Mal J Nutr 17(2): 213 - 228, 2011

Differences in Eating Behaviours, Dietary Intake and Body Weight Status between Male and Female Malaysian University Students

Gan WY, Mohd Nasir MT*, Zalilah MS & Hazizi AS

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

ABSTRACT

Introduction: University students are potentially important targets for the promotion of healthy lifestyles as this may reduce the risks of lifestyle-related disorders later in life. This cross-sectional study examined differences in eating behaviours, dietary intake, weight status, and body composition between male and female university students. **Methodology:** A total of 584 students (59.4% females and 40.6% males) aged 20.6±1.4 years from four Malaysian universities in the Klang Valley participated in this study. Participants completed the Eating Behaviours Questionnaire and two-day 24-hour dietary recall. Body weight, height, waist circumference and percentage of body fat were measured. **Results:** About 14.3% of males and 22.4% of females were underweight, while 14.0% of males and 12.3% of females were overweight and obese. A majority of the participants (73.8% males and 74.6% females) skipped at least one meal daily in the past seven days. Breakfast was the most frequently skipped meal. Both males and females frequently snacked during morning tea time. Fruits and biscuits were the most frequently consumed snack items. More than half of the participants did not meet the Malaysian Recommended Nutrient Intake (RNI) for energy, vitamin C, thiamine, riboflavin, niacin, iron (females only), and calcium. Significantly more males than females achieved the RNI levels for energy, protein and iron intakes. **Conclusion:** This study highlights the presence of unhealthy eating behaviours, inadequate nutrient intake, and a high prevalence of underweight among university students. Energy and nutrient intakes differed between the sexes. Therefore, promoting healthy eating among young adults is crucial to achieve a healthy nutritional status.

Keywords: Dietary intake, eating behaviours, nutritional status, university students

INTRODUCTION

The transition from adolescence to young adulthood is important for health promotion and disease prevention because this is a period where individuals are more likely to develop unhealthy eating habits, substance abuse, and have low physical activity level (Nelson *et al.*, 2008). University students are potentially important targets for the promotion of healthy lifestyles as this may reduce the risks of lifestyle-related disorders

* Correspondence author: Dr Mohd Nasir Mohd Taib; Email: *nasir.jpsk@gmail.com*

later in life (von Bothmer & Fridlund, 2005). However, this population has long been neglected and is an overlooked area of research as compared to children and adults (Herrera *et al.*, 2003; Moy *et al.*, 2009; Nelson *et al.*, 2008).

Poor eating habits and obesity are important public health issues especially among young adults who are experiencing transition into university life (Nelson *et al.*, 2008). Most university students make their own food choices (Šatalić, Barić & Keser, 2007). Hence, the lack of skills in selecting healthy food choices may have a negative impact on their eating behaviours. University students also experience stresses in university life that may negatively influence their diet (Mikolajczyk, El Ansari & Maxwell, 2009). They may exhibit unhealthy eating behaviours due to the high cost of healthy foods and the ease of availability of fast food.

Previous studies have shown that university students often failed to meet the recommended intakes for fruits and vegetables (Huang *et al.*, 2003; Moy *et al.*, 2009), had frequent snacking habits of high fat and calorie dense food (Kremmyda *et al.*, 2008; Yahia *et al.*, 2008), tended to skip meals, especially breakfast, and had higher frequency of fast food consumption (Alizadeh & Ghabili, 2008). Differences between the sexes in their eating behaviours have also been documented (Alizadeh & Ghabili, 2008; Kiefer, Rathmanner & Kunze, 2005; Sakamaki *et al.*, 2005). Female students were always found to have better dietary habits as compared to their male counterparts (Kiefer *et al.*, 2005; Kremmyda *et al.*, 2008; Mikolajczyk *et al.*, 2009), particularly daily breakfast intake and meal frequency (Yahia *et al.*, 2008). Additionally, female students were found to be more commonly consuming fruits, vegetables, milk and milk products, cereals, sweets and cakes while males were found to be more commonly consuming soft drinks, meat, fish (Mikolajczyk *et al.*, 2009) and fast food (Huang *et al.*, 2003). Moreover, a high proportion of university students, for example, Japanese (Shimbo *et al.*, 2004), Turkish (Sanlier & Unusan, 2007), and Croatians (Šatalić *et al.*, 2007) failed to meet the recommended intakes for most of the macro- and micro-nutrients. Nutrient intakes significantly differed between sexes with better macro-nutrient but not micro-nutrient intakes among female students (Šatalić *et al.*, 2007).

An unbalanced diet due to excessive or inadequate intake of calories or other nutrients is closely related to a higher prevalence of overweight and obesity, while a balanced diet should provide adequate energy, macro- and micro-nutrients (Herrera *et al.*, 2003). There is a limited body of knowledge on eating behaviours, dietary intake, weight status, and body composition of Malaysian university students as research among this population is scarce. Therefore, the purpose of this study was to obtain a preliminary understanding of the differences in eating behaviours, dietary intake, weight status, and body composition between male and female university students. This study provides recent data on the eating behaviours and nutritional status among university students in Malaysia, which could provide insights for the development of future intervention and nutrition education programmes that aim to improve the nutritional status of university students.

METHODOLOGY

This cross-sectional study was conducted in the Klang Valley. A multistage stratified random sampling was employed. A list of universities was obtained from the Ministry of Higher Education. Four universities that met the inclusion criterion of offering multiple programmes encompassing the arts, sciences and technical fields were randomly selected for this study. The sample from these universities was stratified based on their fields of study which were the arts,

sciences, and technical field in accordance with that categorised by the Ministry of Higher Education. One faculty was randomly selected from each field of study. Participants were sampled based on the sex and fields of study compositions of the actual Malaysian university student population according to the Ministry of Higher Education. Participation in this study was fully voluntary and no monetary reimbursement was made.

Data collection was conducted from October to December 2009 using a bi-lingual (English and Malay language) self-administered questionnaire. The study protocol was approved by the Medical Research Ethics Committee, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, and also by the Ministry of Higher Education. Permission letters to enter the selected universities were obtained prior to data collection. Participants were given an information sheet explaining the purpose of the study and informed consent was obtained prior to interview.

Measures

Socio-demographic background

Socio-demographic information including date of birth, age, ethnicity, sex, current living arrangement, academic year, and field of study were self-reported.

Anthropometric measurements

Body weight and height were measured to determine body mass index (BMI) of the participants. Body weight was measured using a TANITA Digital Weight Scale HD306 (TANITA Corporation, USA) to the nearest 0.1 kg, whereas height was assessed using a SECA Body Tape Measure SE206 (SECA, Germany) to the nearest 0.1 cm. Body Mass Index was calculated as weight (kilogram) divided by the square of the height (meter^2). The WHO (2000) criteria were used to classify the BMI of the participants. Waist circumference (WC) was measured to determine the abdominal obesity of the participants by using a SECA Ergonomic Circumference Measuring Tape SE203 (SECA, Germany) to the nearest 0.1 cm. The classification of WC was based on the World Health Organization / International Association for the Study of Obesity / International Obesity Task Force (WHO / IASO / IOTF) cut-offs for Asians with $\geq$90 cm for men and $\geq$80 cm for women to be considered at increased risk for abdominal obesity (WHO / IASO / IOTF, 2000). Waist-to-height ratio (WHtR) is another measurement used to assess health risk of obesity (Ashwell & Hsieh, 2005). A value >0.5 indicates increased risk and >0.6 indicates substantially increased risk of obesity (Ashwell & Hsieh, 2005).

Body fat of the participants was measured by using Omron body fat monitor HBF-302 (Omron Matsusaka Co. Ltd, Matsusaka, Japan) following the instructions given in the manufacturer's manual to obtain the percentage of body fat (%BF) with accuracy up to 0.1%. Participants were required to empty their bladder and to refrain from food and drinks for at least three hours before the measurements. The %BF is divided into four categories according to the Omron manufacturer: low (<10% for males and <20% for females), normal (10-20% for males and 20-30% for females), moderate (20-25% for males and 30-35% for females), and high (>25% for males and >35% for females).

Eating behaviours

The Eating Behaviours Questionnaire (EBQ) is a 9-item scale that assesses frequency of meal consumption, frequency of snacking between meals, types of snacks consumed, frequency of eating outside of home and take-away food, use of dietary supplements, dietary practices, and participation in weight management programmes (Chin & Mohd Nasir, 2009). Additionally, nine items were adopted and modified from the dietary behaviour section in Youth Risk Behaviour Survey 2009 questionnaire (CDC, 2008)

which was used to assess the frequency of different types of foods and beverages consumed (100% fruit juices, fruits, vegetables, bread / rice / noodles, meat / poultry, fish, legumes, canned drinks, and milk) during the past seven days.

Dietary intake assessment

Current dietary intake of the participants was assessed by using the 24-hour dietary recall method. A two-day dietary intake recall which comprised one weekday and one weekend was collected. Detailed descriptions of all foods and beverages including cooking methods and brand names of processed food was recorded. The recall was obtained with the aid of household measurement cups and spoons to estimate the portion size and quantities of food consumed. The estimated amount consumed was then converted into grams. Food databases used in the analysis included the Malaysian Food Composition Tables (Tee *et al.*, 1997) and ASEAN Food Composition Tables (Puwastien *et al.*, 2000). The mean values for caloric and nutrient intake for every participant was then compared with Recommended Nutrient Intake (RNI) for Malaysians (NCCFN, 2005) to determine intake adequacy. The results were presented as means, standard deviations and percentages. Total energy and nutrient intakes were analysed using Nutritionist Pro (First Data Bank Inc., 2011). Under-reporting of energy intake was examined by calculating the ratio between reported total energy intake (EI) and basal metabolic rate (BMR). The BMR was calculated using the BMR equation for Malaysian adults (Mohd Ismail *et al.*, 1998). A ratio of EI / BMR <1.2 was used as the Goldberg cut-off point for under-reporting of EI (Goldberg *et al.*, 1991).

Statistical analysis

Data were analysed with IBM SPSS Statistics 19 (SPSS Inc., Chicago, IL, USA). Univariate analysis was used to analyse descriptive data and the results are presented as frequencies and percentages for categorical variables and as means and standard deviations for continuous variables. Chi-square test of independence was used to estimate associations between categorical variables. Independent sample *t*-test was used to measure differences between sexes. One-way ANOVA was used to determine differences between BMI categories. Statistical significance level was set at $p < 0.05$.

RESULTS

Anthropometric measurements

A total of 584 university students (59.4% females and 40.6% males) with a mean age of 20.6 years (*SD* = 1.4), attending different study programmes participated in the present study. About 14.3% of males and 22.4% of females were underweight (UW), while 14.0% of males and 12.3% of females were overweight or obese (OW) (Table 1). No association was observed between BMI ($\chi^2 = 7.04$, $p = 0.071$), WC ($\chi^2 = 0.016$, $p = 0.901$), and WHtR categories ($\chi^2 = 1.75$, $p = 0.185$) with sex. The %BF was significantly associated with sex ($\chi^2 = 10.441$, $p = 0.015$) where a higher proportion of males (17.3%) had high body fat percentage as compared to females (10.5%).

Body weight status was found to be associated with WC (males: $\chi^2 = 93.30$, $p < 0.001$; females: $\chi^2 = 115.07$, $p < 0.001$), WHtR (males: $\chi^2 = 86.02$, $p < 0.001$; females: $\chi^2 = 102.24$, $p < 0.001$), and %BF (males: $\chi^2 = 142.32$, $p < 0.001$; females: $\chi^2 = 277.26$, $p < 0.001$). More OW males (69.7%) and females (71.4%) were at high risk of abdominal obesity than NW males (1.8%) and females (4.5%). Similarly, more OW males (78.8%) and females (69.0%) were at increased risk of obesity as compared to NW males (7.6%) and females (6.3%). In terms of body fat, more UW males (26.5%) and females (37.7%) than NW males (1.2%) and females (0.9%) had low body fat. Similarly, more NW males (30.6%) and females (29.0%) than OW males

Table 1. Socio-demographic characteristics and anthropometric indices of the participants (n = 584)

Characteristics	*Male(n=237)*	*Female(n=347)*	*p-value**
Ethnicity			
Malay	61 (25.7)	200 (57.6)	
Chinese	152 (64.1)	108 (31.1)	
Indian	23 (9.7)	35 (10.1)	
Others	1 (0.4)	4 (1.2)	
Age (years)			
18 – 20	159 (67.1)	163 (47.0)	
21 – 24	78 (32.9)	184 (53.0)	
Mean ± SD	19.98 ± 1.50	20.62 ± 1.32	
Current living arrangement			
College dormitory	124 (52.3)	272 (78.4)	
Parent's home	62 (26.2)	37 (10.7)	
Sibling's home	2 (0.8)	0	
Relative's home	5 (2.1)	1 (0.2)	
Friends	44 (18.6)	37 (10.7)	
Academic year			
1	130 (54.9)	129 (37.2)	
2	72 (30.4)	136 (39.2)	
3	26 (11.0)	43 (12.4)	
4	9 (3.8)	39 (11.2)	
Fields of study			
Arts	51 (21.5)	190 (54.7)	
Sciences	84 (35.5)	78 (22.5)	
Technical	102 (43.0)	79 (22.8)	
Height (cm)			
Mean ± SD	170.39 ± 6.09	156.92 ± 5.55	
Body weight (kg)			
Mean ± SD	63.69 ± 11.42	52.39 ± 9.62	
BMI (kg / m²)			0.071
Underweight	34 (14.3)	77 (22.4)	
Normal	170 (71.7)	224 (65.3)	
Overweight	26 (11.0)	29 (8.5)	
Obese	7 (3.0)	13 (3.8)	
Mean ± SD	21.91 ± 3.57	21.26 ± 3.66	
Waist circumference (cm)			0.901
No risk of abdominal obesity	211 (89.0)	303 (88.3)	
High risk of abdominal obesity	26 (11.0)	40 (11.7)	
Mean ± SD	77.50 ± 9.55	70.35 ± 8.32	
Waist-to-height ratio			0.185
No risk (≤0.5)	198 (83.5)	300 (87.5)	
Increased risk (>0.5)	39 (16.5)	43 (12.5)	
Mean ± SD	0.45 ± 0.05	0.45 ± 0.05	
Percentage of body fat (%)			0.015
Low	11 (4.6)	31 (9.0)	
Normal	126 (53.2)	203 (59.2)	
Moderate	59 (24.9)	73 (21.3)	
High	41 (17.3)	36 (10.5)	
Mean ± SD	19.29 ± 6.04	27.65 ± 5.89	

Note. Data are expressed as *n* (%) unless otherwise indicated. *χ^2 analyses with significance at $p < 0.05$.

Table 2. Associations between socio-demographic variables, body weight status, and meal skipping behaviours by sex

	Male (n = 237)			*Female (n = 347)*		
	Meal skipping		*p-value**	*Meal skipping*		*p-value**
	Yes	*No*		*Yes*	*No*	
Ethnicity			< 0.001			0.002
Malay	56 (90.3)	6 (9.7)		165 (80.9)	39 (19.1)	
Chinese	100 (65.8)	52 (34.2)		67 (62.0)	41 (38.0)	
Indian	19 (82.6)	4 (17.4)		27 (77.1)	8 (22.9)	
Age groups			0.407			0.058
18 – 20 years	121 (72.0)	47 (28.0)		147 (79.0)	39 (21.0)	
21 – 24 years	54 (78.3)	15 (21.7)		112 (69.6)	49 (30.4)	
Living arrangement			0.059			0.649
College dormitory	99 (79.8)	25 (20.2)		201 (73.9)	71 (26.1)	
Off campus	76 (67.3)	37 (32.7)		58 (77.3)	17 (22.7)	
Fields of study			0.061			0.317
Arts	44 (86.3)	7 (13.7)		142 (74.7)	48 (25.3)	
Sciences	61 (27.4)	23 (72.6)		54 (69.2)	24 (30.8)	
Technical	70 (68.6)	32 (31.4)		63 (79.7)	16 (20.3)	
Body weight status			0.292			0.290
Underweight	24 (70.6)	10 (29.4)		52 (67.5)	25 (32.5)	
Normal weight	130 (76.5)	40 (23.5)		170 (75.9)	54 (24.1)	
Overweight and obese	21 (63.6)	12 (36.4)		33 (78.6)	9 (21.4)	
Total	175 (73.8)	62 (26.2)	-	259 (74.6)	88 (25.4)	0.904

Note. Data are expressed as *n* (%) unless otherwise indicated. *χ^2 analyses with significance at $p < 0.05$.

(21.2%) and females (19.0%) had moderate body fat. In contrast, more OW males (78.8%) and females (78.6%) had high body fat as compared to NW males (8.8%) and females (1.3%).

Dietary Practices

Meal and snack consumption

About 62.2% of the female students consumed breakfast daily or four to six days weekly in the past seven days compared to 57.8% of the male students. Most of the participants (73.4% males and 70.0% females) consumed lunch daily. The majority of the males (84.0%) and more than half of the females (58.8%) consumed dinner daily. Apart from main meals, 19.3% of the females snacked daily during morning tea time, 7.8% snacked during afternoon tea break and 3.5% snacked during supper time. For males, 16.0% snacked daily during morning tea time, 8.9% during afternoon tea break and 10.1% during supper time. Fruits and biscuits / crackers / cookies were the most frequently consumed snacks, whereas tea, milk and chocolate malt drinks were the most frequently consumed beverages. .

Meal skipping behaviours of the participants are shown in (Table 2). Meal skipping was not significantly associated with sex ($\chi^2 = 0.02$, $p = 0.904$). A majority of the participants (73.8% males and 74.6% females) skipped at least one meal daily. Breakfast was the most frequently skipped meal for both sexes. Among males, ethnicity was found to be associated with meal skipping ($\chi^2 = 16.45$, $p < 0.001$). More Malay males (90.3%) skipped at least one meal daily while 34.2% of Chinese and 17.4% of Indian

females never skipped meals. Similarly, among females, ethnicity was associated with meal skipping ($\chi^2 = 12.88$, $p = 0.002$). More Malay females (80.9%) skipped at least one meal daily while more than one-third of the Chinese females (38.0%) never skipped meals. On the other hand, other socio-demographic variables and body weight status were not associated with meal skipping behaviours in both sexes (Table 2).

Eating away from home and eating companion

About one-third of the participants (30.0% males and 32.0% females) reported that they ate at hawker centres, coffee shops or other food stalls daily (Table 3). Only 1.3% of the males and none of the females never ate outside their homes. About 38.4% of the males and half of the females (52.4%) reported that they ate at western fast food restaurants one to three times per month. As for eating companion, more females had their meals with friends (82.7%) and more males had their meals with family members (24.5%) or ate alone (8.9%).

Dietary supplementations

About 16.0% of the male and 21.3% of the female students frequently consumed dietary supplements. Of these, a majority of the participants (81.6% males and 77% females) consumed supplements because their parents advised them to do so. Other sources of advice of dietary supplement consumption included friends, physicians, family members, website, and their own decision (Table 3).

Types of dietary practice

Most of the participants (58.5% males and 40.3% females) claimed that they were not choosy about foods but normally ate foods that were available. About 14.8% of the males and 30.3% of the females claimed that they were not following any special diet but were trying to eat less to lose weight. A small proportion of the males (0.8%) and the females (1.2%) followed a specific weight loss diet regimen (Table 3).

Weight management programmes

A small proportion of the participants (5.9% males and 4.9% females) participated in weight management programmes. Of these, about half the males (57.1%) had workouts at fitness centres, followed by sports games (42.9%). A majority of the females participated in aerobic exercises (82.3%), followed by yoga (11.8%) and workout at fitness centres (5.9%).

Frequency of food groups consumption

The pattern of consumption of food groups between males and females was almost the same (Table 4). More than half of the males and females were commonly consuming vegetables, bread / rice / noodles, and meat / poultry at least one time daily. More females reported that they did not consume fruit juices, fruits, vegetables, fish, legumes, canned drinks, and milk as compared to males.

Dietary intake

Four female participants refused to be interviewed for their 24-hour dietary recall. About 31.4% of the participants were under-reporters of EI, with more female under-reporters (33.8%) than males (27.8%). However, under-reporters of EI were not excluded from the data as this study aimed to determine the energy and nutrient intakes for all the samples. Table 5 shows the average energy and nutrient intakes by sex. Male university students showed significantly higher mean intakes of energy and all nutrients than female university students except for vitamin C and iron. In terms of body weight status, no significant differences in the mean intakes of all the nutrients studied were found among UW, NW, and OW groups ($p > 0.05$) for both sexes.

Table 3. Frequency of different eating behaviours by sex

		Male (n = 237)	*Female (n = 347)*
Eating away from home	Everyday	71 (30.0)	111 (32.0)
Eat at hawker centres, coffee shops or other food stalls	4-6 days a week	71 (30.0)	78 (22.5)
	2-3 days a week	62 (26.2)	73 (21.0)
	Once a week	18 (7.6)	49 (14.1)
	1-3 times a month	12 (5.1)	36 (10.4)
	Never	3 (1.3)	0
Eat at western fast food restaurants	Everyday	1 (0.4)	1 (0.3)
	4-6 days a week	17 (7.2)	12 (3.5)
	2-3 days a week	45 (19.0)	32 (9.2)
	Once a week	66 (27.8)	71 (20.5)
	1-3 times a month	91 (38.4)	182 (52.4)
	Never	17 (7.2)	49 (14.1)
Frequency of buying/take-away food from western fast food restaurants	Everyday	2 (0.8)	4 (1.2)
	4-6 days a week	10 (4.2)	5 (1.4)
	2-3 days a week	26 (11.0)	20 (5.8)
	Once a week	47 (19.8)	39 (11.2)
	1-3 times a month	91 (38.4)	147 (42.4)
	Never	61 (25.7)	132 (38.0)
Eating companions	Family members	58 (24.5)	42 (12.1)
	Friends	158 (66.7)	287 (82.7)
	Alone	21 (8.9)	18 (5.2)
Dietary supplement consumption	Yes	38 (16.0)	74 (21.3)
	No	199 (84.0)	273 (78.7)
Sources of advice of dietary supplement consumption	Parent	31 (81.6)	57 (77.0)
	Own decision	4 (10.6)	4 (5.4)
	Friend	0	4 (5.4)
	Physician/Pharmacist	0	5 (6.8)
	Sibling	1 (2.6)	3 (4.0)
	Relative	1 (2.6)	1 (1.4)
	Website	1 (2.6)	0
Types of dietary practices			
Reduce high fat and high sugar foods		25 (10.5)	31 (8.9)
Reduce high fat, high sugar and red meat foods		12 (5.1)	38 (11.0)
Reduce high fat foods		17 (7.2)	22 (6.3)
Vegetarians		3 (1.3)	3 (0.9)
Eat according to a specific weight loss diet menu		2 (0.8)	4 (1.2)
No special diet menu but eat less to lose weight		35 (14.8)	105 (30.3)
Not choosy on the types of food eaten and eat any food available		139 (58.6)	140 (40.3)
Others		4 (1.7)	4 (1.2)

Continued on next page

From previous page

		Male (n = 237)	*Female (n = 347)*
Weight change program participation	Yes	14 (5.9)	17 (4.9)
	No	223 (94.1)	330 (95.1)
Types of weight change programme	Gym	8 (57.1)	1 (5.9)
	Sports games	6 (42.9)	0
	Aerobic	0	14 (82.3)
	Yoga	0	2 (11.8)
Sources of advice of weight change program participation	Friends	6 (42.9)	10 (58.8)
	Own decision	8 (57.1)	6 (35.3)
	Physicians	0	1 (5.9)

Note. Data are expressed as *n* (%).

The percentage of contributions of each macronutrient towards total EI was similar by sex (Table 5). More than half (52.7%±7.1%) of the total EI for male university students was contributed by carbohydrates, followed by fat (32.1%±5.4%) and by protein (15.3%±3.5%). For females, 52.7%±6.6% of the total EI was derived from carbohydrates, 32.8%±5.7% from fat and the remaining 14.9%±3.3% from protein. Results indicate that the mean intakes of energy and most of the nutrients for males and females did not meet the RNI for Malaysians (NCCFN, 2005). Male and female students achieved 86.9% and 81.2% of the RNI for energy respectively. For males, the mean protein, vitamin A and iron intakes were much higher than the RNIs (128.6%, 163.7% and 208.9%, respectively). For females, only mean intakes of protein and vitamin A met the RNI levels (110.6% and 160.6% respectively).

Intakes of energy ($\chi^2 = 4.06$, $p = 0.044$), protein ($\chi^2 = 23.53$, $p < 0.001$), and iron ($\chi^2 = 143.73$, $p < 0.001$) were significantly associated with sexes. Significantly higher proportions of the females failed to meet the RNI levels for energy (80.5%), protein (45.5%), and iron (68.2%) intakes as compared to the males (73.0%, 25.3%, and 17.3% respectively). A majority of the participants did not meet the RNI levels for energy, vitamin C, thiamine, riboflavin, niacin, calcium and iron. Most of the males (74.7%) achieved the RNI for protein as compared to 54.4% of the females. A majority of the females (68.2%) did not meet the RNI level for iron intake. About 90.7% of the females and 88.6% of the males failed to meet the RNI level for calcium intake.

Additionally, sodium intake for the participants was also measured. Males consumed about 3000 mg of sodium which was about 650 mg more than the sodium intake of female students. A significant association between sodium intake and sexes ($\chi^2 = 22.86$, $p < 0.001$) was found. A total of 55.9% of the participants (67.9% males and 47.5% females) exceeded the suggested Tolerable Upper Intake Levels (UL) of 2300 mg for sodium intake (IOM, 2004).

Table 4. Frequency of different food groups consumption by sex

Foods/Beverages		*None*	*1-3 times during the past 7 days*	*4-6 times during the past 7 days*	*1 time per day*	*2 times per day*	*3 times per day*	*4 or more times per day*
100% fruit juices	Male	69 (29.1)	83 (35.0)	33 (13.9)	26 (11.0)	14 (5.9)	5 (2.1)	7 (3.0)
	Female	107 (30.8)	159 (45.8)	31 (8.9)	29 (8.4)	11 (3.2)	5 (1.4)	5 (1.4)
Fruits	Male	30 (12.7)	102 (43.0)	46 (19.4)	28 (11.8)	19 (8.0)	7 (3.0)	5 (2.1)
	Female	52 (15.0)	165 (47.6)	50 (14.4)	55 (15.9)	14 (4.0)	8 (2.3)	3 (0.9)
Vegetables	Male	8 (3.4)	37 (15.6)	46 (19.4)	48 (20.3)	58 (24.5)	22 (9.3)	18 (7.6)
	Female	14 (4.0)	56 (16.1)	66 (19.0)	95 (27.4)	82 (23.6)	23 (6.6)	11 (3.2)
Bread/rice/noodles	Male	7 (3.0)	28 (11.8)	30 (12.7)	41 (17.3)	65 (27.4)	41 (17.3)	25 (10.5)
	Female	7 (2.0)	49 (14.1)	45 (13.0)	102 (29.4)	92 (26.5)	42 (12.1)	10 (2.9)
Meat/chicken	Male	12 (5.1)	29 (12.2)	28 (11.8)	62 (26.2)	64 (27.0)	27 (11.4)	15 (6.3)
	Female	11 (3.2)	65 (18.7)	65 (18.7)	115 (33.1)	63 (18.2)	24 (6.9)	4 (1.2)
Fish	Male	32 (13.5)	62 (26.2)	48 (20.3)	48 (20.3)	28 (11.8)	9 (3.8)	10 (4.2)
	Female	63 (18.2)	109 (31.4)	58 (16.7)	76 (21.9)	20 (5.8)	17 (4.9)	4 (1.2)
Legumes	Male	52 (21.9)	82 (34.6)	39 (16.5)	39 (16.5)	18 (7.6)	6 (2.5)	1 (0.4)
	Female	109 (31.4)	130 (37.5)	46 (13.3)	30 (8.6)	18 (5.2)	9 (2.6)	5 (1.4)
Canned drinks	Male	55 (23.2)	95 (40.1)	37 (15.6)	22 (9.3)	15 (6.3)	9 (3.8)	4 (1.7)
	Female	138 (39.8)	149 (42.9)	33 (9.5)	14 (4.0)	7 (2.0)	2 (0.6)	4 (1.2)
Milk	Male	72 (30.4)	65 (27.4)	35 (14.8)	34 (14.3)	15 (6.3)	10 (4.2)	6 (2.5)
	Female	115 (33.1)	117 (33.7)	40 (11.5)	49 (14.1)	16 (4.6)	7 (2.0)	3 (0.9)

Note. Data are expressed as *n* (%).

Table 5. Energy and nutrient intakes by sex

Nutrients	*Male(n = 237) n (%)*	*Female(n = 343) n (%)*	*Male(n = 237) Mean±SD*	*Female(n = 343) Mean±SD*
Energy (kcal / d)[a]***			2120±614	1624±506
% RNI [a]**			86.9±25.2	81.2±25.3
< RNI [b]*	173 (73.0)	276 (80.5)		
≥ RNI	64 (27.0)	67 (19.5)		
Carbohydrate (g / d) [a]***			279.8±90.6	214.0±72.7
Protein (g / d) [a]***			80.6±27.1	60.7±23.4
% RNI [a]***			128.6±43.2	110.6±42.6
< RNI [b]***	60 (25.3)	156 (45.5)		
≥ RNI	177 (74.7)	187 (54.4)		
Fat (g / d) [a]***			75.7±26.1	59.2±21.2
% of energy from carbohydrate			52.7±7.1	52.8±6.6
< 55%	153 (64.6)	208 (60.6)		
55 – 70%	80 (33.8)	135 (39.4)		
> 70%	4 (1.7)	0		
% of energy from protein			15.4±3.5	14.9±3.3
< 10%	8 (3.4)	14 (4.1)		
10 – 15%	111 (46.8)	184 (53.6)		
> 15%	118 (49.8)	145 (42.3)		
% of energy from fat			32.1±5.4	32.8±5.7
< 20%	51 (21.5)	92 (26.8)		
20 – 30%	101 (42.6)	156 (45.5)		
> 30%	85 (35.9)	95 (27.7)		
Vitamin A (μg / d) [a]*			982.1±955.0	803.2±751.5
% RNI			163.7±159.2	160.6±150.3
< RNI	74 (31.2)	117 (34.1)		
≥ RNI	163 (68.8)	226 (65.9)		
Vitamin C (mg / d)			42.0±40.3	46.5±45.4
% RNI			60.0±57.5	66.5±64.9
< RNI	182 (76.8)	261 (76.1)		
≥ RNI	55 (23.2)	82 (23.9)		
Thiamine (mg / d) [a]**			0.96±0.55	0.74±0.44
% RNI			80.4±45.6	67.3±40.0
< RNI	180 (75.9)	283 (82.5)		
≥ RNI	57 (24.1)	60 (17.5)		
Riboflavin (mg / d) [a]**			1.14±0.50	0.97±0.69
% RNI			87.4±38.5	88.6±63.3
< RNI	166 (70.0)	247 (72.0)		
≥ RNI	71 (30.0)	96 (28.0)		
Niacin (mg / d) [a]*			9.8±5.9	8.5±6.9
% RNI			61.0±36.8	60.0±49.1
< RNI	208 (87.8)	313 (91.6)		
≥ RNI	29 (12.2)	30 (8.7)		

Continued on next page

From previous page

Nutrients	*Male(n = 237) n (%)*	*Female(n = 343) n (%)*	*Male(n = 237) Mean±SD*	*Female(n = 343) Mean±SD*
Calcium (mg / d) [a]**			547.2±285.2	471.7±313.1
% RNI [a]*			65.0±34.3	58.0±38.0
< RNI	210 (88.6)	311 (90.7)		
≥ RNI	27 (11.4)	32 (9.3)		
Iron (mg / d)			18.8±10.8	17.2±10.4
% RNI [a]***			208.9±119.6	85.6±52.1
< RNI [b]***	41 (17.3)	234 (68.2)		
≥ RNI	196 (82.7)	109 (31.8)		
Sodium (mg / d) [a]***			2971.2±1273.1	2322.5±958.0

Note. RNI = Recommended Nutrient Intake according to NCCFN (2005)
[a] Significant differences between sexes were measured by the *t*-test, $*p < 0.05$, $**p < 0.01$, $***p < 0.001$
[b] Significant associations between sexes were determined by χ^2analyses, $*p < 0.05$, $***p < 0.001$

DISCUSSION

The prevalence of underweight was quite high (19.1%) among university students in our study. Specifically, the prevalence of underweight and overweight were almost the same (14.3% vs. 14.0%) in the male students. However, there were more underweight (22.4%) than overweight female students (12.3%). These findings are consistent with a recent study conducted by Huda & Ruzita (2010) on 264 male and 360 female students in Universiti Sains Malaysia which reported that 27.4% of the students (32.8% females and 20.1% males) were underweight, 9.6% (6.1% females and 14.4% males) were overweight and 1.8% (0.6% females and 3.4% males) were obese. These findings are also consistent with other studies in Asia which found a high prevalence of underweight among female university students (Sakamaki *et al.*, 2005; Sanlier & Unusan, 2007). Sakamaki *et al.* (2005) explained that the high prevalence of underweight among female university students might be due to their desire for a thinner body size.

We found that the prevalence of abdominal obesity was 11.0% among males and 11.7% among females. The Third National Health and Morbidity Survey 2006 (NHMS III) conducted in Malaysia reported that the overall national prevalence of abdominal obesity (WC >102 cm in males and WC >88 cm in females) in adults aged 18 to 29 years was 13.8% (Kee *et al.*, 2008). The prevalence of abdominal obesity for Filipino adult population aged 20 years and above was 17.7% in males and 35.1% in females, using the cut-off of WC for Asians (Morales *et al.*, 2008). A study on Vietnamese young adults aged 20-29 years revealed that the prevalence of abdominal obesity (WC ≥86 cm in both sexes) was 9.4% in males and 7.8% in females (Cuong *et al.*, 2006). However, the prevalence of abdominal obesity in our study could not be directly compared to other studies as different cut-off values were used in different countries and the age group was also different. Currently, there is still no universal consensus on the cut-off points for WC (Garnett, Baur & Cowell, 2008). Therefore, Ashwell and Hsieh (2005) proposed the adoption of WHtR as a simple tool to overcome these problems. Our study is the first published study in Malaysia that used WHtR to assess health risk of obesity among university students.

Only a third of the participants (30.8% males and 38.6% females) consumed breakfast daily. This finding was higher as compared to another Malaysian study by Moy *et al.* (2009) which found that the prevalence of breakfast skipping was 29.2% among university students. Similarly, about 32.3% of the Lebanese male university students and 31.5% of the females reported eating breakfast daily (Yahia *et al.*, 2008). In addition, the most frequently skipped meal was breakfast (69.2% males and 61.4% females) and this was similar to the findings from a study among Iranian medical students (Alizadeh & Ghabili, 2008). Moy *et al.* (2009) suggested that reasons for breakfast skipping were the lack of time to eat, lack of appetite, dislike eating early in the morning or oversleeping.

Our study showed that 27.8% of the male and 20.5% of the female students ate fast food at least once a week. This finding was lower as compared to another Malaysian study by Moy *et al.* (2009) which reported that 35.3% of the university students ate fast food at least once a week. A reason for this low intake of fast food may include higher cost for fast food as compared to the price of other traditional food. In terms of eating companion, female students tend to eat with friends more frequently than males. This result is comparable to the study by Sakamaki *et al.* (2005) which found that female students tend to eat with friends and family more frequently than males.

We found that the mean intakes of energy and most of the nutrients for males and females failed to meet the RNI. Shimbo *et al.* (2004) reported that Japanese female university students had inadequate intake of energy, protein, calcium and iron and adequate intake of vitamin A and riboflavin. Furthermore, sex differences were also found in energy and nutrient intake in our study. Previous studies similarly reported that there was a difference in energy intake between sexes with males having a higher energy intake (Herrera *et al.*, 2003; Mirnalini *et al.*, 2008; Šatalić *et al.*, 2007). However, a majority of our participants (73.0% males and 80.5% females) had total energy intake below the RNI level.

Several studies showed micro-nutrient intake to be parallel with total energy intake (Mirnalini *et al.*, 2008; Sanlier & Unusan, 2007; Shimbo *et al.*, 2004). Specifically, the mean iron intake in our study exceeded the RNI level by 208.9% for males. This finding is in agreement with the findings of Sanlier & Unusan (2007) which showed a significantly higher proportion of Turkish male university students (52.6%) than females (38.1%) with adequate iron intake. Kiefer *et al.* (2005) explained that there was higher consumption of animal products by males, particularly meat and meat products. The results of our study indicate that the majority of female university students had inadequate intake of iron which may lead to iron deficiency anaemia.

Another finding that should be highlighted in our study is calcium intake. We found that almost all of our participants did not meet the RNI level for calcium intake. This is not surprising as about one- third of the participants reported that they had not taken milk for the past seven days prior to the data collection. This finding is consistent with the national findings of Malaysian Adult Nutrition Survey (MANS) in Malaysia which found that calcium consumption was lowest for the age group of 18-39 years in both sexes (Mirnalini *et al.*, 2008). A longitudinal study, Project EAT (Eating among Teens), in the United States reported a decrease in daily intakes of calcium, total servings of dairy products, and servings of milk during the transition from adolescence to young adulthood (Larson *et al.*, 2009). These studies suggest that calcium intake and milk consumption among university students are low. Sodium intake was particularly high among university students in our study. The mean sodium intake was significantly higher in males than in females

which was consistent with the MANS findings (Mirnalini *et al.*, 2008).

Our study has several limitations. First, the temporal relationship could not be established due to the cross-sectional study design used in our study. Second, all measures were self-reported which were highly dependent on the participants' memory, honesty and truthfulness in answering the questions. Hence, the results may not reveal the actual dietary intake and eating behaviours of the participants. Third, the Malaysia food composition database (Tee *et al.*, 1997) has not been updated for years and this may affect the accuracy of the estimation of nutrient intake. The nutrient composition of raw food materials was used when the cooked food items were not available in the database and this might introduce bias in estimation (Shimbo *et al.*, 2004). Nevertheless, the database was used due to its relevance to the local context in terms of food items. Last but not least, the use of 24-hour dietary recall as a single measurement for dietary assessment may not be adequate. It is suggested that future studies use a combination of 24-hour dietary recall, food diary, and food frequency questionnaire to further ascertain the accuracy of the assessment.

CONCLUSION

The prevalence of underweight was quite high among university students (14.3% males and 22.4% females). Most of the students skipped breakfast and consumed snacks. Moreover, energy and nutrient intakes differed between the sexes. Thus, more attention should be focused on the energy and nutrient intakes of this population based on the recommended intake in order to maintain health. Nutrition education programmes and interventions among university students should highlight the importance of the consumptions of three main meals, iron and calcium rich foods, and reduction in sodium intake. Future research should assess serum micro-nutrients concentration in combination with anthropometric and dietary assessments to have a clearer picture of the nutritional status of university students. A longitudinal study following these students through their university years could be conducted to investigate the changes in their eating behaviours. This would provide insight for the development of effective intervention trials to help improve their eating behaviours.

ACKNOWLEDGEMENTS

We would like to thank all the parties who had been involved in this study including the Malaysia Ministry of Higher Education, the officers of the Department of Student Affairs of the participating universities, the enumerators, and also all the participants for their support and co-operation throughout data collection.

REFERENCES

Alizadeh M & Ghabili K (2008). Health related life style among the Iranian medical students. *Res Biol Sci* 3(1): 4–9.

Ashwell M & Hsieh SD (2005). Six reasons why the waist-to-height ratio is a rapid and effective global indicator for health risks of obesity and how its use could simplify the international public health message on obesity. *Int J Food Sci Nutri* 56(5): 303–307.

Centers for Disease Control and Prevention (CDC) (2008). 2009 State and Local Youth Risk Behavior Survey. Available at: *http://www.cdc.gov/HealthyYouth/yrbs/index.htm*

Chin YS & Mohd Nasir MT (2009). Eating behaviours among female adolescents in Kuantan district, Pahang, Malaysia. *Pakistan J Nutr* 8(4): 425–432.

Cuong TQ, Dibley MJ, Bowe S, Hanh TTM & Loan TTH (2006). Obesity in adults: an emerging problem in urban areas of Ho Chi Minh City, Vietnam. *Eur J Clin Nutri* 61(5): 673–681.

Garnett SP, Baur LA & Cowell CT (2008). Waist-to-height ratio: A simple option for determining excess central adiposity in young people. *Int J Obes* 32(6): 1028–1030.

Goldberg GR, Black AE, Jebb SA, Cole TJ, Murgatroyd PR, Coward WA & Prentice AM (1991). Critical evaluation of data using fundamental principles of energy physiology: 1. Derivation of cut-off limits to identify under-recording. *Eur J Clin Nutr* 45: 569–581.

Herrera H, Rebato E, Arechabaleta G, Lagrange H, Salces I & Susanne C (2003). Body mass index and energy intake in Venezuelan University students. *Nutr Res* 23(3): 389–400.

Huang TTK, Harris KJ, Lee RE, Nazir N, Born W & Kaur H (2003). Assessing overweight, obesity, diet and physical activity in college students. *J Am Coll Health* 52(2): 83–86.

Huda N & Ruzita A (2010). Preliminary survey on nutritional status among university students at Malaysia. *Pakistan J Nutr* 9(2):125–127.

IOM (2004). Dietary Reference Intakes for Water, Potassium, Sodium, Chloride and Sulfate. National Academy Press, Washington, DC

Kee CC, Jamaiyah H, Noor Safiza MN, Geeta A, Khor GL, Suzana S, Jamalludin AR, Rahmah R, Ahmad AZ, Ruzita AT, Wong NF & Ahmad Faudzi Y (2008). Abdominal obesity in Malaysian adults: National Health and Morbidity Survey III (NHMS III, 2006). *Mal J Nutr* 14(2): 125–135.

Kiefer I, Rathmanner T & Kunze M (2005). Eating and dieting differences in men and women. *JMHG* 2(2):194–201.

Kremmyda L-S, Papadaki A, Hondros G, Kapsokefalou M & Scott JA (2008). Differentiating between the effect of rapid dietary acculturation and the effect of living away from home for the first time, on the diets of Greek students studying in Glasgow. *Appetite* 50(2-3): 455–463.

Larson NI, Neumark-Sztainer D, Harnack L, Wall M, Story M & Eisenberg ME (2009). Calcium and dairy intake: Longitudinal trends during the transition to young adulthood and correlates of calcium intake. *J Nutr Educ Behav* 41(4): 254–260.

Mikolajczyk R, El Ansari W & Maxwell A (2009). Food consumption frequency and perceived stress and depressive symptoms among students in three European countries. *Nutr J* 8(1): 31.

Mirnalini K, Zalilah MS, Safiah MY, Tahir A, Siti Haslinda MD, Siti Rohana D, Khairul Zarina MY, Mohd Hasyami S & Normah H (2008). Energy and nutrient intakes: findings from the Malaysian Adult Nutrition Survey (MANS). *Mal J Nutr* 14(1): 1–24.

Mohd Ismail N, Ng KK, Chee SS, Roslee R & Zawiah H (1998). Predictive equations for estimation of basal metabolic rate in Malaysian adults. *Mal J Nutr* 4: 81–90.

Morales DD, Punzalan FER, Paz-Pacheco E, Sy RG & Duante CA (2008). Metabolic syndrome in the Philippine general population: Prevalence and risk for atherosclerotic cardiovascular disease and diabetes mellitus. *Diab Vasc Dis Res* 5(1): 36–43.

Moy FM, Johari S, Ismail Y, Mahad R, Tie FH & Wan Ismail WMA (2009). Breakfast

skipping and its associated factors among undergraduates in a public university in Kuala Lumpur. *Mal J Nutr* 15(2): 165–174.

National Coordinating Committee on Food and Nutrition (NCCFN) (2005). Recommended Nutrient Intakes for Malaysia. Ministry of Health Malaysia, Putrajaya

Nelson MC, Story M, Larson NI, Neumark-Sztainer D & Lytle LA (2008). Emerging adulthood and college-aged youth: An overlooked age for weight-related behavior change. *Obes* 16(10): 2205–2211.

Puwastien B, Burlingame M, Raroengwichit P & Sungpuag P (2000). ASEAN Food Composition Tables. Institute of Nutrition, Mahidol University, Thailand

Sakamaki R, Toyama K, Amamoto R, Liu C-J & Shinfuku N (2005). Nutritional knowledge, food habits and health attitude of Chinese university students-a cross sectional study. *Nutr J* 4(1): 4.

Sanlier N & Unusan N (2007). Dietary habits and body composition of Turkish university students. *Pakistan J Nutr* 6(4): 332–338.

Šatalić Z, Barić IC & Keser I(2007). Diet quality in Croatian university students: Energy, macro-nutrient and micro-nutrient intakes according to gender. *Int J Food Sci Nutr* 58(5): 398–410.

Shimbo S, Zhang Z-W, Matsuda-Inoguchi N, Higashikawa K, Nakatsuka H, Watanabe T & Ikeda M (2004). Effects of life away from home and physical exercise on nutrient intake and blood / serum parameters among girl students in Japan. *Tohoku J Exp Med* 203(4): 275–286.

Tee ES, Ismail MN, Nasir MA & Khatijah I (1997). Nutrient composition of Malaysian foods. 4th Ed. Malaysian Food Composition Database Programme, Institute for Medical Research, Kuala Lumpur

von Bothmer MIK & Fridlund B (2005). Gender differences in health habits and in motivation for a healthy lifestyle among Swedish university students. *Nurs Health Sci* 7(2): 107–118.

WHO (2000). Obesity: Preventing and managing global epidemic. WHO Technical Report Series 894. World Health Organization, Geneva

WHO / IASO / IOTF (2000). The Asia Pacific Perspective: Redefining Obesity and Its Treatment. Health Communications Australia Pty Limited, Australia

Yahia N, Achkar A, Abdallah A & Rizk S (2008). Eating habits and obesity among Lebanese university students. *Nutr J* 7: 32.