The Effect of HHIM Program on Health Related Physical Fitness and Brain Derived Neurotrophic Factor in Elementary Students

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Abstract. The purpose of this study is to examine the effect of 12 week-HHIM program on health related physical fitness (HRPF) and brain derived neurotrophic factor (BDNF) in elementary students. To achieve this purpose, 20 girls were selected and assigned 10 girls for exercise group (EG) and control group (CG) respectively. The HHIM program was done three times a week, 50 minutes per one try for 12 weeks. The data analysis was conducted by using t-test which examine differences within and between groups. With regard to the changes on HRPF and BDNF, EG revealed statistically significant changes on all variables. Cardiopulmonary endurance, % body fat and BDNF in the blood were revealed statistically significant differences between two groups after experiment. In conclusion, HHIM program can be a positive and effective program that contribute for improvement on the HRPF and BDNF in elementary school girls.

Keywords: HHIM Program, Health Related Physical Fitness, Brain Derived Neurotrophic Factor
1 Introduction

The Childhood is an important time in the physical, emotional, intellectual and social development. Physical activity in Childhood gives help to improve health related physical fitness and prevent hypokinetic diseases associated with obesity and cardiovascular disease, also play an important role in improving the quality of life [1]. However, the lack of physical activity can cause obesity, physical deterioration and increase the risk of metabolic syndrome, cardiovascular disease even anxiety, depression and stress as well, adversely affect brain function such as cognitive impairment, memory loss. Regular physical activity has been suggested as an effective method to contribute the improvement of health related physical fitness and improve the cognitive function of the brain such as learning ability or memory [2].

Recently various researches to find the factors which control the brain cell activity, proliferation, survival and differentiation have been conducted on actively. These studies have been reported neurotrophic factor or neurotransmitter is increased during the exercise plays an important function in generating brain cells and improving brain function [3]. BDNF (Brain derived neurotrophic factor) is neurotrophic protein on a variety of effects on the central nervous system, it is known to act effectively to improve the damages of nervous system [4]. Increase of BDNF in connection with the exercise can play an important role, such as nerve growth, nerve regeneration and synaptic plasticity in the hippocampus and cerebral cortex of the brain [5].

HHIM is a program combine the eastern and western medical gymnastics developed in order to help the brain function activated through the creation of new brain cells to stimulate cerebral and brain nervous system basis on brain neurophysiology[6]. Because it’s aerobic exercise easily practice at schools for children without the constraints of time and space, the research is considered to be very significant to identify how application of HHIM program affects the health related physical fitness and brain derived neurotrophic factor in elementary school girls.

2 Methodology

2.1 Subjects

The purpose of this study is to examine the effect of 12 week-HHIM program on health related physical fitness and BDNF, 20 elementary school girls were selected (exercise group: 10, control group: 10) and physical characteristics of the subjects are shown in <Table 1>.
Table 1. Characteristics of Subjects

<table>
<thead>
<tr>
<th>Items</th>
<th>Group</th>
<th>Age (yr) ± SD</th>
<th>Height (cm) ± SD</th>
<th>Weight (kg) ± SD</th>
<th>BMI (kg/m²) ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Exercise Group (female 10)</td>
<td>12.45 ± 0.23</td>
<td>149.77 ± 7.67</td>
<td>41.13 ± 3.73</td>
<td>18.30 ± 1.24</td>
</tr>
<tr>
<td></td>
<td>Control Group (female 10)</td>
<td>12.55 ± 0.24</td>
<td>148.63 ± 5.16</td>
<td>41.12 ± 6.60</td>
<td>18.55 ± 2.85</td>
</tr>
</tbody>
</table>

Values are means ± SD

2.2 Measurement Items

Measurement items of this research experiment are shown in the <Table 2>.

Table 2. Measurement Items

<table>
<thead>
<tr>
<th>Variables</th>
<th>Sub-factors</th>
<th>Measurement Items</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Muscular Strength</td>
<td>Grip Strength</td>
<td>Kg</td>
</tr>
<tr>
<td></td>
<td>Muscular Endurance</td>
<td>Sit-up</td>
<td>Times</td>
</tr>
<tr>
<td>Health Related Physical Fitness</td>
<td>Cardiopulmonary</td>
<td>Shuttle Run</td>
<td>Times</td>
</tr>
<tr>
<td></td>
<td>Endurance</td>
<td>Sit and Reach</td>
<td>Cm</td>
</tr>
<tr>
<td></td>
<td>Flexibility</td>
<td>% Body Fat</td>
<td>%</td>
</tr>
<tr>
<td></td>
<td>Body Fat Percentage</td>
<td>Serum BDNF</td>
<td>pg/ml</td>
</tr>
</tbody>
</table>

Values are means ± SD

2.3 HHIM Program

The HHIM program used in this study consists of 15 movements. Once carried movement time is conducted repeatedly three in a row at 13 minutes and 39 minutes carried out and 6 minute warming up and 5 minute cooling down organized a total workout time to 50 minutes was performed three times a week for 12 weeks.

2.3 Data Analysis

The collected data to analyze the differences between the two groups and within groups on health related physical fitness and BDNF levels were conducted t-test respectively using WIN SPSS VER 18.0 program. Statistical significance for all analyzes was set at $\alpha = .05$. 

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3 Results and Discussion

As a result, HHIM program conducted for 12 weeks targeting elementary 6th grade female students, changes in health related physical fitness variables serum BDNF levels of exercise group and control group before and after the experiment are as follows: <Table 3>.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Exercise Group(n=10)</th>
<th>Control Group(n=10)</th>
<th>t-value (within)</th>
<th>t-value (between)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Muscular Strength</strong></td>
<td>pre</td>
<td>post</td>
<td>pre</td>
<td>post</td>
</tr>
<tr>
<td>(kg)</td>
<td>20.10±3.36</td>
<td>20.77±3.76</td>
<td>-4.344**</td>
<td>20.23±2.37</td>
</tr>
<tr>
<td><strong>Muscular Endurance</strong></td>
<td>pre</td>
<td>post</td>
<td>pre</td>
<td>post</td>
</tr>
<tr>
<td>(time)</td>
<td>36.10±19.57</td>
<td>43.90±21.66</td>
<td>-4.575**</td>
<td>34.60±18.51</td>
</tr>
<tr>
<td><strong>Cardiopulmonary</strong></td>
<td>pre</td>
<td>post</td>
<td>pre</td>
<td>post</td>
</tr>
<tr>
<td><strong>Endurance</strong></td>
<td>89.30±8.03</td>
<td>94.80±8.23</td>
<td>-2.318*</td>
<td>89.80±12.73</td>
</tr>
<tr>
<td>(time)</td>
<td>10.06±6.12</td>
<td>11.90±5.61</td>
<td>-2.459*</td>
<td>13.00±6.09</td>
</tr>
<tr>
<td><strong>Flexibility</strong></td>
<td>pre</td>
<td>post</td>
<td>pre</td>
<td>post</td>
</tr>
<tr>
<td>(cm)</td>
<td>11.19±1.60</td>
<td>10.07±2.34</td>
<td>2.429*</td>
<td>11.13±4.91</td>
</tr>
<tr>
<td><strong>% Body Fat</strong></td>
<td>pre</td>
<td>post</td>
<td>pre</td>
<td>post</td>
</tr>
<tr>
<td>(%)</td>
<td>24645.31 ±2242.92</td>
<td>38934.03 ±6338.75</td>
<td>-9.075***</td>
<td>25833.25 ±3266.11</td>
</tr>
</tbody>
</table>

Values are means±SD

As it is shown in <Table 3>, the changes in health related physical fitness variables within groups before and after 12 week-HHIM program conducted, in the exercise group before and after the experiment muscular strength was changed from 20.10±3.36kg, to 20.77±3.76kg(p<.01), muscular endurance was changed from 36.10±19.57 times to 43.90±21.66 times(p<.01), cardiopulmonary endurance was changed from 89.30±8.03times to 94.80±8.23times(p<.05), flexibility was changed from 10.06±6.12cm to 11.90±5.61cm(p<.05), body fat was changed from 11.19±1.60% to 10.07±2.34%(p<.01) therefore statistically significant differences in all variables revealed but control group did not show statistically significant differences in all variables. In change between the exercise group before and after the experiment, cardiopulmonary endurance of exercise group was 94.80±8.23 times, control group was 86.10±8.28 times, body fat of exercise group was 10.07±2.34%, control group was 12.23±2.15%, statistically significant differences revealed but the other variables did not show a significant difference.

Prior studies [8][9] reporting aerobic exercise promotes muscular strength due to stimulate muscle contraction of the upper limbs for movements using the gross, mak-
ing improvement in strength of lower extremity by the movement, having many stand-
ing motions have supported these findings. There was consistent with the study Kim [7] reported the 12 weeks-jump rope during music targeting elementary school girls had positive effects on muscular endurance, flexibility, agility, cardiopulmonary en-
durance and Jeon & Lee [8] were reported as a result of the jump rope workout that targets elementary students muscular endurance increases. The cardiopulmonary en-
durance as the most essential elements of physical fitness in our daily lives are closely
related to physical activity. It was reported by Lee et al. [9] that 8 week-physical edu-
cation classes targeting elementary school students made cardiopulmonary endurance increases and Jeon & Lee [8] were reported as a result of the jump rope workout that targets elementary students cardiopulmonary endurance increases. These results were consistent with the results of this study and this results is believed to result due to the development of cardio-respiratory system and efficient adaptation on the exercise stimulations through regular physical activity. Flexibility means a joint range of motion and it is an essential element to the daily life. Kim [7] reported the results by significantly improving the flexibility to jump rope exercise for 12 weeks in elementary school girls was consistent with the findings. Changes in % body fat in the exercise group were significantly decreased after experiment but changes in the control group were increased after the experiment. This seems to be associated with the natural growth of the fat mass according to the growth and development since childhood is the time significantly increased fat cells. In the study of Kim [7] and Jeon & Lee [8] results were reported to decrease % body fat of aerobic exercise in elementary stu-
dents, therefore this was consistent with the findings.

Although a positive changes appeared in the overall variables of health related physical fitness within exercise group in this study, it showed a significant difference only two variables-body fat and cardiopulmonary endurance between group. It believed the reason is because they did not be controled children's dietary intake and lifestyle patterns because they were in period of growth. In addition, the reason for this is considered due to a number of possible cause, such as the type of exercise, exercise intensity, exercise duration, exercise frequency have been an impact on the health related physical fitness sub-variables. Compared to the results of this study and previous research comprehensively, 12 week-HHIM program is considered to have a positive impact on improving health related physical fitness of elementary school girls.

As it is shown in <Table 3> the changes in serum BDNF within groups before and after 12 weeks-HHIM programs conducted, indicated by 24645.31±2242.92pg/ml, 38934.03±6338.75 each in the exercise group before and after the experiment and 25833.25±3266.11pg/ml, 31557.51±5727.84 pg/ml(p<.01) each in the control group therefore statistically significant differences revealed in all group. The changes be-
tween the groups were found with statistically different between the exercise group and control group(p<.05).

The BDNF promotes the formation of nerve cells is important for learning and memory, increased by the exercise [3], especially aerobic exercise showed a high positive correlation with cognitive functions cause it utilizes oxygen as the energy required for movement, spend primarily fat for fuel and it is capable of generating energy for a long time without accumulation of fatigue substances. The results of this
study is consistent with the research of Lee et al [9] and Jeon [10] reported that a significant increase in BDNF levels performed aerobic exercise targeting elementary school students. According to the results of this study, BDNF levels were increased significantly in control group as well, this is thought to be due to the time childhood when the brain cells produce a vigorous and complete brain function. It is also thought to be acting as the cause of improving BDNF levels in the control group the learning and exercise consisting of daily school life because BDNF increased by exercise and learning.

4 Conclusions

In this research, the aim is to examine the effect of 12 week-HHIM program on health related physical fitness and brain derived neurotrophic factor in elementary school girls. After the HHIM program apply to the exercise group, it showed statistically significant differences in all the variables of health related physical fitness but the control group did not show a significant difference. In the changes between two groups statistically significant differences were shown in cardiopulmonary endurance and body fat percentage variables. Serum BDNF showed a statistically significant difference in both exercise group and control group and showed statistically significant differences even between groups.

In conclusion, 12 week-HHIM program can be a positive and effective program that contribute for improvement on the health related physical fitness and brain derived neurotrophic factor in elementary school girls.

References