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Effects of YONGMOODO Exercises on Physical Fitness and Gait Ability in Body Imbalance Obesity Elementary Students

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Abstract

This study was to investigate the effects of yongmoodo exercises on physical fitness and gait abilities in the body imbalance obesity elementary students. The participants were divided into two groups: Yongmoodo exercise group(EG, n=20) and non exercise group(NEG, n=20). The EG took part in the functional balance mat for Yongmoodo exercise for 12 weeks. The results of this study were as follows: First, there were significantly increased in physical fitness in EG compared with NEG after 12 weeks. Second, there were significantly increased in gait abilities in EG compared with NEG after 12 weeks. As conclusions, this study confirmed that the functional balance mat for Yongmoodo exercise program could improve the posture alignment pursuant and gait abilities of body imbalance of obese elementary students.

[Keywords] ***Yongmoodo Exercises, Physical Fitness, Gait Ability, Body Imbalance, Obesity Elementary Students***

1. Introduction

The physical imbalance caused by obesity in elementary school students was mainly due to the lack of physical activity along with westernized eating habits[1][2]. This trend has been continuously increasing for the last 20 years. This is a recent social problem as a risk factor for increasing the incidence of addictive diseases[3]. This decrease in the physical activity of the elementary school children is accompanied by a decrease in muscular strength and a decrease in basal metabolism. This leads to an imbalance of energy metabolism, inhibits the secretion of growth hormone. And it induces musculoskeletal dysfunction, which has a great influence on the deformation and disorder of the physical and functional aspects of growing elementary school students[4]. In addition, the physical dysfunction of the elementary school students in the growth period due to the decrease of the physical activity shows many changes in terms of growth factors such as physical imbalance and physical strength such as exercise performance ability. This means that the improvement of health and physical fitness of elementary school students is growing as a national problem[5]. Particularly, during the elementary school age when the development and development are active, the regular exercise habits promote healthy physical fitness as the physical activity increases sharply. Healthy physical fitness induces stabilization of musculoskeletal system due to increased muscle strength, and stabilization of posture plays a role in maintaining a balanced body posture[6].

Thus, problems related to childhood obesity are well known, and a variety of exercise programs have been developed for solving the causes. However, the disadvantages of the newly developed various exercise intervention programs are mainly limited to school physical education and academic physical education, and the exercise program is not able to escape from the program

which has been preceded. Also, Because of lack of research on the development of exercise equipment and exercise programs for the elimination of physical imbalance among obese children among elementary school students, there is a need for continued research. Therefore, this study was to investigate the effects of Yongmoodo exercises on physical fitness and gait abilities in the body imbalance obesity elementary students.

2. Materils & Methods

2.1. Subject of study

This study was In this study, 40 elementary school students with a body fat percentage of over 26% and ages 10-12 were selected among the Yongmoodo trainees of Y Youth Sports Club in D city. The subjects participated in this study were fully informed about the experimental purpose, experimental method and the exercise program under participation of the protector and the coach. The preliminary experiments for verifying the effectiveness of the exercise program and selecting the subjects using the functional mat which has been patented were conducted as a play form from March to April 2017. This experiment was carried out from June 2017 to August 2017. The subjects of the study were divided by 2 groups of Yongmoodo Exercise group(EG, n = 20) and Non Exercise group(NEG, n = 20) using random sampling. The physical characteristics of the subjects are shown in <Table 1>.

Table 1. Physical characteristics of subjects.

Items	Age(yrs)	Height(cm)	Weight(kg)	BMI(kg/㎡)	Body Fat(%)
Exercise group (N=14)	11.68±1.82	140.64±8.26	52.36±4.18	29.46±1.84	30.12±2.04
Non exercise group (N=14)	11.72±1.96	139.92±6.84	51.96±5.64	30.08±2.02	30.26±1.92

Note: M±SD.

2.2. Measure and method

2.2.1. Yongmoodo exercise

The exercise program using functional mats was composed of Yongmoodo textbook written by Kang Min-cheol[7] and Kim Byeong-cheon[8]. It composed of only rolling, spinning, and walking exercises considering the physical functions of obese elementary students.

This functional balance exercise program was performed for a total of 60minutes with 10minutes of warming up, 40minutes of main exercise, and 10minutes of cooling down in compliance with the exercise recommendation shown in ACSM[9]. Exercise was applied at a frequency of 4 times a week for 12 weeks. The exercise program using the functional mat applies the incremental exercise load principle which increases the exercise intensity while increasing the range and the function mat of motion range and repetition time. So that the set maximum exercise intensity is not deviated. In addition, Yongmoodo rolling was carried out from the 20cm high elasticity mat to the incrementally low mat in consideration of the stability of the subjects by incremental exercise load principle. Yongmoodo spinning was carried out from a 10cm low elasticity mat to the incrementally high mat due to the characteristics of the movement to maintain body-centered balance, and specific exercise programs are shown in <Table 2>.

Table 2. Yongmoodo exercises program.

Stage	Exercise program		1~4 Week (reps/set/pad level)	5~8 Week (reps/set/pad level)	9~12 Week (reps/set/pad level)	Motion Frequency
Warm-up (10min)	Stretching					
Work-out (40min)	Roll	Forward roll, Back roll Leg open forward roll, Leg open back roll Leg close forward roll, Leg close back roll Forward roll gulleochigi, Back roll gulleochigi	5/3/20	5/3/15	5/3/10	RPE 8~10
	Turn	Side turn. Front turn, Back turn Front roll turn, Somersault	5/3/10	5/3/15	5/3/20	
	Gait	Walking in place Stand walking Continuous walking Knee walking Turn walking	50/3/10	50/3/15	50/3/15	
Cool-down (10min)	Stretching					

2.2.2. Physical fitness test

2.2.2.1. Push-up

The subject holds both hands with their shoulders wide and the fingertips of a 30cm high push-up bar go forward. The arms were placed at right angles to the ground, and head, shoulders, waist, hips, and legs were straightened. When the upper arms and shoulders of the arm were leveled, the arm came back to its original position. The total number of repetitions was recorded for 1minute.

2.2.2.2. Sit-up

The subject was instructed to draw up the knee in a lying position with both fingers behind the head. The upper body was raised in a lying position, and both elbows were brought to both knees and then lie down again. At this time, both shoulders should be touching the floor without rebound. The total number of repetitions was recorded for 1minute.

2.2.2.3. Side step

Three parallel lines were marked on the floor at 100cm intervals. When the subject did not step on the center line, the subject's right foot crossed the right line at the start signal. At this time, the number of times was set to 1. If the subject crossed the line to the right, he was returned to the first posture with a quick action. At this time, the number of times was set to 2. After returning, the subject performs a side step so that the left foot goes beyond the left line. At this time, the number of times was set to 3. This operation was carried out for 10 seconds twice, and better score was recorded.

2.2.2.4. Sit and reach

The subjects were taken off their shoes and their knees were straightened so that both feet were in full contact with the vertical plane of the measuring instrument. The spacing of both shots should not exceed 5cm. The floor of both hands was straightened and the floor of the left hand was placed on the right hand of the hand so that it overlapped and prepared. The examiner pressed the knee lightly so that the subject did not bend the knee when bending the upper body forward. This measurement was taken twice and better score was recorded in units of 0.1cm.

2.2.2.5. Standing long jump

The subject stood so as not to cross the marking line on the foot plate, and allowed to jump forward after sufficient preliminary operation of the arm and torso. After the jump without stepping starting line, the rear end of landing spot was measured twice and better score was recorded in units of 1cm.

2.2.2.6. Skipping rope

The subjects warm-up for using rope skipping such as shoulder, waist, knee, ankle and wrist before rope skipping. The knee was bent slightly to reduce the impact, and the front of the sole was used instead of the entire sole. The total number of times was recorded for 1minute.

2.2.3. Gait ability test

The gait ability test was used to measure the temporal and spatial walking ability using GAITRite to collect quantitative gait analysis data on the patient's gait pattern[10][11]. The gait analyzer is an electronic walking board with a length of 7.32m, a width of 61cm, and a height of 0.6cm. 13,824 sensors with a diameter of 1cm are arranged vertically along the walk plate at intervals of 1.27cm to collect information on temporal and spatial variables. The instrument collects the load of the experimenter's feet at a sampling rate of 80Hz per second when the experimenter walks and sends the information to the computer via the serial interface cable. The information on the collected temporal and spatial variables is shown in GAITRite GOLD Version 3.2 software. In this study, the subjects were allowed to stand at the front of the gait plate and then walked at the most comfortable walking speed by the verbal signals of the tester. The shoes were made comfortable according to the characteristics of the subjects. The pre-test and the post-test were measured under the same conditions. And this measurement was taken three times, the mean value was used.

2.3. Data process

For the data processing of the study, the mean and standard deviation of all collected data was caculated using SPSS 20.0(window statistical package). And paired t-test was performed for the significance test of before and after experiment in the group, independent sample t-test was performed for the experiment between the groups. The significance level was $p<.05$.

3. Results

3.1. Changes in physical fitness

Changes in physical fitness are shown in <Table 3>. As for the physical fitness of EG group, statistically significant differences were found in all variables of muscular strength($p=.000$), muscle endurance($p=.000$), flexibility($p=.000$), agility($p=.000$), power($p=.000$), cardiovascular endurance($p=.000$). In addition, statistically significant differences in the physical fitness changes of post-test between CG and EG were found in muscle endurance($p=.000$).

Table 3. The change of physical fitness.

Items	Group	Pre	Post	T*
Push-up	EG(n=14)	20.52±3.84	23.66±4.12	-4.102†††
	NEG(n=14)	20.42±4.61	20.88±3.68	0.326
	*t**	0.212	3.710†††	
Sit-up	EG(n=14)	19.88±4.44	24.82±4.16	-5.002†††
	NEG(n=14)	18.82 ±4.82	19.25 ±5.02	0.402
	*t***	0.321	5.426†††	
Standing long jump	EG(n=14)	16.22 ±4.84	20.88 ±4.62	-5.624†††
	NEG(n=14)	15.99±4.62	16.13±4.88	0.326
	*t***	0.338	5.016†††	
Sit and reach	EG(n=14)	16.42±2.32	20.96 ±2.54	6.104†††
	NEG(n=14)	16.95±2.37	17.06 ±2.42	-0.525
	*t***	0.302	4.336†††	
Side step	EG(n=14)	11.85 ±2.62	8.13±2.76	-4.288†††
	NEG(n=14)	11.38±2.66	10.97 ±2.52	0.336
	*t***	-0.404	3.206†††	
Skipping rope	EG(n=14)	86.03±16.10	112.78±22.56	-14.060†††
	NEG(n=14)	84.75±12.86	88.13±13.27	1.036
	*t***	-0.448	12.602†††	

Note: M±SD.

* Paired t-test between pre- and post-values in a group.

**: Independent sample t-test' results between pre- and post-values in both groups.

†,††, and ††† mean P < 0.05, P < 0.01, and P < 0.001, respectively.

3.2. Changes in gait ability

Changes in gait ability are shown in <Table 4>. As for the gait ability of EG group, statistically significant differences were found in all variables of velocity(p=.000), cadence(p=.000), left step length(p=.000), right step length(p=.000), left stride length(p=.000), right stride length(p=.000). But statistically significant differences in the gait ability changes of the post-test between CG and EG were found in all variables of velocity(p=.000), cadence(p=.000), left step length(p=.000), right step length(p=.000), left stride length(p=.000), right stride length(p=.000).

Table 4. The change of gait ability.

Items	Group	Pre	Post	T*
velocity	EG(n=14)	31.26±9.12	38.14±11.46	4.204†††
	NEG(n=14)	30.92±10.21	31.14±10.82	-0.422
(cm/s)	*t***	0.388	-3.882†††	
cadence	EG(n=14)	62.62±16.24	69.08±14.26	6.844†††
	NEG(n=14)	63.09±15.16	63.01±16.82	0.224
(steps/min)	*t***	-0.342	-6.062†††	

step length (cm)	Left	EG(n=14)	24.06±5.12	29.04±4.06	5.824†††
		NEG(n=14)	24.32±6.22	24.38±5.84	0.218
		*t***	-0.296	-5.262†††	
	Right	EG(n=14)	23.88±5.62	28.88±5.02	6.462†††
		NEG(n=14)	24.06±6.06	24.33±4.84	-0.222
		*t***	0.446	-5.990†††	
stride length (cm)	Left	EG(n=14)	47.82±11.16	52.88±10.94	6.606†††
		NEG(n=14)	47.94±8.36	46.92 ±10.94	-0.438
		*t***	-0.336	-7.422†††	
	Right	EG(n=14)	46.72±9.28	51.98±10.82	6.026†††
		NEG(n=14)	46.36±11.06	46.44±10.88	0.206
		*t***	0.242	-6.322†††	

Note: M±SD.

EG/Exercise group, NEG/Non Exercise group

* : Paired t-test between pre- and post-values in a group

**: Independent sample t-test' results between pre- and post-values in both groups(pre/a, post/b)

†,††, and ††† mean P < 0.05, P < 0.01, and P < 0.001, respectively.

4. Discussion

The purpose of this study was to compare the effects of Yongmoodo exercise program on physical fitness and gait ability of the body imbalance obesity elementary students.

Obesity is a typical metabolic disorder that causes unbalanced energy metabolism by inducing an increase in body fat due to irregular eating habits and a decrease in physical activity, and it is reported as a risk factor for increasing the incidence of musculoskeletal and nervous system diseases[12]. This obesity induces physical dysfunction due to decrease in physical activity of elementary students in growing age, and this shows more severe dysfunctions in developmental aspect of elementary students[12]. Physical dysfunction due to physical imbalance is associated with dysfunctional musculoskeletal nervous system, leading to physical dysfunction and chronic diseases of growing elementary students[13]. This physical imbalance is a factor that impedes the movement of neck, back, back, pelvis, knee, and ankle, which is called physical connection chain through musculoskeletal deformation and it is a serious problem in terms of growth and development[14] The purpose of this study was to evaluate the effect of Yongmoodo exercise program on the performance of mats with 25% elasticity and 40% restitution. As a result, it was found that elementary students with obesity during the growing period had an excellent effect on eliminating the physical imbalance and walking ability. These results are consistent with the results of a study in which an increase in physical activity of a growing elementary student has an effect on the physical balance ability[15], and the physical activity of the growing elementary student has a strong relationship with physical fitness and physical function[16][17]. In addition, the results of Park et al.[18], which reported the effect of the exercise program for obese elementary school students, were derived.

Although many studies have been conducted on various physical exercise programs to improve physical function and to recover physical imbalance in elementary students, mat exercises have been selected as the most effective exercise methods. In this study, all the programs such as rolling, turning, and walking were performed on the mat, so that the Yongmoodo exercises were the most popular among the exercise methods in the aspects of playing and growth. In addition, the difference in the elasticity and restoring force of the mat has a great effect on the exercise performance[15][16], and

the elasticity and restoring force of the functional mat used in this study will have a great influence on the improvement of the physical function of the elementary students. The results of this study suggest that the Yongmoodo exercises have a positive effect on the physical fitness and gait ability of obese elementary students through improvement of coordination and body stabilizing. These results support a report about the physical stability on the mat[17][18] and the physical effects of mat exercises[19]. This mat movement is reported to be the most effective in enhancing the motor function of the growing elementary students and promoting the harmonious development of the body[20], and the physical stability and balance ability of the growing elementary students. In this study, it was confirmed that improvement of physical imbalance through Yongmoodo exercise affects positively the improvement of gait ability. The results of the study showed that the increase in the balance ability of obese children positively affected the improvement of gait function[21][22]. Also obesity improvement through obese children's physical activity leads to stabilize left and right displacement of body center during walking, and it shows a stable walking pattern with uniform movement at the knee and ankle joint angles[18][23]. Thus exercise program using functional mat is an effective exercise program for obese elementary school students' physical fitness and walking ability in obese elementary school students who showed unsupportive support.

5. Conclusion

The purpose of this study was to compare the effects of Yongmundo exercise program on physical fitness and gait ability of obese elementary students.

1. As for the physical fitness of EG group, statistically significant differences were found in all variables of muscular strength, muscle endurance, flexibility, agility, power, cardiovascular endurance. And statistically significant differences in the physical fitness changes of post-test between CG and EG were found in muscle endurance.

2. As for the gait ability of EG group, statistically significant differences were found in all variables of velocity, cadence, left step length, right step length, left stride length, right stride length. And statistically significant differences in the gait ability changes of the post-test between CG and EG were found in all variables of velocity, cadence, left step length, right step length, left stride length, right stride length.

This study suggests that Yongmoodo exercise program is an effective exercise for obese elementary students' physical fitness and gait ability. In addition, it is thought that it is necessary to develop appropriate training for obese elementary students to repetitive training in order to perform detailed and stabilized operation through improvement of physical unbalance and stabilization of posture.

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