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Body Image Perception, Dietary Practices and Physical Activity of Overweight and Normal Weight Malaysian Female Adolescents

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ABSTRACT

Body image plays an important role in the management of body weight, especially among female adolescents. This study examined the differences in body image perception, weight management knowledge, eating behaviour and physical activity between overweight and normal weight Malaysian female adolescents. Body mass index screening was done on 588 secondary school students to identify overweight (OW) and normal weight (NW) subjects. A BMI-for-age of => 85th percentile and between => 5th and < 85th percentile were used as cut-offs for identifying suitable subjects of overweight and normal weight, respectively. Fifty girls identified as being OW were matched for age and ethnicity with 50 NW students. Subjects completed a self-administered questionnaire on demographics, eating behaviour and physical activity, a weight management knowledge inventory (WMKI) and the Body Silhouette Chart. The study sample comprised Malays (40%), Chinese (30%) and Indians (30%) with a mean age of 14.76 ± 1.15 years. The majority of them were from families with a monthly household income of less than RM1,000. Significantly more NW subjects (χ^2=6.112, p=0.013) than OW subjects had incorrect perception of their current body weight status. The WMKI revealed that more OW subjects (64%) than NW subjects (52%) had a low level of weight management knowledge. Eating behaviour patterns were not significantly different between OW and NW subjects, but more OW subjects skipped one or more daily meals as compared to their NW counterparts (χ^2=0.174, p=0.010). Physical activity patterns were similar in both groups. Healthy eating and physical activity promotion programmes in schools should include sound weight management practices.

INTRODUCTION

Once considered a phenomenon observed only in developed countries, obesity is now occurring at epidemic proportions in many Asian countries as well. The World Health Organization has now identified obesity as a global epidemic affecting an estimated 250 million adults worldwide (WHO, 1998). A global increase in the incidence of overweight and obesity among children and adolescents was also highlighted in this report. Obesity acquired during childhood or

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adolescence may persist into adulthood, increasing later risk for chronic conditions such as diabetes, heart disease, hypertension, stroke and some types of cancers.

Malaysia is at the crossroads of nutrition and lifestyle transition. Economic and technological advancements in the past three decades have led to increased purchasing power and an unprecedented affluence with concomitant changes in lifestyles. Malaysians are increasingly consuming diets that are high in fat and calories and generally leading sedentary lives (Tee, 1999). While under-nutrition is still found in remote parts of Malaysia, more children and adolescents are overweight now than ever before (Ismail & Tan, 1998).

In a large study of over 6000 school children aged between 7 and 16 years, overweight and obesity prevalence were found to be 6% and 3.6% respectively (Kasmini *et al*., 1997). This study and other data strongly indicate that the problem of overweight and obesity will pose a major public health challenge for Malaysia in the years to come.

Adolescence is a transitional period that involves physiological, psychological and social changes that may contribute towards the development of overweight or obesity. A number of predisposing factors have been identified, which include among others, genetic disposition, diet, physical activity and environmental factors. Genetic and metabolic factors create the foundation in which cultural, environmental and social factors merge to determine body weight. Since the roots of adult obesity and its subsequent effects on morbidity are laid down in childhood, early identification of the risk factors is pertinent and bears important public health implications.

Body image plays an important role in the management of body weight, especially among female adolescents. A high incidence of body dissatisfaction in adolescent girls has been repeatedly reported in the literature (Cooper & Goodyear, 1997; Pritchard, King & Czajka-Narins, 1997). Research has shown that with increasing age, the prevalence of body shape and weight concerns during adolescence rises from one in 10 among 11 year olds to one in five among 15-16-year olds (Cooper & Goodyear, 1997). However, little research has been reported on body image and weight concerns in Malaysian overweight children and adolescents. The assessment of body image in relation to overweight or obesity is important in order to understand its relationship to the maintenance of excess weight or in initiating motivation for weight reduction. It has been suggested that these concerns and dietary restraint may be more prominent among overweight adolescents. Childhood obesity has been implicated as a risk factor for the development of anorexia nervosa and bulimia nervosa (Fairburn *et al*., 1999)

Eating behaviours and attitudes also influence weight gain in adolescents. Obese adolescents have been reported to consume larger meals with a higher percentage of energy from fat and protein than normal weight adolescents (Ortega *et al*., 1995). Restrained eating and skipping of meals have not often been investigated in overweight girls. It is likely that overweight adolescents may practise dietary restraint and erratic eating behaviour more consistently and this needs to be investigated.

Overweight children and adolescents have been found to have a relatively low level of aerobic power and performance fitness. Studies have shown that individuals with a low level of physical activity have greater body weight and body fat levels as compared to their active counterparts (Schulz & Schoeller, 1994; Ryan, Nicklas & Elahi, 1996). Variations in physical activity and fitness by age and gender have also been observed. Sallis (1993) noted a decline in aerobic power of about 2% per year in female children and adolescents relative to body mass, while overall physical activity declined by about 7.4%

per year throughout the school years. The study concluded that female youths were at greater risk of developing obesity.

This study focuses on female adolescents, as it is this gender that is overly concerned about body image and possesses great dissatisfaction with body weight and shape. As few studies have reported on these issues for female Malaysian students (Khor, Cobiac & Skrzypiec, 2002; Leong, Poh & Ng, 2004), this study explores three potential factors for the development of obesity in this population group i.e. body image disturbances, weight management knowledge, dietary practices and physical activity.

SUBJECTS AND METHODS

Study location

This study was conducted among students of a multi-ethnic, non-residential, all-girls secondary school in Teluk Intan, the capital town of the District of Hilir Perak in the State of Perak. This town has a population of about 150,000 and could be considered as semi-rural. The study protocol was reviewed for design as well as ethical and sensitive issues and approved by the Ministry of Education.

Screening and recruitment of study subjects

Two hundred and ninety-seven female students, all of whom were from Form Two and 291 female students from Form Four classes were invited to participate in this study. Form One and Form Five students were excluded. Form One students were considered as still being in the pubertal stage while Form Five is a major public exam-going year and participation in the study was considered too time consuming. Parents were sent letters notifying them about the study and were also given a copy of the questionnaire to enable them to better understand its objectives as well as to indicate their consent for their child's participation. Signed informed consent was obtained from each of the student's parents prior to participation in this study. 588 students with parental consent were screened for BMI status. Each subject was measured twice for both height and weight using a non-flexible fiberglass measuring tape and a calibrated digital weighing scale (TANITA, Japan) respectively. All duplicate measurements for height and weight were recorded to the nearest 0.1 cm and 0.1 kg respectively and the average of the two values for each measurement was used in the data analyses. Body mass index (BMI), defined as weight (kg) divided by height (m^2) was calculated and used as an index of body weight status. A BMI value of =>85 percentile is considered as overweight and a BMI of =>5 percentile and <85 percentile indicates normal weight (WHO, 1995).

Questionnaires

Subjects completed four separate pre-tested, self-report questionnaires including a demographics questionnaire during the school recess break under the supervision of the research assistant. All questionnaires were administered in Bahasa Malaysia.

Body image perception was assessed using a modified version of the Figure Rating Scale of Stunkard *et al*. (1998). This nine-figure silhouettes scale was modified after a pretest to include only five of the silhouettes. The modified scale consists of five silhouette drawings of the female figure ranging in morphology representing 20% underweight, 10% underweight, average or normal weight, 10% overweight and 20% overweight. Each silhouette was given a score ranging from 1-5 from which a mean score was to be derived using the methodology of Fallon and Rozin (1985). Subjects were required to select the figure that most represented

their current body shape (actual) as well as the figure which they most desired to have (ideal body size). The discrepancy between 'actual' and 'ideal' figure was calculated by subtracting the numeric values that correspond to each weight ideal. This score represented the degree of body image dissatisfaction.

The Weight Management Knowledge Inventory (WMKI) by Thombs, Mahoney & McLaughlin (1998) was used to assess adolescents' knowledge on weight management practices. This inventory consists of 12 knowledge items, each of which had one correct and three incorrect answers. Each correct answer was given a score of 1 while an incorrect answer was scored as 0. Possible range of scores is from 0 to 12. Based on their total scores the subjects' weight management knowledge was categorised into three levels as being low (0-6), moderate (7-9) and high (10-12).

Eating behaviour was examined by 20 items on daily meal patterns, meal-skipping habits, and snacking habits, frequency of visits to fast food outlets and whether food intake pattern changed in times of emotional distress.

A one-day 24-hour dietary recall was carried out by direct interviews to determine the energy and nutrient intake of study subjects. Subjects' food intake was estimated using standard household measures, recorded in grams and converted to nutrient intake. The mean daily intake of energy, fat, protein, carbohydrate and selected micronutrients (vitamin A, C, calcium, and iron) as well as percentage of energy derived from macronutrients were computed using NUTRICAL (Malaysian Neura Media Technologies), a dietary data analysis software based on the Nutrient Composition of Malaysian Foods (Tee *et al.,* 1997). Energy and nutrient intake were compared to the Malaysian RDA (Teoh, 1975). As the study sample included subjects in two different age groups, the RDA used was weighted for age.

The subjects' general physical activity pattern was assessed using three statements. The first and second statements were: "I often participate in sports" and "I get as much exercise or physical activity as I need" respectively. The subjects were required to respond with either a 'yes' or 'no' for these two statements. The third statement was: "I am physically active" for which the response categories were: never, sometimes or always. In addition, subjects were also asked to provide an estimate of the total number of hours per day spent watching television and playing computer or video games, during the weekdays and weekends.

A 3-day physical activity record was used to assess the subjects' mean daily energy expenditure. Subjects were required to keep a record of all their physical activities carried out throughout the day for a duration of three days, which consisted of two weekdays and a weekend. Gross energy expenditure was first determined by listing out the activity factor of specified activities carried out throughout the 24 hours. Total energy expenditure was expressed as a multiple of the Basal Metabolic Rate (BMR). The BMR of the subjects was calculated from their weight and height based on the equation by FAO/WHO/UNU (WHO, 1985):

7.4 weight (kg) + 482 height (m) + 217

Gross energy expenditure was calculated using the following formula:

Gross energy expenditure
= Basal Metabolic Rate x Activity Factor

The gross energy expenditure for the three days was averaged to obtain the mean energy expenditure per day.

Data analysis

All data from this study were analysed using the Statistical Package for Social Sciences for Windows (SPSS for Windows 10.0, SPSS, Chicago, IL). The results are presented as frequencies for categorical data, and as means and

standard deviations for continuous data. Independent sample t tests were done to observe differences between groups for continuous data. The χ^2 test of independence was used to compare group differences in categorical data. Statistical significance was set at $p<0.05$

RESULTS

From the screening exercise, fifty students were found to be overweight or obese giving a rate of 8.5%. Fifty normal weight girls who were of the same age and ethnic group were matched with the overweight students. All subjects were post-menarcheal at the time of the study.

Socio-economic characteristics

The socio-economic characteristics of the study subjects are described in Table 1. The sample included 100 students with a mean age of 14.8 years (range 14-17 years). The study sample was multi-ethnic in composition, comprising Malays (40%), Chinese (30%), and Indians (30%), representing the three main ethnic groups in Malaysia. The total monthly household income of all subjects ranged from RM200 to RM7000. Students of normal weight (NW) come from homes with a mean household income that was higher (RM 1488.8 ± 214.31) than that of overweight (OW) students (RM 1189.7 ± 180.4) but this

Table 1. Selected demographic characteristics of subjects

Characteristics	*Subjects (n = 100)*	
	OW Subjects (n = 50)	NW Subjects (n = 50)
Mean age (years ± SD)	14.7 ± 1.15	14.8 ± 1.15
Race		
Malays	20 (40%)	20 (40%)
Chinese	15 (30%)	15 (30%)
Indians	15 (30%)	15 (30%)
Father's educational level		
Primary school	12 (24%)	10 (20%)
Secondary school	28 (56%)	29 (58%)
College/universities	10 (20%)	11 (22%)
Mother's educational level		
Primary school	23 (46%)	22 (44%)
Secondary school	24 (48%)	18 (36%)
College/universities	3 (6%)	10 (20%)
Total household income		
=< RM 500	18 (36%)	9 (18%)
RM 501 - RM 1000	17 (34%)	20 (40%)
RM 1001 - RM 2500	10 (20%)	13 (26%)
=>RM 2501	5 (10%)	8 (16%)
Mean household income (RM ± SD)	1189.7 ± 180.5	1488.8 ± 214.3

NW : Normal weight
OW : Overweight

difference was not statistically significant (t = -1.002, p=0.321). The educational level of fathers (χ^2=0.247, p=0.884) and mothers (χ^2=4.649, p=0.098) of OW and NW subjects was not significantly different, although more parents of the NW group were better educated than the parents of the OW students.

Weight and body mass index

The weight of OW subjects ranged from 55.0 kg to 97.8 kg with a mean of 68.93 ± 8.49 kg, while for the NW subjects it ranged from 43.0 kg to 60.2 kg with a mean of 50.66 ± 4.49 kg. The NW subjects were shorter and lighter than the OW girls. The mean BMI of OW and NW subjects were 27.24 ± 2.97 and 20.61 ± 1.54 respectively with the groups differing significantly ($p<0.05$).

Body image perception and body dissatisfaction

The subjects' perception of their current body weight was compared to their actual body weight status as determined by BMI. Overall, 38% of the subjects reported incorrect perception of their current weight status. In the normal weight group, 50% considered themselves as being overweight while the OW group presented a different profile. Nearly three-fourths (74%) of the OW students were found to have correctly perceived themselves as being overweight. Differences in the perception of current weight between groups were found to be significant (χ^2=6.112, p=0.013).

For the Figure Rating Scale, 95% of all subjects selected the second silhouette in the chart (representing 10% underweight) while 5% identified figure 3, which represents the average weight, as representing their ideal or desired body shape. In the OW group, 85% of them selected figure number 4 (10% overweight) as resembling their actual body shape. The OW group had a higher mean discrepancy score (actual-ideal) (1.58 $\pm$ 0.20) but this was not significantly different from that of the NW group (0.90 $\pm$ 0.68).

Almost all (98%) of the students in the overweight category expressed an earnest desire to reduce their weight. While this was to be expected in the OW group, interestingly the NW group too had a large majority (74%) who desired to lose weight.

Weight management knowledge

Table 2 describes the distribution of study subjects according to items on the weight management knowledge inventory. Item 1 had the most number of correct answers with over 90% in either group being correct. In contrast, for item 3, an incorrect response was given by over 90% in each of the group. For both groups combined, items 2, 3, 5, 8, 9, 11 and 12 had the most incorrect answers. Generally, there were no differences in responses to the items between OW and NW subjects with the exception of one (item 11). For this item, "knowledge about speed of weight loss when dieting", answers between the two groups were found to be significantly different (p=0.023). More NW subjects (84%) had reported an incorrect answer for this item as compared to OW subjects (64%), which may reflect a better knowledge about rate of weight loss during dieting. When the distribution of scores obtained by subjects were categorised into tertile levels, two-thirds (64%) of the OW subjects and slightly more than half (52%) of NW subjects were found to be in the first tertile representing a low level of knowledge. Neither of the groups achieved a high level for overall knowledge on weight management. Nevertheless, the differences observed in the weight management knowledge level between both groups were not significant (p=0.224).

Table 2. Distribution of subjects' responses to items on weight management knowledge inventory

No	*Knowledge Item*	*Subjects' Responses*			
		Correct (%)		*Incorrect (%)*	
		OW	*NW*	*OW*	*NW*
1.	Which is the healthiest way to lose weight?	46 (92)	49 (98)	4 (8)	1 (2)
2.	If you eat 2400 calories and use 3000 calories per day, what will happen?	21 (42)	27 (54)	29 (58)	23 (46)
3.	Quick, large changes in weight loss are most likely caused by:	2 (4)	4 (8)	48 (96)	46 (92)
4.	The healthiest way to lose weight is to eat:	34 (68)	38 (76)	16 (32)	12 (24)
5.	A reducing diet can be successful only when the weight loss:	18 (36)	21 (42)	32 (64)	29 (58)
6.	The best way to begin a weight-loss diet is to:	48 (96)	48 (96)	2 (4)	2 (4)
7.	A safe and reasonable weight loss is:	39 (78)	45 (90)	11 (22)	5 (10)
8.	Yo-yo, or on-again /off dieting causes:	15 (30)	12 (24)	35 (70)	38 (76)
9.	Which is the main function of energy ?	8 (16)	8 (16)	42 (84)	42 (84)
10.	You gain weight even though you eat the proper number of calories. Hence, you should:	39 (78)	42 (84)	11 (22)	8 (16)
11.	On a process of dieting, a person losses weight rapidly at first and slower later on because:*	18 (36)	8 (16)	32 (64)	42 (84)
12.	Which of the following has the highest calories?	24 (48)	19 (38)	26 (52)	31 (62)

* Significant difference between OW and NW subjects ($\chi 2 = 5.198$; $p = 0.023$)

NW : Normal weight
OW : Overweight

Meal practices

Table 3 describes selected meal practices of the study groups. To the question of whether the students practised a consistent mealtime for their daily meal consumption, 36% of the subjects responded *yes,* 38% responded *sometimes* while 26% said that they *did not.* Interestingly, there was no difference in mealtime practices between the NW and OW groups. To the question on whether they skipped meals, only 79 girls responded. Significantly more OW subjects (40%) were likely to skip their daily meals when compared to their NW counterparts (16%) ($p<0.05$). The meal that was most likely to be skipped by all subjects was breakfast (45.6%), followed by lunch (30.4%) and lastly dinner (24.1%), but this pattern was not significantly different between both groups ($\chi^2=5.451$, $p=0.142$). As for snacking in between meals, more girls in both groups reported they did so. Group comparison of this habit, however, failed to show a significant difference. Eating at fast food outlets was infrequent in both groups. Slightly more (58%) NW subjects than OW subjects (52%) reported that they ate fast foods only about 2 to 3 times a month.

Table 4 presents the distribution of subjects' response on eating more or less than usual whenever they experienced some emotional distress. Across the total sample, majority of the subjects (89%) reported no increment in their food intake when they were emotionally disturbed. Interestingly, both groups were found to have a similar pattern of distribution. On the other hand, slightly more than half (56%) of the total sample said that they ate less when they were unhappy. Significantly more OW subjects (72%) claimed to eat less than usual when they were emotionally upset as compared to their NW (40%) counterparts.

Table 3. Meal practices of OW and NW subjects

Meal practices	*Responses*	*Subjects*		
		OW *n (%)*	*NW* *n (%)*	
Regular Mealtime	Yes	16 (32)	20 (40)	
	Sometimes	21 (42)	17 (34)	
	No	13 (26)	13 (26)	
Skipping Daily Meals	Yes	20 (40)	8 (16)	
	Sometimes	24 (48)	27 (54)	$\chi^2 = 9.176$
	No	6 (12)	15 (30)	($p < 0.05$)
Snacking Between Meals	Yes	29 (58)	32 (64)	
	No	21 (42)	18 (36)	
Supper	Yes	6 (12)	5 (10)	
	Sometimes	21 (42)	26 (52)	
	No	23 (46)	19 (38)	

NW : Normal weight
OW : Overweight

Table 4. Subjects' responses to eating more/less than usual during an emotional distress period.

	Responses	*Subjects*		
		OW *N (%)*	*NW* *n (%)*	*p*
Eating more than usual during emotional distress period	Yes	6 (12)	5 (10)	$\chi^2 = 0.102$
	No	44 (88)	45 (90)	
Eating less than usual during emotional distress period	Yes	36 (72)	20 (40)	$\chi^2 = 10.390$
	No	14 (28)	30 (60)	($p < 0.05$)

NW : Normal weight
OW : Overweight

Table 5. Subjects' responses to statements on physical activity

Statement	*Responses*	*Subjects*		
		OW *N (%)*	*NW* *n (%)*	*p*
1. I am often involved in sports and I am very active in games	Yes	22 (44)	19 (38)	$p = 0.542$
	No	28 (56)	31 (62)	
2. I get as much exercise or physical activity as I need	Yes	40 (80)	33 (66)	$p = 0.115$
	No	10 (20)	17 (34)	
3. I am physically active	Never	2 (4)	-	
	Sometimes	38 (76)	36 (72)	$p = 0.257$
	Always	10 920)	14 (28)	

NW : Normal weight
OW : Overweight

Physical activity pattern

Responses of the two groups to the three statements on physical activity patterns were elicited. For the first statement, more subjects in both groups responded negatively while for the second statement, majority of both groups gave an affirmative response. For the third statement, which has three response categories, slightly more subjects in the NW group said that they were always physically active while more than 70% in both groups responded that they were physically active sometimes. The differences observed in the distribution by response categories in the two groups were not significant for all three statements (Table 5). As for time

Table 6. Average time (hours/day) spent on watching television and computer/video games during weekdays and weekends days by OW and NW subjects

Subjects	Average hours per day spent on			
	Watching Television		Computer/Video Games	
	Weekdays	Weekend days	Weekdays	Weekend days
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
OW	2.87 ± 2.26	4.88 ± 2.68	0.87 ± 1.28	1.42 ± 1.47
NW	2.63 ± 2.44	4.91 ± 1.84	0.56 ± 0.88	0.86 ± 1.17

NW : Normal weight
OW : Overweight

spent on watching television and playing computer or video games, the study groups were not significantly different (Table 6).

Energy and macronutrient intake

Table 7 presents the mean daily energy intake of the two groups and the contribution of energy from macronutrients as determined through the 24-hour dietary recall. The mean energy intake of NW subjects was slightly more (1636 ± 528 kcal/day) than OW subjects (1518 ± 572 kcal/day). However the difference in energy intake between groups was not significant [t =-1.478, p=0.146]. Even so, for both groups, energy intake met only 70 to 75% of the RDA. The contribution of protein, fat and carbohydrates to total energy intake were almost similar in both groups. For the OW group they were 13.9 ± 10.0%, 27.8 ± 14.4%, and 58.3 ± 33.3% respectively while for the NW subjects they were 12.7 ± 3.8%, 29.0 ± 15.7%, and 58.3 ± 26.6% respectively.

Total energy expenditure (TEE) and energy balance

The OW subjects were found to have a significantly higher TEE with a mean of 2096 ± 257 kcal/day than NW subjects (1928 ± 173 kcal/day) (Table 8). A negative energy balance was found in the total sample (76%) with the majority being OW subjects (84%) as compared to the NW subjects (68%). This implies that OW subjects have higher energy expenditure (due to their increased REE) than energy intake. However, the differences between the two groups were not significant (p=0.061).

DISCUSSION

In this study, we have compared body image perception, weight management knowledge, dietary practices and physical activity between overweight and normal weight girls of multi-ethnic composition. To control for the effects of age and ethnicity, we matched overweight and normal weight students by using a matched pair study design. In a study of young Australian women, O'Dea (1998) concluded that young women from different ethnic backgrounds and with varying body size were similarly influenced by the Western ideal of a slim body with consequential negative effects on body image perception. Our study subjects were also not different in their socio-economic back-

Table 7. Energy and nutrient intake (mean ± SD) of OW and NW subjects

		Subjects			
		OW		*NW*	
		Mean	*SD*	*Mean*	*SD*
Energy intake	(kcal/day)	1518	572	1636	528
Protein	(g/day)	52.9	38.1	51.8	15.6
	(% energy)	13.9	10.0	12.7	3.8
Fat	(g/day)	46.9	24.4	52.7	28.5
	(% energy)	27.8	14.4	29.0	15.7
Carbohydrate	(g/day)	221.1	126.4	238.6	108.7
	(% energy)	58.3	33.3	58.3	26.6
Vitamin C	(mg/day)	67.4	68.7	55.6	53.3
Vitamin A	(㎍/day)	715	458	792	534
Iron	(mg/day)	17.7	12.6	18.7	12.7
Calcium	(mg/day)	281	131	371	212

NW : Normal weight
OW : Overweight

Table 8. Differences in total daily energy intake and energy expenditure (mean ± SD) between OW and NW Subjects

Subjects	*Energy intake (kcal/day) Mean ± SD*		*Energy expenditure (kcal/day) Mean ± SD*	
OW	1518 ± 572	$t = 1.478$	2096 ± 257	$t = 1.478$, $p < 0.05$
NW	1636 ± 528		1928 ± 173	

NW : Normal weight
OW : Overweight

ground although there is some indication that overweight girls came from homes with lower household incomes and had parents with a lower educational level.

More OW (74%) than NW adolescents (50%) in this study had an accurate self-perception of their weight status. However, the OW group showed significantly greater body image dissatisfaction as observed by the significant difference in mean discrepancy scores between the study groups. In many societies, overweight and obese individuals experience some degree of social stigmatisation and isolation, as a result of which many develop distorted body image problems. The degree to which the OW group in this study was dissatisfied is suggestive of an underlying rational desire for wanting to be thin. Thus it is not surprising that almost all of the girls in the OW group wanted to lose weight. Similarly, Fatimah *et al.* (1995) in their study of young Malaysian women reported that the majority of obese subjects (94.3%) correctly perceived themselves as obese and earnestly desired to lose weight. A study by Burrows and Cooper (2002) on 12-year-old American females also revealed significantly higher scores for weight and shape concerns among overweight girls than in average weight girls. Body weight concerns, however, are not unique to overweight girls. Herzog *et al.* (1992) had observed that female dissatisfaction with body weight is not only a characteristic of overweight individuals but is also a feature in women of all weight categories. Likewise, O'Dea (1998) also noted that many young women with normal body weight and even those who are underweight display a high degree of body dissatisfaction, which indicates an aberration in body image perception.

The high prevalence of distorted body image in normal weight girls is a distressing finding. Normal weight girls were twice as likely to have incorrect perception of their body weight as compared to their OW counterparts. Heightened concern over body weight is a very common preoccupation with adolescents today. Body image problems surface as teenagers struggle to obtain independence and control over the emotional upheaval that they experience during this period. Dissatis-faction with body weight leads to chronic dieting and eventually to full-blown eating disorders. Similar observations have also been reported by Leong, Poh & Ng (2004) in their study on 523 adolescent girls in Kuala Lumpur.

Many normal, healthy adolescents compare themselves with images of very thin men and women portrayed in the media and view themselves as being fat. In their pursuit to follow the dictums of the media, they resort to disrupted and abnormal patterns of eating, such as skipping meals and *yo-yo* dieting. In this study, both NW and OW adolescents skipped one or more of their daily meals, particularly breakfast, this habit being more frequent in the latter group. The practice of skipping meals has been identified as weight control behaviour (Shisslak *et al.,* 1998). As highlighted earlier, a higher proportion of OW adolescents portrayed dissatisfaction with their current weight. Therefore, the practice of skipping meals might suggest an initiative to reduce weight. Wolfe *et al.* (1994) reported a positive association between breakfast skipping and overweight. A probable reason identified for their observation is that children who missed breakfast would be likely to eat more at later meals. For the NW group, the fear of becoming overweight may be the driving force for frequent skipping of meals. Wong *et al.* (1999) in their study on college females in Taiwan noted a high frequency of skipping breakfast and lunch even among average weight women. It thus appears that skipping of meals, as a dieting method, is prevalent irrespective of body weight category.

Previous studies have reported that dieting is independently associated with

weight gain (Korkeila *et al.,* 1999; Coakley *et al*., 1998). In addition, repeated dieting failures may have psychological consequences, compounding the risk for depression that has been shown to increase with body image dissatisfaction in the adolescent group (Koenig and Wasserman, 1995; Oates-Johnson & DeCourville, 1999). Khor, Cobiac & Skrzypiec (2002) previously reported that Malaysian female undergraduates with low self-esteem tended to practice some form of dieting. Chronic dieting, and the habitually low total food intake associated with it may also result in low levels of a variety of essential nutrients.

Overeating is defined as a behavioural problem that occurs during periods of depression and boredom or is related to stressful life events. This study revealed no difference in whether OW girls ate more than usual in comparison to NW girls during an emotional distress period. This observation is different from that of Jebb (1997) who had reported that overweight or obese persons were more likely to overeat when they were emotionally upset. However, the high prevalence of restrictive eating during emotional distress in this study is in line with that of Neumark-Sztainer *et al.* (1997), who found that overweight female adolescents with poorer emotional well-being ate less in comparison with normal weight subjects.

Findings from the weight management knowledge inventory revealed a higher proportion of NW adolescents with correct knowledge than their OW counterparts. This may suggest a probable reason of better weight control among NW adolescents compared with their OW counterparts. Overall, a high rate of incorrect responses given by most adolescents for weight management knowledge on healthy weight loss, concept of calorie functions, energy balance and relative calorie content of foods reflects a general lack of nutrition knowledge among school-going adolescents. It is important that adolescents improve their understanding about healthy weight management prior to any involvement in weight loss behaviour. Weight management knowledge and weight loss behaviour among adolescents were reported to have a strong positive relationship (Tombs *et al.,* 1998).

Unlike other studies (Neumark-Sztainer *et al.,* 1997; Gordon-Larsen, 2001), which reported that regular exercise was lower among OW adolescents, we did not find any significant difference in physical activity patterns between the two groups. A study by Klesges, Shelton and Klesges (1993) had demonstrated that television viewing had a lowering effect on resting energy expenditure, thereby suggesting an underlying physiological explanation for a direct relationship between duration of television watching and playing computer or video games with the prevalence of obesity. In our study we did not observe such a relationship. However, this finding is in agreement with that of Wolfe *et al.* (1993) and Robinson *et al*. (1993), who noted a weak relationship between the duration of TV watching and obesity.

Overall energy and nutrient intakes of OW and NW adolescents were also not significantly different. These results correspond well with that of previous studies, which found that OW subjects consume no more energy compared with their NW counterparts when body weight was taken into consideration (Gazzaniga & Burns, 1993; Miller *et al.,* 1990). Gordon-Larsen (2001) also found no difference in macronutrient and micronutrient intake between obese and non-obese female adolescents. The OW adolescents in this study were found to have higher energy expenditure than the NW adolescents, which might be due to their increased resting energy expenditure resulting from increased body size. Comparative studies carried out by Gazzaniga & Burns (1993) among children and Geissler, Miller & Shah (1987) among adults also reported

similar results. A large majority of the OW subjects (84%) too were found to have negative energy balance compared to the NW subjects (68%).

Our study is not without its limitations. Ideally, a bigger sample involving urban and rural adolescents and a longitudinal study design would have enabled us to observe a causal effect of the factors studied here. In addition, the use of validated measures of eating behaviour, psychological measures of self-esteem as well as for physical activity may have enabled us to further elucidate our findings, particularly with reference to the development of eating disorders. Our results are thus preliminary in nature and warrant further investigation.

The present investigation revealed marked differences in adolescent girls for body image perception and body dissatisfaction by body weight status. While a greater rate of body image misperception was observed among normal weight girls, overweight subjects were more dissatisfied with their body shape. More overweight students skipped meals and practised irregular meal times in order to lose weight, although these practices were found in normal weight students too. Overweight and NW adolescents were almost similar in their weight management knowledge level. On the other hand, no difference was found in energy and nutrient intake, and physical activity pattern between OW and NW adolescents. Our findings lend support to the hypothesis that overweight girls are at an increased risk for developing eating disorders. The factors that were examined in this study are also those that have been shown to contribute to the development of eating disorders in adolescent girls in other populations.

In conclusion, prevention strategies for overweight and obesity among adolescents should be directed towards achieving and maintaining a healthy weight and a positive body image. Adolescents need firstly to be given the correct information on nutrition and weight management. Secondly, they should be taught on how to incorporate and increase their physical activity levels into their daily routine and to adopt healthy eating habits, not only to prevent the development of obesity but also eating disorders. In this respect, schools provide an effective setting to implement such strategies. Schoolteachers and counsellors can be re-trained to identify excessive body weight concerns and disordered eating and to promote a better understanding of weight management practices among school-going teenagers.

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Table 2. Distribution of subjects' responses to items on weight management knowledge inventory

No Knowledge Item Subjects' Responses Correct (%) Incorrect (%) OW NW OW NW
1. Which is the healthiest way to lose weight? 46 (92) 49 (98) 4 (8) 1 (2) 2. If you eat 2400 calories and use 3000 calories per day, what will happen? 21 (42) 27 (54) 29 (58) 23 (46) 3. Quick, large changes in weight loss are most likely caused by: 2 (4) 4 (8) 48 (96) 46 (92) 4. The healthiest way to lose weight is to eat: 34 (68) 38 (76) 16 (32) 12 (24) 5. A reducing diet can be successful only when the weight loss: 18 (36) 21 (42) 32 (64) 29 (58) 6. The best way to begin a weight-loss diet is to: 48 (96) 48 (96) 2 (4) 2 (4) 7. A safe and reasonable weight loss is: 39 (78) 45 (90) 11 (22) 5 (10) 8. Yo-yo, or on-again /off dieting causes: 15 (30) 12 (24) 35 (70) 38 (76) 9. Which is the main function of energy ? 8 (16) 8 (16) 42 (84) 42 (84) 10. You gain weight even though you eat the proper number of calories. Hence, you should: 39 (78) 42 (84) 11 (22) 8 (16) 11. On a process of *dieting*, a person losses weight rapidly at first and slower later on because:* 18 (36) 8 (16) 32 (64) 42 (84) 12. Which of the following has the highest calories? 24 (48) 19 (38) 26 (52) 31 (62)
* Significant difference between OW and NW subjects ($\chi^2 = 5.198$; $p = 0.023$)

NW : Normal weight
OW : Overweight

Table 3. Meal practices of OW and NW subjects

Meal practices	*Responses*	*Subjects OW* *n (%)*	*NW* *n (%)*	*p*
Regular Mealtime	Yes	16 (32)	20 (40)	
	Sometimes	21 (42)	24 (48)	
	No	13 (26)	6 (12)	
Skipping Daily Meals	Yes	20 (40)	8 (16)	
	Sometimes	17 (34)	27 (54)	
	No	13 (26)	15 (30)	
			$\chi^2 = 9.176$	
			(p<0.05)	
Snacking Between Meals	Yes	21 (42)	32 (64)	
	No	29 (58)	18 (36)	
Supper	Yes	23 (46)	26 (52)	
	Sometimes	5 (10)	19 (38)	
	No	6 (12)	21 (42)	

NW : Normal weight
OW : Overweight

Table 4. Subjects' responses to eating more/less than usual during an emotional distress period

Responses	*Subjects OW* *N (%)*	*NW* *n (%)*	*p*
Eating more than usual during emotional distress period			
Yes	45 (90)	44 (88)	
No	5 (10)	6 (12)	
			$\chi^2 = 0.102$
Eating less than usual during emotional distress period			
Yes	30 (60)	20 (40)	
No	20 (40)	36 (72)	
			$\chi^2 = 10.390$
			(p <0.05)

NW : Normal weight
OW : Overweight

Table 5. Subjects' responses to statements on physical activity

Statement	*Response*	*Subjects OW* *n (%)*	*NW* *n (%)*	*p*
I am often involved in sports and I am very active in games	Yes	31 (62)	22 (44)	
	No	19 (38)	28 (56)	
				p=0.542
I get as much exercise or physical activity as I need				

Yes
No 40 (80)
10 (20) 33 (66)
17 (34) p=0.115 I am physically active
Never
Sometimes
Always 2 (4)
38 (76)
10 (20) -
36 (72)
14 (28)

p=0.257
NW : Normal weight
OW : Overweight

Table 6. Average time (hours/day) spent on watching television and computer/video games during weekdays and weekends days by OW and NW subjects

Subjects Average hours per day spent on Watching Television Computer/Video Games Weekdays Weekend days Weekdays Weekend days Mean ± SD Mean ± SD Mean ± SD Mean ± SD
OW
2.87 ± 2.26

4.88 ± 2.68
0.87 ± 1.28
1.42 ± 1.47 NW
2.63 ± 2.44 4.91 ± 1.84 0.56 ± 0.88 0.86 ± 1.17
NW : Normal weight
OW : Overweight

Table 7. Energy and nutrient intake (mean ± SD) of OW and NW subjects

Subjects	*OW*	*NW*	*Mean*	*SD*	*Mean*	*SD*
Energy intake (kcal/day)						
			1518			
			572			
			1636			
528	Protein		(g/day)			
			(% energy)		52.9	
			13.9		38.1	
			10.0		51.8	
			12.7		15.6	
3.8						
Fat			(g/day)			
			46.9			
			24.4			
			52.7			
28.5		(% energy)	27.8	14.4	29.0	
15.7						
Carbohydrate			(g/day)			
			221.1			
			126.4			
			238.6			
108.7		(%energy)				
58.3	33.3	58.3	26.6	Vitamin C		(mg/day)
67.4	68.7	55.6	53.3	Vitamin A		(mg/day)
715	458	792	534	Iron		(mg/day)
17.7	12.6	18.7	12.7	Calcium		(mg/day)
281	131	371	212			

NW : Normal weight
OW : Overweight

Table 8. Differences in total daily energy intake and energy expenditure (mean ± SD) between OW and NW Subjects

Subjects	*Energy Intake (kcal/day)*		*Energy expenditure (kcal/day)*	
	Mean	± *SD*	*Mean*	± *SD*
OW				
	1518	± 572		
			2096	± 257
NW			*t*=1.478	
			1636	± 528 *t*=1.478, *p<0.05*
			1928	± 173

NW : Normal weight
OW : Overweight