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Effects of Naegong-Chesool EXERCISE on Physical Fitness and Balance Abilities in Male Elderly

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Abstract

This study was to investigate the effects of Naegong-Chesool exercise on physical fitness and balance abilities in male elderly. The participants were divided into two groups: Exercise group (n=20) and Control group(n=20). The Naegong-Chesool exercise program for 12 weeks. The results of this study were as follows: First, there were significantly increased in muscular strength, muscular endurance, cardiovascular endurance, flexibility and agility. Second, there were significantly increased in UP, Down, Left, Right Balance abilities. As conclusions, this study confirmed that the Naegong-Chesool exercise could improve the physical fitness and balance ability of male elderly.

[Keywords] Sport, Naegong-Chesool, Physical Fitness, Balance Abilities, Male Elderly

1. Introduction

A recent characteristic of global population change is the shift to an aging society due to the rapid increase in the elderly population. As the average life span of humans is gradually extended due to improvement of health hygiene and improvement of modern medicine due to low fertility and improvement of average life, the elderly population is continuously increasing. This has become a global social problem not only in Korea. The society where aged 65 and over accounts for more than 7% of the total population is called aging society, more than 14% is aged society, and more than 20% is post-aged-society. According to the National Statistical Office[1], it is also expected to enter the super-aged society in 2030 as the Aged Society in 2020 and the fastest rate of aging in OECD countries.

Decreased physiological function of the elderly due to aging reduces adaptability to disease and environment, such as weakening of physical function, slowing of exercise function, weakening of musculoskeletal system, lowering of cardiopulmonary function and immune function[2]. It causes negative effects on the quality of life of the elderly, causing the mental and physical damage of the elderly. In addition, it causes functional problems of health related physical fitness(muscle strength, muscle endurance, cardiopulmonary endurance, flexibility) and behavior related physical fitness(balance, agility, system response time) as the aged of the elderly grows[3]. Thus, the importance of health for elderly is an absolute necessity, and health maintenance is a problem to be solved. The decline in functional fitness due to aging can not be completely prevented, but adequate physical activity can slow down the rate of physical fitness [4]. Therefore, it is essential

to maintain regular exercise and proper lifestyle in order to live healthily in old age[5].

In an aging society, the elderly are encouraged to participate in exercises as an effective way to reduce medical costs by improving the physical function of the elderly, enabling independent physical activity and lifestyle, and reducing the treatment of chronic diseases[6]. Continuous exercise is also effective in improving health-related fitness and antioxidant enzyme activation and prevention of metabolic syndrome[7]. Regular participation of aerobic exercise improves the risk factors of chronic metabolic diseases, improves cardiovascular function, and improves the health and fitness of the elderly with preventive effects[8]. A study of Kim KJ et al[9] reported that regular exercise participation has positive effects on changes in body composition by increasing muscle mass and decreasing body fat mass in the elderly. And the body fat, body fat and body fat were decreased, and fat, muscle strength, and oxygen uptake were improved[10][11]. Fatouros et al[12] also reported that regular exercise improves the bones of elderly people, improves flexibility, improves overall balance, as well as overall cardiovascular function. However, despite the positive effects of exercise on the elderly, many older people do not practice systematic exercise. The reason for this is that the necessity of physical activity decreases with increasing age. Second, it thinks that exercise is dangerous. Third, it thinks that light exercise does not help health[13]. And fourth, If you have an attitude to avoid exercise because of illness[14], because they are generally low in physical fitness and are interested in health but improve their physical and mental health without a limited facilities, space and economy.

Therefore, this study is a movement that strengthens physical strength and energy simultaneously by coinciding breathing and movement, and is widely applied to all age groups[15]. The purpose of this study is to clarify the effect of the Korean traditional martial arts Naegong-Chesool exercise, which is similar to Chinese taijiquan, on the physical fitness and balance ability of the elderly. The

purpose of this study is to verify the feasibility and efficiency of the exercise program for elderly people.

2. Materils & Method

2.1. Subject of study

The subject of this study is composed of male elderly in D city and physically healthy persons without any medically specific findings. The subject is divided into two groups through random sampling: Naegong-Chesool exercise group(EG/20 people) and non-exercise group(CG/20 people). The physical characteristics of subjects are shown in <Table 1>.

Table 1. Physical characteristics of subjects.

	Age(yrs)	Height(cm)	Weight(kg)	BMI(kg/m ²)
EG(N=20)	68.93±2.31	168.27±2.94	65.07±3.41	26.47±1.33
CG(N=20)	69.13±1.81	169.60±2.80	65.67±3.35	27.20±1.54

2.2. Exercise program

The Naegong-Chesool program consisted of the basic textbook of the handicapped, and composed of stroke, pushing, and blocking exercises in consideration of elderly's physical functions[16]. The Naegong-Chesool program was performed for 60 minutes 4 times a week for 12 weeks in compliance with the exercise recommendation shown in ACSM[17]. The contents of Naegong-Chesool program are as shown in <Table 2>.

Table 2. Naegong-Chesool program.

Contents	Exercise program	1~4 weeks (reps/set)	5~8 weeks (reps/set)	9~12 weeks (reps/set)	Exercise intensity
Warm-up (10min)	Stretching walking, stroke, pushing				

Work-out (40min)	punching(palm, fist, side-fist)	20/3	30/3	50/3	RPE 8~10
	Pushing (lower wrist, side hand, chin, one hand, two hands, neck, trunk)	20/3	30/3	50/3	
	Blocking (hands, feet, knees, twist trunk, hanging, turning) /	20/3	30/3	50/3	
Cool-down (10min)	Stretching				

2.3. Measurt and method

2.3.1. Measurt and physical fitness

As the physical fitness was measured by five variables, which was based on the Senior Fitness Test(SFT) developed to evaluate elderly 's physical fitness[18]. Muscular strength(grip strength), muscular endurance(chair stand test), cardiovascular endurance(2 minute step test), flexibility(chair and reach), Agility(244 cm up and go) were mesured according to SFT.

2.3.1.1. Measurt and muscular strength

Muscular strength is measured by using a tonometer(TAKE 1, Japan), holding the instrument panel facing outward, and then adjusting the width so that the second joint of the second finger is almost perpendicular in an upright posture. Higher values were selected after 2 measurements(unit of measurement: kg).

2.3.1.2. Measurt and muscular strength

Muscle endurance was measured by using a chair. The subjects were sitting on their chairs for 30 seconds with their arms held together in front of their chests and measuring the total number of times they had occurred.

During the measurement, the subjects were allowed to stretch their knees to the maximum extent. In order to prevent the mobilization of both arms or other muscles, muscular endurance were measured so that only lower extremity could be mobilized with their hands crossed on both shoulders.

2.3.1.3. Measurt and cardiovascular endurance

The whole body endurance test was performed with a 2 minute step test. Subjects walked for 2 minutes with a "start" command in a comfortable position. The right knee was regarded as one occasion when it reached the specified position, and it was recognized that the knee was raised to the middle part between the patella and the iliac crest[19].

2.3.1.4. Measurt and flexibility

Flexibility was achieved by sitting and reaching the body. Participants should be careful not to bend their knees with their two knees on their knees and to stretch their fingers to their fullest extent. A total of 2 measurements were performed and the highest value was recorded. A measuring instrument(Helmsas NH-3000G, Korea) was used for the measurement.

2.3.1.5. Measurt and agility

The agility was measured using 244 cm up and go walk. The chair was placed on the wall and the point 244 cm from the chair was marked as a turning point. The subjects placed their backs on their chairs, their hands on their thighs, and their entire soles to sit on the floor. When the "start" command was received, the subject walk up from the chair and measured the time to sit on the chair again after turning around. The unit was 0.01 seconds.

2.4. Date process

To process the data of this study, the mean and standard deviation of all the data were calculated using SPSS 20.0. The significance test before and after experiment was conducted by paired t-test, and the significance test between each groups was conducted by independent sample t-test. The significance level was $\alpha < .05$.

3. Results

3.1. Changes in physical fitness

Changes <Table 3> shows the change of physical fitness after Naegong-Chesool program. Changes in physical fitness of EG group were statistically significant in all variables of left muscular strength(p=.000), right muscular strength(p=.000), muscular endurance(p=.003), cardiovascular endurance(p=.000), flexibility(p=.000), and agility(p=.000). Changes in physical fitness of CG group were not statistically significant in all variables. In the pre-test, there was no statistically significant difference of all variables between groups. In the post-test, there were statistically significant differences of left muscular strength(p=.000), right muscular strength(p=.000), muscular endurance(p=.000), cardiovascular endurance(p=.000), flexibility(p=.000), and agility(p=.000) between groups.

Table 3. Changes in physical fitness.

Contents	Group	Pre-test	Post-test	t*	
Muscular strength	Left	EG(n=20)	21.73±1.58	23.09±1.17	-3.532 ^{***}
		CG(n=20)	21.54±1.38	21.61±1.16	-0.338
		t**	0.367	3.972 ^{***}	
	Right	EG(n=20)	22.96±1.13	23.95±0.99	-3.051 ^{***}
		CG(n=20)	22.58±0.99	22.82±0.84	-0.316
		t**	0.476	3.369 ^{***}	
Muscular endurance	EG(n=20)	16.33±2.79	18.00±1.31	-2.820 ^{**}	
	CG(n=20)	16.53±2.20	16.27±1.33	0.695	
	t**	-0.218	2.991 ^{***}		
Cardiovascular endurance	EG(n=20)	81.38±2.61	83.46±1.80	-3.731 ^{***}	
	CG(n=20)	81.14±2.26	81.23±1.69	-0.396	
	t**	0.272	3.492 ^{***}		
Flexibility	EG(n=20)	8.07±3.15	10.93±3.13	-4.489 ^{***}	
	CG(n=20)	7.53±3.02	7.60±2.50	-0.250	
	t**	0.473	4.224 ^{***}		
Agility	EG(n=20)	7.65±1.18	6.55±0.90	3.292 ^{***}	
	CG(n=20)	7.92±1.06	7.84±1.02	0.360	
	t**	-0.667	-3.073 ^{***}		

Note: Value EG/Exercise group, CG/Non Exercise group

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

**: Independent sample t-test in pre-test and post-test between groups

†† and ††† mean p<0.01, and p<0.001 respectively.

3.2. Changes in balance ability

<Table 4> shows the change of physical fitness after Naegong-Chesool program. Changes in balance ability of EG group were statistically significant in all variables of Up(p=.000), Down(p=.003), Left(p=.000), and Right(p=.000). Changes in balance ability of CG group were not statistically significant in all variables. In the pre-test, there was no statistically significant difference of all variables between groups. In the post-test, there were statistically significant differences of Up(p=.000), Down(p=.003), Left(p=.000), and Right(p=.000) between groups.

Table 4. Changes in balance ability.

Contents	Group	Pre-test	Post-test	t*
Up	EG(n=20)	-1.63±0.37	-0.61±0.65	-5.533 ^{***}
	CG(n=20)	-1.72±0.29	-1.59±0.33	-1.702
	t**	0.728	5.179	
Down	EG(n=20)	-1.57±0.59	-0.76±0.49	-4.109 ^{**}
	CG(n=20)	-1.41±0.66	-1.47±0.63	0.730
	t**	-0.705	3.413	
Left	EG(n=20)	-1.11±0.57	-0.10±0.51	-5.329 ^{***}
	CG(n=20)	-1.15±0.46	-1.24±0.51	0.932
	t**	0.179	6.133	
Right	EG(n=20)	-0.77±0.53	0.16±0.51	-7.954 ^{***}
	CG(n=20)	-0.92±0.48	-1.01±0.45	2.053
	t**	0.820	6.657	

Note: EG/Exercise group, CG/Non Exercise group

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

**: Independent sample t-test in pre-test and post-test between groups

†† and ††† mean p<0.01, and p<0.001 respectively.

4. Discussion

For As a result of comparing and analyzing effects of Naegong-Chesool exercise program on physical fitness and balance ability of 40 male elderly(exercise group of 20, non exercise group of 20), discussion is as follows.

4.1. Exercise and physical fitness

The physical fitness required for the elderly is muscular strength, muscular endurance, cardiovascular endurance, flexibility, and agility of the lower and upper body in order to ensure safe and normal life activities[18], a significant change due to aging has been reported change of muscle and musculoskeletal

system which is the major factor affecting self-reliance directly[20].

These physical strength factors generally decrease with physical performance ability as age increases, and muscular strength, muscular endurance decrease gradually after age 30 and decrease by 50% until age 70. In addition, the decrease in muscular strength, muscular endurance, as well as all physical fitness, also decreased rapidly with aging at the age of 75 years[4]. However, according to various previous research results, exercising regularly for 24-32 weeks can help elderly people aged 80-90 improve their VO_{2max} by 15-17%. Also aerobic endurance training improves older people's ability to maintain exercise at maximum energy expenditure[21], and regular participation in physical activity programs reported a positive change in improving physical fitness of the elderly[22].

The changes in physical fitness of elderly people in this study showed positive effects on Naegong-Chesool exercise group all physical fitness variables such as muscular strength, muscular endurance, cardiovascular endurance, flexibility, and agility, which is the same as the research results of Kim et al[22] and Oh et al[21], also supports the research results of Kim[23] which was a significant difference in all the variables of physical fitness between exercise group and non exercise group in the change of physical fitness difference by age.

4.2. Exercise and balance ability

Changes Balance is a complex phenomenon due to the integration of senses, musculo-skeletal and nervous systems[24], and these functions deteriorates with age. In particular, depression of proprioception causes falls by impairing body function that maintains balance, which is perceived as a serious health problem[25]. Many studies have shown that prevention of falls in elderly people requires improvement of physical fitness and regular exercise to improve balance ability[26]. Lee[27] reported 3 times a week, 30 minutes daily mat exercise improved the overall balance ability of elderly people aged 65 and over, and muscle strength increase and ROM increase through regular exercise improved

the balance ability of the elderly and reduce the risk and fear of falling[28]. Falling refers to falling over to a lower position or floor than originally, except falling outside due to external forces, loss of consciousness, or sudden paralysis[29]. Due to the physiological changes due to the aging process, elderly people are 10 times more likely to fall than other age groups[8], 30% of elderly people aged over 65 experience more than one fall each year[30], and fall is recognized as a serious social problem due to the high risk of relapse[31].

The changes in balance ability of elderly people in this study showed positive effects on Naegong-Chesool exercise group all balance ability variables and it is the same as the research results of Park[32] which is improvement of the elderly physical fitness had a positive effect on the improvement of balance ability, and supports the preliminary study[33] that the declining fitness of the elderly is increasing the risk of falls due to poor balance, also supports the research results of Kim[3] that decrease in physical fitness of elderly is increasing the risk of falls due to decrease in balance ability[33]. In addition, results of this study is supporting that reported that Naegong-Chesool exercise makes body and soul united by matching abdominal respiration and Naegong-Chesool's motion, and it is gentle enough to slowly stretch joints and muscles to improve strength and overall endurance, to improve body balance and agility[15].

5. Conclusion

The purpose of this study is to investigate the effect of Naegong-Chesool exercise on physical fitness and balance abilities in male elderly. The participants were divided into two groups: Exercise group(n=20) and Control group(n=20). Naegong-Chesool program was performed for 60 minutes 4 times a week for 12 weeks. And the effects of Naegong-Chesool exercise on physical fitness and balance abilities in male elderly were as follows.

1. Changes in physical fitness of EG group were statistically significant in all variables of

muscular strength, muscular endurance, cardiovascular endurance, flexibility, and agility, but there was no significant difference in all variables of CG group.

2. Changes in balance ability of EG group were statistically significant in all variables of UP, Down, Left, and Right, but there was no significant difference in all variables of CG group.

The results of this study suggest that Nae-gong-Chesool is an effective exercise on physical fitness and balance abilities in male elderly. Therefore, it is thought that the elderly people can provide more information to improve physical fitness, performance fitness and balance ability, if they develop programs to exercise such as exercise therapy considering eating habits, lifestyle and environment.

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