex and age groups. For men they were less important than *number of vegetarian friends* and beliefs in meat, while for older people they did not feature at all.

Vegetarianism health concerns and appreciates meat was the key predictor of frequency of meat consumption for all respondents considered as a group and for women and most age groups. This partly concurs with the results of Worsley and Skrzypiec's (1998) study of attitudes and meat consumption, in which meat appreciation was the key factor. However, with regard to hypothesis 2, generally it was the perceived *unhealthiness* of vegetarian diets that was more important, rather than the perceived *healthiness* (or necessity) of meat. This suggests that an effective way of influencing meat consumption may be to focus on the nutritional adequacy of plant-based diets.

Lack of knowledge about vegetarian eating and the perceived inconvenience of vegetarian diets were also found to be important influences on meat consumption, especially for women and middle-aged people. For

Table I. Principal components of perceived difficulties with vegetarian diets

Factor and items	Factor loading
Factor 1: Vegetarianism health concerns and appreciates meat	
Eigenvalue: 9·92	
Cronbach alpha: 0·92	
Percent of variance: 39·7%	
There is not enough protein in vegetarian diets	78
There is not enough iron in vegetarian diets	76
I like eating meat	70
I think humans are meant to eat meat	70
I would be (or am) worried about my health (other than lack of iron or protein)	67
Vegetarian diets are boring	67
I wouldn't (or don't) get enough energy or strength from the food	66
I do not want to change my eating habit or routine	64
Vegetarian diets are not filling enough	61
It takes too long to prepare vegetarian food	44
It is inconvenient	42
I don't want to eat strange or unusual foods	41
My family/spouse/partner won't eat vegetarian food	36
Factor 2: Lack of knowledge and convenience re vegetarianism	
Eigenvalue: 1·80	
Cronbach alpha: 0·86	
Percent of variance: 7·2%	
I don't know what to eat instead of meat	72
I need more information about vegetarian diets	69
I lack the right cooking skills	68
I don't have enough willpower	59
There is too limited a choice when I eat out	57
It is inconvenient	54
It takes too long to prepare vegetarian food	48
Vegetarian options are not available where I shop or in the canteen or at my home	44
Factor 3: Social concerns about vegetarianism	
Eigenvalue: 1·53	
Cronbach alpha: 0·84	
Percent of variance: 6·1%	
I don't want people to stereotype me negatively (e.g. that I must be strange)	77
People would (or do) think that I'm a wimp or not macho enough	75
I don't want to eat strange or unusual foods	57
I would (or do) feel conspicuous among others	55
Vegetarian options are not available where I shop or in the canteen or at my home	51
Someone else decides on most of the food I eat	44
Vegetarian diets are not filling enough	36
It takes too long to prepare vegetarian food	35
Factor 4: Social influences against vegetarianism	
Eigenvalue: 1·11	
Cronbach alpha: 0·79 (0·81 if last item omitted)	
Percent of variance: 4·5%	
My family eats meat	89
My friends eat meat	87
I would (or do) feel conspicuous among others	41
My family/spouse/partner won't eat vegetarian food	39

Factor loadings are in one hundredth units.

example, if people are unsure about how to prepare meat-free meals, perhaps because of lack of information or a perception that preparation of vegetarian meals is inconvenient, they are left with preparing meals that they know—ones which contain meat. In addition, if vegetarian food is not readily available when they eat out or shop, the lack of options means they are more likely to consume meat more frequently.

The role of personal values was weak, as predicted (hypothesis 8). In a similar way, neither use of, nor trust in information sources were important predictors of meat consumption, although this was unexpected. One

Table 2. Results of principal components analysis of beliefs about meat

Factor and items	Factor loading
Factor 1: Meat is a necessary dietary component	
Eigenvalue: 8·29	
Cronbach alpha: 0·22 (0·38 if 9th item omitted)	
Percent of variance: 41·4%	
Meat is important for the health of babies and toddlers	86
Meat is necessary in children's diets	85
Meat is necessary in the adult human diet	73
Meat is important for building strength	66
Red meat is the best-absorbed source of dietary iron	57
Non-vegetarians are healthier than vegetarians	47
I love to eat red meat such as beef, veal or lamb	42
Meat such as beef and lamb is unhealthy to eat	−41
I think meat is disgusting	−40
Humans have no right to kill animals for food	−39
Meat production is cruel to animals	−39
Factor 2: Red meat appreciation	
Eigenvalue: 2·06	
Cronbach alpha: 0·49 (0·62 if 8th item omitted)	
Percent of variance: 10·3%	
I prefer to eat red meat more than fruit or vegetables	80
Nothing satisfies my appetite like a thick juicy steak	80
When I eat out to celebrate a social occasion, I usually eat some kind of red meat	72
I love to eat red meat such as beef, veal or lamb	68
Vegetarians are hippies or weirdos	52
Meat production is cruel to animals	−46
Meat is important for building strength	45
I think meat is disgusting	−45
Meat is necessary in the adult human diet	40
Non-vegetarians are healthier than vegetarians	38
Humans have no right to kill animals for food	−38
Factor 3: Meat is unhealthy	
Eigenvalue: 1·21	
Cronbach alpha: 0·73 (0·85 if last item omitted)	
Percent of variance: 6·1%	
Meat causes heart disease	77
Meat causes cancer	74
Red meat such as beef or lamb is fattening	73
Meat such as beef and lamb is unhealthy to eat	66
I think meat is disgusting	53
Humans have no right to kill animals for food	47
Meat production is cruel to animals	44
Red meat is very expensive	43
I love to eat red meat such as beef, veal or lamb	−35

Factor loadings are in one hundredth units.

explanation could be that information sources are a stronger influence on beliefs about meat than on meat consumption, as is true for personal values. Further research on meat beliefs and information sources is required to verify this.

The impact of demographic variables in the overall regression equation was also low (as it was in Worsley and Skrzypiec's 1998 study), although when the respondents were split into sex and age groups there were differences. It appears that men and women need to be considered separately in any attempt to influence frequency of meat consumption. In contrast to women, men were influenced more by their friends and beliefs about meat than by their difficulties with vegetarianism *per se*. It has been well documented that women are more health conscious than men (Warde & Hetherington, 1994; Kemmer *et al*., 1998; Fagerli & Wandel, 1999) and this was also true for the present study (hypothesis 7). Contrary to our hypothesis, older people were not more concerned about health than the other age groups: *all* age groups had strong health concerns. They were concerned with *different aspects* of health, however. A perceived lack of iron and protein in vegetarian diets was a positive predictor of meat consumption for the two

Table 3. Multiple regression of frequency of meat consumption

	B	*SE*	*p*
All respondents			
Vegetarianism health concerns and appreciates meat	0·33	0·08	***
Number of vegetarian friends	−0·3	0·06	***
Lack of knowledge and convenience re vegetarianism	0·35	0·05	***
Meat is unhealthy	−0·72	0·06	***
Red meat appreciation	0·8	0·07	***
Meat is a necessary dietary component	0·79	0·07	***
Constant	**7·3**	**0·12**	***
R square: 72·4%			
Women			
Vegetarianism health concerns and appreciates meat	0·35	0·11	***
Lack of knowledge and convenience re vegetarianism	0·34	0·07	***
Meat is unhealthy	−0·71	0·08	***
Red meat appreciation	0·93	0·1	***
Meat is a necessary dietary component	0·77	0·09	***
Universal values	−0·3	0·08	**
Number of children < 18 years in household	0·14	0·06	*
Constant	**6·8**	**0·08**	***
R square: 72·0%			
Men			
Number of vegetarian friends	−0·38	0·09	***
Meat is a necessary dietary component	0·86	0·09	***
Red meat appreciation	0·32	0·08	***
Meat is unhealthy	−0·68	0·08	***
Lack of knowledge and convenience re vegetarianism	0·86	0·09	***
Trust advertising and mass media	0·77	0·08	***
Constant	**7·34**	**0·18**	***
R square: 77·7%			
Young people			
Vegetarianism health concerns and appreciates meat	0·37	0·12	**
Recall of the promotion of vegetarianism	−0·43	0·21	*
Number of vegetarian friends	−0·2	0·08	*
Lack of knowledge and convenience re vegetarianism	0·32	0·08	***
Meat is unhealthy	−0·68	0·09	***
Meat is a necessary dietary component	0·73	0·1	***
Red meat appreciation	0·79	0·11	***
Number of children < 18 years in household	0·24	0·06	***
Recall of the promotion of meat	−0·53	0·19	**
Constant	**7·23**	**0·23**	***
R square: 82·9%			
Middle-aged people			
Vegetarianism health concerns and appreciates meat	0·38	0·13	**
Lack of knowledge and convenience re vegetarianism	0·46	0·09	***
Red meat appreciation	0·93	0·11	***
Meat is unhealthy	−0·75	0·1	***
Meat is a necessary dietary component	0·84	0·11	***
Constant	**6·89**	**0·08**	***
R square: 68·2%			
Older people			
Meat is a necessary dietary component	0·93	0·11	***
Meat is unhealthy	−0·78	0·1	***
Red meat appreciation	0·74	0·11	***
Use social sources	0·29	0·1	**
Constant	**7·02**	**0·1**	***
R square: 55·1%			

$^{***}p < 0{\cdot}001$; $^{**}p < 0{\cdot}01$; $^{*}p < 0{\cdot}05$.

younger groups, whereas for older people it was the perceptions that: (i) meat is necessary in the diet in general; and (ii) that it does not cause disease and is not fattening.

The more vegetarian friends respondents had, the less often meat was consumed, as predicted (hypothesis 6). Indeed, for men the presence of vegetarian friends was the main (negative) predictor of the frequency of meat consumption. It is not known whether vegetarians influence their meat-eating friends to decrease their meat consumption, or if people who eat little or no meat are more likely to become friends with people with similar meat consumption frequency. The latter may occur because vegetarians hold different worldviews to non-vegetarians.

Beliefs about meat were important predictors of meat consumption, particularly for older people. The most important were that meat does not cause heart disease or cancer or is otherwise unhealthy and that meat is a necessary dietary component. Although it is likely that meat does not cause cancer or heart disease, there is evidence (reported above) that vegetarians have lower mortality from ischaemic heart disease. If the general population—particularly those in their mid-50s or older—was more aware of such research, perhaps meat consumption would be more susceptible to change. Also, health promotion campaigns that focus on whether meat is necessary for humans could be an important influence on meat consumption. This may be particularly so if they were directed predominantly at older people and men.

One possible limitation of the survey was the Meat Consumption Score. It was a simple measure of frequency of red and white meat consumption, which in future work could be extended to include subcategories such as beef, pork, processed meat and poultry. The amount of meat eaten could be measured in more detail to provide a more complete description of meat consumption.

The present findings have important public health implications. Some of the difficulties people find with meat-free diets will also apply to plant-based diets generally. Plant-based diets are becoming more widely acknowledged as providing health benefits, including a decrease in the risk of particular diseases (Key *et al.*, 1999a,b). The promotion of plant-based diets is desirable not only from a health perspective, but also from environmental and animal welfare perspectives.

A large proportion of the variance in frequency of meat consumption was predicted by difficulties with vegetarian diets, beliefs about meat, and the number of vegetarian friends, with difficulties being most important overall. The study has highlighted the importance of taking sex and age into account when looking at predictors of frequency of meat eating, which in turn should be important when attempting to influence the consumption of plant-based diets. Ways to promote plant-based diets might include the provision of information about the nutritional adequacy and preparation of plant-based meals and more vegetarian-friendly shopping and dining environments.

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