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Relation of Dietary Fat Intake Perception to Nutritional Status and Psychosocial Factors

Yong HY, Zalilah MS & Yap LD

Department of Nutrition and Dietetics, Faculty of Medicine and Health Sciences
Universiti Putra Malaysia, 43400 Serdang Selangor, Malaysia

ABSTRACT

Excess dietary fat intake is associated with many chronic diseases. This cross-sectional study determines the differences in nutritional status and diet-related psychosocial factors by accuracy levels of dietary fat intake perceptions among adults. A total of 202 Universiti Putra Malaysia staff (20-55 years old) volunteered to participate in the study. Dietary fat accuracy levels (under-estimate, accurate and over-estimate) were determined by assessing actual fat intake through 24-hour diet recall and self-rated fat intake. Diet-related psychosocial factors assessed were perceived risks, intention to change, outcome expectancies and perceived barriers. About half (49.5%) of the respondents were classified as accurate estimators, while 35.6% and 14.9% were under-estimators and over-estimators, respectively. Dietary fat intake differed significantly between the dietary fat accuracy groups with under-estimators having the highest amount of dietary fat intake ($F=17.10$; $p<0.001$) and percentage of fat calories ($F=103.99 \pm 0.533\%$, $p<0.001$). Over-estimators had the highest mean BMI ($F=3.11$, $p<0.05$) compared to other groups. Among the fat accuracy groups, under-estimators reported the least barriers to eating low fat foods ($F= 3.671$, $p<0.05$). There were no significant differences in waist circumference, energy intake, perceived disease risks, intention to change and outcome expectancies among the dietary fat accuracy groups. These findings suggest that inaccurate perceptions of dietary fat intake should not be overlooked as one of the cognitive barriers to dietary change and factors that influence nutritional status among adults.

Keywords: Dietary fat intake perception, nutritional status, psychosocial factors

INTRODUCTION

Excess dietary fat intake is a major contributor to chronic disease (O'Brien, Fries & Bowen, 2000). Dietary fat intake is a complex health-related behaviour as it is not only partly habitual, but is also influenced by many psychosocial factors (Bogers *et al.*, 2004). Generally, people know that high fat intake constitutes an unhealthy diet and is detrimental to health. However, many do not accurately estimate their dietary fat intake and believe that their diets meet dietary fat recommendation (O'Brien *et al.*, 2000). The Washington State Cancer Risk Behavior Survey reported that those who believed there was a strong relationship between diet and cancer would have the largest fat intake reduction (Kristal *et al.*, 2001). It was also found that although people might perceive others as having a health risk, they tend to think of themselves as being less at

Correspondence author: Zalilah Mohd Shariff; Email: *zalilah@medic.upm.edu.my*

risk (Oenema & Brug, 2003). As people tend to be unaware or under-estimate their personal risk for disease, this optimistic view of own health risk may prevent dietary change to low fat eating.

Belief alone is not enough to motivate an individual to change dietary fat intake. Behavioural intention has been implicated as a salient and powerful predictor of health and nutrition related behaviours. O'Brien *et al*.(2000) showed that people who under-estimate the amount of fat in their diets were the least likely to report that they intended to change their diets. The likelihood of someone engaging in healthful eating may also be predicted by their outcome expectancies associated with fat reduction (Arredondo *et al.*, 2006). Agreement with sentiments such as consuming a low fat diet makes people feel good or improves the way people look may reflect the greater values individuals attribute to the anticipated outcomes of dietary fat reduction. Auld *et al.* (2000) found that the majority of individuals, who said they would adopt a fat-reducing behaviour if it was good for their health, reported practising that behaviour often or usually.

Perceived barriers tend to inhibit individuals' behavioural change efforts. People might regard healthy eating as being difficult to achieve when it requires significant changes to one's food preference and choices (Giskes *et al.*, 2005; Stewart-Knox *et al*., 2005). Other factors that have been shown to be barriers to healthy eating include cost (Eikenberry & Smith, 2004), limited availability and choices of healthy foods (Fila & Smith, 2006), more energy and time required to purchase and prepare healthy foods (John & Ziebland, 2004; Giskes *et al*., 2005) and lack of motivation (Andajani-Sutjahjo *et al*., 2004). Higher perceived barriers to healthy eating may hinder individuals from consuming diets low in fat (Kristal *et al*., 2001) and high in fruits and vegetables (Steptoe *et al.*, 2003).

In order to promote healthy dietary practices in adults, it is necessary to explore one's own perception of dietary intake and understand the wide range of factors that may influence such a perception. There are very few studies on accuracy of people's perceptions of their own fat intakes and how this perception is associated with nutritional and psychosocial factors. Thus, this study was carried out to examine the accuracy of dietary fat intake perceptions and the differences in nutritional status and diet-related psychosocial factors according to these perceptions.

METHODOLOGY

Subjects

Nine faculties were randomly selected from a list of 13 faculties in Universiti Putra Malaysia. A list of non-academic staff from each selected faculty was obtained either from the UPM Registrar Office or the faculty itself. All staff members were invited to participate in the study and those who volunteered were screened using an interviewer-administered questionnaire for the following study criteria - healthy (e.g. not handicapped and not on any prescribed medications), free from any chronic diseases (e.g. hypertension, diabetes mellitus, cardiovascular diseases and cancer), non-pregnant (for women) and aged between 18-56 years. All screening information was self-reported and no physical or medical examination was conducted.

The minimum calculated sample size was computed based on 95% confidence level, 60% estimated prevalence of non-accurate fat estimation and 10% error. The minimum number of subjects required for this study was 93. The final sample consisted of 202 adults. The majority (95%) of subjects were Malays, reflective of the main ethnic group among the staff workforce.

Dietary intake

Dietary intake was assessed using a 24-hour diet recall method on two non-consecutive days. The DIET 4 software was used to

analyse the dietary data for total energy and fat intake as well as percentage of fat calories. The percentage of fat calories was then categorised into three categories of actual dietary fat intake – (i) low dietary fat intake (< 20% of calories consumed from fat), (ii) moderate dietary fat intake (20 – 30%), and (iii) high dietary fat intake (> 30%) (NCCFN, 2005). Respondents were also asked to estimate the amount of dietary fat in their daily diets as low, moderate or high (perceived dietary fat intake) using a close-ended question.

Based on the actual and perceived dietary fat intakes, three dietary fat accuracy groups were created (accurate, under-estimated and over-estimated) (O'Brien *et al.*, 2000). Respondents were classified as accurate estimators if they were in the same categories for both actual and perceived dietary fat intake groups. The under-estimator group consisted of respondents whose perceived dietary fat intake was lower than actual dietary fat intake. Those with a perceived dietary fat intake higher than the actual intake were categorised as over-estimators.

Anthropometric measurements

Weight, height and waist circumference were measured using TANITA digital weighing scale, SECA body meter and SECA micro-toise tape, respectively. Each measurement was taken twice and the average was used for final analysis. Body mass index (BMI) was calculated and then classified according to World Health Organization classification (WHO, 1995). Waist circumference $\geq$ 102cm for men and $\geq$ 88cm for women was considered as at high risk for abdominal obesity (WHO, 1998).

Diet-related psychosocial factors

Four diet-related psychosocial factors (perceived risk to disease, intention to change, perceived outcome expectancies and perceived barriers to change) were assessed using items adapted from Bowen *et al.* (2004). Respondents were asked to rate on their perceived risk to disease using 3 items with a scale of 1 (no risk at all) to 5 (very much at risk). A single item was used to measure respondents' intention to change the amount of dietary fat intake with a scale of 1 (no intention) to 5 (definite intention to change). Perceived outcome expectancies for eating a low fat diet as well as a high fat diet were assessed using 5 items with a scale of 1 (strongly disagree) to 5 (strongly agree). There were 5 items on perceived barriers to eating a low fat diet with a scale from 1 (strongly disagree) to 5 (strongly agree). For both perceived outcome expectancies and perceived barriers, a higher score reflected the greater value subjects placed on expected outcomes and higher perceived barriers to reduce dietary fat intake. All the scores for the diet-related psychosocial factors were reported as mean $\pm$ standard deviation.

Face validity of the items was assessed via a pretest with 10 Malay UPM non-academic staff who fulfilled the research selection criteria. The staff was requested to evaluate the items for clarity, meaning and cultural sensitivity. Content validity of the items was established through extensive reviews of the items by nutrition and health behaviour experts. The internal consistency (reliability) of the items was assessed using the final research data (n=202) and the Cronbach's α coefficient was 0.73.

The study protocol was approved by the Medical Research Ethics Committee of the Faculty of Medicine and Health Sciences, Universiti Putra Malaysia. Permission to conduct the study on UPM's non-academic staff was obtained from the Department of Human Resources, Universiti Putra Malaysia. All respondents were requested to sign the consent forms prior to the inception of data collection.

Data analysis

All data were analysed using the Statistical Package for the Social Sciences for Windows (SPSS version 11.5) (Chicago, IL, USA) and

presented descriptively. General linear model of analysis of covariance (ANCOVA) was used to test the differences in BMI, waist circumference, dietary intake and diet-related psychosocial factors according to the dietary fat accuracy groups with age, gender and / or BMI as covariates. Least Significant Difference (LSD) test was applied to evaluate statistically significant mean difference among the dietary fat accuracy groups.

RESULTS

More than two-thirds (72.3%) of the respondents were females and the sample's mean age was 33.8 ± 10.3 years (Table 1). Approximately 57% had more than 11 years of schooling. The mean dietary fat intake and the percentage of calories from fat were 50.3 ± 21.3g and 27.8 ± 6.4%, respectively. More than half (55.2%) of the respondents had

Table 1: Sample characteristics: socio-demographic, nutritional and psychosocial factors (n=202)

Characteristics	*n (%)*	*Mean + SD*	*Min- Max*
Sex			
Male	56 (27.7)		
Female	146 (72.3)		
Age group (years)		33.81 ± 10.34	20 - 55
18- 29	104 (51.5)		
30- 39	23 (11.4)		
40- 49	60 (29.7)		
≥ 50	15 (7.4)		
Education (years)		13.14 ± 2.78	6 - 22
1- 6	4 (2.0)		
7- 11	83 (41.1)		
≥ 12	115 (56.9)		
Energy Intake (kcal)	201 (100)	1641 ± 582	476 - 3983
Fat (g)	202 (100)	50.25 ± 21.26	8 - 148
Percentages of calories from fat (%)		27.78 ± 6.44	11 - 51
Low (< 20)	21 (10.4)		
Moderate (20- 30)	111 (55.2)		
High (> 30)	69 (34.2)		
Waist Cimcumference (cm)		80.09 ± 11.85	60.8 - 111.6
Low risk[1]	168 (84.4)		
Increased risk[2]	31 (15.6)		
BMI (kg / m^2)		23.34 ± 4.54	15.19 - 35.39
Underweight (<18.50)	16 (8.0)		
Normal (18.5- 24.99)	105 (52.8)		
Overweight (25.00- 29.99)	52 (26.1)		
Obese (≥ 30.00)	26 (13.1)		
Perceived risk[a]	202 (100)	8.57 ± 2.34	3 - 14
Intention to change[b]	202 (100)	3.92 ± 1.17	1 - 5
Outcome expectancies[c]	202 (100)	19.24 ± 3.93	7 - 5
Perceived barrier[c]	202 (100)	15.50 ± 3.52	5 - 25

[a]1- 5 scale (not at all at risk to very much at risk)
[b]1- 5 scale (do not intend to change at all to definite intention to change)
[c] 1- 5 scale (strongly disagree to strongly agree)
[1] Males ≤ 102 cm; Females ≤ 88 cm
[2] Males ≥ 102 cm; Females ≥ 88 cm

percentage of fat calories within the recommended range of 20-30%. The mean BMI of females and males were 24.0 ± 4.5 kg / m^2 and 25.1 ± 4.6 kg / m^2, respectively. About 39% of them were overweight and obese and 15.6% had at-risk waist circumference. The mean scores of perceived risk, intention to change, outcome expectancies and perceived barrier were 8.6 ± 2.3, 3.9 ± 1.2, 19.2 ± 3.9 and 15.5 ± 3.5, respectively.

Table 2 shows the distribution of respondents in the dietary fat accuracy groups by sex. While more females (52.7%) than males (41.1%) were accurate estimators, a higher proportion of males (42.8%) than females (32.9%) under-estimated their dietary fat intake.

The adjusted mean BMI of accurate estimators, over-estimators and under-estimators were 24.1 ± 0.4 kg / m^2, 25.8 ± 0.8 kg / m^2 and 24.1 ± 0.5 kg / m^2, respectively (Table 3). Over-estimators had significantly higher adjusted mean BMI than accurate estimators or under-estimators (F= 3.112, p<0.05). In addition, over-estimators had the highest proportion of overweight and obese subjects (60%) compared to under-estimators (40.8%) and accurate estimators (31.6%). There was no significant difference in adjusted mean waist circumference among the dietary fat accuracy groups.

Energy intake did not differ significantly among the fat accuracy groups (Table 4). Under-estimators had the highest amount

Table 2. Dietary fat accuracy by gender

Dietary fat accuracy groups	*Male (n = 56) n (%)*	*Female (n = 146) n (%)*	*Total (n = 202) n (%)*
Accurate	23 (41.1)	77 (52.7)	100 (49.5)
Over-estimate	9 (16.1)	21 (14.4)	30 (14.9)
Under-estimate	24 (42.8)	48 (32.9)	72 (35.6)

Table 3. Body Mass Index and waist circumference by dietary fat accuracy groups

Anthropometric measurements	*Under-estimate (n = 71) n (%)*	*Accurate (n = 98) n (%)*	*Over-estimate (n = 30) n (%)*	*F-value*
BMI (kg / m2)				
Mean ± SE	24.06 ± 0.49	24.09 ± 0.42	25.79 ± 0.76	3.11*[a]
Not overweight (< 24.99)	42 (59.2)	67 (68.4)	12 (40.0)	
Overweight & obese (g”25.00)	29 (40.8)	31 (31.6)	18 (60.0)	
Waist circumference (cm)				
Mean ± SE	79.83 ± 1.17	79.46 ± 1.00	82.79 ± 1.81	1.33
Low Risk[1]	61 (85.9)	84 (85.7)	23 (76.7)	
Increased Risk[2]	10 (14.1)	14 (14.3)	7 (23.3)	

Mean was adjusted for age and gender
[1] Males ≤ 102 cm; Females ≤ 88 cm
[2] Males > 102 cm; Females > 88 cm* p < 0.05
[a] Significant difference between over-estimate and accurate groups

Table 4. Energy & fat intake by dietary fat accuracy groups

Dietary Intake	*Under-estimate (n = 71) n (%)*	*Accurate (n = 98) n (%)*	*Over-estimate (n = 30) n (%)*	*F-value*
Energy (kcal) Mean ± SE	1627 ± 65	1597 ± 55	1774 ± 101	0.81
Fat (g) Mean ± SE	60.35 ± 2.236	46.096 ± 1.901	39.87 ± 3.476	17.10***[a, b]
Percentage of Calories from Fat (%) Mean ± SE	33.41 ± 0.533	26.07 ± 0.453	20.29 ± 0.828	102.99***[a, b, c]
Low (< 20)	0 (0.0)	1 (1.0)	20 (66.7)	
Moderate (20 – 30)	10 (13.9)	91 (91.9)	10 (33.3)	
High (> 30)	62 (86.1)	7 (7.1)	0 (0.0)	

Mean was adjusted for age, gender and BMI
***p< 0.001
[a] Significant difference between under-estimate and accurate groups
[b] Significant difference between under-estimate and overestimate groups
[c] Significant difference between over-estimate and accurate groups

Table 5. Diet-related psychosocial factors by dietary fat accuracy groups

Diet-related psychosocial factors	*Mean ± SE*			*F-value*
	Under-estimate (n = 72)	*Accurate (n = 100)*	*Over-estimate (n = 30)*	
Perceived risk	8.51 ± 0.27	8.47 ± 0.23	9.21 ± 0.42	1.27
Intention to change	4.05 ± 0.14	3.88 ± 0.12	3.72 ± 0.21	0.97
Outcome expectancies	19.72 ± 0.46	19.09 ± 0.39	19.08 ± 0.72	0.59
Perceived barriers	14.77 ± 0.41	16.21 ± 0.35	15.20 ± 0.64	3.67*[a]

Mean was adjusted for age, gender and BMI
* $p<0.05$
[a] Significant difference between under-estimate and accurate groups

of fat in their diets compared to accurate estimators and under-estimators (F= 17.101, p< 0.001). There were significant adjusted mean group differences for percentage of fat calories (F= 102.993, p<0.001), with the adjusted mean percentage of fat calories for accurate, over-estimate and under-estimate groups being 26.1 ± 0.5%, 20.3± 0.8% and 33.5 ± 0.5%, respectively. A high proportion (86.1%) of under-estimators had more than 30% of fat calories, the majority (91.9%) of the accurate estimators had moderate fat calories (20-30%) and 66.7% of over-estimators were in the low fat calories group (< 20%).

Table 5 shows the adjusted mean differences of diet-related psychosocial factors by dietary fat accuracy groups. There were no significant differences in perceived risk, intention to change and outcome expectancies among the dietary fat accuracy groups. However, adjusted mean perceived barriers differed significantly among the dietary fat accuracy groups, with accurate

estimators and under-estimators having the highest and lowest perceived barriers to reduce fat intake ($F=3.67$, $p<0.05$), respectively.

DISCUSSION

More than half (50.5%) of the respondents inaccurately estimated their dietary fat intakes. Other studies have also shown that a majority of adults were more likely to under-estimate or over-estimate the actual amount of dietary fat consumed. O'Brien *et al*.(2000) found that only 44.7% of subjects were accurate estimators while 28.7% and 26.5% were under-estimators and over-estimators, respectively. In the Health Bergeijk Project (Netherlands) and the Working Well Trial (United States), the percentages of accurate estimators, under-estimators and over-estimators of fat intake were 42-46%, 27-37% and 20-28%, respectively (Glanz, Brug & van Assema, 1997). A possible explanation for the high proportion of adults lacking accurate awareness about their dietary fat intake is inadequate knowledge on fat content of foods. Inadequate or ineffective published health messages or nutrition campaigns targeting on dietary fat consumption, lack of understanding of nutrition label information, as well as confusing fat information could contribute to inadequate fat knowledge. Nutrition knowledge has been shown to be associated with many healthful dietary practices, including dietary fat intake (Wardle, Parmenter & Waller, 2000). Another explanation is that perceptions can also lead to motivation to change (O' Brien *et al.*, 2000; Oenema & Brug, 2003). If an individual perceives that he/she is not at risk of any disease, then he/she may not likely be attentive to his/her diet.

While more females (52.7%) accurately estimated their dietary fat intake, more males (42.8%) under-estimated their fat intake. A possible explanation for this observation is that women are more likely than men to be involved in household food preparation. This responsibility could motivate women to be more knowledgeable on nutrient content of foods prepared for family members. In addition, women are more health conscious and tend to be more aware of health messages than men (Fagerli & Wandel, 1999).

Similar to the findings of O'Brien *et al.* (2000), we also found that dietary fat intake differed significantly among the dietary fat accuracy groups, with the under-estimators having the highest amount of fat in their diets. These under-estimators also had a normal mean BMI. The findings indicate that an unrealistically low perception of dietary fat intake is motivating subjects to consume more fat. The subjects may perceive that since they have normal weight, their dietary fat intake is also within the normal range or they should not be worried about their fat intake. In this study, over-estimators had the least dietary fat intake but the highest proportion (60%) of overweight and obese subjects. Studies have demonstrated that under-reporting of energy intake and dietary fat intake increases with increasing adiposity (Goris, Westerterp-Plantenga & Westerterp, 2000). As overweight is generally associated with eating too much fat, over-estimators might respond to the questions on fat intake in the direction perceived to be desired by the researcher. Another explanation is that the overweight and obese subjects in this study could have already initiated behaviour change, that is, reduce dietary fat intake. Thus, the low mean dietary fat intake and percentage of fat calories among the over-estimators reflected current fat consumption behaviour.

Studies have shown that high perceived barriers could prevent the adoption of healthy behaviours (Kristal *et al*., 2001; Steptoe *et al*., 2003; Giskes *et al*., 2005; Fila & Smith, 2006). In contrast, we found that accurate estimators had the most perceived barriers while under-estimators reported the least perceived barriers to dietary fat change.

People often encounter barriers whether attitudinal or practical when they try to change their dietary or eating behaviours (Lea & Worsley, 2003). For example, the belief that diet is already balanced or healthy is an attitudinal barrier to dietary change (Cox *et al.*, 1998), while irregular working hours is a practical barrier to healthy eating (Lappalainen *et al.*, 1997). Accurate estimators and under-estimators have been found to have the highest and least knowledge on high fat foods, respectively (O' Brien *et al.*, 2000). Thus, for accurate estimators, having knowledge on fat content of foods could also mean that they are aware of the barriers to eating low fat foods or they have experienced the barriers while attempting to reduce dietary fat intakes. However, for under-estimators, lack of knowledge on high fat foods combined with the belief that they do not need to change as they are not at significant risk (O' Brien *et al.*, 2000; Oenema & Brug, 2003) could explain their optimistic views on fat reduction efforts.

There were no significant differences in intention to change, perceived risk to disease, and expected outcomes among the fat accuracy groups. As dietary behaviours are habitual, intention-behaviour relationship may be weakened and this would suggest that factors other than intention may drive healthy eating behaviours (Bogers *et al.*, 2004). People's perceptions of risks are often subjective and may not be directly linked to behavioural change unless they feel personally vulnerable to the health threats (Oenema & Brug, 2003). The likelihood of individuals engaging in healthful eating may be predicted by the values placed on the expected outcomes of the behaviour or benefits gained from performing the behaviour (Arrendondo *et al.*, 2006). However, the relationship between outcome expectancies and dietary behaviour is complex as the values placed on expected outcomes can be influenced by personal factors such as self-efficacy, nutrition knowledge and perceived risk (Schwarzer, 2001). Neglect of own personal needs to focus on other's needs (e.g. family members) and unpleasant experiences (e.g. unsuccessful attempts to lose weight) could also contribute to low outcome expectancies (Chang *et al.*, 2008).

Several limitations should be considered when interpreting the study findings. First, the diet-related psychosocial items were adapted from a western-based instrument. Although the items were pre-tested for clarity, cultural sensitivity and meaning prior to data collection, the items could still produce cultural bias which might contribute to lack of comprehension or misinterpretation of the items. Also, as these were self-reported measures, the validity of the findings was highly dependent on the subjects' honesty and cooperation to respond to the psychosocial items. Second, the use of volunteers might contribute to self-selection bias. These volunteers might be more health conscious or more likely to engage in healthful eating. Consequently, volunteers might demonstrate different behaviours than non-volunteers. Third, the use of 24-hour diet recall is subject to recall errors related to intake of certain food types (e.g. condiments, sweetened beverages, gravy and high fat dessert), cooking methods that may alter fat intake and intake of food with mixed ingredients that could result in under-estimation of fat intake. Finally, subjects might attempt to match the information given in 24-hour diet recall to the responses with the diet-related psychosocial items as well as perceived dietary fat intake. Subjects with perceived low fat intake may consciously exclude high fat foods from their dietary intake reports.

CONCLUSION

It is important to understand people's subjective assessment of their own diets because inaccurate perceptions of dietary intake (e.g. fat, fibre or energy intake) could be a cognitive barrier to dietary change that may influence nutritional status. Nutrition

education or intervention targeting on dietary fat reduction to prevent chronic diseases or improve health status may not produce the desired effects if people incorrectly perceive their own dietary fat intake. Dietary behaviour change is a complex process that is not only influenced by nutrition knowledge but also psychosocial factors such as intention, perceived barriers, perceived risks, self-efficacy, outcome expectancies and self-control. Knowledge of these factors is crucial for developing health and nutrition messages that are relevant and meaningful for the target population. Accuracy of people's perception of own dietary intake and its effect on actual food intake as well as the influence of psychosocial factors on dietary behaviours warrant continued research efforts.

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