Prevalence of overweight and obesity in Thai population: Results of the National Thai Food Consumption Survey

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Abstract

Overweight and obesity are considered a serious health problem in Thailand. This study examined the prevalence of overweight and obesity in a nationally representative sample of Thai children and adults based on international standards. A cross-sectional population survey of 16,596 Thais aged 3 years and over was conducted. Heights and weights were obtained using standardized methods. Estimates of the overweight and obesity prevalence in children, adolescents, and adults were computed. The prevalence of overweight and obesity among children and adolescents aged 3 to 18 years was 7.6% and 9.0%, respectively, and was higher among boys than girls. Among adults, using the the Regional Office for the Western Pacific (WPRO) standard, 17.1% of adults were classified as overweight [body mass index (BMI) 23.0–24.9 kg/m^2], 19.0% as class I obesity (BMI 25.0–29.9 kg/m^2), and 4.8% as class II obesity (BMI 30.0 kg/m^2). Using the World Health Organization (WHO) definition, 19.0% were overweight (BMI 25–29.9 kg/m^2), 4.0% class I obesity (BMI 30.0–34.9 kg/m^2), 0.8% class II obesity (BMI 35.0–39.9 kg/m^2), and 0.1% class III obesity (BMI 40.0 kg/m$^{2)}$. There was a vast difference in obesity prevalence between the WHO and the WPRO criteria. Obesity prevalence when using the WPRO definition (23.8%) was almost five times greater than when defined with the WHO standard (4.9%). The present study found a high prevalence of overweight and obesity in nationally representative sample of the Thai population. Higher rates of overweight and obesity prevalence were computed using the WPRO standard when compared to the WHO standard.

Keywords

Children; adolescents; adults; obesity; overweight; prevalence; Thailand

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INTRODUCTION

For almost two decades, overweight and obesity have been considered a serious health problem worldwide (1). In Europe, the prevalence of obesity increased by 10–40% during the past 20 years, and currently around 400 million adults are overweight and almost 130 millions are obese (2). The US demonstrated similar prevalence and trends, with overweight and obesitu prevalence rates increasing from 44.9% and 13.3% in the First National Health and Nutrition Examination Survey (NHANES I, 1960–1962) to 66.2% and 32.9% in the NHANES 2003–2004, respectively (3).

Moreover, recent data indicate that overweight and obesity are emerging as significant health issues in developing countries and rates are increasing alarmingly, even though many developing nations also experience high prevalence of malnutrition (4). For example, Wu found that the prevalence of overweight and obesity among Chinese was 14.7% and 2.6%, respectively, and accounted for one-fifth of the one billion overweight or obese people in the world (5). Similar trends are observed in South-East Asia (6–7). Currently, both developed and developing countries are experiencing increasing rates of overweight and obesity. The new World Health Organization (WHO) report indicated that 1.6 billion adults were overweight and more than 400 million adults were obese, and at least 20 million children under 5 years were overweight (8). Interestingly, if these trends continue, by 2015 the number of overweight and obese persons will increase to 2.3 billion and 700 million, respectively.

Thailand, in particular, has experienced significant economic and health transitions since 1980. The country structure has progressively transformed from an agricultural to an industrialized setting and from a rural to an urban community, which has significantly affected Thai lifestyles, such as diet patterns and physical activities (9–11). Recent data demonstrated an alarming rate of overweight and obesity in Thai adults, from 13.0% in men and 23.2% in women (or 25% total) in 1991 to 22.4% and 34.3% (or 48% total) in 2004, respectively (12, 13). However, not many studies to date have examined overweight and obesity prevalence in a nationally representative sample of the Thai population, including children younger than 5 years. This is very important because childhood overweight and obesity are associated with health risks and increased risk of adult obesity (14). Also, the present study is unique because it is the first study to examine and compare overweight and obesity prevalence by geographic distribution. The aimes of the present study are to investigate the prevalence of overweight and obesity among Thai population, aged 3 years and older, and to compare the prevalence of overweight and obesity in Thai adults, aged 18 years and older based on the WHO criteria (15) and the Regional Office for the Western Pacific (WPRO) standards (1).

MATERIALS AND METHODS

Design

The Thai Food Consumption Survey (TFCS) was a nationally representative, cross-sectional population-based survey that targeted Thai population aged 3 years and older. The primary

aim of this survey was to evaluate food and nutrient consumption patterns and health status in the Thai population as a whole and to evaluate regional differences (16).

A stratified three-stage sampling method was employed to select participants in order to ensure that each individual represents the country adult population. Four regions of Thailand (North, Northeast, South, and Central) were assigned as a stratum (75 provinces in 4 regions and Bangkok). In the first step of sample collection, all provinces in each stratum were ranked according to the average income per household from the lowest to the highest. A systematic random sampling was used to select the representative provinces for each stratum, resulting in 17 provinces including Bangkok. Next, representative villages from all province samples were randomly chosen, yielding 293 villages. Within each village, a random sample of households was drawn from the local government registers of household lists and only one individual was recruited from a household. Eligible participants who were neither pregnant nor breast-feeding were invited to participate. Pregnant and lactating women were excluded from this study because of differences in body weight accumulation during pregnancy.

Measurements

Prior to the interview, trained data collection staff described the study protocol and an institutionally approved signed consent form was obtained from all participants, or their parents or caregivers. Data collection included face-to-face interviews and a physical examination with one selected participant from each household. Both components were conducted at the participants' homes. Relevant to the current study, each participant was asked to provide their demographic characteristics (e.g., age, marital status, education level, and occupation). Physical examination was performed with anthropometric measurements including body weight and height with participants wearing indoor clothes without shoes. Participants' heights were measured to the nearest 0.1 cm with the portable wooden stadiometer [locally constructed Institute of Nutrition, Mahidol University (INMU), Thailand] and weights were measured to the nearest 0.1 kg on electronic personal weight scales (model EB 6571, Camry Electronic Ltd., Guangdong, China). Body mass index (BMI) was calculated as weight (kg) divided by height squared (m^2) and was rounded to the nearest 0.1 (kg/m^2). The sample size by age group and gender are shown in Table 1.

The research team from INMU provided intensive training to field data collection staff before starting the study. During data collection, the research team visited each province four times to supervise data collection, review procedures, and calibrate the anthropometric equipment. For quality control, 20% of participants were asked to provide their data for a second time on the next 3 days. In addition, supervisors from each province examined the questionnaires and anthropometric data from their field staff before submitting it to the research team. All data were entered and verified by INMU research team.

Classifications of overweight and obesity

In this study, overweight and obesity classifications among children and adolescents aged 3–18 years were defined based on the sex-specific BMI for age standard from the 2000 reference proposed by the International Obesity Task Force (IOTF), which was developed

using data from six countries on approximately 190,000 participants from birth to 25 years of age (17). According to the IOTF reference, the international cut-off points for BMI for overweight and obesity between 2 and 18 years were defined to pass through BMI of 25 and 30 kg/m^2 for adult overweight and obesity, respectively.

For adults aged 19 years and over, two BMI classifications, the WHO standard (15) and the WPRO standard (1), were used to categorize overweight and obesity. According to the WHO criteria, BMI is classified as normal between 18.5 and 24.9 kg/m^2, overweight between 25.0 and 29.9 kg/m^2, and obese 30.0 kg/m^2. Although the WHO criteria have been well-accepted and widely used internationally, it has been documented that the WHO standard might not be appropriate for classification of obesity in Asian populations due to different body fat percentage and body composition (18, 19). The alternative weight status classification, or the WPRO standard, was proposed by the international Association for the Study of Obesity and the IOTF in 2000 (1) in order to have more applicable and appropriate BMI cut-off points for Asian populations. According to the WPRO criteria, BMI is classified as normal between 18.5 and 22.9 kg/m^2, overweight between 23.0 and 24.9 kg/m^2, and obese 25.0 kg/m^2.

Statistical analyses

Statistical analyses were performed using SPSS® (version 16.0; SPSS Inc., Chicago, IL, USA). Prevalence of overweight and obesity was calculated based on age and gender. Independent t-tests and χ^2 tests were used to compare characteristics between age intervals and between genders.

RESULTS

Prevalence of overweight and obesity among Thai children and adolescents

Overall, among children and adolescents aged 3 to 18 years, 9.1% were overweight and 6.5% were obese (Table 2).

The prevalence of overweight, and obesity was higher among boys than girls (χ^2=6.9, p<0.01). In both genders, the highest prevalence of overweight was found in school-age children (6–11 years), and the highest prevalence of obesity in pre-school children (3–5 years). Although the prevalence of overweight and obesity were commonly found in urban communities, there was no statistically significant difference in overweight and obesity rates between those who lived in urban and rural areas. In addition, children and adolescents who lived in central and southern regions were found to be more overweight and obese than those living in other regions.

Prevalence of overweight and obesity among Thai adults

The overall mean BMI was 22.6 kg/m^2 [standard deviation (SD)=4.1; 95% confidence interval (CI)=18.5–26.6] for all adults. Mean BMI was significantly higher in women (23.1 kg/m^2, SD=4.5; 95% CI=18.6–27.6) than in men (22.1 kg/m^2, SD=3.5; 95% CI=18.6–25.6; p<0.001), and among people living in urban (22.8 kg/m^2, SD=4.1; 95% CI=18.8–26.9) compared with rural communities (22.3 kg/m^2, SD=4.0; 95% CI=18.3–26.3, p<0.001).

Comparing all participants across all four regions and Bangkok, people in Northern and Northeastern regions had lower BMI (p<0.01), and those who lived in Bangkok had the highest BMI, regardless of gender (p<0.05).

Using the WPRO standard, the combined prevalence of overweight and obesity (BMI 23.0 kg/m^2) in Thai adults aged 19 years and over was 40.9%. Approximately 17.1% of this population were classified as overweight (BMI 23.0–24.9 kg/m^2), 19.0% as class I obesity (BMI 25.0–29.9 kg/m^2), and 4.8% as class II obesity (BMI 30.0 kg/m^2). When stratified by gender, the prevalence of overweight and obesity was higher in women (46.1%) than in men (35.5%), p<0.001 (Table 3). The highest prevalence rates of overweight and obesity were found in the 40–59-year-old group in both genders (20.6% and 34.6%, respectively). Although there were no significant differences in overweight and obesity prevalence in areas of residence, the prevalence tended to be higher in urban areas than in rural communities. In addition, Central region had the highest prevalence of overweight (17.8%) and Bangkok had the highest prevalence of obesity (29.5%).

Using the current WHO definition, the overall prevalence rate of overweight and obesity combined (BMI 25.0 kg/m^2) was 23.9% (Table 4).

In total, 19.0% were overweight (BMI 25–29.9 kg/m^2), while 4.0%, 0.8%, and 0.1% met the criteria for class I (BMI 30.0–34.9 kg/m^2), class II (BMI 35.0–39.9 kg/m^2), and class III obesity (BMI 40.0 kg/m^2), respectively. Approximately 15.4% of male and 22.4% of female adults were overweight, while 2.2% of male and 7.3% of female adults were classified as obese according to this standard. Men and women aged 40–59 years also were found to have the highest overweight and obesity prevalence compared to all other age groups, 27.8% and 6.7%, respectively. A similar trend of overweight and obesity prevalence in areas of residence when using the WHO criteria was found showing that urban areas had higher prevalence than rural areas. In addition, Bangkok had the highest prevalence of overweight and obesity (22.5% and 7.0%, respectively). Interestingly, there was a vast difference in obesity prevalence between the WHO and the WPRO criteria. Obesity prevalence, using the WPRO definition (23.8%), was almost five times greater than the rate computed using the WHO definition (4.9%).

DISCUSSION

Childhood and adolescent obesity

Because there are very few data illustrating overweight and obesity rates in children and adolescents aged 3–18 years in Thailand, we computed our prevalence estimates using methods similar to previous studies by using age group comparisons and similar overweight and obesity definitions. In this study, BMI cutoff values for overweight and obesity proposed by the IOTF (17) were applied, which are internationally and scientifically accepted. In addition, the current study is the first to report the prevalence of overweight and obesity in children and adolescents using a nationally representative sample from Thailand.

Overall, the prevalence of overweight and obesity in this representative sample was 9.1% and 6.5%, respectively. Boys were more obese and overweight than girls across age groups.

Stratified by age groups, the results show that the overweight and obesity prevalence in both genders was lower than reports from other studies (20–22). However, it is clear that overweight and obesity among Thai children and adolescents has increased noticeably during the past 10 years. For example, according to the results from a cross-sectional survey [cited in (9)] of school children conducted between 1994–1995 and from this present study (2004–2005), the prevalence of overweight and obesity among children and adolescents has dramatically changed from 6.1% to 9.5% in urban areas, and 3.5% to 6.1% in rural areas.

Our findings are in agreement with other studies (23–26), demonstrating that the prevalence of overweight and obesity decreased with increasing age. Growth spurts could be an explanation for the decline in overweight and obesity rates in this sample. Langendijk et al. (20) suggested that children older than 9 years are likely to have secular changes in height that could catch-up with weight. Therefore, obesity prevalence may be hidden. Other possible explanations of the decline in overweight and obesity prevalence in this sample might relate to weight and diet consciousness that increases during adolescence (27, 28). A longitudinal study of obesity and overweight in adulthood of this sample is required.

Adult obesity

In the present study, we found that the WPRO criteria identified higher prevalence rates of overweight and obesity in Thai adults aged 19 years and over when compared to estimates calculated using the WHO standard. Based on the WRPO BMI cut-off points (BMI 23–24.9 kg/m^2 and BMI 25 kg/m^2), the prevalence of overweight and obesity was 17.1% and 23.8%, respectively; however, only 19.0% and 4.8% of the same population were defined as overweight or obese using the WHO standard (i.e., BMI 25–29.9 kg/m^2 and BMI 30 kg/m^2, respectively).

Noticeably, obesity rates, defined using the WHO standards were five times lower than those using the WPRO criterion. Wen et al. (29) noted that using the high WHO BMI cutoffs (at 30 kg/m^2) would have small impacts on the Asians compared to the Americans or Europeans because of the low number of Asians who had BMI>30 kg/m^2. For example, only 4.8% of adults in the present study met the WHO criterion for obesity, a finding that is in line with other studies with Asian samples (29, 30), compared to those reported for the USA (32.0%) (31) and Europe (23.0–36.0%) (2). This is an important issue because it has been reported that Asians who have BMI>25.0 kg/m^2 experience greater mortality risk and obesity-related disease risk than Caucasians in the same BMI category (29, 30, 32, 33). For example, Shiwaku et al. (30) reported the associations between BMI<25.0 kg/m^2 and higher values of obesity-related diseases markers such as blood pressure, triglyceride, HDL-cholesterol, insulin, and homoeostasis model assessment of insulin resistance, indicating that those who have BMI<25.0 kg/m^2 are likely to have higher risks for obesity-related metabolic disorders. Moreover, there was increasing evidence showing that Asian populations had high risk of type 2 diabetes and cardiovascular disease at BMI<25.0 kg/m^2 due to higher percentage of body fat and difference in body fat distribution, specifically subcutaneous and abdominal fat (34–39). Therefore, lowering the obesity BMI cut-off point for Asians from 30.0 to 25.0 kg/m^2 would estimate the proportion of obese individuals (23.8%) closer to that

demonstrated in US and Europe and better reflect the increased risk of obesity-related mortality and morbidity among Asian populations.

Regardless of definitions, the prevalence rates of overweight and obesity were significantly lower compared to those in western countries (2, 31, 40), but were comparable with other Asian countries (29–30, 38). However, when comparing the present study using WPRO criteria with data from previous studies with Thai samples [e.g., the National Health Examination Survey (NHES) I and II] (41, 42), the prevalence of overweight and obesity dramatically increases in both genders and in all regions of Thailand. On the other hand, the present data showed higher prevalence of obesity when compared with those reported by Aekplakorn and Mo-suwan (13). Because WPRO criteria used in our study have lower cut-off values than WHO standards used in those studies, they captures higher prevalence rates of obesity and properly identifies obese Thai adults who account for 23.8% of Thai population in our study.

Study implications

The rising trend of overweight and obesity in the Thai population is likely related to changing lifestyle, i.e., changes in food consumption and dietary patterns due to the country economic and social transitions since mid 1980s. Their eating patterns have shifted from a traditional Thai diet – vegetable, rice-based and low-fat diet – to a westernized diet, which is rich in meat, fats and sugars (9, 10). In addition, with increasing urbanization, people engage in fewer work-related physical activities and spend more time in very sedentary activities, such as watching TV, surfing the internet, and playing video games (11, 43). Both situations could imply that Thai people spend their leisure time being less active and that would be associated with a growing prevalence of overweight and obesity since 1990s. Moreover, data showed that Bangkok and Central regions had higher overweight and obesity prevalence compared to the other regions of Thailand, which might result from differences in lifestyles as mentioned above. Thai health care professional should focus on these regions.

As obesity prevalence is increasing in Thailand, the risk for mortality and morbidities such as type 2 diabetes, hypertension, and coronary heart disease is increasing too (15). Although Thailand has launched policies and programs for preventing and controling the growing rate of overweight and obesity, e.g., the Healthy Thailand program in 2004, aggressive policies are needed. In addition, national and local health care professionals should promote and provide greater education about physical activity and healthy lifestyles to prevent excess weight gain in Thai population.

One limitation of this study was the cross-sectional design, which limited study conclusions and only allowed us to compare prevalence estimates from our nationally representative sample with studies using more limited samples of the Thai population. Therefore, a longitudinal study needs to be conducted in order to confirm the results and the trends of overweight and obesity prevalence in Thailand. In addition, data from a longitudinal study could provide more important information regarding risk and protective factors and allow a better observation of trends over time than comparison of unrelated samples from different cross-sectional studies. Next, this study did not collect data on physical activity or waist circumference, which can be used to assess factors associated to overweight and obesity in

this sample. Last, BMI alone may overestimate overweight and obesity in some subgroups and the addition of waist circumference can be used to verify weight status and estimate risk (44).

However, this study had several methodological strengths. First, it was conducted in a nationally representative sample covering all geographic regions of Thailand. The data from this study can be used to examine national prevalence estimates for a variety of health issues and provide important insight into the issue of preventing and controling the excess weight gain. In addition, the sample population in this study was large and included individuals of various ages, ranging from 3 to more than 70 years. Next, the heights and body weights of participants were actually measured rather than using self-reported values, resulting in much more accurate assessments of BMI than typically found in most population-based studies. Moreover, the present study compared overweight and obesity prevalence using both BMI cut-off points from WPRO and WHO standards, which are the current international guidelines for overweight and obesity. However, data regarding body fat, waist circumference, and obesity-attributable mortality and morbidity are needed in this population in order to properly specify the appropriate cutoff point of BMI for obesity in Asia, and in particular, Thailand.

In conclusion, the present study found a high prevalence of overweight and obesity in Thai population. The WPRO definition identified more individuals as overweight and obese than did the WHO standard. This indicates that Thai adults may require lower BMI cut-off points to accurately identify obesity compared with Caucasian and European adults. In addition, health care professionals and health policy makers could use the findings from this study for further health promotion and obesity-related diseases prevention.

Acknowledgments

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TABLE 1

Sample size of Thai adults, children, and adolescents by age and gender.

Age (yr)	All (N=16,596)	Males (N=8210)	Females (N=8386)
3–5	2310	1147	1163
6–11	3370	1694	1676
12–18	3607	1775	1832
19–39	2858	1403	1455
40–59	1702	826	876
60	2719	1356	1363

TABLE 2

Prevalence of overweight and obesity in children and adolescents by gender, age, areas of residence and regions.

	Overweight* (95% CI)			Obesity** (95% CI)		
	Total	Males	Females	Total	Males	Females
Overall	9.1% (7.1–11.1)	9.2% (6.4–12.0)	9.1% (6.3–11.9)	6.5% (4.5–8.5)	7.4% (4.6–10.2)	5.5% (2.7–8.3)
Age (yr)						
3–5	2.6% (0.5–4.7)	2.3% (−0.6–5.2)	2.8% (−0.1–5.7)	2.9% (0.9–4.9)	3.2% (0.3–6.1)	2.6% (−0.3–5.5)
6–11	4.2% (2.2–6.2)	4.3% (1.4–7.2)	4.1% (1.2–7.0)	2.7% (0.6–4.8)	3.0% (0.1–5.9)	2.3% (−0.6–5.2)
12–18	2.4% (0.4–4.4)	2.6% (−0.3–5.5)	2.2% (−0.7–5.1)	0.9% (−1.8–4.2)	1.2% (−1.8–4.2)	0.6% (−2.3–3.5)
Area of residence						
Rural	3.5% (1.5–5.5)	3.4% (0.5–6.3)	3.6% (0.7–6.5)	3.9% (1.4–6.4)	3.0% (0.1–5.9)	2.3% (−0.6–5.2)
Urban	5.6% (3.6–7.6)	5.7% (2.8–5.6)	5.5% (2.7–8.3)	2.6% (0.9–4.3)	4.5% (1.6–7.4)	3.3% (0.4–6.2)
Geographic regions						
Bangkok	1.0% (−1.0–3.0)	1.2% (−1.7–4.1)	0.9% (−2.0–3.8)	0.6% (−1.5–2.7)	0.8% (−2.2–3.8)	0.4% (−2.5–3.3)
Central	2.2% (0.2–4.2)	2.3% (−0.6–5.2)	2.1% (−0.8–5.0)	1.9% (−0.1–3.9)	2.1% (−0.8–5.0)	1.7% (−1.1–4.6)
North	2.0% (−0.1–4.1)	1.8% (−1.1–4.7)	2.1% (−0.8–5.0)	1.3% (−0.7–3.3)	1.7% (−1.2–4.6)	1.0% (−1.9–3.9)
South	2.3% (0.3–4.3)	2.4% (−0.5–5.3)	2.3% (−0.6–5.2)	1.6% (−0.5–3.7)	1.7% (−1.2–4.6)	1.4% (−1.5–4.3)
Northeast	1.6% (−0.5–3.7)	1.4% (−1.5–4.3)	1.8% (−1.1–4.7)	1.0% (−1.0–3.0)	1.1% (−1.9–4.1)	1.0% (−1.9–3.9)

*
Implies a body mass index (BMI) between 25 and 30 kg/m^2 at age 18;

**
implies a BMI>30 kg/m^2 at age 18.

CI: confidence interval.

TABLE 3

Prevalence of overweight and obesity in adults by gender, age, areas of residence and regions using obesity definition proposed by the Regional Office for the Western Pacific [*] (2000).

	Overweight (95% CI)			Obesity (95% CI)		
	Total	Males	Females	Total	Males	Females
Overall	17.1% (15.0–19.2)	17.8% (14.8–20.8)	16.4% (14.8–20.8)	23.8% (21.8–25.8)	17.7% (14.7–20.7)	29.7% (27.0–32.4)
Age (yr)						
19–39	14.9% (11.5–18.3)	15.8% (11.0–20.6)	13.9% (9.1–18.7)	19.6% (16.3–22.9)	14.9% (10.1–19.7)	24.1% (19.6–28.6)
40–59	20.6% (16.4–24.8)	22.0% (16.0–28.0)	19.3% (13.3–25.3)	34.6% (30.8–38.4)	25.5% (19.6–31.4)	43.2% (38.2–48.2)
60+	17.2% (13.8–20.6)	17.3% (12.5–22.1)	17.1% (12.3–21.9)	21.6% (18.3–24.9)	16.0% (11.1–20.9)	27.2% (22.7–31.7)
Area of residence						
Rural	16.0% (12.8–19.2)	16.5% (12.0–21.0)	15.6% (11.1–20.1)	21.6% (18.5–24.7)	13.9% (9.3–18.5)	29.1% (25.0–33.2)
Urban	17.9% (15.1–20.7)	18.8% (14.9–22.7)	17.0% (13.1–20.9)	25.6% (23.0–28.2)	20.7% (16.8–24.6)	30.3% (26.7–33.9)
Geographic regions						
Bangkok	17.7% (11.7–23.7)	19.4% (10.6–28.2)	16.2% (7.9–24.5)	29.5% (23.9–35.1)	20.6% (11.9–29.3)	37.1% (29.9–44.3)
Central	17.8% (13.4–22.2)	18.4% (12.1–24.7)	17.3% (11.1–23.5)	25.8% (21.6–30.0)	19.7% (13.5–25.9)	31.8% (26.1–37.5)
North	16.5% (12.0–21.0)	18.0% (11.7–24.3)	15.1% (8.7–21.5)	21.7% (17.4–26.0)	18.5% (12.2–24.8)	24.9% (18.9–30.9)
South	17.1% (12.6–21.6)	17.3% (11.0–23.6)	16.9% (10.6–23.2)	25.7% (21.5–29.9)	17.4% (11.1–23.7)	33.9% (28.3–39.5)
Northeast	16.4% (11.9–20.9)	16.8% (10.5–23.1)	16.1% (9.8–22.4)	19.0% (14.6–23.4)	13.8% (7.4–20.2)	24.2% (18.2–30.2)

[*] Body mass index (BMI)=23–24.9 kg/m^2 for overweight; BMI 25 kg/m^2 for obesity.

CI: confidence interval.

TABLE 4

Prevalence of overweight and obesity in adults by gender, age, areas of residence and regions using obesity definition proposed by the World Health Organization [*] (2000).

	Overweight (95% CI)			Obesity (95% CI)		
	Total	Males	Females	Total	Males	Females
Overall	19.0% (16.9–21.1)	15.4% (12.4–18.4)	22.4% (19.6–25.2)	4.8% (2.6–7.0)	2.2% (−1.0–5.4)	7.3% (4.2–10.4)
Age (years)						
19–39	14.9% (11.5–18.3)	12.8% (7.9–17.7)	16.9% (12.2–21.6)	4.6% (1.1–8.1)	2.1% (−3.1–7.3)	7.1% (2.2–12.0)
40–59	27.8% (23.8–31.8)	22.5% (16.5–28.5)	32.9% (27.5–38.3)	6.7% (2.1–11.3)	3.0% (−3.7–9.7)	10.1% (3.8–16.4)
60+	17.8% (14.4–21.2)	13.9% (9.0–18.8)	21.6% (16.9–26.3)	3.8% (0.1–7.5)	2.1% (−3.2–7.4)	5.6% (0.4–10.8)
Area of Residence						
Rural	16.9% (13.7–20.1)	12.2% (7.6–16.8)	21.5% (17.2–25.8)	4.7% (1.3–8.1)	1.7% (−3.3–6.7)	7.5% (2.8–12.2)
Urban	20.6% (17.9–23.3)	17.9% (13.9–21.9)	23.2% (19.4–27.0)	5.0% (2.0–8.0)	2.7% (−1.6–7.0)	7.0% (2.9–11.1)
Geographic Regions						
Bangkok	22.5% (16.7–28.3)	17.1% (8.2–26.0)	27.1% (19.4–34.8)	7.0% (0.6–13.4)	3.5% (−6.1–13.1)	10.0% (1.4–18.6)
Central	19.5% (15.1–23.9)	17.6% (11.3–23.9)	21.3% (15.2–27.4)	6.3% (1.6–11.0)	2.2% (−4.8–9.2)	10.2% (3.7–16.7)
North	17.7% (13.3–22.1)	16.1% (9.7–22.5)	19.3% (13.1–25.5)	4.1% (−0.8–9.0)	2.4% (−4.5–9.3)	5.6% (−1.1–12.3)
South	21.4% (17.1–25.7)	15.5% (9.1–21.9)	27.2% (21.3–33.1)	4.3% (−0.5–9.1)	1.8% (−4.9–8.5)	7.7% (0.6–14.8)
Northeast	15.4% (10.9–19.9)	11.7% (5.2–18.2)	19.2% (13.0–25.4)	3.6% (−1.2–8.4)	2.1% (−4.7–8.9)	4.9% (−1.8–11.6)

[*] Body mass index (BMI)=25–29.9 kg/m^2 for overweight; BMI 30 kg/m^2 for obesity.