PROLONGED EFFECT OF CHILDREN AND FAMILY BASED INTERVENTION ON TREATING CHILDHOOD OBESITY

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Abstract The effects of modest lifestyle modifications in growing obese children using a children and family based intervention were interesting. This study was aimed to investigate the long term effect of intervention on the BMI percentile change and anthropometric measure change in obese/overweight children, compared with normal weight children. Three hundred and twelve children aged 6-7 years participated in this study. They were defined as normal weight, overweight, and obese, based on the BMI criterion from the International Obesity Task Force (IOTF). The obese/overweight children and their parents enrolled in a 1-day seminar including education and behavioral modification, and group discussion. In addition, an interview and suggestions were made for each family 4 times a year via the telephone. The anthropometric data such as BMI and WC value as well as the changes in BMI percentile of all children were examined at pre- and post- 1 year intervention. The results showed that, at follow-up, the BMI percentile change of the obese/overweight children had not altered, which compared with normal weight children (odds ratio, 1.69: 95%CI, 0.71-4.02; p=0.17). Similarly, the mean change in BMI and WC values of obese/overweight children remained significantly higher than that of normal weight children (p<0.001). Thus, long-term intervention that focused on dietary education and behavioral modification, including a follow-up 3 times a year, did not provide any advantages on the BMI percentile change, or BMI and WC values of the obese/overweight children. Chiang Mai Medical Journal 2008;47(1):19-25.

Keywords: obesity, longterm intervention, BMI percentile change, BMI, WC

According to adiposity rebound, early childhood is a critical period in the development of obesity. Previous researches on obesity management include actions in 4 realms: encour-
aging family behaviour modifications, increasing physical activity, decreasing sedentary behaviour, and improving eating practices. Moreover, parental involvement was a crucial contributing factor for the effectiveness of intervention. Thus, the combined use of these interventions should be implemented in children with obesity. However, the effectiveness of such programs in the long-term is not well established. The purpose of this study was to evaluate the long-term effectiveness of combined intervention on the BMI percentile and anthropometric measure change in obese/overweight children.

**Methods**

**Subjects and study design**

Three hundred and twelve children aged 6-7 years, attending Chiang Mai Kindergarten School, Chiang Mai, participated in the study. This study was approved by the Ethics Committee of the Faculty of Associated Medical Sciences, Chiang Mai University. Informed consent was obtained from the parents or guardians of the children. Body weight, height, and waist circumference (WC) of each child was measured before and at 1 year follow-up over the period 2005-2006. Anthropometric measurements were performed by trained examiners. BMI was calculated as body weight divided by height squared (kg/m²). Children were categorized into normal weight (NW), overweight (OW), and obesity (OB) according to the international Obesity Task Force (IOTF) cut-off points. Children who were classified as overweight/obese were informed and included in the intervention program.

**Intervention components**

The intervention involved giving lectures, distributing printed materials and holding discussion meetings with families and children. The lectures were given by two pediatricians and a physiotherapist. The contents of lectures and printed material comprised 4 subjects, including lifestyle modification, environment modification, adverse effect of childhood obesity and nutrition. Various obstacles in preventive childhood obesity and some solutions were raised and debated. Parents and children were encouraged to solve the problems in their own way. After that, they were called 4 times a year for information collection on the weight maintenance and physical activity of the children and receive some suggestions. The anthropometric data of each obese/overweight child were measured and the results informed to each child and his/her parents every 4 months.

**Anthropometric assessment**

Body weight and height were measured for each participant using a mechanical beam medical scale (Health O Meter 402KL) according to standard practice. Waist circumference was measured laterally at the narrowest part of the torso between the lowest rib margin and the iliac crest, and anteriorly 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. Each piece of anthropometric equipment was calibrated before each measurement period.

**Statistical analysis**

Descriptive statistics for the anthropometric data were reported as mean ± SD. The change of BMI was defined according to the
international BMI cut-off points and presented as a percentage change. Odd ratios were calculated using logistic regression and presented with 95% confidence intervals. One-way Analysis of Variance (ANOVA) was used to compare the anthropometric characteristics and change of BMI and WC measurements after a 1-year intervention among the 3 groups. LSD post-hoc comparisons were made when a significant F value resulted to determine where the differences occurred.

Results

Anthropometric characteristics

Two hundred and ninety-five children, who were classified as overweight/obese, were included in the intervention program. Seventeen children dropped out because they resigned (n=5) or died (n=2). Table 1 shows the baseline anthropometric characteristics including body weight, height, body mass index and waist circumference of the obese (n=22), overweight (n=33) and normal weight children (n=240). Both obese and overweight groups had significantly higher in body weight, stature, BMI and WC values compared to the normal weight group (p<0.001). The significant difference of those parameters was also found among the obese and the overweight group (p<0.001), except in stature.

Percentage change in BMI classification

Percentage distribution of the adiposity status in obese overweight and normal weight categories of obese, overweight and normal weight children at pre- and post- 1 year intervention is shown in Table 2. From pre to post-intervention, the obese and overweight groups showed an improvement in BMI classification. In the obese group, the percentage of obesity decreased to 81.82% (18 out of 22), with 18.18% (2 out of 22) becoming overweight and no child reaching normal weight. A similar trend was also seen in the overweight category. The percentage of overweight decreased to 63.64% (21 out of 33), with 12.12% (4 out of 33) reaching normal weight. However, 24.24% (8 out of 33) became obese. Without the intervention, the normal weight group demonstrated an increase in the percentage of obesity and overweight as well as a reduction in the percentage of the normal weight category. After analysing the relative risk of worse cases by dividing the proportion of obese/overweight children by the proportion of normal weight children, it was equal to 1.59. Likewise, the relative risk of improvement/unchanged was equal to 0.94. Thus, the odds ratio was 1.69

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<th>Table 1. Baseline anthropometric characteristics of obese, overweight and normal weight children aged 6-7 years</th>
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<td><strong>Parameters</strong></td>
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<tr>
<td>Body weight (kg)</td>
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<td>Height (cm)</td>
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<td>Body mass index (kg/m²)</td>
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<td>Waist circumference (cm)</td>
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* p<0.001 compared with normal weight children; ** p<0.001 compared with overweight children
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(95% CI, 0.71-4.02; \( p = 0.17 \)). This indicated that there was no significant difference in BMI percentile change among obese/overweight children and normal weight children.

### Changes in BMI and WC after intervention

Changes in BMI and WC among obese, overweight and normal weight children are shown in Figure 1 and 2, respectively. After intervention, there were no differences in BMI and WC changes between obese and overweight groups. However, the normal weight group had significantly less increase in BMI and WC than the obese and overweight groups (\( p < 0.001 \)).

### Discussion

After intervention and follow-up every 4 months for 1-year, the obese/overweight children revealed no significant change in BMI percentile compared with normal weight children. However, the scale of improvement in BMI percentile change (Table 2) was similar to that of Simonette et al.,(8) who reported a 12.2% reduction in obesity and a 12.1% reduction in overweight after 1-year of a high intensity dietary education program. In addition, the mean changes in the BMI and WC of obese and overweight children were still higher than those of normal weight children. Similar to the outcomes of Donnelly et al.\(^{(9)}\) who aimed to attenuate obesity via a nutrition and physical activity intervention, intervention had no impact on obesity at 2 years follow-up. Several factors potentially affected the results of our long-term management of obesity in school children. Parental involvement as well as active participation from the children themselves are considered crucial parts of achieving program effectiveness. Previous studies have reported that parental involvement leads to more favorable results in childhood obesity prevention and treatment because parents are responsible for managing environment, food offerings as well as influencing exercise and recreation.\(^{(10,11)}\) In this study, two seminars were provided for parents and their overweight/obese children. All children attended at least once, whereas parent participation was relatively small. In addition, it was noticed that at this age, most obese/overweight children did not pay the least attention to their stigmatization during the 1-year treatment program. The main barrier to the results of our program was insufficient active contribution from the

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<th>Percent change in BMI classification</th>
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<th>Normal weight (N=240)</th>
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<td>Pre</td>
<td>Post</td>
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<tr>
<td>Obese</td>
<td>100</td>
<td>81.82 (22/22)</td>
<td>0</td>
</tr>
<tr>
<td>Overweight</td>
<td>0</td>
<td>18.18 (0/22)</td>
<td>100</td>
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<tr>
<td>Normal weight</td>
<td>0</td>
<td>0 (0/22)</td>
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Table 2. Results of percentage change in BMI classification according to Cole et al.\(^{(4)}\) between obese, overweight and normal weight children after 1 year of intervention.
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Figure 1. Comparisons of body mass index changes between obese, overweight and normal weight children.

* p<0.001 compared with normal weight children

Figure 2. Comparisons in waist circumference changes between obese, overweight and normal weight children.

* p<0.001 compared with normal weight children
children and their parent, including disengagement from the program by some participants.\(^{(12)}\) Therefore, future study should aim on encouraging greater parental and child involvement in the intervention.

**Conclusion**

A one-year program for treating childhood obesity, with dietary education and behavioral modification, based on children and family, has no significant impact on the BMI percentile change or mean change in BMI and WC measurements of obese/overweight children, when compared with normal weight children.

**Acknowledgement**

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**References**

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ผลระยะยาวของการแก้ปัญหาโรคอ้วนในเด็ก โดยการมีส่วนร่วมของเด็กและครอบครัว

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ภาควิชากายภาพบำบัด คณะเทคนิคการแพทย์ มหาวิทยาลัยเชียงใหม่

บทคัดย่อ ผลการปรับพฤติกรรมในการดังร่วมของเด็กและครอบครัวซึ่งกำลังเจริญเติบโตโดยอาศัยการมี

ส่วนร่วมจากเด็กและครอบครัวที่มีเป็นสิ่งที่สำคัญ การศึกษานี้จึงมีวัตถุประสงค์เพื่อดู

ผลระยะยาวของการแก้ปัญหาโรคอ้วนในเด็กและครอบครัวผ่านการเปลี่ยนแปลงพฤติกรรมของ

คัดชีนมวลกาย และผลการประกอบของร่างกายโดยเปรียบเทียบกับเด็กน้ำหนักดั้บปกติ ผู้รับ

การทดลองเป็นเพียงอายุ 6-7 ปี จำนวน 312 ราย ซึ่งเข้าร่วมการจัดแนวในเด็กน้ำหนักดั้บปกติ

น้ำหนักเด็กและครอบครัว โดยใช้ค่าดัชนีมวลกายตามเกณฑ์อ้างอิงของ the International Obesity Task

Force (IOTF) จากนั้นเด็กที่ได้รับการจัดแนวเป็นเด็กน้ำหนักดั้บปกติ รวมทั้งครอบครัวถูกลุกขึ้น

เข้าร่วมการสัมัตตาเป็นเวลา 1 ปี ประกอบด้วยการให้รู้การปรับเปลี่ยนพฤติกรรมชุดว่างมี

การเยี่ยมชมเด็กและให้สัมภาษณ์ถึงการเปลี่ยนแปลงสุขภาพและ

การเกิดการส่งเสริมในเด็กและให้สัมภาษณ์ทางโทรศัพท์ทุก 3 เดือน วัตถุประสงค์

ของการวิจัยคือ ลดคัดชีนมวลกาย และเสริมสร้างสุขภาพ เรามาประเมินการเปลี่ยนแปลง

เปอร์เซ้นต์ไทล์ของค่าดัชนีมวลกาย ออกและหลังการจัดแนวเป็นเวลา 1 ปี จากการติดตั้งผลที่

พบว่า กลุ่มเด็กน้ำหนักดั้บปกติ (odds ratio, 1.69; 95%CI, 0.71-4.02; p=0.17) ในที่ที่อยู่ในเด็กที่คัดชีนมวลกาย

และมีผลการตอบสนองของค่าดัชนีมวลกายและคัดชีนน้ำหนักกินถึง 97% ซึ่งกลุ่มน้ำหนักดั้บปกติ

อย่างมีสิ่งที่กำลังดูดซึม คิดว่าการหรือกระทบคาดว่าจะเริ่มต้นเกี่ยวกับการ

ปรับเปลี่ยนพฤติกรรมและคัดชีนมวลกายเป็น 3 ปี ไม่ยังผลต่อการเปลี่ยนแปลงของคัดชีนมวลกาย

คัดชีนมวลกาย รวมทั้งไม่สามารถจะดูการมีส่วนร่วมของคัดชีนมวลกายและเสริมสร้างความ


คำสำคัญ: วัย ผลระยะยาว การเปลี่ยนแปลงพฤติกรรม คัดชีนมวลกาย คัดชีนมวลกาย