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The Effects of Aqua Rehabilitation Exercise on Body Shape and Visual Analogue Scale in Elderly Women

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Abstract: The physical effects of underwater exercise includes muscle relaxation, decrease of muscular spasm and pain, increase of joint moving range and muscular strength and improvement of stability and balance of body. This study aimed to investigate the changes in body shape and visual analogue scale of elderly women after 12 weeks of aqua rehabilitation exercise. The research subjects were elderly in 70s living in Korea who do not exercise regularly do not take dietary supplement and wish to attend 12 weeks of aqua rehabilitation exercise program. The aqua rehabilitation exercise was performed for a total of 48 sessions 4 times a week for 12 weeks each of 60 min. Walking, stretching, shaking, jumping, jogging were performed in order focusing on the spine in which low pressure was started and intensity was increased to optimum pressure. Body shape changes (Bodystyle S-8.0: Korea) was used for body shapein which they were measured as shoulder, pelvis, leg length, balance of right and left. VAS (Visual Analogue Scale) was used for level of pain in which they were measured as subjective pain score. PASW 18.0 statistical program was used on the pre-test and post-test data to identify the effect of 12 week treatment. Descriptive statistics was suggested for each measurement period and two way 2-way repeated ANOVA was applied to find the interaction of the treatment effect. The significance level was set to be 0.05. First, shoulder angle showed significant interaction effect between EG and CG with $p<0.05$. Pelvis angle showed significant interaction effect between EG and CG with $p<0.05$ leg length showed significant interaction effect between EG and CG with $p<0.05$. Balance of right and left showed significant interaction effect between EG and CG with $p<0.05$. Second, VAS showed significant interaction effect between EG and CG with $p<0.001$. Aquatic exercises make people to work out with the resistance in water and ultimately strengthen the muscular strength of muscles around the joints. Furthermore, the underwater exercise program will help the participants to effectively use the resistance underwater and actively bring on euphoria to decrease pain.

Key words: Aqua rehabilitation exercise, body shape, visual analogue scale, shoulder angle, pelvis angle, leg length, balance of right and left

INTRODUCTION

The rate of the aging population over 65 years old in Korea recorded 2.9% in 1960s but it increased 4.5 times in 2015. The National Office of Statistics in Korea estimates that the number of elderly people in Korea will keep rising, rating 24.3% in 2030 and 40.1% in 2060. In 2015, South Korea was ranked in the top 51 of 133 countries in elderly population rate and it is assumed that it will skyrocket to the top 2 in 2060. Rapid population aging and low birth rate are chosen as the main two factors that accelerate the status quo.

As aging proceeds, total physical functions including muscle system, skeletal system, nerve system and joint working range decline and as the age increases, the moving range of coxa decreases (Shim and Kim, 1996). Furthermore, the scientists discovered that the biggest physical change which happens to the elder and accounts for almost 94% was from problems with bones and muscles (Keller *et al*., 1991). Likely, the weakening muscles and asymmetric use of muscles trigger joint inflammation and brings about more serious muscular weakening (Ettinger and Afble, 1994). Especially, muscular strength of human rapidly decline after the age 60 and the muscular weakening of lower body decreases the ability of the stabilizing muscle and ultimately make everyday life hard to be maintained (Fukagawa *et al*., 1995). Furthermore, since the muscular strength and muscle quantity decrease as well, it disturbs the coordination of muscles and their balancing ability. It finally makes the body of the elder to be easily hurt (Shephard, 1993).

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Regular exercise positively influence the life of the elder people by lengthening their life and maintain their healthy life. Crucially, it decreases the danger of chronic diseases (Kang and Park, 2008; Kim and Park, 2007). In addition, regular work outs psychologically stables the elder people and is now considered as a pivotal factor which helps them to maintain both sound mind and body (Belmin and Konrat, 2006; Perez, 2008).

Physical activity of senior citizens should be decided after carefully considering their motor abilities and physical conditions and most of all, their articular conditions. Exercises for senior citizens should be constructed to extend the joint moving range of the seniors and increase their muscular strength at the same time (Colado *et al*., 2008).

There are a myriad of physical activities which are recommended to the seniors but under water exercise is considered as the best way to boost both muscular strength and joint moving range without giving too much stress to the body (Lee *et al*., 2009). It not only minimizes the danger of myotonia and relapses which easily happens when people exercise on land but also enables people to easily adjust the level of resistance and maintain their body (Wilder and Brennan, 1993).

Resistance in water gets bigger when people move their hands and legs faster and more intense while it gets smaller when people move slower. Moving slowly under water helps people to freely adjust the resistance and find exercises which fits well to each of them (Bandy and Sanders, 2001). Aquatic rehabilitation exercise is one of the special form of physical therapy which helps people who had abnormal patterns in their physical systems (muscular, skeletal, nervous, circulatory systems) and emotional systems due to certain diseases or accidents. By using the unique characteristics of water such as water temperature, water resistance, buoyancy and water pressure (WATSU, Bad RagazRing, Halliwick) aquatic rehabilitation exercise assists people to recover their abnormal patterns back to normal patterns (ACSM, 2008). The physical effects of underwater exercise includes muscle relaxation, decrease of muscular spasm and pain, increase of joint moving range and muscular strength and improvement of stability and balance of body (Bate and Hanson, 1996).

This study aimed to investigate the changes in body shape and visual analogue scale of elderly women after 12 weeks of aqua rehabilitation exercise.

MATERIALS AND METHODS

Study method

Subject of study: The research subjects were elderly in 70s living in Korea who do not exercise regularly do not take dietary supplement and wish to attend 12 weeks of aqua rehabilitation exercise program. The Experimental Group (EG) participates in the aqua rehabilitation exercise whereas Control Group (CG) does not participate in the treatment program of this study. About 8 subjects were assigned to each group but 1 subject from CG quit from the program. Therefore, total of 15 subjects participated in this program (Table 1).

Table 1: Physical characteristic of subjects (M±SD)

Group	N	Age (years)	Height (cm)	Weight (kg)	Fat (%)
EG	7	72.28±1.35	158.88±2.94	63.21±2.27	29.33±3.20
CG	8	71.84±1.49	159.11±3.17	64.05±2.34	29.51±3.41

Table 2: Aqua rehabilitation exercise

Program	Intensity	Exercise
Aqua rehabilitation exercise	RPE<17/ repetitions 10	Warm up/cool down: stretching main exercise: forward walking, backward walking, backward flexion, upper body flexibility, lower body flexibility, elbow gathering, should roll, pelvic rotation, ankle twist, wrist twist, chest extension

Treatment program: The aqua rehabilitation exercise was performed for a total of 48 sessions 4 times a week for 12 weeks each of 60 min.

Walking, stretching, shaking, jumping, jogging were performed in order focusing on the spine in which low pressure was started and intensity was increased to optimum pressure (Table 2).

Measurement: Body shape changes (Body style S-8.0: Korea) was used for body shapein which they were measured as shoulder, pelvis, leg length, balance of right and left. VAS (Visual Analogue Scale) was used for level of pain in which they were measured as subjective pain score.

Data analysis: PASW 18.0 statistical program was used on the pre-test and post-test data to identify the effect of 12 weeks treatment. Descriptive statistics was suggested for each measurement period and two way 2-way repeated ANOVA was applied to find the interaction of the treatment effect. The significance level was set to be 0.05.

RESULTS

Change in body shape: Shoulder angle showed significant interaction effect between EG and CG with $p<0.05$. Pelvis angle showed significant interaction effect between EG and CG with $p<0.05$. Leg length showed significant interaction effect between EG and CG with $p<0.05$. Balance of right and left showed significant interaction effect between EG and CG with $p<0.05$ (Table 3-7).

Table 3: Body shape descriptive statistics

Factors	Groups	Pre-test	Post-test
Shoulder (°)	EG	4.28±0.85	3.72±0.360
	CG	4.31±0.94	4.33±0.940
Pelvis (°)	EG	4.05±1.37	3.81±1.230
	CG	4.26±1.33	4.27±1.570
Leg length (mm)	EG	24.33±9.22	22.26±9.650
	CG	24.87±9.38	24.52±10.13
Balance (%)	EG	4.49±1.27	3.69±1.720
	CG	4.60±1.09	4.41±1.130

Table 4: Shoulder angle 2-way repeated ANOVA

Factors	SS	df	MS	F-values	p-values
Group	0.7790	1	0.779	0.610	0.449
Error	16.6010	13	1.277		
Period	0.5200	1	0.520	6.638	0.023
Group*period	0.6230	1	0.623	7.955	0.014
Error	1.0190	13	0.078		

Table 5: Pelvis angle 2-way repeated ANOVA

Factors	SS	df	MS	F-values	p-values
Group	0.841	1	0.841	0.219	0.647
Error	49.869	13	3.836		
Period	0.100	1	0.100	4.960	0.044
Group*Period	0.116	1	0.116	5.739	0.032
Error	0.262	13	0.020		

Table 6: Leg length 2-way repeated ANOVA

Factors	SS	df	MS	F-values	p-values
Group	14.658	1	14.658	0.080	0.782
Error	2393.145	13	184.088		
Period	10.952	1	10.952	12.473	0.004
Group*Period	5.572	1	5.572	6.346	0.026
Error	11.415	13	0.878		

Table 7: Balance 2-way repeated ANOVA

Factors	SS	df	MS	F-values	p-values
Group	1.315	1	1.315	0.391	0.543
Error	43.764	13	3.366		
Period	1.820	1	1.820	16.602	0.001
Group*Period	0.706	1	0.706	6.445	0.025
Error	1.425	13	0.110		

Table 8: VAS descriptive statistics

Factors	Group	Pre-test	Post-test
VAS	EG	6.39±1.49	4.98±1.25
	CG	6.59±1.24	6.42±1.12

Table 9: Pain 2-way repeated ANOVA

Factors	SS	df	MS	F-values	p-values
Group	5.059	1	5.059	1.561	0.234
Error	42.137	13	3.241		
Period	4.638	1	4.638	254.511	0.001
Group*period	2.888	1	2.888	158.461	0.001
Error	0.237	13	0.018		

Change in pain: VAS showed significant interaction effect between EG and CG with $p<0.001$ (Table 8 and 9).

DISCUSSION

This study aimed to investigate the changes in body shape and visual analogue scale of elderly women after 12 weeks of aqua rehabilitation exercise. Under water exercise is considered one of the most effective ways to recover the body to regain balance without causing any pressure and stress to the human body. Therefore, it can be broadly used from children to the elder people and even can be developed as a rehabilitation method to maintain health (AEA, 2005).

Soma to type is considered as a phenotype which is decided by the influence of environment and genes and the elements which decides the change in body also can be changed according to the factors including aging process, exercise and nutrition (Norton and Olds, 2002). Therefore, correct body posture improves the physical efficiency and declines the danger of being damaged, whereas imbalance of posture increases stress of human body and decrease the physical ability. To achieve a correct body type, development of muscular strength and correct range of skeletal system are necessary.

There were 5 similar and significant cases according to several preceding researches which were related to the mentioned subject. First, Ahn (2014) showed that there was a positive change in body type of university students after 4 weeks of thai massage therapy and aerobic exercise. Second, Lee (2005) had underwent a 12 week-complex-exercise program for obese female university students and found out that the complex-exercise program were much more effective than simple aerobic exercises. Third, Kim and Han (2015) underwent rehabilitation exercises for 12 weeks to aged women group and figured out that the rehabilitation exercise program brought significant effect to their body type. Fourth, Jeon *et al.* (2011) found that the complex chiropractic exercise program helped the body type of female students who were suffering from scoliosis. Finally, Park (2005) found the balancing ability of senior women who were suffering from degenerative arthritis had improved after 16 weeks under water rehabilitation exercise.

In this study, 12 weeks of underwater rehabilitation exercise will be underwent to female seniors to develop their physical balance which includes the length of legs, height of pelvis and horizontality of shoulders, since underwater rehabilitation exercises highly use the characteristics of water itself. Exercises which use buoyancy and resistance of water help the physical balance to increase, joint moving range to expand and the coordination to improve (Nam *et al*., 2004).

Pain is one of the most common and the most important health problems to the seniors and is estimated that half of the seniors in the society under go (Chang *et al*., 2007). Chronic diseases and the aging process mainly give rise to the pain. Therefore, various health-related services should be provided to overcome the chronic pains which makes the seniors suffer (Jonathan *et al*., 2005).

Under water exercise helps the body to be lighter in the water thanks to the buoyancy of water (Brody and Geigle, 2009) helps the seniors who have weak joints and muscular strength to regain their health and improve their quality of life (Yin *et al*., 2013), improves the physical strength by using the water resistance and viscosity (Becker, 2009) and relieves the pain which comes from hip and knee joint inflammation (Rahmann, 2010).

There were 4 effective cases from several preceding researches which were related to the pain relieving effect of exercise. First, Park (2016) found out that 12 weeks aquatic rehabilitation exercise brought significant decrease in waist pain to female seniors who actually suffered from waist pain. Second, Park (2015) underwent a 8-week-underwater-exercise program and brought a positive effect in degenerative joint inflammation. Third, Silva (Shim and Kin, 1996) reported that the patients who were suffering from knee joint inflammation did had a significant decrease in pain after aquatic exercises. Lastly, Lee (2008) also underwent 4 weeks of aquatic exercise program for curing purpose for rheumarthritis patients over age 50.

In this study as well, positive and significant change in pain is expected after 12 weeks of aquatic rehabilitation exercise program aimed at female seniors, since the aquatic exercises make people to work out with the resistance in water and ultimately strengthen the muscular strength of muscles around the joints (Bennell and Hinman, 2011). Furthermore, the underwater exercise program will help the participants to effectively use the resistance underwater and actively bring on euphoria to decrease pain.

CONCLUSION

This research was aimed to find out how the aquatic rehabilitation exercise change the female senior's body type and subjective pain scale. To find out the result, the participants were divided in two groups and underwent the exercise including warming ups and warming downs, 4 times a week for total 12 weeks. After 12 weeks of program, results of the study were same as the following. First, the horizontality of shoulders and pelvis, length of legs and the body balance had an interactive effect with the exercise program. Second, 12 weeks of program had a positive effect on the subjective pain scale of the participants. Therefore, it had showed that the 12 weeks of aquatic rehabilitation exercise did have a significant influence on female seniors with both aspects of body type and pain scale.

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