

# Prevalence of Childhood and Adolescent Obesity in Thailand: A Review

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**Background:** Obesity in children and adolescents is a major public health problem in many countries including Thailand. However, the use of different growth references applied to the data could contribute to the difference in magnitude of problem. **Objective:** To examine the prevalence rate of overweight and obesity among Thai children and adolescents between 1995 and 2012.

**Material and Method:** Relevant published articles and nutrition survey reports were obtained by a systematic search through multiple electronic databases published between 1995 and 2012.

**Results:** Of 627 published articles and reports retrieved, six national surveys were examined for the trend of childhood obesity. With the use of Thai growth references, the trends of obesity among preschool, school-age children, and adolescents were found to fluctuate between 1995 and 2009. This might be due to the difference in age categorization and use of dissimilar growth references. The use of the 2000 International Obesity Task Force (IOTF) reference provided a lower estimate of prevalence of obesity when compared to that from Thai growth reference. However, similar fluctuating pattern and trends were observed.

**Conclusion:** A standard protocol using a single set of child growth standard, similar age categorization, obesity indices, and cut-points for defining high-risk children should be applied to track trend of childhood obesity effectively.

**Keywords:** Obesity, Thai, Children, Adolescents, Prevalence, Growth reference

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Obesity is emerging as a major public health problem affecting adults and children across developed and developing countries<sup>(1,2)</sup>. Obesity is associated with a wide range of metabolic disorders and mortality<sup>(3,4)</sup> and contributes to significant increase in health care cost<sup>(5)</sup>. In many countries, shifts towards higher consumption of meat, dairy products, and foods containing saturated fat and refined sugar, together with reduced energy expenditure, have contributed to the rising prevalence of obesity and non-communicable chronic diseases<sup>(6)</sup>. Thailand is currently undergoing an economic transition whereby improved economic conditions have led to changes in diet and lifestyle, with subsequent effects on health. One particular concern is the rising prevalence of overweight and obesity in children and adolescents, in both urban and rural areas<sup>(7)</sup>. The present report reviews the available evidence and examines the trends of prevalence of

childhood obesity in Thailand between 1995 and 2012. The prevalence resulting from the use of different growth references was also discussed.

## Material and Method

### Definition of overweight and obesity

“Obesity” is defined as an excess accumulation of adipose tissue in the body to the extent that physical health may be adversely affected, whereas the term “overweight” describes the excess body weight in relation to height<sup>(8)</sup>. The assessment of obesity in children and adolescents is based on various proxy indicators such as weight-for-height<sup>(9)</sup> or body mass index (BMI) of which the value changes with child’s age. The BMI-for-age growth charts have been developed for specific countries<sup>(10)</sup> and for international comparison<sup>(11-13)</sup>.

### Thai growth references

In Thailand, national surveys have used weight-for-height (WH) to define overweight and obesity in children and adolescents<sup>(14-18)</sup>. The Department of Health, Ministry of Public Health has developed two Thai Growth References (TGR).

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The first TGR was developed in 1985 and 1986 for use in nutrition surveillance and program evaluation. The fourth National Food and Nutrition Survey (4<sup>th</sup> NFNS) conducted by the Department of Health in 1995 used this reference and overweight was defined as WH >110%-120% whereas obesity was WH >120% of median<sup>(19)</sup>. The second TGR was established in 1999 based on Thai children who met the criteria of full potential growth<sup>(20)</sup>. Overweight was defined as weight-for-height-Z-score (WHZ) >1.5 SD to 2 SD and obesity as WHZ >2 SD of median. This reference was used in the Holistic Development of Thai Children Study (HDTCS)<sup>(15)</sup>, the fifth National Food and Nutrition Survey (5<sup>th</sup> NFNS)<sup>(16)</sup> and in the fourth National Health Examination Survey (NHES IV)<sup>(18)</sup>. For comparison with other countries, some survey reports also determined the prevalence using international growth references<sup>(17,21)</sup>.

### Search strategy

The authors identified Thai studies through systematic searches in the following computerized databases: PubMed, Scopus, CINAHL, Science Direct and ProQuest Nursing & Allied Health Source. The keywords were defined as “overweight”, “obese”, “Thai”, “children”, and “adolescents”. They were combined with the MeSH terms: “prevalence”. Additional searches were performed by retrieving the electronic reports and articles from the websites of Thai government organizations, the Bureau of Nutrition, Health System Research Institute and Bureau of Policy and Strategy that were affiliated to the Ministry of Public Health and the report from the National Statistical Office and the Thailand Research Fund.

### Inclusion criteria

The criteria for selection of studies were population-based and cross-sectional studies from published articles and/or reports of national nutrition survey with large sample size, study design of systematic random sampling technique, and conducted from year 1995 onward. Studies with unclear characteristics of children and/or disabled children or with poor methodologies were excluded from the review. The extracted data for prevalence trend were population characteristics, age group, study area and the growth reference used.

### Results

Six hundred twenty two articles were found in the initial search of the electronic databases;

i.e., PubMed (n = 109), Scopus (n = 228), Science Direct (n = 150), CINAHL (n = 6) and Proquest Nursing & Allied Health Source (n = 129). Five additional reports were retrieved from the website of Thai Government Organizations and the Thailand Research Fund. Six hundred ten studies were excluded because they were irrelevant to the prevalence subject, five because the sample groups were not the representative of regions, five because they were found to be duplicated in different database, and one because it presented the unclear study design. After excluding the studies and articles or reports that did not meet the inclusion criteria, six prevalence studies were found as shown in Fig. 1.

Table 1 shows the characteristics of the included six national surveys, which were conducted between 1995 and 2012. All utilized the stratified multi-stage sampling techniques for the recruitment of subjects from all regions of Thailand. Demographic information and anthropometric data were collected from representative different age groups of children and adolescents.

Table 2 shows the results of four national surveys that used Thai growth references to classify overweight and obesity. Among preschool children, with the use of the 1987 TGR, the prevalence of overweight and obesity in the 4<sup>th</sup> NFNS (1995) was 12.3% and 5.4%, respectively<sup>(14)</sup>. In contrast, by using the 1999 TGR, Mo-suwan et al found that the prevalence of overweight among 2 to <6 year-old children in 2001 was lower (3%) whereas the obesity rate was higher (7.9%)<sup>(15)</sup>. When the 1999 TGR was used, the prevalence of obesity declined between 2001 and 2003, but increased from 4.0% in 2003 to 8.5% in 2008 and 2009 in which the obesity rate

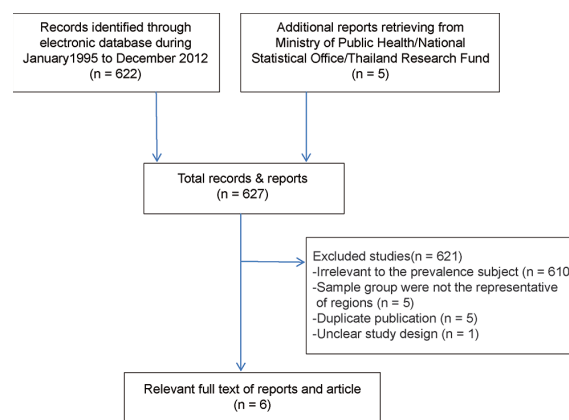


Fig. 1 Diagram showing process of selection of studies.

**Table 1.** Characteristics of the included studies during 1995-2009

Survey, year of data collection	Author	Age range (years)	Sample size	Study area	Growth reference used	Cut-off for overweight	Cut-off for obesity
4 <sup>th</sup> National Food and Nutrition Survey (4 <sup>th</sup> NFNS), 1995	Department of Health	0-5 6-14 15-18	4,261 1,247 213	4 regions/ 10 provinces	1987 TGR	WH >110% to 120% of median	WH >120% of median
Holistic Development of Thai Children Study (HDTCS), 2001	Mo-suwan et al.	2-<6 6-<13 13-18	2,327 3,175 3,153	4 regions/ 17 provinces	1999 TGR	WHZ >1.5 SD to 2 SD	WHZ >2 SD
5 <sup>th</sup> National Food and Nutrition Survey (5 <sup>th</sup> NFNS), 2003	Department of Health	0-5 6-14 15-18	2,486 2,250 256	4 regions/ 10 provinces	1999 TGR	WHZ >1.5 SD to 2 SD	WHZ >2 SD
National Thai Food Consumption Survey (NTFCS), 2004-2005	Jitnarin et al.	3-5 6-11 12-18	2,310 3,370 3,607	4 regions/ 17 provinces	2000 IOTF	Passing through BMI of ≥25 kg/m <sup>2</sup> at 18 years of age	Passing through BMI of ≥30 kg/m <sup>2</sup> at 18 years of age
Multiple Indicator Cluster Survey (MICS), 2005-2006	National Statistical Office	0-<5	9,409	4 regions/ 42,302 households	1978 WHO/ NCHS	-	WHZ >2 SD
4 <sup>th</sup> National Health Examination Survey (NHES IV), 2008-2009	National Health Examination Survey Office	1-5 6-9 10-14	3,015 2,504 3,483	4 regions/ 21 provinces	1999 TGR	WHZ >1.5 SD to 2 SD	WHZ >2 SD

TGR = Thai Growth Reference; WH = weight-for-height; WHZ = weight-for-height-Z-score; IOTF = International Obesity Task Force; WHO/NCHS = World Health Organization/National Center for Health Statistics Growth Reference; BMI = body mass index

was greater among boys than girls, 9.1% versus 7.9%. In spite of this fluctuation, the overall picture is the rise of obesity between 2001 and 2009. In urban area such as Bangkok, one cross-sectional study in 2006 revealed that, by using the 1999 TGR, obesity prevalence in young children was as high as 16.4%<sup>(22)</sup>. Fluctuation of prevalence of overweight and obesity among school-aged children and adolescents were also observed between 2001 and 2009 by using the same reference i.e. the 1999 TGR, for nutritional classification. Due to different age grouping, it is difficult to compare the results and determine the exact trend. Nevertheless, the obesity rate of the 6 to 18-year-old children slightly increased from 15.3% in 2001 to 18.3% in 2003.

Table 3 shows the results of the national surveys that used international growth references<sup>(15-18,21)</sup> to estimate the prevalence of childhood obesity. Two international references were used, the 1978 WHO/NCHS standard<sup>(9)</sup> and the 2000 International Obesity

Task Force (IOTF) reference<sup>(11)</sup>. For preschool children, the 2001 HDTCS<sup>(15)</sup>, the NTFCS (2004-2005)<sup>(21)</sup>, and the NHES IV (2008-2009)<sup>(18)</sup> used the 2000 IOTF reference to define obesity. There was a decrease in prevalence of overall overweight and obesity, from 14.1% in 2001 to 5.5% in 2005, but an increase to 13.2% in the latest survey in 2008 and 2009. Different age grouping of these three surveys limits the conclusion of prevalence trend. Slight reduction of prevalence is observed if comparison is made between the 2001 HDTCS and NHES IV in which age grouping is comparable. Nevertheless, it could be seen that proportion of the obese boys was higher than that of the obese girls in all surveys.

Among school-age children and adolescents, the use of 2000 IOTF reference provided a higher estimate of overweight prevalence but a lower obesity rates in comparison to those using the 1999 TGR. Again, fluctuation of prevalence is observed as noted in the use of TGR. Unexpectedly the 2004 to 2005

**Table 2.** Prevalence of overweight and obesity in Thai children and adolescents using Thai Growth References (TGR) cut-points, by age and sex

Source, year of data collection	Author	TGR used	Age range (years)	Overweight (%)			Obese (%)		
				Boys	Girls	Total	Boys	Girls	Total
<b>Preschool children</b>									
4 <sup>th</sup> National Food and Nutrition Survey (4 <sup>th</sup> NFNS), 1995	Department of Health	1987 TGR	0-5	12.2	12.3	12.3	5.3	5.4	5.4
Holistic Development of Thai Children Study (HDTCS), 2001	Mo-suwan et al.	1999 TGR	2-<6	2.7	3.3	3.0	8.7	7.1	7.9
5 <sup>th</sup> National Food and Nutrition Survey (5 <sup>th</sup> NFNS), 2003	Department of Health	1999 TGR	0-5	2.2	3.1	2.6	3.8	4.2	4.0
4 <sup>th</sup> National Health Examination Survey (NHES IV), 2008-2009	National Health Examination Survey Office	1999 TGR	1-5	3.3	3.8	3.5	9.1	7.9	8.5
<b>School age children &amp; adolescents</b>									
4 <sup>th</sup> National Food and Nutrition Survey (4 <sup>th</sup> NFNS), 1995	Department of Health	1987 TGR	6-14 15-18	3.4 17.5	6.2 24.9	4.8 23.5	5.8 2.1	4.6 18.5	5.2 15.5
Holistic Development of Thai Children Study (HDTCS), 2001	Mo-suwan et al.	1999 TGR	6-<13 13-18	3.4 4.2	3.5 5.0	3.5 4.6	8.7 8.1	4.5 9.2	6.7 8.6
5 <sup>th</sup> National Food and Nutrition Survey (5 <sup>th</sup> NFNS), 2003	Department of Health	1999 TGR	6-14 15-18	1.9 3.4	2.1 7.1	2.0 5.9	5.9 17.2	4.9 10.6	5.4 12.9
4 <sup>th</sup> National Health Examination Survey (NHES IV), 2008-2009	National Health Examination Survey Office	1999 TGR	6-9 10-14	3.8 3.4	3.4 4.6	3.6 4.0	8.2 13.4	7.5 8.4	7.9 10.9

Overweight; weight-for-height Z-score >1.5 SD to 2 SD of median  
Obese; weight-for-height Z-score >2 SD of median

NTFCS showed a surprisingly low prevalence of both overweight and obesity in comparison to the 2001 HDTCS and NHES IV (2008-2009). If considering only the 2001 HDTCS and the 2008 to 2009 NHES IV, the obesity prevalence is increased as observed previously with the use of TGR.

### Discussion

Six national surveys have been compared to assess prevalence trend of childhood obesity in Thailand between 1995 and 2012. With the use of the same 1999 TGR, results showed fluctuation of prevalence of both overweight and obesity in children and adolescents. Difference in age categorization might explain these findings and render the difficulty in determining the trend. However, the rise in obesity rate in both preschool and school-age children was observed between the period 2001 HDTCS and 2008 to 2009 NHES IV whereas the use of international reference, 2000 IOTF, provided a lower estimate of

prevalence of obesity in the same specific groups between 2001 and 2009.

Generally, the assessment of nutritional status in children and adolescents could be done using various proxy indicators such as weight-for-height (WH) or body mass index (BMI). Previous study in 3 to 19-years-old children has demonstrated the positive correlation between WH and total fat mass ( $r = 0.69$  for boys and  $r = 0.65$  for girls) and the positive correlation between BMI-for-age and total fat mass ( $r = 0.68$  for boys and  $r = 0.67$  for girls)<sup>(23)</sup>. Increased BMI has been shown to be associated with higher mortality in adults<sup>(24)</sup>. For a continuity of assessment of obesity through life, BMI is recommended for use in adolescent population<sup>(25,26)</sup>.

Controversy exists whether and under what circumstances an international reference is appropriate for a specific population. Assessment of BMI in children requires cut-offs that differ from those of adults and the values vary with child's age. The ability

**Table 3.** Prevalence of overweight and obesity in Thai children and adolescents using international growth references, by age and sex

Source, year of data collection	Author	Reference used	Age range (years)	Overweight (%)			Obese (%)		
				Boys	Girls	Total	Boys	Girls	Total
<b>Preschool children</b>									
Holistic Development of Thai Children Study (HDTCS), 2001	Mo-suwan et al.	2000 IOTF*	2-<6	6.8	7.2	7.0	7.8	6.3	7.1
5 <sup>th</sup> National Food and Nutrition Survey (5 <sup>th</sup> NFNS), 2003	Department of Health	1978 WHO/ NCHS**	0-5	N/A	N/A	N/A	2.9	2.7	2.8
National Thai Food Consumption Survey (NTFCS), 2004-2005	Jitnarin et al.	2000 IOTF	3-5	2.3	2.8	2.6	3.2	2.6	2.9
Multiple Indicator Cluster Survey (MICS), 2006	National Statistical Office	1978 WHO/ NCHS	0-<5	N/A	N/A	N/A	7.0	6.7	6.9
4 <sup>th</sup> National Health Examination Survey (NHES IV), 2008-2009	National Health Examination Survey Office	2000 IOTF	1-5	6.1	7.6	6.8	7.1	5.7	6.4
<b>School age children &amp; adolescents</b>									
Holistic Development of Thai Children Study (HDTCS), 2001	Mo-suwan et al.	2000 IOTF	6-<13 13-18	10.2 6.1	9.7 7.4	9.9 6.8	5.3 2.4	3.9 2.3	4.6 2.3
5 <sup>th</sup> National Food and Nutrition Survey (5 <sup>th</sup> NFNS), 2003	Department of Health	1978 WHO/ NCHS	6-14 15-18	N/A N/A	N/A N/A	N/A N/A	5.2 N/A	3.6 N/A	4.5 N/A
National Thai Food Consumption Survey (NTFCS), 2004-2005	Jitnarin et al.	2000 IOTF	6-11 12-18	4.3 2.6	4.1 2.2	4.2 2.4	3.0 1.2	2.3 0.6	2.7 0.9
4 <sup>th</sup> National Health Examination Survey (NHES IV), 2008-2009	National Health Examination Survey Office	2000 IOTF	6-9 10-14	8.2 11.1	7.2 11.6	7.7 11.3	6.5 7.1	6.9 4.6	6.7 5.8

\* Overweight and obesity was defined by sex and age specific BMI-for-age values that passed through BMI of 25 and 30 kg/m<sup>2</sup> at age 18, respectively

\*\* Obese: weight-for-height Z-score >2 SD of median

N/A = not applicable

of BMI to correctly identify obese children relied on the magnitude of sensitivity and specificity. Previously, it has been recommended by expert committee that the use of BMI  $\geq 95^{\text{th}}$  percentiles could effectively identify obese children with low false-positive rate<sup>(27)</sup>. Reilly et al showed that the ability of BMI by 2000 IOTF definition gave the lower sensitivity (46%) among British boys aged 7.3 to 7.6 years<sup>(28)</sup>. Monasta et al compared the performance of 2000 IOTF reference with that of WHO standard in analysis of the overweight and obesity in 2 to 5-year-old Czech children. Therefore, the prevalence of obesity in

5-year-old boys was double if IOTF was used compared with the WHO standard at 3 SD, 3.1% versus 1.5%, respectively<sup>(29)</sup>. Due to the lack of BMI reference for Thai children and adolescents, Thai researchers used international reference such as IOTF or WHO growth reference 2007 for classifying nutritional status. Since there has been the variation of BMI value among different ethnic groups, this might limit the use of cut-points from these international references when they were applied to Thai data. It has been suggested that the anthropometric indices and cut-points should be determined on the basis of child health consideration

and that the ability of BMI or weight-for-height as nutritional indicator should be validated against excess fatness of children and adolescents<sup>(30,31)</sup>.

Although a recent literature review has indicated the leveling off of the obesity prevalence in children and adolescents in some developed countries such as Australia, Japan, and the USA since 1999<sup>(32)</sup>, it is not the case in some developing countries. Based on 2006 WHO standards, de Onis analyzed 450 nationally representative cross-sectional surveys from 144 countries and showed that worldwide prevalence of overweight and obesity in preschool children increased from 4.2% (95% CI = 3.2%-5.2%) in 1990 to 6.7% (95% CI = 5.6%-7.7%) in 2010 and the trend will be expected to be 9.1% (95% CI = 7.3%-10.9%) in 2020<sup>(33)</sup>. The rising prevalence of the overweight and obesity among school-age and adolescents in developing countries have been reported such as the prevalence rate in Brazil increased from 4.1% during 1974 to 1975 to 13.9% during 1996 to 1997 by IOTF cut-offs<sup>(34)</sup>. Obesity rate in China in year 2005 was 14.9% for boys and 8.9% for girls by BMI cut-off equivalent to adult BMI of >28 kg/m<sup>2</sup><sup>(35)</sup>. For Thai data, since there were the differences in methodological problems including different age categorization and diverse use of growth references, it does not conclude the changing trend of childhood obesity. The fluctuation of obesity rate might be attributable to the economic transition that affects changing in food consumption pattern and lifestyles of child population. This review indicates the need for the development of consistent standard protocol for nutrition survey to be used for tracking the prevalence trend. Additionally, the anthropometric indicators must be validated against the level of body fatness and/or other health risk for defining the high-risk group. This will have the implications for an effective screening system and for the evaluation of intervention programs in public health.

### Conclusion

As other countries, Thailand is now facing a problem of childhood obesity due to rapid socio-economic transition. A single set of growth reference with the appropriate indicators and cut-offs for defining obesity should be established for tracking secular trends of childhood obesity.

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### What is already known on this topic?

Obesity in children and adolescents has emerged as an important nutritional problem in Thailand.

### What this study adds?

A single set of child growth standard, similar age categorization, obesity indices, and a cut-points for defining high-risk children is needed to determine secular trend and tracking of obesity prevalence.

The use of 2000 International Obesity Task Force references cut-points for Thai data provided the lower estimates of obesity prevalence.

### Potential conflicts of interest

None.

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### ความชุกของภาวะอ้วนในเด็กและวัยรุ่นในประเทศไทย: ทบทวนวรรณกรรม

อุรุวรรณ แยมบริสุทธิ, ลัดดา เหมาะสุวรรณ

**ภูมิหลัง:** ภาวะอ้วนในเด็กและวัยรุ่นเป็นปัญหาสาธารณสุขสำคัญที่พบได้ในหลายประเทศรวมทั้งประเทศไทย อย่างไรก็ตามการศึกษ้อัตราความชุกของภาวะอ้วนจากการใช้เกณฑ์อ้างอิงการเจริญเติบโตที่แตกต่างกันเป็นเกณฑ์ตัดสิน จะส่งผลให้ได้ขนาดของปัญหาโรคอ้วนที่แตกต่างกัน

**วัตถุประสงค์:** ศึกษาการเปลี่ยนแปลงความชุกของภาวะโภชนาการเกินและอ้วนในเด็กและวัยรุ่นไทยในช่วงระหว่างปี พ.ศ. 2538-2555

**วัสดุและวิธีการ:** ศึกษาทบทวนเอกสารวิชาการและรายงานการสำรวจอาหารและโภชนาการประชากรเด็กและวัยรุ่นที่ตีพิมพ์ในระหว่างปี พ.ศ. 2538-2555 จากฐานข้อมูลอิเล็กทรอนิกส์ต่างๆ

**ผลการศึกษา:** จากบทความตีพิมพ์และรายงาน 627 เรื่อง พบรายงานการสำรวจระดับประเทศ 6 เรื่อง ที่ศึกษาภาวะโภชนาการเด็กและวัยรุ่น เมื่อใช้เกณฑ์อ้างอิงการเจริญเติบโตของเด็กไทย พบว่าเด็กก่อนวัยเรียน เด็กวัยเรียน และวัยรุ่นมีอัตราความชุกของภาวะอ้วนที่แกว่งไปมามีทั้งเพิ่มขึ้นและลดลงในช่วงระหว่างปี พ.ศ. 2538-2552 ทั้งนี้เนื่องจากความแตกต่างในการใช้เกณฑ์อ้างอิงการแบ่งกลุ่มอายุเด็กและจุดตัดของดัชนีชี้วัดภาวะโภชนาการ เมื่อใช้เกณฑ์อ้างอิงสากล 2000 *International Obesity Task Force* พบอัตราความชุกของภาวะอ้วนต่ำกว่าเมื่อเปรียบเทียบกับการใช้เกณฑ์อ้างอิงไทย

**สรุป:** การสำรวจภาวะโภชนาการของประชากรเด็กและวัยรุ่น ควรกำหนดให้มีรูปแบบและเงื่อนไขที่เป็นมาตรฐานเดียวกันทั้งในเรื่องการแบ่งกลุ่มอายุ เกณฑ์อ้างอิง ดัชนีชี้วัด และจุดตัดที่เหมาะสมในการระบุกลุ่มเสี่ยง เพื่อให้สามารถระบุแนวโน้มการเปลี่ยนแปลงความชุกโรคอ้วนได้อย่างมีประสิทธิภาพ