Defining obesity in childhood: current practice[1,2]

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ABSTRACT A survey of information from 26 countries was performed to examine the methods, cutoff points, and reference materials used to define obesity in childhood and adolescence. The body mass index (in kg/m^2) was used frequently, as well as several other methods. Reference materials used were often based on national surveys, although reference data from other countries were sometimes used. The data presented was often insufficient to judge the representativeness of the reference material. Cutoff points varied considerably. Available data allow neither a meaningful international estimation of the prevalence of obesity nor international comparisons. Although associated with considerable problems, this situation can be improved with an international consensus which, by necessity, will be riddled with uncertainties and compromises. *Am J Clin Nutr* 1999;70(suppl):126S–30S.

KEY WORDS Obesity, children, adolescents, body mass index, International Obesity Task Force

INTRODUCTION

Although the long-term effect of overweight and obesity on morbidity and mortality in children has not yet been well documented, several studies suggest that obesity in childhood is followed by serious consequences in adulthood (1, 2). Childhood obesity often tracks into adulthood (3–5). Epidemiologic studies of long duration are needed to explore these issues more thoroughly.

Obesity is defined as an excess of body fat mass. Body mass index (BMI; in kg/m^2) has achieved international acceptance as a standard for the assessment of obesity in adults and correlates with body fat (r = 0.7–0.8) (6). In children, factors such as growth make definitions more complex. Therefore, different methods have been used to calculate prevalence of childhood obesity internationally.

The working group on childhood obesity of the International Obesity Task Force (IOTF) proposed to determine the prevalence of obesity in children and adolescents worldwide and to analyze secular trends internationally. This article is an analysis of the application of different standards using data from different countries. The results indicate clearly that an internationally applicable standard is needed to allow comparisons.

MATERIALS AND METHODS

Data were selected from 30 countries in which published or unpublished data were available. Useful information was obtained from 26 of these countries. The selection procedure for the populations studied in these reports as well as the methods used for measurements are found in references (7–31) or in unpublished communications.

RESULTS

BMI has been used in many countries, although cutoff points used vary between the 85th and 97th percentile **(Table 1)**. Weight-for-height, as well as weight/ideal weight are also often used, the latter with a cutoff limit of >120%. The use of skinfold thicknesses and weight:height^3 was reported by several countries.

To define obesity, a reference population is needed (**Table 2**). Many countries have collected their own reference material. In other countries American (23), British (20), and French (3) as well as the Tanner and Whitehouse (32) standards have been used as references.

The 85th percentile limit of reference standards at different ages from Australia (30), the United Kingdom (20), and the United States (23) are shown in **Figure 1**. The Australian and US curves overlap and the British data are slightly lower. Such

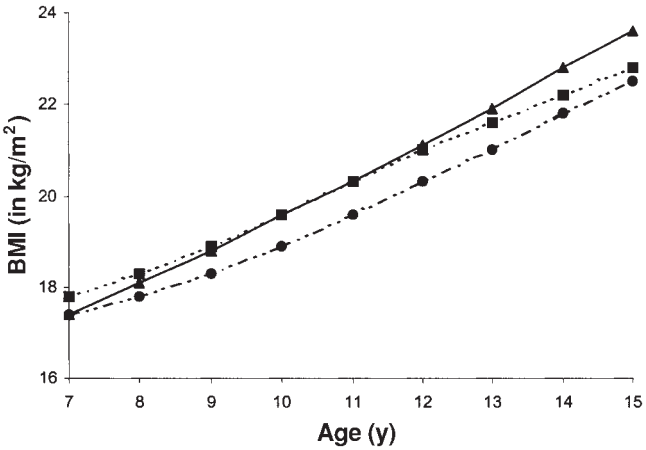

FIGURE 1. Comparison of the 85th percentile cutoff points of BMI for the United States (▲) (23), United Kingdom (●) (20), and Australia (■) (30).

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TABLE 1
Indexes and cutoff points used in different countries to define obesity[1]

Country and reference	BMI	Weight/height[3]	Weight-for-height	Weight/ideal weight	Skinfold thickness
	Percentile		*%*	*%*	*Percentile*
Europe					
Belgium (7, 8)	>97th			>120	
Czech Republic[2]					NA
Denmark (9)	NA				
Finland (10)	>90th				>90th
France (3)	>90th				
Germany (11)				NA	
Greece (12)	>90th				
Hungary[3]	>90th				>90th
Italy (13, 14)	NA			>120	
Spain (15)	NA		NA		NA
Sweden (17)	NA			>120	
Netherlands (18, 19)	>97th				
United Kingdom (20, 21)	>90th	NA			
North and South America					
United States (whites) (23–25)	>95th	>85th	>120		
Canada[4]	>95th				
Argentina[5]			>120		
Chile[6]				>120	
Venezuela[7]			>120		
Asia					
Hong Kong (26)			>120		
Japan[8] (27)	>90th	NA		>120	
Singapore[9]			>120		
Taiwan[10]			>120		
Thailand (29)			>120		
Saudi Arabia (31)	>95th				
Australia (30)	>85th			>120	

[1] NA, not available.
[2–10] Personal communications, 1997: [2] P Blaha; [3] I Dober; [4] C Bouchard; [5] E Carmuega; [6] M Diaz, J Kain, R Uauy; [7] M Lopez Blanco; [8] Y Matsuzawa; [9] U Rajan; [10] N-F Chu.

apparently small differences may, however, be important. Data from children aged >10 y from Australia and >8 y from the United Kingdom appear to be systematically lower than those from US children. These differences appear to increase with age.

Even small differences in BMI cutoff values may produce widely different estimates of the prevalence of obesity when applied to other countries. This is illustrated in **Figure 2** with examples from 6 countries, where the 85th percentile BMI-for-age of the US (23) and the UK (20) standards were applied. For the youngest children (aged 6–8 y), the UK standard gave 0–4% lower prevalence estimates than did the US standard. After age 9 y, the differences were reversed; 3–13% higher prevalence estimates of obesity were obtained when the UK standards were used as the reference compared with the US standards.

Discrepancies in the prevalence of obesity may be even greater if different indexes are used (**Table 3**). In Hungary, when the 90th percentile of triceps skinfold thickness of the Tanner and Whitehouse (32) reference was used to define obesity, the prevalence was ≈3% higher than when the 90th percentile of the BMI of the local population was used. In Argentina, when the 85th percentile of the US first National Health and Nutrition Examination Survey (NHANES I; 23) was used, the prevalence of obesity was more than double the prevalence obtained when the cutoff of >120% of weight-for-height of a local reference population was used. More dramatic differences in the prevalence of obesity were obtained when the cutoff of the local >120% weight-for-height, the US NHANES I (23) and the UK (20) reference standards were applied to the Singaporean data from children (**Figure 3**).

DISCUSSION

This survey of data on childhood obesity examined measurements of obesity, reference material used in different countries, and the use of various methods for identifying the prevalence of obesity in children.

When estimating obesity in children, various means have been used to adjust the effect of body weight on height. Both age and sex affect such adjustments, resulting in complex relations (33) that may also show local variations. The information now available suggests that BMI is used frequently, particularly in Europe. Data collected before 1990 indicate that BMI was less frequently used at that time (34). Furthermore, more European centers now report data on prevalence of obesity in children. The organization and activities of a European Child Obesity Group might have helped to accomplish these changes (35). In North and South America several indexes have been used, which may reflect a lack of consensus. In Latin America and Asia weight-for-height is often used, except in Japan, where BMI is reported.

TABLE 2
Standards from different populations used in different countries to determine the prevalence of obesity

Country and reference	Standard (reference)			
	Local	US (23)	Tanner and Whitehouse (32)	French (3)
Europe				
Belgium (7, 8)	✔			✔
Czech Republic[1]			✔	
Denmark (9)	✔			
Finland (10)		✔	✔	
France (3)	✔			
Greece (12)		✔		
Hungary[2]	✔		✔	
Italy (13, 14)	✔		✔	
Spain (15)	✔			
Sweden (17)	✔			
Netherlands (18, 19)				✔
United Kingdom (20, 21)	✔			
North and South America				
United States (white) (23–25)	✔			
Canada[3]		✔		
Argentina[4]	✔	✔		
Chile[5]	✔	✔		
Venezuela[6]	✔	✔		
Asia				
Hong Kong (26)	✔			
Japan[7]	✔			
Singapore[8]	✔			
Thailand (29)	✔			
Saudi Arabia (31)		✔		
Australia (30)	✔	✔		

[1–8] Personal communications, 1997: [1] P Blaha; [2] I Dober; [3] C Bouchard; [4] E Carmuega, AM O'Donnel, P Duran; [5] M Diaz; [6] M Lopez Blanco; [7] Y Matsuzawa; [8] U Rajan.

The definition of cutoff points for overweight and obesity vary from above the 85th to above the 97th percentiles. Nomenclature also varies; the 97th percentile of BMI is called obesity in Netherlands (18, 19) and super-obesity in France (3).

Most surveys relied on local populations with a defined cutoff point above which obesity was considered to be present. Little information was provided on sample size, sample selection, representation, or refusal rates.

The data available for estimates of prevalence are far from complete, and represent only the responses to a limited inquiry. Nevertheless, the results seem to provide some useful information. Different methods, cutoff points, and reference material were used. This makes international comparisons of the prevalence of childhood obesity of limited value at present. Clearly an international consensus on definitions is needed.

The definition of childhood and adolescent obesity remains unclear. In adults, the comorbidities of obesity can be used to establish cutoff points. Subgrouping into central and peripheral obesity is useful because of the higher risks associated with the former (36). However, morbidity occurs less frequently in children, and the role of body fat distribution has not been studied thoroughly (37–39). The psychologic problems associated with childhood obesity caused by frequent exclusion from group activities are also important to consider. Because discrimination (40, 41) as well as metabolic comorbidities (39–42) follow BMI closely, use of BMI may be justified when screening a population. How well BMI measures body fat mass in children may become a greater problem when different populations are screened and compared.

The definition of obesity in childhood and adolescence is clearly an important question but is hampered by several difficulties. This question should be resolved by consensus and compromise so that we can begin to examine the prevalence of childhood obesity worldwide. In addition, further screening and follow-up of populations is needed to improve the basis on which future decisions will be made.

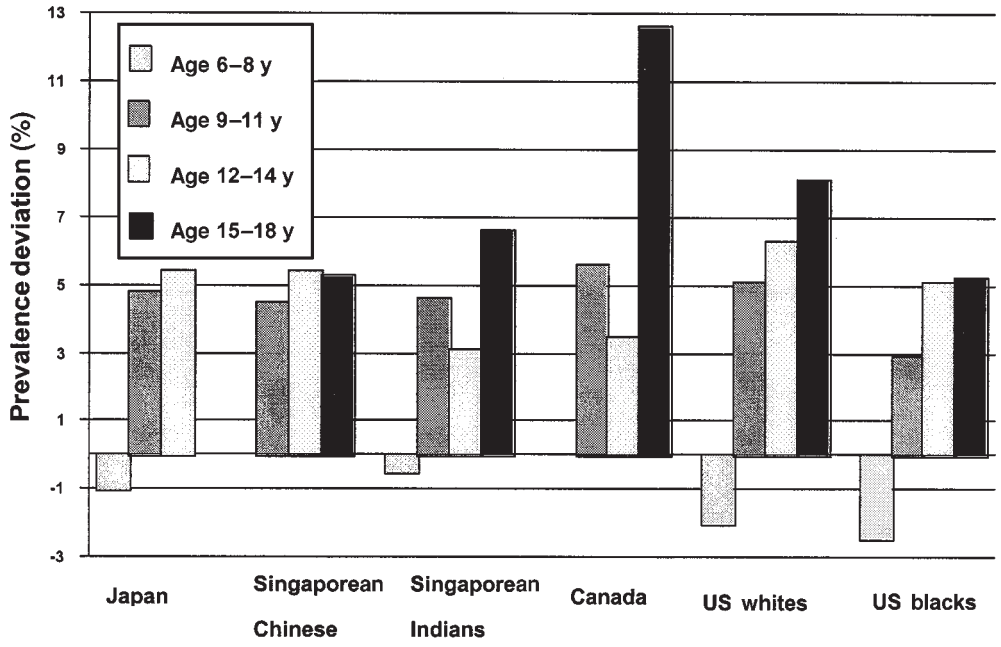

FIGURE 2. Difference in prevalence of obesity when applying the UK reference standard (20) compared with the US reference standard (23).

TABLE 3
Prevalence of obesity in Hungary and Argentina as measured with different indexes

Country, subjects, and index used	Prevalence of obesity
	%
Hungary (6–18-y-olds)[1]	
>90th percentile of triceps skinfold thickness using Tanner and Whitehouse (32) as reference	16.3
>90th percentile of BMI using a local reference	13.2
Argentina (Schoolchildren)[2]	
>120% of weight-for-height using a local population as reference	14.0
>85th percentile of BMI of US NHANES I (23)	33.0

[1,2] Prevalence rates estimated by using data obtained from [1] I Dober, 1997 and [2] E Carmuega et al, 1997. NHANES I, first National Health and Nutrition Examination Survey.

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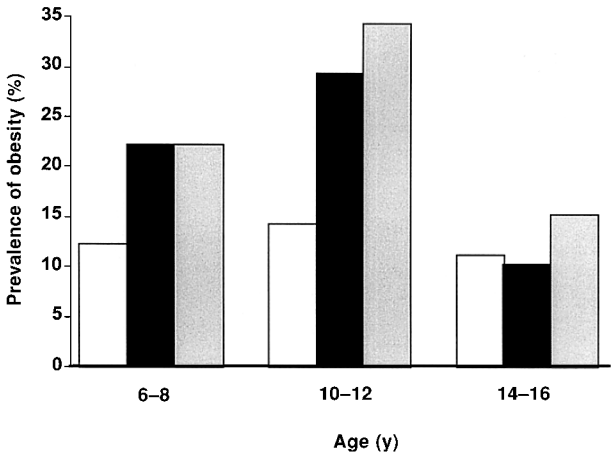

FIGURE 3. The prevalence of obesity in Singaporean children when using different reference standards: □, Singaporean standard, weight-for-height >120%; ■, US standard (23), BMI above the 85th percentile; and ■, UK standard (20), BMI above the 85th percentile.

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