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Nutrition-Related Factors and Binge Eating Behaviour in a Sample of Malaysian University Students

(Faktor Berkaitan Pemakanan dan Tingkah Laku Makan Berlebihan dalam Sampel Pelajar Universiti Malaysia)

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ABSTRACT

Binge eating (BE) behaviour is associated with obesity and eating disorders. This cross-sectional study investigates BE behaviour and its relationship with nutrition-related factors among university students. A total of 170 (69% females) university students in Malaysia aged 19 to 24 years participated in this study. BE behaviour was assessed with the use of Binge Eating Scale (BES) questionnaire. Socio-demographic background and nutritional status (anthropometric measurements, body mass index (BMI) and dietary intake) were also measured. BE behaviour reported by 10% percent of the participants. BE behaviour was associated with increased energy intake, elevated BMI and sex (Adjusted $R^2 = 0.116$, $p < 0.001$). Differences in sex-specific factors in predicting the risk of BE behaviour were evident. In male participants, an increased in energy intake, elevated BMI and had a higher waist circumference associated with the risk of BE behaviour (Adjusted $R^2 = 0.411$, $p < 0.001$). In female participants, only a higher waist circumference associated with BE behaviour (Adjusted $R^2 = 0.028$, $p < 0.05$). The finding suggests that understanding sex-specific factors are necessary to prevent BE. These are the potential targets for tailored eating behaviour intervention among university students.

Keywords: Nutrition; binge eating behaviour; Malaysian university students; obesity; sex

ABSTRAK

Tingkah laku makan berlebihan (BE) dikaitkan dengan obesiti dan gangguan pemakanan. Kajian hirisan lintang ini menentukan tingkah laku BE dan hubungannya dengan faktor berkaitan pemakanan dalam kalangan pelajar universiti. Seramai 170 orang (69% perempuan) pelajar universiti di Malaysia berumur 19 hingga 24 tahun telah menyertai kajian ini. Tingkah laku BE diukur menggunakan soalan Binge Eating Scale (BES). Latar belakang sosial-demografi dan status pemakanan (penilaian antropometrik, indeks jisim tubuh (IJT) dan pengambilan makanan) juga telah diukur. Tingkahlaku BE dilaporkan oleh 10% peserta. Tingkah laku BE berkait dengan peningkatan pengambilan tenaga, peningkatan IJT dan jantina (Pemboleh ubah $R^2 = 0.116$, $p < 0.001$). Perbezaan dalam faktor spesifik-jantina dalam menentukan risiko mendapat tingkah laku BE amat ketara. Dalam kalangan peserta lelaki, peningkatan pengambilan tenaga, peningkatan IJT dan mempunyai ukur lilit pinggang yang besar berkait dengan tingkah laku BE. Dalam kalangan peserta wanita, hanya ukur ukur lilit pinggang yang besar berkait dengan tingkah laku BE (Pemboleh ubah $R^2 = 0.028$, $p < 0.05$). Hasil kajian mencadangkan bahawa pemahaman berkaitan faktor spesifik-jantina adalah perlu bagi mencegah BE. Ini adalah potensi kepada sasaran intervensi tingkah laku pemakanan yang disesuaikan untuk pelajar universiti.

Kata kunci: Pemakanan; tingkah laku makanan berlebihan; pelajar universiti Malaysia; obesiti; jantina

INTRODUCTION

Binge eating (BE) is one of the disordered eating behaviours that is observed across the population (Higgins et al. 2013). It is described by discrete episodes of uncontrolled overeating (Mussell et al. 1995; American Psychiatric Association 2013). BE is a common feature reported by individuals with eating disorders. However, its intensity does not meet the clinical diagnosis of binge eating disorders (BED) (American Psychiatric Association 2013). The BED is a psychiatric disorder characterized by recurrent episodes of binge eating and associated with loss of control and significant distress in the absence of compensatory weight-reducing behaviours frequently presented by patients with bulimia nervosa (American Psychiatric Association 2013). Hence, BE behaviour is a symptom but not an exclusive of BED diagnosis.

BE behaviour has frequently been studied among university students (Shin & Yi 2014; Kelly-Weeder et al. 2014). However, previous studies underscored the importance of BE as a contributor to obesity (Meany et al. 2014). Obesity has been increased dramatically over the

past decades and it is a significant public health concern especially among young adults (Poobalan & Aucott 2016).

The prevalence of BE behaviour among university-age students varies considerably. It is reported ranging from 8 to 38% among college students in the United States (Kelly-Weeder et al. 2014; Ivezaj et al. 2010; Napolitano & Himes 2011; Davila et al. 2014; Kelly-Weeder et al. 2012). While relatively common in Western nations, increasing prevalence of BE behaviour has also been observed in Asia (Pike & Dunne 2015). Gan and colleagues assessed the risk of disordered eating using Eating Attitudes Test-26 (EAT-26) among male and female university students in Malaysia (Gan et al. 2011a). In that study, about 18.3% university students in Malaysia were at heightened risk of disordered eating. While it is not specific to BE behaviour, the prevalence of students who were at risk of eating disorders was alarmingly high and warrants further study.

The interest on sex-specific factors in BE behaviour has emerged. BE is commonly reported in female students (Napolitano & Himes 2011; Kelly-Weeder et al. 2012). However, some studies reported that BE behaviour occurred at equal rates in both males and females (Kelly-Weeder et al. 2012; Striegel et al. 2012). A study identified few differences in the correlates of BE behaviour by sex (Kelly-Weeder et al. 2012). Female students who were bingeing were more likely to have a higher BMI, increased usage of the compensatory behaviour and have a different perception of body image as compared to their male counterparts (Kelly-Weeder et al. 2012). Nevertheless, the role of nutrition-related factors to influence BE behaviour according to sex is unclear.

University-age students, typically between 18 and 25 years old are vulnerable to the risk of disordered eating (Gan et al. 2011b). This period is critical during which they have considerable autonomy over food choice and adopt lasting health behaviour pattern (Allman-Farinelli et al. 2016). Unhealthy eating habits may compromise nutritional status. In this context, increasing evidence shows that BE may precede the development of obesity (Mussell et al. 1995). Hence, more precise understanding of BE behaviour from the nutritional perspective is warranted. This study is designed to determine the BE behaviour and identify nutrition-related factors associated with the risk of having BE behaviour among a sample of university students in Malaysia.

EXPERIMENTAL METHODS

STUDY DESIGN AND SUBJECTS

This cross-sectional study was conducted with a convenience sample of undergraduate students at a selected university in Malaysia. The inclusion criteria were age between 18 and 24 years and enrolled in the university during data collection. Participants were excluded if they had medical conditions, pregnant, breastfeeding and having a diagnosis of any psychotic disorder or substance abuse. We invited 245 students to participate in the study. Of these, 30 (12.2%) declined to participate. Data from 45 (18.4%) participants were not analysed as the questionnaires were incomplete. Hence, we analysed data from 170 participants of the study providing an acceptable response rate of more than 80%.

SAMPLE SIZE

The sample size was estimated using a proportion formula for a single cross-sectional survey with a desired 80% confidence level and the adjustment for the 20% non-responses (Dean et al. 2004). The calculation was based on 38.1% prevalence of BE behaviour reported among diverse college students in the United States (Ivezaj et al. 2010). Hence, a total of 170 respondents were recruited to the study.

SOCIO-DEMOGRAPHIC BACKGROUND AND NUTRITIONAL STATUS ASSESSMENTS

Socio-demographic data includes the date of birth, age, sex and ethnicity were collected. Nutritional status assessments included measurements of anthropometry and dietary intake. The same well-trained study enumerators performed all measurements to ensure consistency and minimise measurement errors. Body weight was assessed using a digital weighing machine to the nearest 0.1 kg (SECA Digital Scale THD-360, Tanita Health Equipment Ltd., Japan). The machine was calibrated every morning with standard weight before each used. Participants weighed in with an empty bladder, in light clothing with empty pockets, without shoes, watch and other accessories. Height was assessed with a wall-mounted microtoise tape suspended upright against a smooth wall to the nearest 0.5 cm (SECA microtoise tape 206, Vogel and Halke GmbH & Co., Germany) with participants not wearing shoes. Assessment of body weight and height were for body mass index (BMI) calculation (WHO 2000). Waist circumference was measured using a non-elastic tape (SECA SE203, Vogel and Halke GmbH & Co., Germany) to the nearest 0.1cm. The measuring tape placed at the horizontal plane around the abdomen on the mid-axillary line between the upper hip bone and iliac crest. The cut-off points for waist circumference are 90 cm and 80 cm for men and woman respectively (WHO/IASO/IOTF 2000).

A non-consecutive two-day dietary recall assessed the dietary intake for randomly selected days during one weekday and one weekend day. Participants were asked about foods and beverages consumed during the chosen days in details. Cooking methods and brand names of processed foods were recorded. The portion sizes were estimated using a standard household measurement such as a cup, teaspoon and tablespoon. The food photographs were also used to help the participants described the food and beverages accurately. All foods converted into grams

based on the standard household measurements. Nutrient analyses (Nutritionist Pro™, Axxya Systems) for the two-day dietary recalls were averaged and reported as a daily consumption.

BINGE EATING BEHAVIOUR ASSESSMENT

BE behaviour was assessed with the use of binge eating scale (BES) questionnaire (Gormally et al. 1982). The BES consists of 16-items self-report questionnaire to identify the behaviour manifestation (e.g. eating a large amount of food; n = 8 items), emotional and cognitive characteristics (e.g. guilt, fear or being unable to stop eating; n = 8 items) associated with uncontrolled eating behaviour in individuals. Each of the items contains three to four different statements reflecting a range of severity for each character which is 0 for no binge eating problems to 3 for severe binge eating problems. Respondents would choose the best statement described their perceptions and feeling related to eating behaviour. For example, item number 13 has four statements that read: (1) I eat three meals a day with only an occasional between meal snack (score 0); (2) I eat 3 meals a day, but I also normally snack between meals (score 1); (3) When I am snacking heavily, I get in the habit of skipping regular meals (score 2), (4) There are regular periods when I seem to be continually eating, with no planned meals (score 3).

The possible range of score is 0 to 46 with the higher score indicates, the higher the risk of developing BE behaviour. The clinical cut-off points for the BES representing none-to-minimal (< 17 total scores), moderate (18-26 scores) and severe BE scored more than 27 (Greeno et al. 1995). The BES has a good test-retest reliability ($r = 0.87$, $p < 0.001$) and moderate associations with BE severity as measured by food records ($r = 0.20 – 0.40$, $p < 0.05$) (Timmerman 1999). The Malay version of BES is validated in people age between 18 and 68 years old and showed good internal consistency, reliability and validity (Cronbach's alpha value = 0.89) (Robert et al. 2013).

ETHICAL CONSIDERATION

The Committee on Human Studies of Universiti Putra Malaysia approved the study and participants provided their written consent before enrolment (UPM/FPSK/PADS/T7-MJKetikalPer/F01). Participation in this study was voluntary and no monetary reimbursement provided.

DATA ANALYSIS

Data were analyzed using IBM SPSS version 22 (Chicago, IL, USA) and a statistical level of $p < 0.05$ was considered significant. Frequencies (n; %) were used to describe the sample distribution in reported BMI and BES categories.

TABLE 1. Social-Demographic characteristics and nutritional status of the in male and female participants ($n = 170$)

	Male ($n = 52$)	Female ($n = 118$) Mean (SD)#	Total ($n = 170$)
Characteristics			
Age, (year)	21.0 (1.4)	20.8 (1.4)	20.9 (1.4)
Year in University (year)	2.4 (1.2)	2.7 (1.0)	2.5 (1.1)
Malay (%)	67.3	47.5	53.5
Program (%)			
Health Sciences	63.5	77.1	72.9
Medical	36.5	22.9	27.1
Stay in-campus (%)	94.2	97.5	96.5
Anthropometric assessment and BMI			
Weight (kg)	66.0 (13.1) *	51.7 (8.6)	56.1 (12.1)
Height (m)	169.1 (6.0) *	157.2 (6.2)	160.8 (8.2)
Waist circumference (m)	85.9 (8.9) *	79.0 (8.5)	81.1 (9.1)
BMI (kgm^{-2})	23.0 (4.3) *	20.9 (3.3)	21.6 (3.8)
Dietary intake			
Energy (kcal/day)	1611.4 (448.5)*	1464.4 (405.2)	1509 (423.03)
Protein (g/day)	59.5 (15.8)	56.5 (17.1)	57.5 (16.7)
Percent from energy (%)	15.1 (2.5)	15.7 (3.0)	15.5 (2.8)
Fat (g/day)	56.3 (19.7)*	49.8 (18.3)	51.8 (18.9)
Percent from energy (%)	31.3 (6.4)	30.6 (6.3)	30.8 (6.3)
Carbohydrates (g/day)	212.2 (60.9)	194.4 (59.9)	199.8 (60.6)
Percent from energy (%)	53.6 (7.2)	53.7 (7.7)	53.64 (7.56)
Binge Eating Scores	8.4 (6.2)	9.8 (6.7)	9.3 (6.6)

Data reported in Mean (SD) unless otherwise stated; SD = standard deviation; BMI = Body mass index;
* Independent T- test, significant at 0.05 level

Descriptive statistics including means and standard deviations (SD) used to report BES scores and nutritional status. Pearson product moment correlation or Chi-square used to test the relationship between nutrition-related factors and BE eating scores. Variables significantly related with BES were entered in multiple linear regression models (using a stepwise method) to predict the score in BES. Sex-stratified analyses were performed based on the evidence that BE behaviour differed by sex (Kelly-Weeder et al. 2012; Striegel et al. 2012)

RESULTS

SAMPLE CHARACTERISTICS AND NUTRITIONAL STATUS

A total of 170 participants with the mean age of 20.9 (SD = 1.4) years old participated in the study. Participants were predominantly female (69.4%) with more than half were Malays (53.5%) (Table 1). The overrepresentation of females in this population is consistent with the higher proportion of females in Malaysian higher education.

On average, participants had normal BMI with males had a higher BMI than females participants ($p < 0.05$). The prevalence of overweight and obesity in this population were 14.0% and 3.0% respectively. More females (7.7%) than males (12.7%) were overweight. However, more males (7.7%) than females participants were obese (0.8%). The association between sex and BMI were significant ($p < 0.01$). A waist circumference of male and female participants was within the acceptable range. However, compared with male participants (8.8%), females had a significantly higher prevalence of central obesity (41.2%). Males had higher daily energy and fat intakes compared to female participants ($p < 0.05$) (Table 1).

BINGE EATING BEHAVIOUR

In this study, 10% of the participants (about one in 10 participants) classified with BE behaviour. Among those classified with BE, 8.8% categorised as moderate and 1.2% as severe binge eaters. Total BES scores (Table 1) and each BES item analysis (Table 2) were comparable between male and female participants except for BES item 6 (feeling guilty after overeating). Females were more likely to feel guilty after overeating than male participants ($p < 0.01$). In general, more female than male participants classified with BE behaviour. Within a sex subgroup, 5.7% of the male and 11.9% of the female participants classified with BE behaviour with no significant association between them (Figure 1). The relationship between ethnicity and BE behaviour were not significant.

Within the BMI categories, about 52.5% of the overweight or obese participants classified with BE behaviour (40% were obese and 12.5% were overweight). A small proportion of the participants who were classified with BE behaviour had a normal BMI or underweight. Interestingly, about 1.8 % classified with severe BE had a normal BMI (Figure 2). However, the association between the severity of BE behaviour and BMI was not significant ($p = 0.09$).

BES scores were significantly higher in participants with BE behaviour than who did not ($p < 0.05$). Participants classified as BE behaviour had significantly elevated BMI and higher daily energy and carbohydrates intake than those did not ($p < 0.05$). Other nutrients did not differ significantly between the two groups (Table 3).

TABLE 2. Comparisons in binge eating scale items between male and female participants ($n = 170$)

BES Item	Descriptions	Male ($n = 52$)	Female ($n = 118$)
		Mean (SD)	
BES 1	Self-conscious about weight	0.15 (0.50)	0.22 (0.57)
BES 2	Eat quickly	0.76 (0.94)	0.77 (0.90)
BES 3	Difficulty controlling eating urges	0.44 (0.84)	0.40 (0.77)
BES 4	Eat when bored	0.04 (0.27)	0.15 (0.53)
BES 5	Eat when not hungry	0.87 (0.95)	1.09 (0.93)
BES 6	Guilt after overeating	0.25 (0.43)*	0.64 (0.70)
BES 7	Diet and binge	0.85 (1.26)	0.87 (1.26)
BES 8	Eat till stuffed	0.75 (0.84)	0.86 (0.91)
BES 9	Diet/restrict and binge	0.65 (0.95)	0.49 (0.75)
BES 10	Difficulty controlling eating	0.46 (0.80)	0.61 (0.87)
BES 11	Eat till stuffed, sometimes vomit	0.37 (0.56)	0.39 (0.61)
BES 12	Conceal eating	0.35 (0.62)	0.39 (0.61)
BES 13	Eat continually (no planned meals)	0.65 (1.17)	0.64 (1.12)
BES 14	Preoccupation with eating	0.60 (0.72)	0.80 (0.77)
BES 15	Preoccupied with food	0.65 (0.81)	0.87 (0.78)
BES 16	Uncertain how much food is normal	0.50 (0.75)	0.57 (0.73)

SD = standard deviation; *Independent *T*- test, significant at 0.05 level

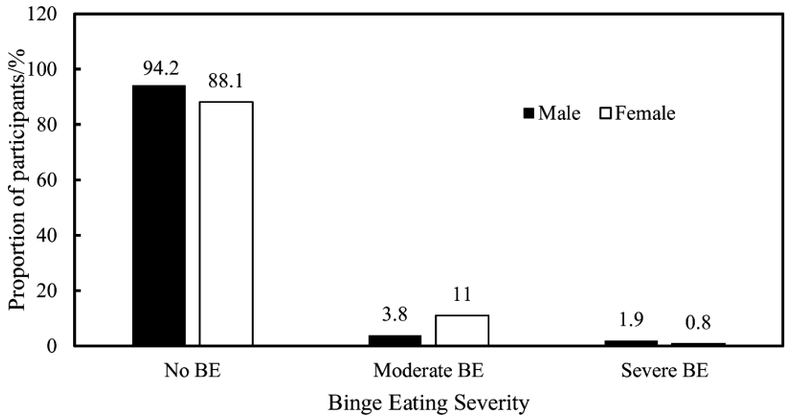

FIGURE 1. Binge eating severity in males and females participants (n = 170) (BE = binge eating; p > 0.05 Chi-Square Tests)

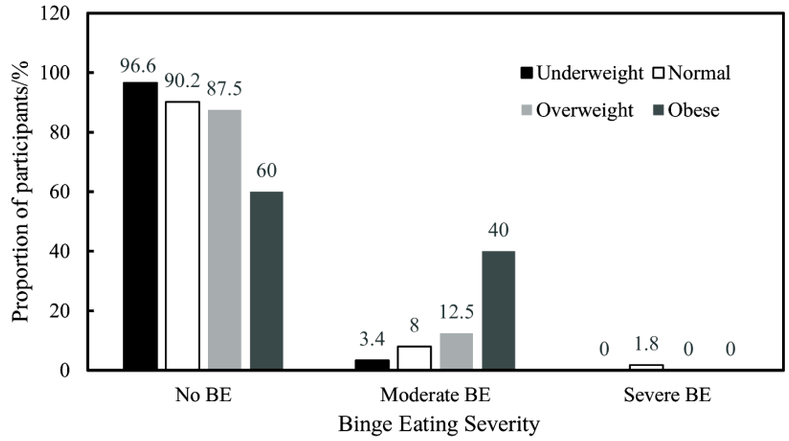

FIGURE 2. Binge eating severity according to Body Mass Index (n = 170) (BE = binge eating; p > 0.05 Chi-Square Test; Collapse into underweight/normal and overweight/obese for analyses

TABLE 3. Binge eating scores and dietary intake comparisons between participants classified with and without binge eating behaviour

	With Binge Eating Behavior (n = 17)	Without Binge Eating Behavior (n = 153)
	Mean (SD)	
Binge Eating Scores	23.4 (6.5)*	7.8 (4.4)
Anthropometric assessment and BMI		
Weight (kg)	60.2 (17.6)	55.6 (11.3)
Height (m)	158.9 (7.9)	161.0 (8.2)
Waist circumference (m)	84.9 (11.7)	80.7 (8.8)
BMI (kgm^{-2})	23.5 (5.0)*	21.4 (3.5)
Dietary intake		
Energy (kcal/day)	1762.0 (536.7)*	1481.3 (400.9)
Protein (g/day)	64.1 (17.5)	56.7 (16.5)
Percent from energy (%)	15.3 (3.3)	15.6 (2.8)
Fat (g/day)	60.5 (22.3)	50.8 (18.3)
Percent from energy (%)	31.6 (6.5)	30.7 (6.4)
Carbohydrates (g/day)	229.1 (76.3)*	196.5 (57.9)
Percent from energy (%)	53.0 (8.4)	53.7 (7.5)

SD = standard deviation; BMI = Body mass index *Independent T- test, significant at 0.05 level

In bivariate association, there was a weak but significant positive correlation of BES scores with BMI (r = 0.204, p < 0.01), waist circumference (r = 0.204, p < 0.01), energy intakes (r = 0.232, p < 0.01), carbohydrate intakes (r = 0.200, p < 0.01) and fat intakes (r = 0.189; p < 0.05). In a stepwise regression model, the variables that significantly predict the BES scores included energy intakes, BMI and sex (Adjusted R^2 = 0.116, F (3, 166) = 8.402, p < 0.001). Increased energy intake, had a higher BMI and female participants were more likely to be classified with BE behaviour. These variables explained 11.6% of the variability of BE behaviour risks (Table 4).

TABLE 4. Contribution of energy intake, body mass index and sex to binge eating scores (n = 170)

Variables	Standardized coefficient	t	R^2 Change
	Beta		
Constant			
Energy Intake/kcalday^{-1}	0.260	3.543**	0.054
Body Mass Index/kgm^{-2}	0.252	3.361**	0.040
Sex (Male = 1; Female = 0)	- 0.206	- 2.712*	0.038

**p < 0.001, *p < 0.01; R^2 = 0.116, F = (3,166), p < 0.01, multiple linear regression model (using a stepwise method)

We further identified nutrition-related factors that predicted the risk of BE behaviour according to sex. In male, energy intake and BMI predicted the BES scores (Adjusted R^2 = 0.411, F = (2, 49) 18.80, p < 0.001). These variables explained 41.1% of the variability of BE behaviour risk in male participants. In female, waist circumference was associated with BES scores (Adjusted R^2 = 0.028, F = (1, 116) 4.318, p < 0.05). This variable explained 2.8% of the variability of BE behaviour risk in female participants.

DISCUSSION

Although BE behaviour appears to be increasing in non-Western countries, it is still lower than in the West (Makino et al. 2004). We observed that 10% of the university students in this study classified with BE behaviour. Other studies in Malaysia identified about 19% of the adults at the workplace (unpublished data) and 10.8% of those seeking weight loss treatment in the clinical setting reported having BE behaviour (Loo et al. 2006). Although not specific to BE behaviour, about one in five university students in Malaysia (18.3%) were also at risk of disordered eating (Gan et al. 2011a). This rate was relatively higher than university-age students in Korea (8%) and Japan (9.1%) (Shin & Yi 2014; Kiriike et al. 1988) but lower among college students in the United States (Kelly-Weeder et al. 2014; Davila et al. 2014; Kelly-Weeder et al. 2012; Napolitano & Himes 2011; Ivezaj et al. 2010). Asia is experiencing a new wave of industrialization that stimulate new environmental and lifestyle changes leading to non-communicable diseases including eating disorders (Pike & Dunne 2015).

Our investigation focused on the risk of BE behaviour and nutritional status in particular obesity. BE behaviour is traditionally regarded as a psychological disorder while obesity is seen as a sole nutritional issue. It is understood that both obesity and BE behaviour may share common aetiology factors (Meany et al. 2014). Hence, assessing BE behaviours as part of the nutritional status assessments is relevant for obesity prevention among university-age students. This is the practice that has been widely excercised among bariatric surgery candidates as part of the nutritional status evaluation (Meany, Conceição and Mitchell 2014).

Females are believed to be more likely to engage in disordered eating compared to male students (Gan et al. 2011a). The increased rates of BE behaviour among female university-age students as compared to males are consistent with other studies (Shin & Yi 2014; Kelly-Weeder et al. 2012; Striegel et al. 2012; Saules et al. 2009). Contrary to this finding, we found that the proportion of participants classified with BE in males (5.7%) and females (11.8%) were not different. This rate is relatively low as compared to 10.0 – 21.7% of males and 10.0 – 33% of females in other studies (Kelly-Weeder et al. 2012; Kiriike et al. 1988; Saules et al. 2009).

In this study, although the rates were comparable, sex is one of the predictors for BES scores with female respondents were more likely to be classified with BE behaviour. The possible explanation could be related to the increased cultural and psychological pressure in females that may lead to depressive symptoms. High levels of depression predicted the onset of overeating among adolescents and young-adult females in the United States (Saules et al. 2009). In the same study, BE was also related to the development of depressive symptoms. We did not assess depressive symptoms but could partly explain by having the experience of guilt following overeating (Sanftner & Crowther 1998). We observed that females were more likely to feel guilty after overeating than males (BES item 6). This cyclical association may account for the predictive influence of depression on BE behaviour, especially among females. Moreover, the experience of guilt after overeating is a criterion that significantly associated with BED diagnosis among obese women (Meany et al. 2014; Greeno et al. 1995). It is well understood that individuals with BED had a much higher rate of depression than those without BED (Sanftner & Crowther 1998). It is essential to understand how each BES item functions in predicting BE behaviour among university-age students.

In this study, participants classified with BE behaviour had elevated BMI than those who did not. Even though body weight status was not associated with the severity of BE behaviour, a significant proportion of participants

classified with moderate BE behaviour were overweight. The relationship between BE behaviour and elevated BMI has been reported consistently among college students (Kelly-Weeder et al. 2014; Napolitano & Himes 2011). Overreliance of less-nutrition and energy density loads with fat and sugar as one of the stress coping mechanisms may lead to body weight gain among university students (Gan et al. 2011a). If BE behaviour persists, those normal weight individuals will eventually become overweight or obese. This is of particularly alarming as almost half of Malaysian are either overweight or obese with increasing in rates among university-age students (Khambalia and Seen 2010; Gan et al. 2011a).

We also observed that participants who classified with severe BE behaviour had a normal BMI. We did not assess compensatory behaviour such as self-induced vomiting and laxative use. However, there is a possibility that participants with normal BMI who engaged in BE had also engaged in compensatory behaviour to avoid weight gain (Kelly-Weeder et al. 2014; Kelly-Weeder et al. 2012). This component should be explored in future to further understand how compensatory behaviour, depression and anxiety co-exist in the normal weight individuals.

Nutrition-related factors that predicted those at risk of BE behaviour include increased in BMI, high energy intake and sex with females were more likely to engage in BE. However, these factors explained 11.6% of the variability of BE behaviour risk. The relatively small contributions of nutrition-related factors justify that other factors including psychosocial-related behaviour, body image and depression may play an important role in predicting the risk of BE behaviour. Psychosocial-related behaviour includes self-esteem; emotional well-being and social pressure were not measured in this study. All of these factors were found related to disordered eating particularly in binge eating (Makino et al. 2004; Puhl, Moss-Racusin & Schwartz 2007).

Sex differences in BE behaviour among university students are evident from this study. In males, energy intake and BMI explained 41.1% of the variability of BE behaviour risk. On the other hand, waist circumference explained only 2.8% variability of BE behaviour risk in females. Khor and colleagues reported differences in eating behaviour as assessed using Stunkard and Messick's Eating Behaviour Scales among university students in Malaysia (Khor, Cobiacand Skrzypiec 2002). Male students tend to show uninhibited eating behaviour which could lead to weight gain while females lean towards restrained eating habits (Khor et al. 2002). While restrained eating behaviour is probably a preventive measure to obesity, a growing body of evidence shows that females are at risk of dieting-overeating and BE cycles especially among those with rigid restraint habits (Smith et al. 1999). This cycle may also induce depressive symptoms that lead to glucocorticoid-mediated visceral obesity marked by having a high waist circumference (Chrousos 2000).

The findings of this study need to be interpreted in light of some limitations. First, the nature of this cross-sectional study limits its ability to show the cause-effect relationship, hence requires future prospective cohort study. Second, this study involved a sample of university students which hinder its generalisation to all university students in Malaysia. Also, BE behaviour was only assessed at a single time point and it is possible that it may fluctuate over time. Besides, the used of 2-day dietary recalls may not be enough to capture the overall dietary intake of the respondents. We observed that the calories intake captured in the study was relatively low potentially due to under-reported of energy intake. The trend of low-calorie intake among the samples of undergraduate from this study is uncommon which warrants future investigation (Gan et al. 2011b).

CONCLUSION

The current study confirms and expands the actual knowledge on sex-specific factors influencing BE behaviour among university-age students. BE behaviour should be screened as part of the nutritional status assessment to identify candidates at high risk for obesity. The findings demonstrate an urgent need to develop appropriate nutrition intervention with healthy eating habits as a highlight for university students. Understanding sex-specific factors that influence binge eating is necessary to prevent BE behaviour. These are the potential targets for tailored eating behaviour intervention among university-age students.

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