Original article

**ACUTE EFFECT OF CHILDREN AND FAMILY BASED INTERVENTION IN TREATING CHILDHOOD OBESITY**

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**Abstract**

Overweight and obesity in children has dramatically increased worldwide. Few researches on prevention approaches in targeted high-risk populations are reported. Thus, the aim of this study was to determine the efficacy of family and children based intervention on the body mass index (BMI) percentile change and anthropometric measure change in overweight/obese children. Three hundred and twelve children aged 6-8 years participated in this study. Overweight and obesity were categorized using the BMI criterion from the International Obesity Task Force (IOTF). The overweight/obese children and their parents were invited to join the intervention, which included giving lectures on health education and behavioral modification, distributing printed material and holding discussion meetings. The changes in BMI percentile, BMI value and triceps skin thickness (TST) value of the overweight/obese children were examined at baseline, pre- and post- 14 weeks intervention. Approximately 20% of the children were found to be overweight/obese at baseline screening. After 14 weeks intervention, the BMI percentile change of the overweight/obese children had improved. Moreover, the BMI value was significantly reduced, whereas, the TST value had not increased when compared with those of pre-intervention. Thus, providing intervention comprising health education, behavioral modification and discussion meetings for family and children led to an improvement in childhood overweight/obesity. *Chiang Mai Med Bull* 2006;45(4):145-153.

**Keywords:** overweight, obesity, intervention, BMI, TST

Overweight and obesity in children are large-scale, global and public health concerns. Obesity prevention approaches are needed at normal population level as well as in targeted high-risk populations. Most primary prevention studies have included at least one of the following components: dietary changes, nutrition/health education, physical activity,
behavior and social modification, and family participation.(2) In addition, changes in lifestyle, attitudes and motivation, and also the context in which the person lives including family, peers, school and community should be recognized.(2,3) Thus, knowledge of factors related to obesity, as mentioned above, should be implemented to overweight/obese children as fast as possible to prevent adult obesity. Therefore, this study integrated those interventions and provided them for overweight/obese children and their parents. The effect of combined intervention on the BMI percentile change of overweight/obesity and anthropometric measure change were studied.

Methods

Subjects and study design

Three hundred and twelve children aged 6-8 years of age, who were attending Chiang Mai Kindergarten School, Chiang Mai, participated in this study, which was approved by the Ethics Committee of the Faculty of Associated Medical Sciences, Chiang Mai University. Informed consent was obtained from their parents or guardians. Body weight, height, triceps skinfold thickness (TST) and waist circumference (WC) of each child were measured on three occasions: at baseline screening (Aug 2005), pre-intervention and post-14 weeks intervention (Mar 2006). The duration between baseline and pre-intervention was 14 weeks. Anthropometric measurements were performed by trained examiners. Body mass index (BMI) was calculated as body weight divided by height squared (kg/m²). Children were assigned into 3 groups based on the BMI criterion according to Cole et al.(4) normal weight (NW); overweight (OW), and obese (OB). Children who were classified as overweight/obese were informed and included in the intervention program.

Intervention components

The intervention involved giving lectures, distributing printed material and holding discussion meetings with families and children. The lectures were given by two Pediatricians and a physiotherapist. The contents of the lectures and printed material was composed of 4 subjects including lifestyle modification (L), environment modification (E), the adverse effect of childhood obesity (A) and nutrition (N) (LEAN). Various obstacles in preventing childhood obesity and some solutions were raised and debated. Parents and children were encouraged to solve the problem in their own way. To arouse consciousness in the children and their parents on being overweight/obese and the practice of a healthy lifestyle, a session of WC measurement was taught to the parents. They were asked to take a measurement of their children’s WC at least once a month and record it in a booklet. Children whose parents recorded at least 3 WC measurements at the end of the intervention period were rewarded.

Anthropometric assessment

Body weight and height were measured for each participant using the mechanical beam medical scale (Health O Meter 402KL) according to standard practice.(5) Triceps skinfold was determined through the use of a Lange skinfold caliper on the right side of the body. The triceps skinfold locus, which is halfway between the acromion and olecranon on the back of the arm, was measured with the elbow stretch out. Readings were taken 3 seconds after the caliper jaws were released.(5) Waist circumference was measured laterally at the narrowest part of the torso between the
lowest rib margin and the iliac crest, and
anteriortly midway between the xiphoid process
of the sternum and the umbilicus at the end of
gentle expiration. Two measurements were
taken to the nearest centimeter using a
flexible tape. If the two measurements were
identical, then that value was used. If the two
measurements differed, a third value was
taken to determine which one was correct.(6,7)
All anthropometric equipment was calibrated
before each measurement period.

**Statistical analysis**

Descriptive statistics for the anthropomet-
ric data were presented as mean± SD. Repeated-measures analysis of variance
(ANOVA) was used to compare the mean
BMI and TST between baseline, pre- and post-
intervention. After a significant difference was
detected in the ANOVA, LSD post-hoc com-
parisons were made to determine where the
differences occurred. The BMI percentile
change of overweight/obese children was
determined as percentage change in normal,
overweight and obese from baseline to
pre-intervention, and from pre- to post-inter-
vention, using the cut-off percentile points
suggested by Cole et al.(4) All analyses were
performed using the statistics system SPSS
10.0.

**Results**

The distribution of obese, overweight and
normal weight in boys and girls at baseline
screening, pre- and post- 14 weeks interven-
tion are shown in Table 1. The incidence of
overweight (n=38) and obese (n=21) was
approximately 20% at the initial measurement.
Boys and girls were similar in the distribution
of overweight/obese. In comparison with
baseline, the fatness distribution was improved
at both pre- and post-intervention. From
baseline to pre-intervention, the number of
overweight children was reduced and the num-
ber of normal weight children was increased.
However, an increase of obese children was
also found. After receiving the intervention,
the number of obese children was decreased,
whereas, the number of overweight and
normal weight children was increased. These
results might be in part due to growth during
the period of follow-up. The pattern of changes
in the obesity category at pre- and post-inter-
vention were still not clear. Thus, the per cent-
age distribution of the adiposity status in
obesity, overweight and normal weight catego-
ries between the baseline and pre-intervention
period was classified, as shown in Fig. 1. This
status had no intervention and pre- to post-
tervention period, which received the health
education program. It was found that in the

| Table 1. Results of the change in BMI classification according to Cole et al(4) between 3 trials (baseline, pre-
| intervention and post intervention) in boys and girls (N=59) |
|----------------|----------|----------|----------|----------|----------|----------|----------|----------|
| Classification |OB |OW |NW |OB |OW |NW |OB |OW |NW |
| boys | 10 | 17 | 0 | 13 | 12 | 2 | 10 | 12 | 5 |
| girls | 11 | 21 | 0 | 11 | 19 | 2 | 9 | 20 | 3 |
| Total | 21 | 38 | 0 | 24 | 31 | 4 | 19 | 32 | 8 |
| OB: obese, OW: overweight, NW: normal weight |
obese category with no intervention period, 80.95% (17 out of 21) and 19.05% (4 out of 21) of obese children remained obese and became overweight, respectively, and no children reached normal weight. The intervention period showed an improvement, when the percentage of obesity was decreased to 70.83% (17 out of 24), with 29.17% (7 out of 24) becoming overweight and no child reaching normal weight. A similar trend was also demonstrated in the overweight category. With no intervention, 71.05% (27 out of 38) of them remained overweight, 18.42% (7 out of 38) of overweight children became obese and 10.53% (4 out of 38) reached normal weight. After receiving the intervention, the percentage of overweight (77.42%, 24 out of 31) and normal weight children (16.13%, 5 out of 31) was increased, whereas, the percentage of overweight children that became obese was reduced (6.45%, 2 out of 31). An improvement was also shown in the normal weight category after intervention, when 75% of children were identified as normal weight (3 out of 4) and 25% (1 out of 4) overweight, whereas, normal weight children were not found in the no intervention period. It could be concluded that after receiving the intervention, roughly 20% of the overweight and obese children demonstrated more improvement than those in the no intervention period.

Repeated measure analysis depicted significant differences for both variables; BMI ($F_{2,116} = 4.48$, $p=0.02$) and TST ($F_{2,116} = 38.26$, $p=0.001$). BMI and TST values of the overweight/obese children from the 3 measurement periods are shown in Figure 2 and 3, respectively. LSD post hoc comparisons indicated

![Figure 1. Percentage distribution of the adiposity status in obesity (OB), overweight (OW) and normal weight (NW) categories between a no intervention period and after receiving an intervention period (N=59).](image-url)
Figure 2. Comparisons in body mass index (BMI) of overweight and obese children between baseline, pre-intervention and post-intervention (N=59).

Figure 3. Comparisons in triceps skinfold thickness (TST) of overweight and obese children between baseline, pre-intervention and post-intervention (N=59).
that BMI was significantly increased from baseline to pre-intervention ($p<0.01$). However, after receiving the intervention, BMI markedly decreased when compared with the value at pre-intervention ($p<0.05$). A similar outcome was found in TST between baseline and pre-intervention ($p<0.001$), but no alteration in TST value between pre- and post-intervention. Therefore, the intervention program attributes a favorable effect on BMI and TST in overweight/obese children.

**Discussion**

Effective intervention for treating childhood obesity including dietary change, reduction of sedentary behavior, lifestyle modification, and family involvement have been mentioned in many studies.\(^{(8-12)}\) Active participation from children also contributed to the effectiveness of intervention. Doak\(^{(13)}\) suggested that an education-based intervention might simply encourage children to be more active and alter their behavior. Audiovisual and discussion meetings on dietary change with teachers and parents led to reductions in the prevalence of overweight and obesity.\(^{(14)}\) Therefore, this study integrated these strategies to include the overweight and obese children. Integrating the communication techniques for behavioral changes, including seminars and discussion meetings, was also introduced simultaneously into the intervention. The results revealed that, at the initial measurement, the percentage of overweight children was almost twice that of obese children. Thereby, the incidence of children overweight and obese was 12.18% and 6.73%, respectively. In the no intervention period, an improvement in adiposity of overweight and obese children was found. This may be explained in part by the health awareness of parents and children. The aims of this study and fatness categories of each child were informed to the parents before and after baseline screening. However, it was found that the fatness distribution of overweight and obese children was also improved after intervention period (Figure 1). Fatness distribution improved at all levels of categories including obesity and overweight. For example, in the obese category, the percentage of obese children was decreased by becoming overweight during the intervention period. In the overweight category, a reduction in the percentage of obese children was shown to be nearly 3 times greater after the intervention, when it reached overweight and normal weight categories.

When considering the anthropometric change, the BMI and TST values of overweight/obese children were significantly increased from baseline to pre-intervention. However, after giving intervention a statistical reduction in BMI value and minimal increase in TST value of the overweight/obese children were found (Fig. 2 and 3). These results indicated that the increment of BMI and TST values in no intervention period may be caused by the growth within a time period, whereas, the intervention may contribute to deceleration of BMI and TST development according to the growth of overweight and obese children. Thus, it can be concluded that family and children based intervention including health education, dietary and lifestyle modifications, and environment modification via seminars and discussion meetings, was helpful in treating childhood overweight/obesity. However, in consensus with the studies Graf,\(^{(15)}\) involvement of the parents should be intensified in order to reduce the incidence of overweight and obesity further. As a role model, the parents have a significant influence on their children’s perception of lifestyle and behavior.\(^{(13)}\)
through determining the home environment.\(^{(11)}\)

There have been several reports on the effect attributed to family participation on the improvement in BMI\(^{(16-17)}\) and skinfold thickness.\(^{(18)}\) In this study, two seminars were provided for parents and overweight/obese children at different places and times. All children attended once at least, whereas, the parents participation was relatively small. Therefore, the printed material, booklets, instruction and equipment for measuring waist circumference were sent to parents via the children instead. There was a limited number of waist circumferences reported from parental records. Therefore, waist circumference analysis could not be done. Many contributing factors including family concern, education level, and socio-economic change during the intervention period may have affected the outcomes. Additionally, an effective communication approach should be concerned with individuals according to cultural specificity.\(^{(19)}\)

Therefore, frequent contact for encouragement and support via the phone is needed for future study.

**Conclusions**

A fourteen week period of LEAN intervention offers 20% favorability in adiposity in overweight and obese children. The deceleration in growth of BMI and TST after intervention and the improvement in BMI percentile indicated a remarkable step in the prevention of further childhood obesity. To gain more benefit from the program, encouragement for parental participation should be intensified.

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**References**


ผลระยะสั้นของการแก้ปัญหาโรคอ้วนในเด็กโดยการมีส่วนร่วมของเด็กและครอบครัว

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บทคัดย่อ ภาวะน้ำหนักตัวเกินและอ้วนในเด็กเพิ่มขึ้นอย่างรวดเร็วในทั่วโลก แต่การมีรายงานไม่มากนักถึงวิธีการป้องกันในเด็กกลุ่มนี้ การศึกษาต่อมาในระยะยาวจะเป็นสิ่งที่สำคัญในการป้องกันโรคอ้วนในเด็ก ด้วยการมีส่วนร่วมของเด็กและครอบครัวในกระบวนการรักษาจึงเป็นสิ่งที่ควรได้รับการศึกษาอย่างเพิ่มเติม โปรแกรมการรักษาที่นี้ได้รับการตั้งชื่อว่า Program for the Treatment of Childhood Obesity (PTCO) โดยมีวัตถุประสงค์เพื่อศึกษาการเปลี่ยนแปลงเปอร์เซนต์ไทล์ของค่าดัชนีมวลกายระหว่างเด็กน้ำหนักเกินและอ้วนในเด็กที่มีอายุ 6-8 ปี จำนวน 312 ราย ซึ่งจะรับการจัดทำภาวะป้องกันน้ำหนักเกินและอ้วน โดยใช้ค่าดัชนีมวลกายตามเกณฑ์อ้างอิงของ the International Obesity Task Force (IOTF) เด็กที่ได้รับการจัดทำภาวะป้องกันน้ำหนักเกินและอ้วน รวมทั้งครอบครัวจะได้รับการร่วมโปรแกรมการรักษาซึ่งประกอบด้วยการบรรยายความรู้ทางด้านสุขภาพ การปรับเปลี่ยนพฤติกรรมสุขภาพ แจกเอกสารและสัมมนา และทำการประเมินการเปลี่ยนแปลงเปอร์เซนต์ไทล์ของค่าดัชนีมวลกายและความหนาของไขมันใต้ผิวหนัง triceps ในเด็กน้ำหนักเกินและอ้วน จะต้องมีการจัดทำโปรแกรมการรักษาในสัปดาห์ที่ 14 ผลการศึกษาพบว่าจะมีการเปลี่ยนแปลงมีน้ำหนักเกินและอ้วนประมาณ 20 เปอร์เซนต์ หลังจากนั้นโปรแกรมการรักษาเด็กน้ำหนักเกินและอ้วนจะมีการเปลี่ยนแปลงเปอร์เซนต์ไทล์ของค่าดัชนีมวลกายในทิศทางที่ดีขึ้น ค่าดัชนีมวลกายมีมีการเปลี่ยนแปลงแต่ไม่สำคัญ ในขณะที่ความหนาของไขมันใต้ผิวหนังมีการเปลี่ยนแปลงจากการรักษาตามโปรแกรมการรักษาโดยไม่ให้ความดูดซึมของไขมัน การปรับเปลี่ยนพฤติกรรมและสัมมนาถูกเก็บเกี่ยวและเผยแพร่จากน้ำหนักเด็กเกินและอ้วนในเด็กโดย เชิงใหม่สาร 2549;45(4):145-153.

คำสำคัญ: น้ำหนักเกิน เด็ก อ้วน การรักษา ค่าดัชนีมวลกาย ความหนาของไขมันใต้ผิวหนัง
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