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Effect of Aquatic Exercises on Strength and Quality of Life in Sarcopenia Older Individuals

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Abstract

There are various definitions for sarcopenia. The "European Working Group on Sarcopenia in the Elderly" (EWGSOP) has defined Sarcopenia as "a frail syndrome with a progressive and generalizing loss of the person's muscle strength, which carries the risk of undesirable consequences such as physical disability, poor quality of life and death." It is an analysis of the effect of water exercises on strength and quality of life in individuals. 40 volunteer sarcopenic elderly individuals living in the Muğla region, with inclusion and exclusion criteria, were included in our study. In the following weeks, the exercise program progress was started 2 days a week, 40 minutes (10 minutes nutrition, 23 minutes conditioning, 5 minutes stretching/cooling down). The data obtained as a result of the study was analyzed using the IBM SPSS 23 package program. . Shapiro-Wilks test to determine normal distribution of variables; Paired Samples T-Test was used for comparisons before and after exercise. Analysis result; There are permanently significant differences in the values of the ratios. ($p<.0.05$). As a result, it has been proven that exercise training for older individuals has a number of positive effects, and 8-week exercises have been observed to significantly increase muscle strength and decrease fat percentage. In parallel, it has been determined that Aquatic exercise has a positive effect on Energy / Vitality / Vitality, which is the subcategory of the life category.

Keywords: Ageing, Sarcopenia, Exercise, Aquatic exercise, Quality of life

Özet

Sarkopenik Yaşlı Bireylerde Aquatik Egzersizlerin Kuvvet ve Yaşam Kalitesi Üzerine Etkisi

Sarkopeni için yapılmış çeşitli tanımlamalar mevcuttur. Bunlardan "Avrupa Yaşlılarda Sarkopeni Çalışma Grubu"(EWGSOP) Sarkopeniyi "fiziksel engellilik, düşük hayat kalitesi ve ölüm gibi istenmeyen sonuçların riskini taşıyan, iskelet kas kütlesinin ve gücünün ilerleyici ve jeneralize kaybı ile karakterize bir sendrom" olarak tanımlamıştır. Bu çalışmanın amacı, sarkopenik yaşlı bireylerde aquatik egzersizlerin kuvvet ve yaşam kalitesi üzerine etkisinin araştırmasıdır. Çalışmamıza Muğla bölgesinde yaşayan Tazelenme Üniversitesinin aktif öğrencilerinden, katılım ve dışlanma kriterleri taşıyan 40 gönüllü sarkopenik yaşlı bireyler dahil edilmiştir.

Yaşlılarda fiziksel Aktivite Anketi (PASE), yaşam kalitesinin objektif olarak değerlendirilebilmesi için Yaşam Kalitesi Ölçeği uygulanmıştır. Egzersiz programı suya adaptasyon ve nefes egzersizleri ile başlanmıştır. Sonraki haftalarda egzersiz programının ilerleyişi haftada 2 gün, 40 dk (10 dk ısınma, 25 dk kondisyonlama, 5 dk germe /soğuma) olacak şekilde uygulanmıştır. Çalışmanın sonucunda elde edilen veriler IBM SPSS 23 paket programı kullanılarak analiz edilmiştir. Değişkenlerin normal dağılıma uygunluk durumunu belirlemek için Shapiro-Wilks testi; egzersiz öncesi ve sonrası karşılaştırmalarında ise, Paired Samples T-Testi kullanılmıştır. Analiz sonucunda; katılımcıların değerlerinde istatistiksel olarak anlamlı fark bulunmuştur. ($p<.0,05$). Sonuç olarak Yaşlı bireyler için egzersiz eğitiminin bir dizi olumlu etkisi olduğunu gösteren kanıtlar tespit edilmiştir 8 haftalık uygulatılan egzersizlerin önemli düzeyde kas kuvvetini arttırdığı ve yağ yüzdesinde de düşüş sağladığı gözlemlenmiştir. Buna paralel olarak Aquatic egzersizin yaşam kalitesi alt kategorisi olan Enerji/Canlılık/Vitaliteye pozitif etkisi olduğu tespit edilmiştir.

Anahtar Kelimeler: Yaşlılık, Sarkopeni, Egzersiz, Aquatik Egzersiz, Yaşam kalitesi

INTRODUCTION

Ageing and Sarcopenia

Ageing is an inevitable life stage that will be experienced in line with the social determinants of societies, unless there are premature deaths due to genetic diseases, accidents or any other reason (9). It is described as a period known as the last phase of human life, following development and maturation, where the interaction between the genetic structure and the environment is seen at the highest level, physiological and psychological changes occur, losses, chronic diseases and collapse (25,10). The world is aging rapidly. As people get older the emergence of physical limitations is caused by many factors. The elderly population, defined by the World Health Organization (WHO) as the group aged 65 and above, is increasing at an approximate rate of 5% annually in both developed and developing countries (13).

Global ageing has brought to the forefront chronic health problems and the concept of geriatric syndromes related to the elderly. Geriatric syndromes encompass a set of symptoms that are not fully explained by disease definition, manifesting with atypical symptoms because of the interaction between age and the impact of the disease on multiple systems in practice (7,24).

One of the commonly observed significant geriatric syndromes in the elderly population, sarcopenia, is named by combining the Greek words "sarcos" (flesh) and "penia" (loss). It was initially defined by Irwin Rosenberg as age-related muscle mass loss. The definition used for sarcopenia was redefined in 2010 by the European Working Group on Sarcopenia in Older People (EWGSOP) as a syndrome characterised by progressive and widespread loss of skeletal muscle mass and strength, increasing the risk of negative outcomes such as physical limitations, low quality of life, and death (7).

Sarcopenia is a geriatric syndrome characterised by progressive and widespread loss of muscle strength and is acknowledged as a disease. Sarcopenia, leading to physical dependence and falls in the elderly, causing a loss of quality of life and resulting in death, is more prevalent in individuals aged 80 and above, with a range of 5-13% in the 60-70 age group and 11-50% in those aged 80 and older (15).

Generally, the human body reaches its peak muscle mass around the age of 30. It is known that a gradual decline in muscle mass occurs with aging. The muscle mass, which constitutes approximately one-third of the total body mass in youth, starts to decrease after the age of 40 and halves by the age of 75 (20,1). Although muscle loss is more significant in men, the prevalence of sarcopenia is higher in women.

Sarcopenia is a syndrome characterized by the general and progressive loss of muscle mass and strength, leading to physical inadequacy, impaired quality of life, and death. In the aging process, there is a cycle between muscle mass and functionality: initially, there is a decrease in muscle mass, i.e., sarcopenia, followed by associated skeletal muscle insufficiency, subsequent reduction in muscle strength, and then the development of restricted functionality. Ultimately, this leads to decreased mobility and strength difficulties (11). This issue is faced by 4 out of every 10 individuals aged 80 and above, and this loss of muscle mass particularly manifests as a strength reduction in the back, arms, waist, and leg muscles (20).

Sarcopenia is practically divided into primary and secondary categories. Primary sarcopenia develops directly due to aging. Secondary sarcopenia, on the other hand, arises from one or more underlying causes (13). However, making this distinction is not always very possible when observing sarcopenia in the elderly.

The European Working Group on Sarcopenia in Older People (EWGSOP) has classified sarcopenia into three stages for staging: presarcopenia, sarcopenia, and severe sarcopenia. In the pre sarcopenia stage, muscle strength and physical performance are unaffected, but there is a decrease in muscle mass. In the sarcopenia stage, there is a decrease in muscle mass along with a reduction in muscle strength or performance. Severe sarcopenia, on the other hand, involves a decrease in all three criteria—muscle mass, muscle strength, and performance (6).

Sarcopenia Assessment Methods

Various methods are employed to determine sarcopenia. For measuring muscle mass in sarcopenic patients, the Dual Energy X-ray Absorptiometry (DEXA), also known as DXA (Dual Energy Xray Absorptiometry), Bioelectrical Impedance Analysis (BIA), and anthropometric methods are the most practical and cost-effective techniques. Magnetic Resonance Imaging (MRI) and Computed Tomography (CT) methods, known as MRG and CT, respectively, are specific techniques that can measure the area and mass of muscle mass (26).

Assessing muscle strength is a key parameter for diagnosing sarcopenia and indicates the capacity of a muscle mass to generate force in a very short period. Measurement of handgrip strength is considered an ideal test for determining the decrease in muscle strength and is measured using a Jamar dynamometer. Three measurements are taken for each hand, and the highest measurement is taken into account. Cutoff values for grip strength have been established for women and men based on body mass index (BMI) (19).

Exercise and Aquatic Exercise in Sarcopenia

Exercise is considered an effective strategy in the treatment of various pathologies such as cardiovascular diseases, lung diseases, diabetes, and various types of cancer (27). The International Sarcopenia Working Group (International Working Group 2015; Volume: 54 (Supplement) 47 on Sarcopenia (IWGS)] has defined sarcopenia as the "age-related loss of skeletal muscle mass and function" with a common view. Later, this group defined sarcopenia as a "combination of whole-body or appendicular lean mass deficiency and poor physical function" (18). Despite the well-known physical and psychological benefits derived from regular physical activity, studies indicate that approximately 30% of the world's population does not engage in the recommended dose of physical activity, reaching 45% in those over 65 and up to 75% in those over 75. Most elderly individuals are much less active than desired, often reporting that they do not exercise, will not exercise, or believe they should not exercise (23,24). Studies suggest that resistance exercise training can even alleviate skeletal muscle function impairments in elderly individuals. Therefore, elderly individuals should be encouraged to participate in resistance exercise training activities. Physical activity for individuals aged 65 and above includes daily activities performed individually or collectively with family, encompassing recreational activities, leisure activities, activities for transportation (walking and cycling), occupational activities, household chores, games, sports, or planned exercise activities (40).

Although there is no defined treatment method for sarcopenia, lifestyle changes, dietary modifications, and exercise constitute the fundamental principles of treatment. Studies have also observed that elderly individuals with low levels of physical activity have less muscle mass and strength compared to those with higher activity levels, and sarcopenia tends to develop more easily in this group (36). Aerobic activity (such as swimming, running, and walking) has long been associated with improvements in cardiovascular fitness and endurance capacity. While the contribution of aerobic exercise to muscle hypertrophy is less likely, it can increase the cross-sectional area of muscle fibers (34). Scanlon et al. [14] have demonstrated that resistance exercise, along with the changes it induces in the muscle, leads to significant positive developments in the disease level of sarcopenic individuals. In a study involving elderly individuals residing in a nursing home, 12 weeks of resistance training increased overall body balance and walking speed, while also showing a tendency to decrease the frequency of severe sarcopenia [5].

In sarcopenic individuals, resistance exercise training is an effective method to maintain and increase both bone mineral density and muscle strength (37, 5). Eliminating the risk of falls and working against the resistance of water with one's own body weight can reduce muscle stress while enhancing strength. Healthy lifestyle behaviours, proper nutrition, and appropriate exercise programs are effective in preventing sarcopenia and are beneficial at every stage of sarcopenia treatment.

Quality of Life

When reviewing the literature on quality of life, it is noteworthy that studies related to quality of life and the multitude of tools developed to measure it have been particularly prevalent since the 1970s. Quality of life denotes the alignment of healthy life years with the expected years of life at birth in terms of length and similarity. The measurement of health-related quality of life is not only individually utilised to identify patients' issues, observe the course of diseases, and measure the response to treatment but is also employed for societal purposes to evaluate and enhance the quality of public health services and guide health policies in the distribution decisions of health resources (14). While ageing is known to be associated with weakening in the cardiorespiratory and musculoskeletal systems, some of these changes can also be attributed to a sedentary lifestyle (37). Health is one of the determinants of quality of life. Activities such as rising from a seated position, walking, and climbing stairs performed by elderly individuals signify health and ageing healthily. Adverse changes occurring in the musculoskeletal system with age gradually affect physical activity levels. Implementing physical activity is crucial for elderly individuals in nursing homes to lead a healthier life (37). A sedentary lifestyle is prevalent in our country at all ages, continuing as an acquired habit, especially in advanced age (34).

METHOD

Research Design: Our research was conducted using a quasi-experimental model. In adherence to the study design, a control group was not established.

Participants: Our study included 40 volunteer sarcopenic elderly individuals who were active students of Tazelenme University living in the Muğla region and who met the inclusion and exclusion criteria. The impact of Aquatic Exercises on Muscle Strength and Quality of Life was investigated in elderly individuals diagnosed with sarcopenia, with the exercises being applied twice a week on alternate days for a duration of 8 weeks. A total of 39 participants voluntarily completed the study, with one participant expressing the desire to discontinue participation for personal reasons.Considering the possibility of an unusual and unforeseen situation, the necessary health precautions and precautions have been taken for emergency response. Due to risk groups, the exercises were carried out by experts who were trained on this subject and were in the research group.

According to the definition of sarcopenia renewed by the European Sarcopenia Working Group (EWGSOP) in 2018

Criteria for participation in the study.

1) Decrease in muscle strength,

2) Decrease in muscle quantity (mass) and quality,

3) Decrease in physical performance

Exclusion Criteria.

1) Not knowing how to swim and having a health problem that prevents exercise

Protocol: The impact of Aquatic Exercises applied twice a week on alternate days for a duration of 8 weeks, on Muscle Strength and Quality of Life was investigated in elderly individuals diagnosed with sarcopenia. Written informed consent forms were obtained from all participants. Initially, Bioelectrical Impedance Analysis (BIA) was conducted to determine body fat and muscle percentages of the volunteers. Subsequently, the Physical Activity Scale for the Elderly (PASE) was administered to gather information about the activities performed by the participants in their daily lives. The Quality-of-Life Scale was employed for the

objective assessment of life quality, and a 24-hour Dietary Recall and Food Frequency Measurement were conducted to detect dietary changes related to nutritional status.

Exercise Program: The exercise program commenced with water adaptation and breathing exercises. The progression of the exercise program in the subsequent weeks involved sessions conducted twice a week, each lasting 40 minutes (including a 10-minute warm-up, 25-minute conditioning, and 5-minute stretching/cooling down). The difficulty levels of the exercises were adjusted according to the physical activity levels of the participants. The severity and intensity of exercise were adjusted according to changing water depth levels and walking distances.

Warm-up Section: Basic warm-up exercises were performed during the warm-up sessions. In some studies, brief warm-up exercises without entering the water have been implemented.

Main Exercise Section: This section constitutes the foundation of water exercise routines. Depending on the structure of the aquatic exercise program, some walking exercises were complemented with arm movements. In certain studies, the main exercise type consisted of various walking applications. Participants engaged in dual and multiple-task exercises while implementing the water walking program. Walking exercises were conducted at different water depth levels and with designated walking distances.

Table 1. Types of Walking Exercises

forward (without arm support)	walk back. (without arm support)	sideways (without arm support)	Tandem	march step walking obstacle step
forward (arm supported)	walk back. (arm supported)	obstacle step	dance steps	march step walking (arm supported)
diagonal	tiptoe walking	forward fast (arm supported)	rotational walk	heel walking

Table 2. Exercise Program

1.Group Movement Type	**2.Group Movement Types**	**3.Group Movement Types**
Dorsal And Plantar Flexion of The Ankle	Abdominal Exercise	Pedaling
Elbow Flexion and Extension	Jump	Cross Country Ski Trekking
Knee Flexion and Extension	Leg Transitions	Cross Leg Movement
Arm Abduction and Adduction (At Chest Level)	Go Up and Down the Steps	Forward Kick
Trunk Rotation	Neck Exercises	Rocking Horse Movement
Hip Abduction and Adduction	Posture Exercises	Pendulum Exercise
Shoulder Horizontal Flexion and Extension	Sculling Exercises	Kicking Movements: Forward, Diagonal, Side and Back

Categorization of the Types of Movements Implemented in the Aquatic Exercise Program into Three Groups

Ethical approval and institutional permission

The research received approval from Muğla Sıtkı Koçman University Medicine and Health Sciences Ethics Committee on 25.12.2022. Protocol no:220170/151 Written informed consent forms were obtained from all participants.

FINDINGS

Table 3. Skewness – Kurtosis Values

Variables	Test	n	Skewness	Kurtosis
Body fat percentage	Pre-test	39	-0,738	0,128
	Post-test	39	-0,702	0,299
Right hand grip strength	Pre-test	39	0,536	-0,711
	Post-test	39	0,497	-0,740
Left hand grip strength	Pre-test	38	0,609	-0,671
	Post-test	38	0,580	-0,770

P<0.05

The analysis of six independent variables indicates that the skewness-kurtosis outlier values fall within the range of +1.5 to -1.5.

Table 4. Comparison of Participants' Body Fat Percentage and Hand Grip Strength Pre-Test and Post-Test

Variables	Test	n	$\bar{x}$	ss	t	p
body fat percentage	Pre-test	39	36,989	8,751		
	Post-test	39	35,150	8,829	7,072	< 0,001*
Right hand grip strength	Pre-test	39	23,256	5,612		
	Post-test	39	24,535	5,687	-7,744	< 0,001*
Left hand grip strength	Pre-test	38	20,974	5,082	,	
	Post-test	38	22,210	4,924	-8,250	< 0,001*

P<0.05

Since the p-value for all three parameters is less than 0.05, aquatic exercises are positively effective in increasing muscle mass (with a negative impact on body fat percentage) and muscle strength.Muscle strength has been determined to increase positively after aquatic exercises, and a decrease in body fat percentage has also been measured.

Table 5: Comparison of Participants' Quality of Life Form - SF36 Scale Pre-Test and Post-Test

Variables	Test	n	$\bar{x}$	ss	t	p
Energy/Vitality	Pre-test	39	56,048	4,245		
	Post-test	39	58,787	5,094	-7,089	< 0,001*

P<0.05

In the participant group, an examination was conducted on the Energy/Vitality/Vitality values in the Quality-of-Life Scale before and after the exercise, and a statistically significant difference was found in the Energy/Vitality/Vitality values, a subcategory of the quality of life related to aquatic exercise ($p < 0.05$). This effect appears to be positive.

Table 6. Correlation Test between Participant Body Fat Percentage and Hand Grip Strength

Correlations	1	2
Body fat percentage post-test	1	
Hand grip strength (right) post-test	-0,414**	1
Hand grip strength (left) post-test	-0,288	0,828**

****p<0,01 and *p<0,05**

In the correlation test between body fat percentage and muscle strength data, a negative correlation is observed between body fat percentage and muscle strength. Participants showed a decrease in body fat percentage and an increase in muscle strength after aquatic exercise. As right-hand dominance is more

common among participants, the correlation coefficient (-0.414) between right-hand grip strength and body fat percentage is significantly more negative than the other correlation coefficients.

DISCUSSION AND CONCLUSION

There were findings showing that a range of exercise training had a positive effect on older individuals. It has been observed that 8-week exercises significantly increase muscle strength and decrease fat percentages. In parallel, it has been determined that Aquatic exercise has a positive effect on Energy / Vitality / Vitality, which is the subcategory of the life category. With today's technological developments, people's daily physical activity levels are gradually decreasing (39). Villareal et al. In his study, he applied combined exercise to 139 women diagnosed with SO for 60 minutes twice a week for 12 weeks. It was observed that knee extension strength increased in women with CA after 12 weeks of combined exercise. It was also determined that after combined exercise, there was a significant increase in arm and leg muscle mass and a decrease in total body fat mass (23). Exercise training should be personalized to suit each older person's unique abilities and goals. The ideal exercise program should offer a combination of aerobic, resistance, flexibility, and balance exercises. Most studies have been conducted among older, nonsarcopenic obese adults. Resistance exercise (RE) is recommended as first-line treatment to counteract the undesirable consequences of sarcopenia in older adults. For example, as a result of a meta-analysis of 49 studies with a total of 1328 participants aged 50 and over, it was observed that skeletal muscle mass increased by approximately 1.1 kg after an average of 20.5 weeks of resistance exercise training two to three times a week (35). n another study, Hurst C. et al. (20) recommend a resistance exercise program that consists of two exercise sessions per week and includes a combination of upper and lower body exercises performed with a relatively high degree of effort for 1-3 sets of 6-12 repetitions.

Exercise training for seniors can improve physical function, reduce cardiovascular risk factors, reduce the risk of all-cause mortality, and improve overall quality of life.

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