

INCREASING OBESITY IN SCHOOL CHILDREN IN A TRANSITIONAL SOCIETY AND THE EFFECT OF THE WEIGHT CONTROL PROGRAM

Ladda Mo-suwan, Chaon Junjana and Areeruk Puetpaiboon

Department of Pediatrics, Faculty of Medicine, Prince of Songkhla University, Hat Yai, Songkhla 90112, Thailand

Abstract. Childhood obesity is an increasing problem in developed countries. Its persistence into adulthood with accompanied health risks has raised many concerns. In a country with rapid growing economy and changing life styles such as Thailand, the natural history of obesity in school children aged 6-12 years was investigated. Yearly weight and height measurements were performed from 1991 onwards. Of 1,156 primary school children enrolled in 1991, two year follow-up was possible in 1,106 cases. Prevalence of obesity, as diagnosed by weight-for-height > 120% of the Bangkok reference, rose from 12.2% in 1991 to 13.5% in 1992 and 15.6% in 1993. In two years, 74 non-obese children became obese while 28 obese children showed the opposite trend. For those obese children who attended the weight control program, their body mass indices and triceps skinfold thickness increased significantly less than those of the non-attendees in the first year. These findings persisted in the second year but were of a smaller magnitude. Results of this study demonstrate the trend of increasing obesity in school children in the transitional society and the short term benefit of a weight control program.

INTRODUCTION

Childhood obesity is a major nutritional problem in most developed countries. In the United States, the prevalence of obesity among children during 1963-1980 has increased 54% and 30% in the 6-11 year-olds and 12-17 year-olds, respectively (Gortmaker *et al*, 1987). Increasing pediatric obesity raises concern because of the accompanying health risks. Follow-up of 504 overweight Swedish children showed persistence of obesity in 47% of them 40 years later (Mossberg, 1989). In comparison with the reference population, this group had significant increased risks of cardiovascular disease, diabetes, hypertension, locomotor and digestive diseases by 1.5 to 4 fold.

In a developing country like Thailand, with its economy and society in a transitional state, its nutritional problems are of both extremes. While nutritional deficiency diseases are still prevalent in the rural area and some pockets in the slums of most big cities, the urban Thais are facing the problem of overnutrition (Tanphaichitr *et al*, 1991). It is important to investigate whether childhood obesity is a problem and the trend of increasing obesity also holds for this transitional society. We report here the two year follow-up study

of obesity in school children aged 6-12 years and the results of a weight control program on the adiposity of the obese children.

MATERIALS AND METHODS

Study site: Hat Yai, one of the large cities in southern Thailand, is about 1,000 km from Bangkok and only 100 km from the Malaysian border. It is the business center of rubber, sea-food, wood-furniture and tourism industries. Having grown rapidly in the past decade, the population was about 300,000 in 1991, 50% residing in the municipality.

Sampling of subjects: Sample size was calculated by the following formula:

$$\text{sample size, } n = \frac{p(100-p)}{d^2} Z^2$$

Given : estimated prevalence, $p = 10\%$
acceptable error, $d = \pm 2$

$$Z = 1.96 \text{ at } \alpha = 0.05$$

$$n = \frac{10(100-10)(3.842)}{2^2}$$

$$= 864.45$$

INCREASING OBESITY IN SCHOOL CHILDREN

To compensate for drop-outs, we decided to recruit at least 1,000 children. The subjects were primary school (grade 1-6) children, aged 6-12 years old. By using the two-stage cluster sampling, firstly, 6 out of 12 primary schools in the Hat Yai municipality were sampled, 2 public and 4 private schools. Secondly, in each school we sampled class-rooms from each grade. Enrolment of 1,156 children was started in January 1991.

Measurements: Subjects wore student uniforms without belts, all possessions were taken out from the uniform pockets and shoes were taken off. Weights and heights were measured on a Detecto beam-balance and stadiometer. Triceps skinfold thickness (TSF) was measured by using a Harpenden caliper.

Anthropometric measurements were performed yearly in January. For children leaving or changing the school, only those who were still in Hat Yai could be followed.

Weight control program: This was started in April 1991. Mainstay of the therapy includes diet control and exercise. Follow-up is every 2 weeks for the first 2 visits, then monthly and bimonthly for 2 visits each and finally every 3 months. The goal of the program is to control weight till the subject grows to his or her final height. Weight reduction is aimed only in the severely obese (weight-for-height > 160% of the reference).

Statistical analysis: Subjects were classified as underweight, normal, overweight and obesity if their weight-for-height (wt-for-ht) values were < 90, 90-110, > 110-120, > 120% of reference values of Bangkok children (Poskitt, 1987; Wichaidit, 1990). The body mass index (BMI), the ratio of

weight-to-height squared in kg/m², was also calculated for each subject. Descriptive statistical analysis and *t*-test were performed.

This study was approved by the Ethics Committee of Faculty of Medicine, Prince of Songkla University.

RESULTS

Of 1,156 subjects, the follow-up was complete in 1992 whereas 50 children (4.3%) were lost in 1993. Prevalence of obesity was 12.2% and gradually increased to 13.5% in 1992 and 15.6% in 1993. The prevalence of obesity was a little higher when using the NCHS data as the reference, 12.5% with NCHS reference vs 11.5% with the Bangkok reference.

Table 1 shows the anthropometric classification by wt-for-ht criteria of the remaining 1,106 children in 1991 and 1993. Most of the children were able to maintain their status quo. Nevertheless the trend of increasing obesity was observed. Seventy-four formerly non-obese children had turned obese in two years whereas less (28) children had the opposite trend.

From 141 obese subjects in 1991, only 18 children decided to attend the obesity clinic for the weight control program. Demographic characteristics and the degree of obesity as categorized by wt-for-ht of the attendee and non-attendee were not different (Table 2). The rate of weight increment was lower in the attendee group. Their BMI increase was significantly less in the first year ($p=0.01$) (Table 3). This finding persisted in the second year but in much smaller magnitude ($p=0.793$). Similar findings were also observed in the analysis of the TSF values.

Table 1

Anthropometric classification by weight-for-height criteria of 1,106 school children in 1991 and 1993.

1991 Anthro- pometric classes	1993 anthropometric classes			
	Under-weight	Normal	Overweight	Obesity
Underweight	127	53	12	0
Normal	79	224	74	7
Overweight	3	79	244	67
Obesity	0	1	27	109

Table 2
 Characteristics of the obese children attendees vs non-attendees.

	Attendee	Non-attendee	p
Age (y)	10.2 ± 1.6	9.5 ± 1.7	0.09
Sex (M : F)	13 : 5	61 : 62	0.12
Level of obesity			0.32
Mild	11	95	
Moderate	6	25	
Severe	1	3	

Table 3
 Anthropometric changes of the obese children in two years (1991-1993).

	Weight control program		
	Attendee	Non-attendee	p
BMI at the beginning (kg/m ²) (1991)	23.52 ± 2.51	22.01 ± 2.55	0.02
BMI changes			
1 yr (1992)	0.05 ± 1.27	0.94 ± 1.41	0.01
2 yr (1993) ^a	1.34 ± 1.83	1.48 ± 2.19	0.79
TSF at the beginning ^b (1991) (mm)	21.26 ± 4.39	18.78 ± 3.81	0.01
TSF changes			
1 yr (1992) ^b	0.13 ± 4.28	2.08 ± 3.7	0.04
2 yr (1993) ^c	2.70 ± 7.21	3.46 ± 4.73	0.56

^a Only 119 from the total of 123 non-attendee were available for follow-up in 1993.
^b TSF values of 118^b and 117^c from 123 non-attendee were available.

DISCUSSION

Prevalence of childhood obesity in this study was approaching that (3-20%) of the US (Neumann, 1977). The number of obese children kept rising, about 35% in two years. This shows that the increasing obesity observed in the developed countries also happens in the urban setting of a country with rapidly growing economy like Thailand.

Several studies have demonstrated the association of childhood obesity with an increased risk of becoming obese in adulthood (Charney *et al*, 1976; Abraham *et al*, 1970; Stark *et al*, 1981; Abraham and Nordsieck, 1960). The percentage

of obese children becoming obese adults goes from 14 to 41 to about 70 percent as the children go from 6 months to 7 years to 10 to 13 years of age. The relative risk of a child becoming an obese adult markedly increases with age in comparison to thinner peers, from 2.33 in infancy to 6.3 or 6.55 in preadolescence (Epstein *et al*, 1985). Tracking of children for 12 years in the Bogalusa Heart Study showed that atherogenic lipoprotein profile is best predicted by the baseline level and second best by the obesity index (Webber *et al*, 1991). Moreover, increased risks to cardiovascular disease, diabetes, locomotor and digestive diseases were found in those who were overweight in childhood 40 years later (Mossberg, 1989). Concern of continuation of obesity from childhood

into adulthood and its associated health risks lead to intervention program for pediatric obesity.

Weight loss is relatively small and cannot be maintained in most treatment programs for adult obesity (Wing and Jeffery, 1979). Outcome in children is not any better. Only 10-30% of the children could achieve weight loss, which is no better than the natural remission depending on the severity of obesity (Barness *et al*, 1981; Borjeson 1962).

The program with diet control (traffic-light diet), exercise and behavior modification gave different results. Children under such program could maintain their weight loss longer. Almost half (42%) of them were non-obese 5 years later (Epstein *et al*, 1985). Inclusion of the parents in the program produced longer effect. The experimental group had significantly greater decreases in percent overweight after 10 years (-7.5%) than the control group (+14.3%) (Epstein *et al*, 1990).

Our program, aiming at weight control, does not induce any weight loss. Gains in weight during the first year were, however, slower in the group under the present program when linear growths are taken into consideration (BMI difference: 0.05 ± 1.27 for attendee vs 0.94 ± 1.41 for non-attendee, $p=0.01$). In the second year, the benefit of the present program is still detectable but with much smaller effect (BMI difference: 1.34 ± 1.83 for attendee vs 1.48 ± 2.19 for non-attendee, $p=0.79$). The results show that our treatment program can reduce the gain in adiposity in the short term but the effect may not last long.

Determination to lose weight of the children who attend our program dictates the outcome. Since the program demands high commitment in term of number and frequency of the visits, we did not perform randomization. Attendance of the program is on the voluntary basis. Not surprisingly the baseline means of BMI and TSF are higher in the attendee group, hence explaining the greater motivation and result of the program.

From our study, the obese started rapid weight gain during preschool and school periods, 45.5% at 1-5 years of age and 48.5% at 6-10 years of age. Given the minimal effects of the treatment program and the onset of obesity in the school years, schools may be the suitable places to implement the obesity prevention program. Combined nutrition education and physical activity program will not only

benefit the obese children (Brownell and Kaye, 1982) but also the non-obese to improve their fitness and lay the foundation for healthy food habits. Similar programs should also provide for infants and children with risk factors in the early years of life. A developing country moving towards industrialization, resulting in rapidly changing economy and transitional society like Thailand, should be well aware of the increasing childhood obesity. Ignorance of the problem will result in prevalence of high morbid chronic illnesses in adults which is more expensive than the intervention program in childhood.

ACKNOWLEDGEMENTS

This project was financially supported by the Research Fund from the Songkhlanagarind Hospital Foundation.

REFERENCES

- Abraham S, Nordsieck M. Relationship of excess weight in children and adults. *Public Health Rep* 1960; 75 : 263-73.
- Abraham S, Collins C, Nordsieck M. Relationship of child weight status to morbidity in adults. *Public Health Rep* 1970; 86 : 273-84.
- Barness LA, Dallman PR, Anderson H, *et al*. Nutritional aspects of obesity in infancy and childhood. *Pediatrics* 1981; 68 : 880-3.
- Borjeson M. Overweight children. *Acta Paediatr Scand* 1962; 51 (Suppl 132) : 64-69.
- Brownell KD, Kaye FS. A school-based behavior modification, nutrition education, and physical activity program for obese children. *Am J Clin Nutr* 1982; 35 : 277-83.
- Charney M, Goodman HC, McBride M, *et al*. Childhood antecedents of adult obesity : Do chubby infants become obese adults? *N Engl J Med* 1976; 295 : 6-9.
- Epstein LH, Wing RR, Valoski A. Childhood obesity. *Pediatr Clin North Am* 1985; 32 : 363-79.
- Epstein LH, Valoski A, Wing RR, McCurley J. Ten-year follow-up of behavioral family-based treatment for obese children. *JAMA* 1990; 264 : 2519-23.
- Gortmaker SL, Dietz WH, Sobol AM, Wehler CA, Increasing pediatric obesity in the United States. *Am J Dis Child* 1987; 141 : 535-40.

- Mossberg HO. 40-year follow-up of overweight children. *Lancet* 1989; 2 : 492-3.
- Neumann CG. Obesity in pediatric practice : Obesity in the preschool and school - age child. *Pediatr Clin North Am* 1977; 22 : 117-23.
- Poskitt EME. Management of obesity. *Arch Dis Child* 1987; 62 : 305-10.
- Stark D, Atkins E, Wolff DH, *et al.* Longitudinal study of obesity in the National Survey of Health and Development. *Br Med J* 1981; 283 : 12-7.
- Tanphaichitr V, Kulapongse S, Pakpeankitvatana R, *et al.* Prevalence of obesity and its associated risks in urban Thais. In : Oomura Y, Tarui S, Inoue S, Shimazu T, eds. *Progress in Obesity Research* 1990. London : John Libbey 1991: 649-53.
- Webber LS, Srinivasan SR, Wattigney WA, Berenson GS. Tracking of serum lipids and lipoproteins from childhood to adulthood. *Am J Epidemiol* 1991; 133 : 884-99.
- Wichaidit S. Weights, heights and other anthropometric data of Thai children. Bangkok : Prayoonwong Printing Group. 1990: pp 62-73, 159-60, 165-6.
- Wing RR, Jeffery RJ. Outpatient treatments of obesity : A comparison of methodology and results. *Int J Obes* 1979; 3 : 261-79.