

Brief communication (original)

Prevalence of obesity among Thai schoolchildren: a survey in Khon Kaen, Northeast Thailand

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Background: There is a worldwide increase in obese children and adolescents. No systematized biometric data are available to confirm this trend in Thailand.

Objective: Estimate the prevalence of obesity among 12- to 18-years-old attending the secondary school in the municipality of Khon Kaen, Northeast Thailand.

Materials and methods: We used stratified, two-stage, cluster sampling to select 7,096 healthy boys and girls from 12,021 students of grades 7 to 12 at three government schools. Height and weight were measured to calculate body mass index (BMI) (weight (kg)/height (m)²). Sex-specific, BMI-for-age growth charts were created from the data on the 2,593 boys and 4,503 girls (between 12 and 18 years of age) using simple random sampling. Sex-specific BMI-for-age growth charts and the weight-for-height (W/H) were used to estimate the prevalence of obesity and overweight.

Results: The respective national prevalence of obese and overweight children was 4.9% and 9.5% in the BMI-for-age, the rates between boys and girls being comparable. There were no significant differences in the prevalence of either obesity or overweight with increasing age. In the Thai standard W/H, 13.7% of the children were obese and 5.3% were overweight. Obesity was more prevalent in boys (18.9%) than girls (10.8%) and decreased with age. The prevalence of overweight did not change with age regardless of gender.

Conclusion: Obesity among children in Khon Kaen was similar to, or less prevalent than that reported for other areas of Thailand. The prevalence of obesity needs to be judged by the same (or similar) criteria before any comparison among various studies is done.

Keywords: Children, obesity, prevalence, Northeast Thailand

Obesity and overweight are identified as abnormal or excessive fat accumulation leading to serious health problems. Severe obesity in adulthood is more likely if obesity begins in childhood [1]. In 2005, the World Health Organization (WHO) reported that at least 20 million children under five years of age were obese around the world [2].

Body composition in children differs between boys and girls, and changes with age. The Centers

for Disease Control and Prevention (US-CDC) recommended that the classifications for overweight and obesity for children and adolescents should be age- and sex-specific [3].

The incidence of overweight and obesity varies among countries and age groups, but overall obesity trends to be higher in boys than in girls and decreases with age [4-12].

In Thailand, the prevalence of childhood obesity is reportedly between 9% and 31% [13-21]. However, systematized biometric data, as a whole or by region, are not available to confirm the increasing trend of obese children and adolescents in Thailand.

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In this study, we investigated the prevalence of overweight and obesity, creating sex-specific BMI for-age growth charts for children and adolescents in Khon Kaen municipality in Northeast Thailand. In the survey, we used the Thai Standard W/H for children between one day and 19 years of age.

Materials and methods

The study was approved by the Ethics Committee of Khon Kaen University. Data collection was done between June and August, 2007. Our sample included 59% (7,096/12,021) of the secondary school students, both boys and girls between 12 and 18 years of age, in the municipality of Khon Kaen. Sampling was done in two clusters at each of the three schools, Kanlayanawat School, Khon Kaen Wittayayon School, and Kaenakorn Wittayalai School. Students were issued a random number according to the class size.

Age was reckoned from the documented date of birth. We rounded age to a whole number. For example, 12-year-olds comprised all those between 11.5 and 12.4 years of age. This method of rounding was used for all ages.

Anthropometric assessment

Height, weight, hip and waist circumference were measured for each participant, according to the WHO guidelines [22]. Participants wore light clothing and no shoes. Weight was determined using a digital scale (TCS-150-B), to the nearest tenth. Height was measured standing with feet together and arms relaxed at the sides.

The BMI was calculated as weight (W, kg) divided by height (H, m²) and sex-specific, BMI-for-age growth charts were created. A BMI \geq the 95th percentile indicated obesity, between the 85th and <the 95th overweight, \geq the 5th and <the 85th normal, and <the 5th underweight. Since the W/H criteria is commonly used in Thailand, we defined obesity and overweight using the Standard W/H criteria, that is a W/H $> +2.0$ SD (standard deviation) and $> +1.5$ SD to $+2SD$ [11], respectively. The Institute of Nutrition, Mahidol University, which created the 'INMU-Thai Growth' program, allowed us to assess their data for the prevalence of obesity, overweight, normal weight, and underweight.

The outcome of our study is a population estimate of the prevalence of overweight vs. obese in boys and girls between 12 and 18 years of age.

Statistical analysis

Descriptive analyses were conducted to estimate the overall prevalence of overweight, obesity, normal and underweight. All statistical analyses were performed using STATA (version 10.0).

Results

BMI-for-age

The sex-specific, BMI-for-age growth charts for boys and girls based on the data of 7,096 children (36% boys, 64% girls) are presented in **Fig. 1**. By age, 10.8%, 16.1%, 18.1%, 14.7%, 16.0%, 16.7%, and 6.4% of the population were 12, 13, 14, 15, 16, 17 and 18 years of age, respectively. Of the 2,593 boys, the highest and lowest percentage of the population was 21.4% at 14 years of age and 5.4% at 18 years, respectively.

Out of the 4,503 girls, the highest and lowest percentage of the population was 17.8% at 17 years of age and 7% at 18 years. There were no significant changes in the BMI with age, either among the boys or the girls at each percentile. For boys, the BMI-for-age at the 95 percentile was 29.1 kg/m² at 12 years and 29.3 kg/m² at 18 years, whereas for girls it was 26.9 kg/m² at both 12 years and 18 years.

The average BMI for boys was slightly greater than for girls at the 75, 85, 90 and 95 percentiles. At the 95 percentile, for instance, the BMI for boys ranged between 28.1 and 29.5 kg/m² whereas for girls it was between 26.2 and 27.1 kg/m². Despite some differences, the BMI-for-age in boys and girls at the 5, 10, 25 and 50 percentiles were comparable.

The prevalence of obesity and overweight for children in 2007 is shown in **Table 1** (Data for normal weight and underweight are not shown). Overall, 4.9% of children between 12 and 18 were obese from a minimum of 4.6% at 16 to a maximum of 5.3% at 15.

For boys, between 12 and 18, the prevalence of obesity was 4.8% (range, 4.3% at 18 to 5.3% at 15 years of age). Similarly, for girls between 12 and 18, the prevalence of obesity was 4.8% (range, from 4.5% at 16 to 5.3% at 15 years of age). In addition, the overall prevalence of overweight was 9.5%, which was almost double that of obesity; namely, 9.4% in boys vs. 9.9% in girls.

W/H criteria

The prevalence of obesity and overweight for boys and girls using the W/H differed from that using the BMI-for-age criteria (**Table 1**). Obesity was 2.58

times more prevalent than that of overweight (13.7% vs. 5.3%). The percentage of obese boys was greater than girls (18.9% vs. 10.8%). Additionally, the

prevalence of obesity appeared to decrease with age but not that of overweight in either boys or girls.

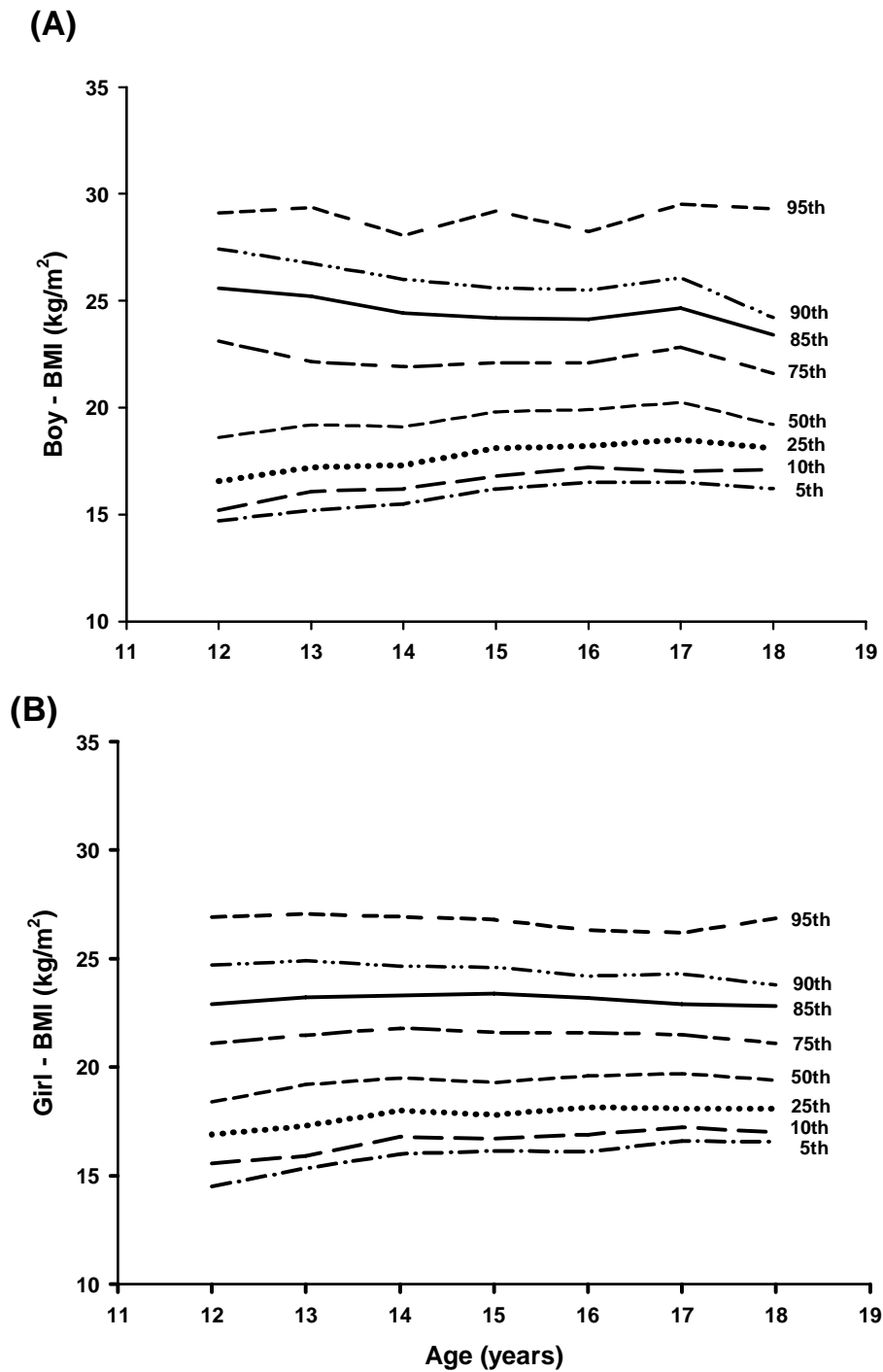


Fig. 1 Body mass index-for-age percentiles in boys **(A)** and girls **(B)**: age 12 to 18 years.

Table 1. Comparison of prevalence of obesity and overweight among 7,096 children (2,593 boys, 4,503 girls) in Khon Kaen, Thailand, as determined by the BMI-for-age percentiles and the weight for height.

	Obese		Overweight					
	BMI ≥ 95 th percentile		W/H (> +2SD)		BMI ≥85 th to <95 th percentile		W/H (> +1.5SD - +2SD)	
	Number	%	Number	%	Number	%	Number	%
Boys and girls, 12-18 years	345	4.9	956	13.7	672	9.5	372	5.3
12	41	4.8	133	16.4	86	10.1	39	4.8
13	56	4.9	169	14.3	111	9.7	56	4.8
14	62	4.8	177	13.9	122	9.5	68	5.4
15	55	5.3	141	13.9	98	9.4	54	5.4
16	52	4.6	134	12.0	99	8.7	64	5.8
17	57	4.8	157	13.6	113	9.6	65	5.7
18	22	4.8	45	10.2	43	9.5	26	5.9
Boys, 12-18 years	125	4.8	474	18.9	244	9.4	147	5.8
12	16	4.8	77	23.0	35	10.4	21	6.3
13	20	4.5	83	18.5	43	9.6	25	5.6
14	29	5.2	97	17.7	53	9.6	26	4.7
15	19	5.3	61	17.6	33	9.2	18	5.2
16	18	4.8	63	17.6	32	8.5	22	6.2
17	17	4.5	75	21.0	36	9.4	27	8.1
18	6	4.3	18	13.9	12	8.6	8	6.2
Girls, 12-18 years	220	4.9	482	10.8	428	9.9	221	5.0
12	25	4.9	56	11.7	51	9.9	18	3.8
13	36	5.2	86	11.7	68	9.8	31	4.3
14	33	4.5	80	11.1	69	9.4	42	5.9
15	36	5.3	80	12.1	65	9.5	36	5.5
16	34	4.5	71	9.4	67	8.8	42	5.6
17	40	5.0	82	10.4	77	9.6	38	4.9
18	16	5.1	27	8.6	31	9.8	18	5.8

BMI= body mass index, W/H= weight for height.

Discussion

The present study provides sex-specific, BMI for-age, growth charts for Thai children/adolescents (between 12 and 18 years of age) in the municipality of Khon Kaen, Northeastern Thailand. There was no evidence to indicate that the BMI-for-age in either boys or girls increased with age. This does not agree with the 2000 US-CDC report for children in the United States for the same age group. In that study, the BMI for-age continued increasing from 12 (boys 24.2 kg/m², girls 25.2 kg/m²) through to 18 years of age (boys 28.9 kg/m², girls 30.3 kg/m²) and the prevalence of obesity among girls was greater than for boys [3]. The difference may be due to different diet and lifestyle as the American population is ethnically diverse.

In our study, the prevalence of overweight in boys or girls was approximately double that of obesity. The prevalence of obesity was comparable to that of German children [6], but approximately 12% less than in American children [4, 5], approximately 5% less than in Portuguese children [7] and Indian children [9], while it was approximately 2% greater than in Indian children in another study [10] and approximately 3% greater than in Iranian children [8]. **Table 2** summarizes previous reports of incidence of overweight and obesity among countries and age groups.

A broad range in the prevalence of obesity using the W/H has been reported among Thai children from different regions of Thailand. However, none of these other studies generated sex-specific BMI-for-age. By using the W/H, the prevalence of obesity agreed with the studies done in students between grades 7 and 12 in Phutthamonthon District, Nakhon Pathom Province [18] and in school children between 6 and 12 years of age from Hat Yai province [16]. However, it was less than the 26% of primary school students from Nakhon Pathom Province [21], or the respective 31% and 30% of Grade 6 children from Bangkok and Saraburi Province [14].

There have only been two studies done in the Northeast region, Sakon Nakorn [14] and Khon Kaen [15]. The prevalence of obesity in our study was approximately 5% less than that observed among the Grade 6 children from Sakon Nakorn. The only study performed among primary school children (between seven and nine years of age) in the municipality of Khon Kaen reported a 3% lower rate of obesity than our study. Similarly though, they found obesity more prevalent among boys than girls (W/H: 13.5% vs. 8.0%, or BMI-for-age: 15.6% vs. 10.1%).

There has been only one study in Pattani province, South Thailand. It revealed a respective 10.7% and 12.7% lower prevalence of obesity for non-Muslim and Muslim children [13] than in our study, possibly because of differences in lifestyle and diet between South and Northeast children.

In conclusion, the prevalence of obesity among secondary school children in Khon Kaen Municipality, Northeast Thailand was less than that reported in most overseas studies using BMI-for-age. It might be more appropriate to use the W/H when comparing the prevalence of obesity and overweight between Thai and overseas children. It is also suggested that a sex-specific, BMI for-age growth chart for Thai children be constructed.

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The authors have no conflict of interest to report.

Table 2. Incidence of overweight and obesity among countries and age groups.

Country	Time frame	Age group	% Overweight	% Obesity
USA [4]	1999-2002	12-19	14.8	16.1
USA [5]	2003-2006	13-19	-	17.4
Germany [6]	2006	3-17	15	6.3
Portugal [7]	2007	13	16.5	10.2
East Iran [8]	2009	7-18	4.8	1.8
India [9]	2004	9-15	11	-
India [10]	2004	11-17	-	2.4

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