

# Effects of Behavior Modification on Body Image, Depression and Body Fat in Obese Korean Elementary School Children

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This study was performed to investigate the effects of behavior modification on body image, depression and body fat in obese elementary school children.

Sixty-two elementary students of the 4th to 6th grade were selected from two different Seoul schools. Thirty-four children in one school were designated as the experimental group, and 28 children from the other school as the control group.

The experimental group received 60-70 minutes of behavior modification, once a week, for 8 weeks. The control group received neither management nor treatment.

The results indicated a significant improvement of body image and a reduction in the increase rate of body fat for the experimental group. This finding strongly supports the theory that behavior modification can be used as an effective strategy in the treatment of obese children.

**Key Words:** Childhood obesity, behavior modification, body image, depression, body fat

## INTRODUCTION

With rising living standards and economic status, the rate of obesity children has been steadily increasing in Korea.<sup>1</sup> The problem of childhood obesity does not cease with the onset of maturity because obese children usually end up becoming obese adults. The earlier the obesity develops, the more excessive the resulting adult obesity will be.<sup>2,3</sup> Unlike adult obesity, childhood obesity is difficult to treat with merely diet control

and exercise as childhood obesity is amplified by the increasing number of fat cells.<sup>4</sup>

Obese children usually have low self-esteem and a hard time fitting in with their normal-weight peers.<sup>5</sup> Obese children may develop a sense of inferiority because of<sup>1-3</sup> their obese body and the constraining negative evaluations from others. This can have undesirable effects on self-respect and threaten the development of their self-identity.<sup>6</sup> With low vitality, more weight is gained by the obese body, which intensifies the mental stress, anxiety and depression, and thereby completes the viscous circle. Eventually, obese children come to discredit their body image and may show symptoms of behavioral disorders.<sup>7,8</sup>

Childhood obesity may be controlled through various effective methods such as exercise, dietary management, behavior modification, medication and surgery. However, prior to treatment, consideration must be given to the prevention of any harm to the child's growth, irrespective of method. For this reason, exercise, dietary management and behavior modification are recommended in preference to medication and surgery in managing obese children.<sup>9</sup>

Under the assumption that the major cause of being overweight is maladaptive eating habits and lack of activity, behavior modification decreases the degree of obesity by changing these maladaptive habits and the associated lifestyle.<sup>9,10</sup>

It has been reported that the peak age for childhood obesity is 10-12 years old for boys and 11-12 years old for girls.<sup>11</sup> Therefore, subjects from 4-6th grade, corresponding with this age of peak occurrence, were selected for a specific study

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on behavior modification. Furthermore, subjects at this age were considered able to understand the program.

In order to determine whether behavior modification is an effective strategy in treating childhood obesity, the changes in body image, depression and body fat of a group of obese children who had undergone treatment for behavior modification were compared with those of another group of obese children that had not undergone any specific management.

## MATERIALS AND METHODS

### Subjects

Sixty-two obese children in the 4-6th grade from two different elementary schools with a similar social background located in Seoul were chosen as subjects for study. The children were all over 20% degree of obesity, did not have any mental or physical disorders, were not undergoing any other types of obesity treatment, and were able to understand the procedures.

Thorough explanation about the purpose and aim of the study was given to the headmaster and school nurse before their permission was received. With that, written parental consent and child assent were obtained from all study subjects.

In order to securely segregate the two groups, one school was designated as the experimental group and the other as the control group. Originally, 41 and 28 children were selected for the experimental and control groups, respectively, but 7 from the experimental group dropped out for personal reasons.

There were no significant differences between the two groups regarding grade, gender, economic status, number of family members and degree of body fat measurement (Table 1).

There were no significant differences between the two groups in the measurements of body image, depression and body fat conducted before the experiment (Table 1).

### Treatment: behavior modification

The behavior modification (BM) used in this

experiment is a newly developed program based on the previous obesity management program developed by Brownwell and Kramer,<sup>9,12,13</sup> which controls body weight by identifying and altering towards a desirable direction the maladaptive habits of the subject. This program consists of the following stages: introduction of behavior modification, self monitoring and stimuli control, diet education, exercise education, individual counseling, social support and conclusion with the establishment of a long term plan (Fig. 1).

The program was administered over a period of 8 weeks to the experimental group in weekly sessions after class under the supervision of the researchers. Each session lasted for 60-70 minutes. During this period, there was no intervention conducted on the control group.

### Measures

#### *Body image*

An implication-measuring method, designed by Osgood<sup>14</sup> was used to measure body image. This tool consists of 10 questions with response rating from 1 to 5; giving a total score ranging from 10 to 50. A higher score indicates a stronger self-assurance in one's body image. The confidence level of the tool was Cronbach's  $\alpha=0.81$  before the experiment, and 0.87 after the experiment.

#### *Depression*

A Depression Self-Rating Scale (DSRS) designed by Birlleson<sup>15</sup> especially to evaluate the degree of depression in children was used. The tool has 18 questions and the highest score for each question is 4 points. With scores ranging from 18 to 72, a higher score represents a more intense depression. The confidence level for this tool was Cronbach's  $\alpha=0.84$  before the experiment, and 0.86 after the experiment.

#### *Body fat*

An impedance fatness analyzer (Bioelectrical impedance fatness analyzer GIF-891DH, Gilwoo, Seoul, Korea) was used to measure body fat percentage and fat mass of the subjects.

Body fat was measured based on the standard body weight of Korean children according to height defined by The Korean Pediatric Society,

**Table 1.** Homogeneity between the Experimental and Control Groups

General characteristics	Exp. N (%) or M $\pm$ SD	Cont. N (%) or M $\pm$ SD	Total N(%)	$\chi^2$ or t	p
Grade of elementary school					
4th	22 (64.7)	12 (42.9)	34 (54.8)	3.24	0.198
5th	2 ( 5.9)	4 (14.2)	6 ( 9.7)		
6th	10 (29.4)	12 (42.9)	22 (35.5)		
Gender					
Boy	22 (64.7)	16 (57.1)	38 (61.3)	0.37	0.543
Girl	12 (35.3)	12 (42.9)	24 (38.7)		
Economic status					
Low	0 ( 0.0)	1 ( 3.6)	1 ( 1.6)	1.36	0.507
Middle	30 (88.2)	23 (82.2)	53 (85.5)		
High	4 (11.8)	4 (14.2)	8 (12.9)		
Number of family members					
Three	4 (11.8)	3 (10.7)	7 (11.3)	3.32	0.19
Four	28 (82.4)	19 (67.9)	47 (75.8)		
Five	2 ( 5.8)	6 (21.4)	8 (12.9)		
Degree of obesity					
Mild	10 (29.4)	5 (17.9)	15 (24.2)	1.12	0.571
Moderate	20 (58.8)	19 (67.9)	39 (62.9)		
Severe	4 (11.8)	4 (14.2)	8 (12.9)		
Body image	3.3 $\pm$ 0.8	3.4 $\pm$ 0.6		0.35	0.728
Depression	1.8 $\pm$ 0.5	1.7 $\pm$ 0.4		0.93	0.358
Body fat					
Body fat (%)	33.3 $\pm$ 6.0	32.0 $\pm$ 6.2		0.78	0.436
Fat mass (kg)	18.4 $\pm$ 4.5	17.7 $\pm$ 5.5		0.59	0.56

Exp., Experimental group (n=34); Cont., Control group (n=28).

1999.<sup>16</sup> The degree of body fat measurement within the range of 20 - 29% was categorized as mild, 30 - 40% as moderate and 50% and above as severe.

### Data analysis

The data was analyzed with SAS program. General characteristics, body image, depression and body fat were tested with  $\chi^2$  test and t-test for homogeneity between the experimental and

control groups. The differences before and after the experiment within each group were tested with paired t-test, while the differences between the two groups were analyzed with unpaired t-test.

### Limitations

Discrepancy would be present when generalizing the data, as this study was limited to elementary students with similar social backgrounds

Week	Contents
1	Introduction of Behavior Modification <ul style="list-style-type: none"> <li>- Understanding the purpose of the program as well as inducing responsibility and interest towards the program</li> <li>- Setting goals based on weight and degree of obesity</li> </ul>
2	Self Monitoring and Stimuli Control <ul style="list-style-type: none"> <li>- Understanding the physical, psychological and emotional effects of obesity</li> <li>- Realizing the current situation and searching for ways to control obesity</li> </ul>
3	Diet Education <ul style="list-style-type: none"> <li>- Learn to discover personal eating habits</li> <li>- Emphasize the importance of balanced diet with the information of which food is good for obesity control and which food is not</li> </ul>
4	Exercise Education <ul style="list-style-type: none"> <li>- Learn the effects of exercise on health and obesity</li> <li>- Emphasize the need for exercise</li> <li>- Fix an exercise plan that is feasible and choose exercises that can be done at home</li> </ul>
5	Individual Counseling <ul style="list-style-type: none"> <li>- Re-evaluate the subject's behavior and emphasize on correcting inappropriate behavior</li> <li>- Learn how to actively cope with situations or causes that are related to obesity</li> </ul>
6	Social Support <ul style="list-style-type: none"> <li>- Find support for obesity control</li> <li>- Find ways to keep away from unsupportive personnels</li> </ul>
7	Change of Perception <ul style="list-style-type: none"> <li>- Have belief that the pattern of behavior can be actively changed by the subject's ability?</li> <li>- Develop self-control and self-esteem over behavior</li> </ul>
8	Establishment of Long Term Plan <ul style="list-style-type: none"> <li>- Concluding the program allowing the subject to independently control obesity?</li> </ul>

Fig. 1. Specific details of 8 week course behavior modification program.

from 2 schools located in the Seoul area.

## RESULTS

### Body image

The score of body image for the experimental group increased significantly from  $3.3 \pm 0.8$  before to  $3.6 \pm 0.8$  after the intervention ( $p=0.008$ ), whereas the control group's score did not show any change at all, being  $3.4 \pm 0.6$  and  $3.4 \pm 0.7$ , before and after the intervention, respectively. As the experimental group showed a score increase of  $0.3 \pm 0.5$ , in contrast to the control group's change of  $0.0 \pm 0.4$ , there was a significant difference in the change of body image between the two groups ( $p=0.028$ ) (Table 2).

### Depression

The experimental group's depression decreased from  $1.8 \pm 0.5$  to  $1.7 \pm 0.5$ , but that of the control group remained the same, from  $1.7 \pm 0.4$  to  $1.7 \pm 0.5$ . Neither change was significant. The rate of change after the experiment for the experimental group was a  $0.1 \pm 0.4$  decrease, while for the control group there was no change with only a slight variance (Table 2).

### Body fat

Although, the experimental group's percentage of body fat decreased from  $33.3 \pm 6.0\%$  to  $32.9 \pm 5.8\%$ , it was not significant. However, for the control group the rate increased significantly from  $32.0 \pm 6.2\%$  to  $36.0 \pm 6.2\%$  ( $p=0.002$ ). The rate of

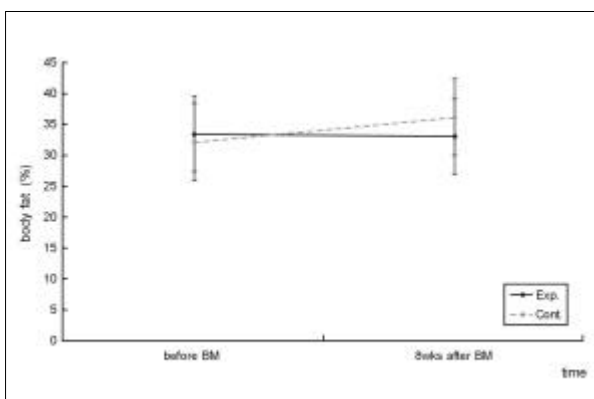
**Table 2.** Body Image, Depression before and after Behavior Modification in the Experimental and Control Groups

	Before M $\pm$ SD	After M $\pm$ SD	t	p	Difference (After-Before)	t	p
Body image							
Exp.	3.3 $\pm$ 0.8	3.6 $\pm$ 0.8	2.84	0.008	0.3 $\pm$ 0.5	2.26	0.028
Cont.	3.4 $\pm$ 0.6	3.4 $\pm$ 0.7	0.21	0.832	0.0 $\pm$ 0.4		
Depression							
Exp.	1.8 $\pm$ 0.5	1.7 $\pm$ 0.5	1.75	0.09	-0.1 $\pm$ 0.4	1.49	0.144
Cont.	1.7 $\pm$ 0.4	1.7 $\pm$ 0.5	0.33	0.758	0.0 $\pm$ 0.3		

Exp., Experimental group (n=34); Cont., Control group (n=28).

change after the experiment for the experimental group was a  $0.4 \pm 3.0\%$  decrease, compared to a  $4.0 \pm 6.1\%$  increase for the control group. These rates between the two groups were significantly different ( $p=0.001$ ) (Fig. 2).

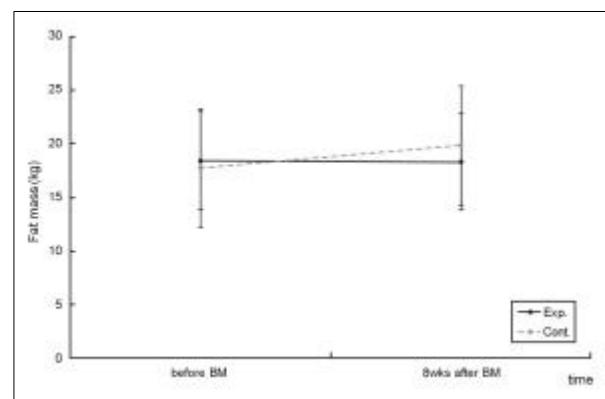
Fat mass for the experimental group decreased from  $18.4 \pm 4.5$  kg before the experiment to  $18.3 \pm 4.6$  kg after the experiment, but the change was not significant. For the control group, it was significantly increased from  $17.7 \pm 5.5$  kg to  $19.8 \pm 5.5$  kg ( $p=0.003$ ). The difference between the two groups was significant. After behavior modification, the experimental group's fat mass decreased by  $0.1 \pm 1.7$  kg, whereas there was a  $2.1 \pm 3.4$  kg increase for the control group ( $p=0.003$ ) (Fig. 3).

**Fig. 2.** Percentage of body fat before and after behavior modification in the experimental and control groups.

## DISCUSSION

Of the recommended methods for treating obese children, behavior modification is one in which bad dietary habits and lifestyles are revised in order to modify or control the calorie intake and increase activity so that the degree of obesity will eventually decrease. Although the degree of weight loss after the treatment isn't exceptionally great, this method has no side effects, the drop out rate during the treatment is low and it is effective in maintaining weight.<sup>12,17</sup>

The behavior modification method used in this research was first developed by Brownwell and Kramer<sup>12</sup> and is now being widely used. However, it was originally designed for western adults, and due to cultural differences the pro-

**Fig. 3.** Changes of fat mass before and after behavior modification in the experimental and control groups.

gram was amended and complementary measures were taken based on an obesity management program developed in Korea.<sup>9,13</sup>

Body image is defined as one's self-feeling or attitude towards one's own physical outlook and function, and acts as a fundamental base in the development of the self-independence, self-esteem and self-value that are needed to become a mature individual character.<sup>18</sup> Body image is a concept in which each individual has one's own perception which may change with growth, disease and injury. Usually, a higher level of body image leads to a favored self-perception. Size, function and potential of one's physical body are also aspects which build up body image.<sup>19</sup> Similar with the previous reports which suggest that obese children tend to have a pessimistic view towards their self body image, the results of the present research demonstrated a noticeable difference as the score for body image increased for the experimental group but remained the same for the control group. Obese children, due to the modern culture favoring a slim body, are likely to form negative views towards their body image and consequently develop low self-esteem as well as emotional anxieties.<sup>20</sup> Such detrimental effects can be prevented through the enhanced body image achieved by behavior modification.

Depression is a persistent state of mind associated with worry, melancholy and a sense self-unworthiness, followed by symptoms of despondency and lack of activity.<sup>21</sup> A marked decrease in depression occurred in the experimental group but there were no significant differences when compared with the control group. Another behavior modification study conducted on Korean middle school students for 8 weeks supports the results of this experiment.<sup>22</sup> However, the results of Wadden et al. showed a noticeable decrease of depression in children after the application of behavior modification together with dietary management for 16 weeks.<sup>23</sup> The reason behind this variation is thought to be the relative shortness of the examination period and further Korean research with a longer trial period should be conducted.

The data acquired for the percentage of body fat in this study is in accordance with that reported by Lee of 34.5%, and by Kim of 32.4%.<sup>24,25</sup> There

were significant differences between the two groups as the body fat percentage and fat mass for the experimental group decreased while those for the control group increased. Previous studies have also reported such changes after the application of behavior modification.<sup>22,23,26</sup> Female children from the age of 10 and male children from<sup>12</sup> develop physically at a rapid rate. At the end of elementary school age (6th grade) female children are taller and heavier than male. In this study, to reduce such differences of physical development between male and female children, the subjects were chosen from 4-6th grade students who showed similar developmental patterns.<sup>20</sup> In addition, the number of male and female subjects was matched between the twogroup.

From the results of this study, it can be concluded that behavior modification is a useful method of obesity management, able to enhance body image and prevent further increase in body fat. Therefore, the administration of behavior modification to obese elementary school children under the supervision of the school nurse may be an effective method of obesity management for children.

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