

# The Relationship between Media Use and Body Mass Index among Secondary Students in Kuching South City, Sarawak, Malaysia

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Submitted: 8 Jul 2010

Accepted: 13 Dec 2010

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## Abstract

**Background:** Overweight and obesity rates among adolescents have increased substantially over the years. This study aimed to determine the body mass index (BMI) of students and parents and the relationship among media use, BMI, socio-demographic profiles, and snacking behaviour during television watching of secondary school students in Kuching South City.

**Methods:** In accordance with the two-stage sampling method, a total of 316 adolescents aged 13–17 years from 7 secondary schools participated. Data were collected using questionnaire and anthropometric measurement. Independent *t* test, one-way ANOVA, Mann–Whitney U test, and chi-square test were performed.

**Results:** The mean BMI was 20.56 kg/m<sup>2</sup> (SD 4.33) for boys and 20.15 kg/m<sup>2</sup> (SD 3.91) for girls. No significant difference in terms of *z* score for BMI-for-age or socio-demographic factors was found. The mean duration of time devoted to media use was 4.69 hours (SD 2.93) on weekdays and 5.69 hours (SD 2.87) on weekends. Boys were found to spend more hours on media use than did the girls ( $t = 4.293, P < 0.01$ ). Respondents were reported to consume more cereal compared with soft drinks and junk foods. Respondents whose fathers worked in the private sector devoted the fewest hours to media use, whereas those with self-employed fathers devoted the most time to media use. Respondents with mothers who were employed spent more time on media use than did respondents whose mothers were housewives ( $F = 4.067, P < 0.01$ ). No significant difference was found between BMI and media time or snacking habits.

**Conclusion:** This finding indicated that media time has no effect on body weight, because respondents were found to have normal weight and to consume less unhealthy food.

**Keywords:** adolescent, behaviour, body mass index, public health, urban population

## Introduction

Obesity affects adults, adolescents, and children (1,2). The World Health Organization (WHO) has indicated that at least 1.6 billion adults (age 15 years and above) are overweight (2). Globally, 400 million adults were obese and 20 million children under the age of 5 years were overweight in 2008. Around the world, children are increasingly vulnerable to overweight and

obesity (3). The International Obesity Task Force estimated that, in 2002, a total of 155 million school-age children (5–17 years) worldwide were overweight or obese. Approximately 30–45 million within that figure were classified as obese, which accounts for 2% to 3% of the world's children in this age group (3).

Adolescents who are overweight may begin to experience health consequences when they are young and run the risk of various weight-related health problems later in life (4). Li et al. (5) have reported that respiratory function deficit has become a problem in obese adolescents, with a reduction of forced vital capacity and forced expiratory volume in 1 second. Furthermore, overweight adolescents have a significant risk of hypertension and lower limb joint disorders (6). Type 2 diabetes, previously considered as an adult disease, has increased dramatically in adolescents (7). Other health risks in obese individuals include heart disease, several types of cancers, sleep apnoea, and arthritis (7). However, the most immediate consequence of overweight, as perceived by children themselves, is social discrimination (7). Overweight children are at an increased risk of teasing and bullying, low self-esteem, and poor body image. Thus, childhood overweight has psychological and emotional consequences (8).

In Malaysia, the third National Health and Morbidity Survey, conducted in 2006, revealed that the national prevalence of underweight children was 13.2%, that the prevalence of normal-weight children was 81.4%, and that the prevalence of overweight children was 5.4%. In Sarawak, 13.5%, 80.3%, and 6.1% of the children were underweight, of normal weight, and overweight, respectively (9).

Many cross-sectional studies have identified a positive relationship between media use and children's weight status. Bradlee et al. (10) found that BMI was highest for children who watched the most television during childhood and was lowest for those who watched the least television (mean BMI of 20.9 versus 18.6 kg/m<sup>2</sup> for those watching television for 3.0 versus 1.75 hours/day, respectively). In particular, ownership and use of television are linked with the shift towards much greater inactivity (11) and snacking during television watching (12–14). As there was limited information on the relationship between media use and BMI among adolescents locally, this study was conducted to determine the BMI of students and parents; the association between media time, BMI and socio-demographic profiles; and snacking behaviour during television watching.

## Subjects and Methods

Kuching is the most populated district in Sarawak, with an estimated population of 579 900 people, consisting of Chinese (220 400), Malays (207 000), Ibans (58 100), Indians

and other ethnic groups (94 400). There are 38 secondary schools in Kuching district. In Kuching South City alone, there are 14 secondary schools with a total of 19 601 students. This research was conducted among students aged 13–17 years in the secondary schools in Kuching South City.

This was a cross-sectional study using a two-stage sampling technique. One school was randomly selected from each of the 7 residential zones in Kuching South City; 1 of the schools was chosen for pilot study, and the remaining 6 schools were included in the main study. Within every school, 1 class was randomly selected from each of the forms (Form 1, 2, and 4); however, Form 3 and 5 students were excluded because they were involved in preparation for public examinations. The selected classes had 30–50 students per class. The minimum sample size was determined using the formula for single proportion (Epi Info version 3.3.2, Centers for Disease Control and Prevention, US). Based on the national overweight prevalence of 6.1% and sampling frame of 19 601, the minimum sample size to achieve results with a confidence rate of 95% or more was estimated to be approximately 346, with a non-response allowance of 10% and the precision of the prevalence of overweight selected as 2.5%. Ethical approval was obtained from the Ministry of Health and permission to conduct the study was granted by the Ministry of Education, Malaysia. Informed consent was obtained from respondents' parents prior to data collection.

A dual-language (Malay and English), 3-section questionnaire was designed for this study. Section 1 included respondents' socio-demographic information such as age, race, gender, number of siblings, and parents' particulars. Section 2 consisted of 11 questions to determine the time devoted by respondents to media use, which included television viewing, computer playing, video games, and other electronic screen equipment. The questions in Section 2 were adapted from Saelens et al. (15) and Eisenmann et al. (16). As most studies found a relationship between snacking and television watching (12–14), Section 3, which contains 4 questions, was designed to investigate respondents' snacking habits while watching television. A series of discussions by experts in the same field verified the validity of the content. Items of the questionnaire were translated to the Malay language using the back-translation method. The questionnaire was piloted in one of the selected schools. Cronbach's alpha of the questionnaire in Section 2 was found to be 0.72.

All respondents were gathered in a designated room in the school during the co-curriculum session. The first, second, or third investigator read the questionnaire to ensure the respondents responded to each item in the questionnaire. Height and weight were measured with the respondents in school uniforms and socks. Height was measured using a Seca body meter suspended upright against a straight wall. The respondents stood underneath the body meter, and the measuring beam was pulled down to rest on their heads. Height was recorded to the nearest tenth of a centimetre. Body weight was measured using a Seca digital weighing scale with an accuracy of 0.1 kg. For classification of overweight, z score for BMI-for-age were generated using AnthroPlus version 1.0.2 (WHO, Geneva, CH). A score of more than 2 standard deviations was classified as overweight.

Data were analysed using SPSS version 15 (SPSS Inc., Chicago, IL). Data were cleaned for outliers and checked for normality using box-plots and Kolmogorov–Smirnov and Shapiro–Wilkes statistics. Significant association between variables was determined using inferential statistics based on a *P* value of less than 0.5 (two-sided). Independent *t* test and one-way ANOVA were performed to compare the difference in means. If data were not normally distributed, Mann–Whitney U test was performed. Chi-square test was performed to determine the association between two categorical variables.

## Results

A total of 316 out of 346 students participated in the study, yielding a response rate of 91.3%. There were similar numbers of boys (48.4%) and girls (51.6%), with a majority of respondents being Chinese (45.3%). Majority of the parents have educational level up to secondary schools. The majority of the respondents had fathers who worked in the private sector (50.9%), whereas their mothers were mostly housewives (52.8%). The mean self-reported total household income was RM3652.90 (SD 3740.60). Detailed background information is presented in Table 1.

The mean BMI for boys (20.56 kg/m<sup>2</sup>, SD 4.33) was almost equal to the mean BMI for girls (20.15 kg/m<sup>2</sup>, SD 3.91). However, the mean BMI of mothers (23.71 kg/m<sup>2</sup>, SD 4.35) and fathers (24.83 kg/m<sup>2</sup>, SD 3.82) differed slightly. Based on BMI-for-age z score, 8% of the respondents were found to be overweight (Table 1), with more overweight boys (64%) compared with girls (36%).

The association between BMI of respondents and socio-demographic factors is presented in Table 2. The findings revealed no significant difference in terms of BMI and socio-demographic factors. Fathers with diplomas and higher levels of education were found to have children with the highest mean BMI (21.62 kg/m<sup>2</sup>, SD 3.96). In contrast, respondents' mothers with primary school educations were found to have children with the highest mean BMI (21.39 kg/m<sup>2</sup>, SD 4.91).

Most of the respondents (39.6%) had 1 television set in the house, followed by 2 sets (37.0%), more than 3 sets (22.8%), and no television set in the house (0.6%). The mean number of television sets was 1.82 sets. Approximately 80.7% (*n* = 255) of the respondents reported having no television set in the bedroom. The Radio Televisyen Malaysia station was reported to be the major station (72.5%) available to the respondents, followed by the Astro station (46.5%), and the satellite stations (19.6%). The mean number of hours spent on media use was 4.69 hours on weekdays and 5.69 hours on weekends, with a total of 10.39 hours spent in this capacity in a given week.

As presented in Table 3, boys spent more hours on media use (11.66 hours, SD 5.64) than did girls (9.19 hours, SD 4.94) in a week. This difference was shown to be significant (*P* < 0.001). Respondents whose fathers worked in the private sector devoted the least amount of time to media use (9.88 hours, SD 5.49), whereas those who had self-employed fathers tended to spend the most hours in this manner (12.17 hours, SD 5.43). However, the difference was not significant. In terms of the mother's occupation, there was a significant difference in the hours of media use for respondents with mothers who were government-employed (11.64 hours, SD 5.47), those who worked for private companies (11.73 hours, SD 5.39), and those who were housewives (9.33 hours, SD 5.13). The parents' educational level did not show a significant difference in terms of the hours spent on media use by the child.

The respondents consumed mostly cereals (26.9%), compared with soft drinks (4.7%), fast food (7%), and junk food (11.7%), every day while viewing television. About 60% of the respondents did not consume food advertised on the television. A chi-square analysis was performed to determine the association between BMI-for-age and snacking habits (Table 4). The result revealed no significant association between different types of snacking habits and BMI-for-age. There was also no significant relationship between BMI and presence of television in the bedroom.

**Table 1:** Background information of the respondents

Item	n	%
<b>Gender</b>		
Male	153	48.4
Famale	163	51.6
<b>BMI-for-age</b>		
Normal	291	92
High	25	8
<b>Race</b>		
Malay	115	36.4
Chinese	143	45.2
Others (including Iban and Bidayuh)	58	18.4
<b>Father's educational level</b>		
None	14	4.4
Primary	32	10.1
Secondary	187	59.2
Diploma & higher	83	26.3
<b>Mother's educational level</b>		
None	25	7.9
Primary	25	7.9
Secondary	202	63.9
Diploma & higher	64	20.3
<b>Father's occupation</b>		
Self-employed	21	6.6
Government sector	80	25.3
Private sector	161	51.0
Others	54	17.1
<b>Mother's occupation</b>		
Housewife	167	52.8
Self-employed	14	4.4
Government sector	54	17.1
Private sector	59	18.7
Others	22	7.0
Item	Mean (SD)	Range
<b>Monthly Income (RM)</b>		
Total household	3653 (3740.6)	0-21 091
Father	2561 (2707.9)	0-20 000
Mother	1091 (1666.0)	0-10 000

Abbreviation: BMI = body mass index.

**Table 2:** Association between BMI of respondents and socio-demographic factors

Variable	BMI (kg/m <sup>2</sup> )	P value
Gender <sup>a</sup>		0.140
Male	20.56 (4.33)	
Female	20.15 (3.91)	
Parents <sup>a</sup>		0.295
Father	24.83 (3.82)	
Mother	23.71 (4.35)	
Father's occupation <sup>b</sup>		0.953
Self-employed	20.83 (2.51)	
Government sector	20.27 (4.34)	
Private sector	20.35 (3.97)	
Other	20.27 (4.76)	
Mother's occupation <sup>b</sup>		0.893
Housewife	20.36 (4.16)	
Self-employed	20.30 (3.67)	
Government sector	19.89 (3.32)	
Private sector	20.55 (4.11)	
Other	20.83 (5.82)	
Father's educational level <sup>b</sup>		0.591
None	20.71 (5.57)	
Primary	20.39 (3.57)	
Secondary	20.11 (3.97)	
Diploma and above	21.62 (3.96)	
Mother's educational level <sup>b</sup>		0.557
None	20.61 (4.28)	
Primary	21.39 (4.91)	
Secondary	20.10 (3.86)	
Diploma and above	20.36 (3.94)	

Data were analysed using <sup>a</sup> independent *t* test and <sup>b</sup> one-way ANOVA and are expressed in mean (SD).  
Abbreviation: BMI = body mass index.

## Discussion

Globally, the number of overweight adolescents is increasing at an alarming rate. The prevalence of overweight adolescents is as high as 21% to 30% in the United States (17). In Malaysia, the prevalence of overweight adolescents ranged from 16.7% to 35% (18,19). This study found that only 8% of the respondents were overweight, which is much lower than figures reported in other studies. This could be due to the voluntary participation of respondents in each randomly selected school and class. Parents with overweight children might not have consented to have their children participate in this study.

Similar mean BMI for both genders was found in this study, which was in agreement with a study done by Norimah et al. (20) in 4 regions of Peninsular Malaysia, Sabah, and Sarawak ( $n = 9374$ ), as well as another study conducted in Malaysia (18). This could be because adolescents in this study had similar dietary patterns in terms of quantity and quality of food intake, physical activities, and environmental factors. As adolescents have a more effective metabolism, their body weight is easily maintained if this metabolism is balanced by proper food intake and physical exercise (21).

**Table 3:** Association between media time, BMI and Socio-demographic profiles

Variable	Media time (hours)		P value
Gender <sup>a</sup>			<0.001 <sup>d</sup>
Male	11.66	(5.64)	
Female	9.19	(4.94)	
BMI-for-age <sup>b</sup>			0.729
Normal	10.364	(5.44)	
High	10.66	(5.34)	
Father's occupation <sup>c</sup>			0.245
Self-employed	12.17	(5.43)	
Government sector	10.76	(5.46)	
Private sector	9.88	(5.49)	
Other	10.65	(5.13)	
Mother's occupation <sup>c</sup>			<0.001 <sup>d</sup>
Housewife	9.33	(5.13)	
Self-employed	12.82	(5.85)	
Government sector	11.64	(5.47)	0.047 <sup>e</sup>
Private sector	11.73	(5.39)	0.026 <sup>e</sup>
Other	10.2	(5.94)	
Father's educational level <sup>c</sup>			0.591
None	10.14	(4.91)	
Primary	9.79	(5.59)	
Secondary	10.74	(5.76)	
Diploma and above	9.87	(4.65)	
Mother's educational level <sup>c</sup>			0.209
None	10.4	(4.25)	
Primary	8.3	(5.05)	
Secondary	10.45	(5.65)	
Diploma and above	11	(5.16)	

Data were analysed using <sup>a</sup> independent *t* test, <sup>b</sup> Mann–Whitney U test, and <sup>c</sup> one-way ANOVA, and are expressed in mean (SD). Differences with <sup>d</sup>  $P < 0.001$  and <sup>e</sup>  $P < 0.05$  are considered significant.

There was no significant association between BMI of respondents and their parents' occupational and educational level. Doustmohammadian et al. (21) also reported similar findings. However, fathers with a high school diploma or higher education tended to have children with higher mean BMI compared with those with lower educational levels. Rahman et al. (22) suggested that, because fathers are the main earners in most families, their level of education might play a role in providing more nutritious food for their children. Wang (23) suggested that those families with higher economic status would have better access to meat and energy-dense food, which were

more expensive, and they also tended to be more sedentary in their lifestyle. Thus, these factors might have contributed to higher BMI among the respondents in the present study.

However, mothers with only primary school-level educations were shown to have children with the highest mean BMI. Giugliano and Carneiro (24) also found similar results. Mothers are usually responsible for shopping and cooking; therefore, their educational level may affect the food items purchased and the method of cooking (21). Mothers with only primary-school educations are most probably housewives. As housewives, they may have more time to devote

**Table 4:** Association between BMI-for-age and snacking habits and presence of television in the bedroom

	BMI-for-age		P value
	Normal	High	
Cereal			0.146
Everyday	77 (26.5)	8 (32.0)	
Occasionally	99 (34.0)	12 (48.0)	
Seldom	115 (39.5)	5 (20.0)	
Soft drink			0.06
Everyday	12 (4.1)	3 (12.0)	
Occasionally	164 (56.4)	9 (36.0)	
Seldom	115 (39.5)	13 (52.0)	
Fast food			0.212
Everyday	22 (7.5)	0 (0.0)	
Occasionally	157 (54.0)	9 (41.0)	
Seldom	112 (38.5)	13 (59.0)	
Junk food			0.294
Everyday	36 (12.4)	1 (4.0)	
Occasionally	162 (55.6)	13 (52.0)	
Seldom	93 (32.0)	11 (44.0)	
Presence of television in bedroom			0.289
Yes	54 (88.5)	7 (11.5)	
No	257 (92.9)	18 (7.1)	

Data were analysed using chi-square test and are expressed in number of respondents (percentage).

to preparing meals for their children. In addition, they may lack knowledge regarding the factors that predispose individuals to high BMI as well as its consequences.

The mean number of television sets found in this study was 1.82, which was lower than that found by a study done in the United States, 2.86 (25). This difference could reflect the fact that American families are more affluent and earn better incomes and are thus able to afford more television sets. The difference could also be due to the fact that most Malaysians regard television as a basic necessity rather than a luxury. Approximately 80% of the respondents did not have a television set in their bedroom. This is in accordance with Malaysian culture, where the television set is commonly placed in the living room. Among respondents who had television sets in their bedrooms, a slightly greater percentage had higher BMI. The presence of a television in the bedroom was found to be a stronger predictor of obesity than the amount of time spent watching television (26,27). This is because adolescents

with a television in their bedroom were less involved in healthy activities, such as exercising, eating fruits or vegetables, and enjoying family meals, and they consumed larger quantities of sweetened beverages and fast food (17).

Respondents devoted approximately 10 hours of their time to media usage in a given week, with more time spent on media during the weekends. This finding is understandable because respondents would have more time for media use during the weekends, when they do not have to go to school. However, the time spent on media use was much lower than that of their American counterparts, who spent around 1 to 5 hours per day on media use (13,14). This was probably the reason for the low percentage (8%) of respondents who were found to be overweight in this study. Boys were shown to spend significantly more hours in a given week on media than did the girls. This finding was in agreement with another study, where boys spent more time playing computer games (27). Study has shown that boys and girls may have different interests with regards to leisure

time where boys spent more time playing video games, and girls spent more time in reading and doing homework (28). There was no significant association between the father's occupation and the respondent's television-viewing behaviour. Respondents who had fathers working in private and government sectors were reported to devote the least time to media use. This could be because these fathers have fixed working hours and hence, they might have more time to spend with their children by bringing them out rather than allowing them to stay in the house watching television during their leisure time. Meanwhile, respondents with fathers who were self-employed tended to devote the most time to media use. This might indicate that these fathers were too busy due to longer and irregular working hours; therefore, the respondents spent most of their leisure time at home watching television.

The respondents' mother's occupation was found to be significantly associated with the respondents' television-viewing behaviour. Respondents with mothers who were government-employed or working for private companies spent more time on media use compared with respondents whose mothers were housewives did. Anderson et al. (29) stated that increased maternal employment would lead to a rise in the prevalence of overweight children. Due to constraints on the mother's time, children are left unsupervised (29); these children may engage in more sedentary activities after school (30). In addition, adolescents may be required to spend a great deal of time indoors rather than outdoors, perhaps due to safety concerns. As such, they spend their time watching television or playing video games rather than engaging in more active outdoor pursuits (29). However, mothers who are housewives may spend more time at home with their children. These mothers might also be able to ensure that their children spend their time engaging in academic activities rather than on media use.

This study found that a higher percentage of respondents consumed cereal as opposed to unhealthy foods, such as soft drinks, fast food, and junk food. This finding was different from findings in the United States, where soft drink consumption while watching television was higher (13).

More than half of the respondents (63%) did not consume food advertised on television. This might be associated with fewer television viewing hours; therefore, respondents had less exposure to food advertisements on television. When adolescents were exposed to more hours of

television watching, there was also an increase in the consumption of advertised foods (14). Another factor that may result in less consumption of advertised food could be that families with higher education levels tend to be more health conscious (31).

There was no significant association between BMI and snacking habits. The majority of respondents with higher BMI reported that they seldom consumed soft drinks, fast food, or junk food; rather, they consumed more cereal. Cereal is known generally as a healthy food, and parents would tend to encourage their children to consume more, especially among those families with higher educational levels, who paid more attention to health considerations (31).

There were limitations in the study. Firstly, the possibility of having more respondents with normal BMI who consented to participate in this study could not be ruled out, which might have contributed to the low percentage of overweight observed. In addition, excluding the participation of students in Form 3 and Form 5 classes might limit the generalisability of the findings to the adolescents residing in Kuching South City. However, these preliminary findings are still valuable for future research related to media use and other contributing factors to overweight and obesity among adolescents in Malaysia.

## Conclusion

Only 8% of the respondents were found to be overweight. The mean media time for respondents with normal and high BMI was almost equal. The mean media time per week was found to be much lower than that found in the United States. In addition, this study found that a smaller percentage of respondents had television sets in their bedrooms. The respondents also reported that, when watching television, they consumed cereal more frequently than other unhealthy foods. Thus, it can be concluded that the low percentage of overweight found in this study could be related to the respondents spending relatively less time on media use and consuming healthy food while watching television.

## Authors' Contributions

Conception and design, critical revision of the article, administrative, technical, or logistic support: WLC, CTC, SR  
Collection, assembly, analysis, and interpretation of the data, drafting of the article: WLC, CTC, LDC, SLY, PHT, KPY

Obtaining of funding, provision of study materials or patients, statistical expertise, final approval of the article: WLC, CTC

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