
PUBLIC HEALTH RESEARCH

Malnutrition among Malaysian Adolescents: Findings from National Health and Morbidity Survey (NHMS) 2011

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ABSTRACT

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Introduction	Malnutrition can be associated as one of the factors which affect health status. The term is used to describe imbalance of nutrients either over- or under-nourished, resulting in measurable adverse effects on body composition, function and clinical outcome.
Methods	The National Health And Morbidity Survey (NHMS) 2011 assessed 4304 individuals aged 10-17 years old through a household survey of Malaysian population. Thinness and obesity are the malnutrition indicators based on Centre for Disease Control (CDC) 2000 classification as recommended by WHO (2007).
Results	The findings of the survey showed that the national prevalence of thinness (BMI for age <-2SD), was 9.7% (95% Confidence Interval: 8.4-11.2). The state of Sabah/Labuan had the highest thinness of prevalence, 17.0% (11.1-25.2) and lowest in Penang at 5.3% (2.7-10.0). The prevalence of thinness was higher in urban areas than in rural areas at 10.3% (8.5-12.3). Meanwhile; national prevalence of obesity (BMI for age ≥+2SD) was only 5.7% (4.9-6.7). The state of Perak had the highest obesity prevalence 10.0% (6.2-15.8) and lowest in Sabah/Labuan at 2.4% (1.4-4.1). The obesity prevalence was higher among adolescents in urban areas at 6.3% (5.2-7.6) than in rural areas.
Conclusions	Thinness as a form of malnutrition is more prevalent than obesity. Even though the prevalence of obesity is low, the impact affects not only the adolescents, but also the family, the society and the nation in the future. The increasing prevalence of obesity will have significant public health implication related to non-communicable diseases.
Keywords	Obesity - Thinness - Adolescents - CDC2000 - Malaysia.

INTRODUCTION

Malnutrition remains one of the most common causes of morbidity and mortality throughout the world. The world's adolescent (10-19 years of age) population around 1200 million people, or about 19% of the total population faces a series of serious nutritional challenges not only affecting their growth and development but also their livelihood as adults¹. It continues to be an important and under-recognized problem in all health care settings². Rapid environmental, economic and social changes that follow urbanization increase the prevalence of major risk factors for chronic diseases. In particular, urban areas in low and middle-income countries are moving through a rapid nutritional transition towards Western-style diets, dominated by more processed foods and a higher fat content^{3,4}.

Malnutrition can be categorized as two extremities, thinness and obesity. The increase in prevalence of overweight and obesity in the population occurs not only in developed countries, but also in developing countries. For example, in Thailand, the prevalence of overweight and obesity among adolescents was 7.6% and 9.0%, respectively, and was higher among boys than girls⁵. In Malaysia The Third National Health and Morbidity Survey (2006) reported a 5.4% prevalence of overweight among adolescents aged below 18 years, with a slightly higher prevalence among males (6.0%) than females (4.7%)⁶. Study by Tan AK et. al (2011)⁷ demonstrates obesity risks in Malaysia are affected by gender, education level, family history, health conditions, smoking status, and ethnic backgrounds. Specifically, the findings pointed out that Malaysians more likely to be obese are females (5.3%), lower educated (0.9%), those with history of family illnesses (4.8%), and non-smokers (6.4%). However, Chinese (9.3%) and other (5.5%) ethnic groups are less likely to be obese when compared with Malays.

While thinness is frequently associated with nutritional deficiencies, menstrual irregularity and eating disorders⁸. Some studies have shown that underweight/thinness might actually be more frequent than obesity⁹. In India, prevalence of thinness was found among boys (53.1%) than girl (32.0%)¹⁰. However in Malaysia The Third National Health and Morbidity Survey (2006) only prevalence of stunting reported (15.8%), with a slightly higher prevalence among males (16.6%) than females (15.0%)⁶.

Thinness is classified as having BMI-for-age (5 to 19 years) below than -2SD while obesity is classified as having BMI-for-age (5-19 years) above +2SD¹¹.

From the study by Wells's *et.al* in 2012¹², obesity is widely assumed to be associated with economic affluence. Moreover, it also becomes more common with economic development. They

found that, males and females may be differently exposed to social and economic inequality.

A study conducted in selected secondary schools in Malaysia among 11 to 15 years old adolescents found that prevalence of overweight were higher among adolescents in urban areas compared to those in the rural areas. The prevalence of overweight was higher among male as compared to female (19.5% vs 16.7%)¹³. Comparing by ethnicity, no significant difference was found in prevalence of overweight between Malay, Chinese and Indian. The prevalence of overweight for each ethnic was in the range 18% to 19%¹⁴.

Thus, the aim of this paper was to determine the socio economic factor that associated with thinness and obesity among adolescents aged 10-17 in Malaysia.

MATERIALS AND METHOD

Sampling

The National Health and Morbidity Survey 2011 used multi-stage stratified sampling design where eligible respondents; i.e, residents of the selected living quarters including adolescents with the specified age-group were included as respondents. Details of the sampling methods which included selector of Enumeration Blocks (EB) and Living Quarters (LQ) were available in the related reports^{15,16}.

Data collection

The data collection was conducted throughout Malaysia simultaneously between April and July 2011. Data collection involved usage of validated questionnaire and measurement of weight and height by trained data collectors. Body weight was measured using a digital weighing scale (Tanita 318, Japan) to the nearest 0.1kg whereas body height was assessed using a seca bodymeter (Seca 206, Germany) to the nearest 0.1cm. Measurements were taken twice for each respondent and the average value was used for the data entry. Based on weight and height measurement, BMI-for-Age Z score (BAZ) were calculated using Nutstat (CDC 2000) software and classified according to z-score for BMI-for-age as recommended by WHO (2007).

Data analysis

Data was analysed using the Statistical Package for the Social Sciences (windows version 19, SPSS INC) with added module for complex sample analysis. Bivariate analysis including cross-tabulation with confidence interval (CI), and range were used to describe the association.

Variable definition

World Health Organization (WHO 2007) classified thinness is as having BMI-for-age (5 to 19 years) below than -2SD while obesity is classified as

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having BMI-for-age (5-19 years) above +2SD¹¹. Household income is defined to three categories based on Household Income Survey (HIS): Conducted by EPU & DOS (Department of Statistic) reported 10MP-Tenth Malaysian Plan (Rancangan Malaysia ke10)¹⁷, where household income of less than RM 2300, was classified as 'low', while household income between RM 2300 – RM 5599, was classified as 'medium', and household income of RM 5600 and above was classified as 'high'.

RESULTS

A total of 4304 adolescents aged 10-17 years old (2161 boys, 2143 girls) were measured for BAZ in this survey. With reference to Table 1, the prevalence of thinness was 9.7% (95% CI: 8.4-11.2) and obesity was 5.7% (95% CI: 4.9-6.7). The study presented that among the states, Sabah/Labuan had the highest prevalence of thinness; 17.0% (95% CI: 11.1-25.2) whereas Penang showed the lowest thinness prevalence; 5.3% (95% CI: 2.7-10.0). In case of obesity, Perak had the highest obesity prevalence of 10.0% (95% CI: 6.2-15.8) meanwhile Sabah/Labuan came out

with 2.4% (95% CI: 1.4-4.1) which was the lowest prevalence of obesity.

According to strata, both thinness and obesity prevalence were higher in urban with 10.3% (95% CI: 8.5-12.3) and 6.3% (95% CI: 5.2-7.6) respectively. For the age group, adolescents with age group 15-17 had higher thinness prevalence of 11.2% (95% CI: 8.8-14.1) as compared to the age 10-14 years while obesity prevalence was higher among adolescents aged 10-14 years; 6.8% (95% CI: 5.3-7.6).

Comparison by ethnicity showed that the prevalence of thinness was highest among Indian which was 17.1% (95% CI: 12.1-23.6), followed by other bumis; 15.3% (95% CI: 9.6.1-23.5), others; 13.8% (95% CI: 6.5-26.9), Malays; 8.4% (95% CI: 7.2-9.9) and Chinese; 6.7% (95% CI: 4.9-9.1). Furthermore, the Indians was found to have highest prevalence of obesity; 9.6% (95% CI: 5.0-17.8), followed by Malays; 6.5% (95% CI: 5.4-7.7), other bumis; 5.2% (95% CI: 3.3-8.1) and Chinese; 3.4% (95% CI: 2.3-5.2).

By economic status, there was an inverse relationship between the prevalence of thinness and household income, while direct relationship was noted between obesity and the household income (Table1).

Table 1 Prevalence of thinness and obesity by socio-demographic

Socio-demographic characteristics	Thinness			Obesity		
	Total	Estimated Population	95% CI	Total	Estimated Population	95% CI
MALAYSIA	413	406849	9.7 (8.4-11.2)	233	239243	5.7 (4.9-6.7)
State						
Johor	34	41613	8.6 (6.1-12)	20	32239	6.7 (3.9-11.2)
Kedah	20	20332	6.4 (4-10)	10	12430	3.9 (2-7.4)
Kelantan	29	23551	8.0 (5.6-11.4)	19	15326	5.2 (3.3-8.10)
Melaka	29	15170	11.5 (7- 18.2)	7	4701	3.6 (1.5-8.1)
Negeri Sembilan	30	14459	9.4 (6.1-14.1)	6	5075	3.3 (1.3-8)
Pahang	21	19220	8.6 (5.7-12.9)	17	15248	6.8 (4.2-10.9)
Penang	24	10492	5.3 (2.7-10)	9	5357	2.7 (1.1-6.8)
Perak	22	41933	11.1 (6.8-17.6)	18	37981	10 (6.2- 15.8)
Perlis	25	4840	12.0 (8-17.6)	19	3358	8.3 (5.2-12.9)
Selangor	47	57776	8.7 (6.5-11.7)	38	41250	6.2 (4.5-8.7)
Terengganu	23	12875	6.7 (4.4-10.1)	15	7826	4.1 (2.4-7)
Sabah/ Labuan	67	95424	17.0 (11.1-25.2)	16	13290	2.4 (1.4-4.1)
Sarawak	25	29466	7.9 (5.2-11.9)	25	33454	9.0 (5.9-13.4)
WP K. Lumpur	10	19202	11.2 (5.3-22)	9	11374	6.6 (3.4-12.5)
WP Putrajaya	7	487	7.2 (3.4-14.4)	5	326	4.8 (2-11.1)
Strata						
Urban	232	293468	10.3 (8.5-12.3)	148	178906	6.3 (5.2-7.6)
Rural	181	113379	8.5 (7.1-10.1)	85	60336	4.5 (3.6-5.8)

Age group (years)						
10-14	240	211473	8.7 (7.3-10.2)	159	154273	6.3 (5.3-7.6)
15-17	173	195375	11.2 (8.8-14.1)	74	84969	4.9 (3.6-6.5)
Ethnicity						
Malay	225	199834	8.4 (7.2-9.9)	164	153256	6.5 (5.4-7.7)
Chinese	59	58642	6.7 (4.9-9.10)	26	30092	3.4 (2.3-5.2)
Indian	57	46012	17.1(12.1-23.6)	17	25896	9.6 (5.0-17.8)
Other Bumi's	52	87365	15.3 (9.6-23.5)	24	29634	5.2 (3.3-8.1)
Others	20	14994	13.8 (6.5-26.9)	2	362	0.3 (0.1-1.5)
Household Income						
Low < RM 2300	220	200624	10.3 (8.3-12.6)	88	78639	4.0 (3.1-5.2)
Middle RM 2300 - RM 5599	28	24533	11.7 (6.5-20.1)	14	13149	6.3 (3.3-11.7)
High ≥RM 5600	48	53937	8.5 (5.4-13.1)	48	50093	7.9 (5.7-10.8)

Analysis by sex had noted significantly higher prevalence of thinness in males compared to females, among adolescents aged 10-14 years, (Table 2). Males were also noted as having significantly higher prevalence of thinness in low and middle income families.

Analysis by sex for obesity had noted a significant higher prevalence among males compared to females. By states, the prevalence was significantly higher in Johor; 11.2% (95% CI: 6.3-

19.4) and Perak; 13.0% (95% CI: 7.5-21.5). The prevalence was also significantly higher among males in both locality; urban and rural. The prevalence of obesity was also significantly higher among males in the age groups of 10-14 years and 15-17 years. By ethnicity, obesity was also noted as significantly higher in males in the Malays. The low income group notes the significantly higher prevalence (Table 3).

Table 2 Profile of thinness by sex

Socio-demographic	Prevalence % (95%CI)	
	Male	Female
MALAYSIA	11.6 (9.6-14.0)	7.7 (6.2-9.5)
State		
Johor	11.2 (7.4-16.7)	5.8 (3.1-10.4)
Kedah	8.3 (4.7-14.4)	4.3 (1.9-9.5)
Kelantan	10.1 (6.3-15.8)	6.0 (3.3-10.5)
Melaka	11.9 (6.1-21.8)	11.1 (5.3-21.6)
Negeri Sembilan	10.1 (5.5-17.8)	8.7 (4.7-15.3)
Pahang	9.9 (5.8-16.3)	7.3 (3.7-14.0)
Penang	5.8 (2.5-12.9)	4.8 (1.7-13.0)
Perak	9.4 (5.1-16.9)	12.6 (6.1-24.1)
Perlis	13.0 (7.4-21.8)	11.0 (6.1-19.2)
Selangor	10.1 (6.9-14.5)	7.4 (4.5-11.8)
Terengganu	8.1 (4.7-13.8)	5.2 (2.8-9.7)
Sabah/Labuan	22.9 (13.4-36.2)	10.5 (5.4-19.4)
Sarawak	8.1 (4.7-13.7)	7.7 (3.9-14.5)
WP Kuala Lumpur	16.0 (6.5-34.1)	5.6 (1.7-17.3)
WP Putrajaya	7.0 (2.7-17.3)	7.3 (2.4-20.4)
Strata		
Urban	12.2 (9.4-15.6)	8.3 (6.4-10.8)
Rural	10.5 (8.5-12.9)	6.4 (4.7-8.6)
Age group (years)		
10-14	10.9 (8.7-13.6)	6.3 (5.0-8.0)*
15-17	12.6 (9.1-17.3)	9.6 (6.8-13.5)

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Ethnicity		
Malay	9.6 (7.9-11.6)	7.2 (5.5-9.5)
Chinese	7.7 (5.2-11.4)	5.7 (3.5-9.2)
Indian	22.8 (14.5-34.0)	11.5 (7.2-17.8)
Other Bumi's	18.9 (10.2-32.5)	11.2 (5.9-20.3)
Others	17.7 (7.3-37.2)	6.9 (2.0-21.6)
Household Income		
Low < RM 2300	13.3 (10.0-17.4)	7.1 (5.5-9.2)*
Middle RM 2300 - RM 5599	19.2 (9.7-34.6)	4.3 (2.0-9.2)*
High ≥RM 5600	8.0 (4.9-12.7)	8.9 (4.2-18.1)

* 95% CI (significant difference)

Table 3 Profile of obesity by sex

Socio-demographic	Prevalence % (95%CI)	
	Male	Female
MALAYSIA	7.6 (6.3-9.1)	3.7 (2.9-4.9)
State		
Johor	11.2 (6.3-19.4)	1.7 (0.6-4.7)*
Kedah	3.2 (1.1-8.8)	4.6 (1.9-10.4)
Kelantan	7.2 (4.2-12)	3.3 (1.5-7.2)
Melaka	3.7 (1.0-12.8)	3.4 (1.1-9.7)
Negeri Sembilan	4.8 (1.7-12.6)	1.8 (0.3-11.7)
Pahang	8.7 (4.8-15.3)	4.8 (2.2-10.4)
Penang	3.9 (1.2-11.9)	1.4 (0.4-5.2)
Perak	13.0 (7.5-21.5)	7.3 (3.0-6.8)*
Perlis	8.7 (4.6-16.1)	7.9 (4.1-4.9)
Selangor	7.6 (5.0-11.4)	4.8 (2.7-8.3)
Terengganu	5.7 (2.9-10.8)	2.5 (1.0-6.0)
Sabah/Labuan	3.0 (1.5-5.7)	1.7 (0.6-4.4)
Sarawak	12.0 (7.3-19)	5.5 (2.6-11.3)
WP Kuala Lumpur	10.0 (4.6-20.4)	2.7 (0.7-10.3)
WP Putrajaya	7.0 (2.7-17.3)	2.4 (0.3-15.4)
Strata		
Urban	8.3 (6.6-10.5)	4.1 (2.9-5.7)*
Rural	6.0 (4.5-8.1)	2.9 (2.0-4.3)*
Age group (years)		
10-14	8.3 (6.7-10.3)	4.2 (3.1-5.8)*
15-17	6.6 (4.6-9.2)	3.1 (1.8-5.1)
Ethnicity		
Malay	8.6 (7.0-10.6)	4.3 (3.1-5.8)*
Chinese	5.1 (3.2-8.3)	1.7 (0.8-4.0)
Indian	11.0 (4.2-25.7)	8.3 (3.4-18.6)
Other Bumi's	7.1 (4.1-12.0)	3.0 (1.4-6.6)
Others	0.5 (0.1-2.4)	-
Household Income		
Low < RM 2300	5.5 (4.1-7.4)	2.4 (1.5-3.8)*
Middle RM 2300 - RM 5599	6.4 (2.3-16.3)	6.2 (2.7-13.6)
High ≥RM 5600	11.2 (7.6-16.1)	4.4 (2.4-8.1)

* 95% CI (significant difference)

DISCUSSION

The present study showed that both forms of malnutrition-thinness and obesity were slightly higher in urban areas compared to rural areas. However, no significant differences were observed in each variable mentioned previously. According

to International Food Policy Research Institute, food and nutrition intervention programmes prominently prioritizing rural areas on the perception that poverty is a rural phenomenon, causing no attention being focused to the growing number of urban poor²⁴. Anecdotally, this

misconception possibly led to high thinness occurrence in urban areas as reported in our study. Against our finding, conventionally, the cases of under nutrition were highest in rural areas²⁵. As reported by Al Mekhlafi *et al.* (2008)¹⁹, most of nutritional studies in Malaysia showed under nutrition is still jeopardy in the rural communities especially among Malaysian young adolescents. Therefore, many researchers agree whether in rural or urban, the determinants to child poor nutritional outcomes are the same such as poverty and low maternal education^{26,27}. On the other hand, our data of obesity seemly profound in urban adolescents because they indulged more in inactive leisure time activities such as television viewing, playing computer games and surfing the net that lead them to comfortably become physically inactive. Furthermore, the aggressive promotion of fast food to children and adolescent may have been another cause of regular or frequent consumption of fast food which is high in fat and calories¹⁸.

As observed in this study, thinness was more prevalent for older age group while obesity was more prevalent for younger age group. Among adolescents in the peri-urban areas of Ouagadougou, Burkina Faso, West Africa, Daboné *et al.* (2011)²⁶ reported thinness prevalent was higher in older adolescents (20.3%) than younger adolescents (12.6%) and surprisingly no occurrence of obesity among adolescent compare to younger group (2.2%) of adolescents in the study. On the contrary, Singh and Devi (2013)²⁸ reported the prevalence of both underweight (33.86%) and overweight (5.18%) were significantly higher among urban Meitei children than adolescent girls in the study. In present study, extension to sex showed thinness and obesity were high and significantly high among male than their female counterparts. This finding is consistent with the study by Khor *et al.* (2009)²² on 1043 boys and 1007 girls resided at the state of Kedah and Penang, Malaysia. The study found that a higher percentage of underweight (31.0%) and overweight (33.2%) were found in boys compared to girls. Zalilah *et al.* (2006)²⁹ also reported that underweight and obesity occurrence was higher in male (14.8% and 19.7%) than female (7.9% and 16.7%) among Malaysian adolescents aged 10 to 15 years old. On the other hand, no sex difference was observed in the prevalence of overweight and obesity among adolescents in Turkish study (Özgüven I *et al.* 2010)³⁰. Senbanjo IO *et al.* (2011)²⁷ reported that age group and gender influencing the nutritional status. As pointed out in the study, increased accessed to food at the older age when the females are culturally involved in the cooking of the family-food, and hence their better nutritional state compared to the male counterparts. Adversely, A. Dutta *et al.* (2009)³¹ found that age

of a child does not influence the child's nutritional status.

Our survey showed that, prevalence of thinness and obesity were highest both in Indian adolescent across the three major ethnic groups in Malaysia. The finding of thinness in our study was in agreement with a study carried out on school children and adolescents in Kuala Lumpur whereby prevalence of underweight was higher in Indian students (24.9%) compared to Malays and Chinese due to genetic factors as this study concluded¹⁸. In case of obesity, the present finding was on contrast with study by Rampal *et al.* (2007)³² among secondary school students in Klang, Selangor, Malaysia which found prevalence of overweight was highest in Malay students with 10.7%. In addition, when narrowing the result by sex, our findings for obesity in male was in parallel with study by Nasir & Dan (2005)³³ among adolescents in Kuantan, Pahang, Malaysia which Indians male (32.3%) had highest percentage of overweight/obesity followed by Chinese (24.5%) and Malay (23.8%). Vice versa, against our findings for obesity in female, Malays female (24.0%) had the highest prevalence of overweight and obesity, followed by Indians (23.3%) and Chinese (12.4%)³⁴. According to Reddy *et al.* (2008)²⁵ race also play a role to the differences between gender-race distributions of nutritional status among adolescents in South Africa and United States. Study by Reddy *et al.* had observed there is social pressure causing white girls to be thin, while there is positive social value to being larger for black south African girls. In other words, the distinctive of cultural norms more or less had contributed to affect nutritional status of individual.

The present study also reported that thinness prevalent was higher among middle income group. Meanwhile, highest prevalence of obesity was reported in high income group. Unfortunately, limited data were available in associating nutritional status and income level in Malaysia. Nevertheless, Samani-Radia & McCarthy (2011)³⁵ found that by assessing basis on BMI, adolescents from the lower income background have greater prevalence of overweight/obesity. On the other hand, Özgüven I *et al.* 2010³⁰ had reported Turkish adolescents from middle socioeconomic status (SES) group were fatter compare to other SES categories while adolescents of low SES were shorter and thinner than those of other SES categories. On contrast Abdallah *et al.* (2007)²³ found that boys of both low and high socioeconomic status had the higher risk of overweight.

Per capita monthly family expenditure emerges as the most important predictor of the anthropometric variables in the presence of age. With respect to indicators of nutritional status, results showed simultaneously a decrease in the

prevalence of stunting and thinness, an increase in the prevalence of overweight, and the emergence of obesity²¹.

Strengths and limitations

The strength of this study is using a large nationally representative sample which allowed reliable information on malnutrition status among adolescents in Malaysia. The definition of age group (10-17 years old) is different from WHO (9-18 years old) which is the limitation for this study.

CONCLUSIONS

In conclusion, prevalence of thinness and obesity were both obviously higher in urban areas compared to rural areas. Being overweight as an adolescent is associated with higher risk for diabetes later in life. High fat intake during adolescence may increase the risk of heart disease. The result indicates the need of continuous efforts from various stakeholders including the non-governmental agencies toward improving the health status of Malaysian adolescents especially those aged 18 years old and below.

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