



ORIGINAL SCIENTIFIC ARTICLE

EFFECTIVENESS OF MOBILITY AND STABILITY EXERCISES IN RESISTANCE-TRAINED MALES WITH SHOULDER IMMOBILITY IN DIFFERENT AGE GROUPS

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Abstract

Background. Resistance-trained males aim to increase their overall health, strength and fitness level. Many resistance-trained males aiming to increase their strength neglect the muscles that stabilize the scapular and glenohumeral joints. The shoulder joint is among the most frequently injured areas in resistance-trained males. In addition, strength training displays different effects in young and old individuals.

The study purpose was to investigate the effects of stability and mobility exercises on range of motion, posture and body awareness in resistance-trained males with shoulder immobility.

Materials and methods. Thirty-two resistance-trained males diagnosed with shoulder immobility were divided into two groups according to their age ranges (G1: Adult, G2: Young Adult). The program consisting of mobility and stability exercises was applied 3 days a week for 8 weeks. The participants were evaluated with a universal goniometer, the New York Posture Rating, and the Body Awareness Questionnaire before and after the treatment lasting 8 weeks.

Results. Following the 8-week treatment, improvements in body awareness and range of motion were observed in all participants ($p \leq 0.05$). There were improvements in the scores of the New York Posture Rating and Body Awareness Questionnaire in both groups, but they were not statistically significant ($p \geq 0.05$).

Conclusions. An exercise program combining stability and mobility exercises was applied to resistance-trained males with shoulder immobility and it was observed to have positive effects on the range of motion of the joint, body awareness and posture. We are of the opinion that various types of exercise should be implemented when planning exercise programs.

Keywords: awareness, body builders, exercise, resistance-trained, posture, shoulder.

Introduction

Skeletal muscles display a high degree of plasticity in response to different mechanical stimuli. Out of these stimuli, overloading, with a combination of quantitative changes in muscle mass and fiber size, is one of the most effective ways to increase hypertrophy both at the whole muscle and at the single fiber level. The increase in fiber, and thus in muscle size, is the result of a positive balance between protein synthesis and degradation. Since mechanical loading is one of the most important methods to increase protein synthesis, the method used to maximize the mechanical stress applied to skeletal muscle is resistance training (Monti et al., 2021). Both strength and endurance are required during a sport-

ing activity (Degens et al., 2019). Resistance exercise and strength training are significant methods for athletes to improve their athletic performance. Intense resistance training should be performed to achieve high-level performance in strength and power-based sports. Generally, weight-training exercises put the shoulder in a bad position, such as external rotation, at the end of the joint range of motion while under heavy load. This results in joint and muscle imbalances and makes the shoulder prone to injury. Training routines aimed at specific muscle groups or exercises often neglect the balance of strength and mobility, which is necessary for unpaired shoulder function (Kolber et al., 2009).

The shoulder joint is one of the joints with the greatest range of motion. However, mobility and stability are inversely proportional. The stability balance of the shoulder joint, which has a large physiological range of motion, is sensitive. Some activities require mobility (e.g. swimming), while

others require stability (e.g. weight lifting, assistant referee) (Best & Tanaka, 2018).

Bodybuilders aim to increase their overall health, strength and fitness level. Many bodybuilders aiming to increase their strength neglect the muscles that stabilize the scapular and glenohumeral joints while concentrating on strength training for the pectoralis, deltoid, and abdominal groups. Bodybuilders have been observed to experience a loss of muscle strength in the scapular stabilizers and rotator cuff muscles. Such strength imbalances may lead to a poor scapulohumeral rhythm during shoulder elevation (Kolber et al., 2009; Grandou et al., 2020).

Strength and endurance training displays different effects in young and old individuals (Stunes et al., 2022). Resistance training is a good stimulant to increase strength in both young and old adults, however, muscle hypertrophy that occurs consistently in young males declines with age. This suggests that strength gains in older adults mostly result from adaptations of non-muscle tissues (Petrella et al., 2007; Kosek et al., 2006).

While being educated on appropriate exercise selection and injury prevention strategies, strength athletes should be trained on changes in shoulder laxity, capsular restriction, or shoulder muscle balance that may develop secondary to weight training (Kolber et al., 2009).

Exercise practices show different effects on individuals depending on age. There are studies indicating the different effects of exercise practices in young and middle-aged individuals in the literature. However, these studies have mostly investigated the effects of strengthening exercises (Rader et al., 2016; Pesta et al., 2014). Our aim in this study is to examine the effectiveness of stability and mobility exercises in bodybuilders with shoulder immobility.

Materials and methods

Study participants

Thirty-two bodybuilders who had been diagnosed with shoulder immobility by a physician were included in our study. A total of 30 participants completed the eight-week exercise treatment. The participants were divided into two groups based on their age ranges. While the first group included those aged 18-30, those aged 30-60 were included in the second group. Inclusion criteria for the study were: having been diagnosed with shoulder immobility by a physician and being a male bodybuilder over the age of 18. Exclusion criteria were: being a female bodybuilder, having scapular dyskinesis, having undergone a surgery within the last six months, and having an orthopedic or neurological disease.

Study organization

The athletes included in the study were given a program including stability and mobility exercises after the initial measurements and evaluations were performed by a blind evaluator. The participants were evaluated for the second time eight weeks later and the effects of the exercise program on them were examined.

The sample size was calculated to be 28 with 0.05 error in the %80 confidence interval. After calculating the drop-out rate as 20%, 32 individuals were included in the study. Thirty two individuals were included in the study in case they might drop out for various reasons (Grgic et al., 2018).

All athletes included in the study were given the "Informed Voluntary Consent Form" and their consent was obtained. Demographic data such as the athletes' age, weight, height, sports age, status of drug use and operation history were collected. Necessary approvals were obtained from the Non-Interventional Clinical Research Ethics Committee of Istanbul Medipol University before conducting the study (E-10840098-772.02-3687, date: 24/06/2022). The study was conducted with the individuals who accepted the informed consent form approved by the Ethics Committee of Istanbul Medipol University

Assesment Parameters

Assesment of Joint Range of Motion. Goniometric measurements were repeated bilaterally with a universal goniometer. Measurements of upper extremity, shoulder flexion, internal and external rotation were made. They were repeated three times for each evaluation. The mean of the measurements was recorded as the score.

Assesment of Posture. Posture assessment was done using the New York Posture Rating, which consists of 13 items. Posture analysis is performed while standing upright. A score of five was given if the participant's posture was correct, three if moderately impaired, and one if severely impaired. The total score to be obtained from the test is a maximum of 65 and a minimum of 13. The higher the score, the better posture the participant has (McRoberts et al., 2013).

Assesment of Body Awareness. Body awareness was evaluated using the Body Awareness Questionnaire. This questionnaire includes physical, emotional and social elements that question the sensitivity of the participant to physical reactions in normal or abnormal body conditions. Conducted to determine the normal or abnormal sensitivity level of body components, the Body Awareness Questionnaire consists of 18 items under 4 subscales (changes in body process, sleep-wake cycle, prediction at the onset of the disease, prediction of body responses). The participant is asked to score each item on a scale of 1-7. Evaluation is performed based on the total score. A higher score indicates a better body sensitivity (Karaca & Bayar, 2021).

Exercise Program

Before the athletes started their exercise program, in order to raise their awareness, they were trained on the importance of shoulder mobilization and stabilization and how to contract the right muscle groups. Following the evaluations, in addition to the usual training programs, the athletes performed an exercise program 3 days a week for 8 weeks, accompanied by the same physiotherapist.

The number and frequency of repetitions of the exercises were updated every two weeks. They would perform Prone I, T, W, Y's, Wall Angels and Anterior Shoulder Stretch, Shoulder Circle Rotation, Prone Shoulder CARs and Shoulder Side Stretch, and stretching exercises for pectoral muscles.

Statistical analysis

SPSS 26.0 (Statistical Package for Social Sciences, Chicago, Illinois, United States) software was used for statistical analysis in the study. Statistical analysis methods including

descriptives, comparators, and correlations were used. Mean, standard deviation, and percentage distribution values were calculated using descriptive statistical methods. Conformity to the normal distribution was evaluated using the Shapiro-Wilk test. Parametric tests were used if the data conformed to the normal distribution, and nonparametric tests were used if they did not. Independent samples t-test was used for the parametric data, and Mann Whitney-U test for nonparametric data. Paired samples t-test was used for the comparison of in-group values before and after the eight-week treatment, Wilcoxon paired two-sample test was used for nonparametric ones, and Chi-square test was used to compare the categorical data. A p value lower than 0.05 was considered statistically significant.

Results

Thirty-five resistance-trained males with shoulder immobility were evaluated in the study. Three of them were excluded from the study because two had scapular dyskinesia and one had undergone shoulder surgery. A total of 32 individuals were included in the study. One participant from each group could not complete the study for various reasons, and the scores of 30 participants were recorded in the end.

Table 1. Demographic Data

	Group 1	Group 2	p
Age	21.36 ± 2.95	41.29 ± 8.67	0.00
Height	178.14 ± 5.96	175.65 ± 5.99	0.279
Weight	75.29 ± 8.08	83.07 ± 9.51	0.028
BMI	23.72 ± 2.30	26.98 ± 3.28	0.05

The values are shown as mean ± SD. $p < 0.05$ was considered statistically significant. Age: years, BMI: Body Mass Index (kg/m^2)

Since the participants were divided into groups based on age, there was a statistical difference in their age, weight and BMI before the treatment ($p \leq 0.05$).

Table 2. General conditions of the groups before treatment

	Group 1	Group 2	p
How many days a week does the athlete train?	4.50 ± 1.01	3.71 ± 1.54	0.124
Does the athlete experience stiffness in their shoulder?	3.36 ± 1.99	3.21 ± 1.42	0.828
Does the athlete experience difficulty or pain when they raise their arms above their head?	3.50 ± 2.28	1.64 ± 1.64	0.020
Happiness after exercise	8.64 ± 1.65	9.71 ± 0.726	0.035

The values are shown as mean ± SD. $p < 0.05$ was considered statistically significant.

There was no statistically significant difference in the number of weekly training sessions and stiffness in the shoulder region in both groups ($p \geq 0.05$). However, the feeling of pain when raising the arms was observed to be higher

in Group 1 ($p = 0.020$). The feeling of happiness after exercise was observed to be higher in Group 2 ($p = 0.035$).

After the exercise programs were completed, a statistically significant increase was observed in all evaluation parameters in both groups ($p \leq 0.05$). There was a statistical difference between the groups in the measurements of right and left shoulder flexion, external rotation of the left shoulder, internal rotation of the left and right shoulder ($p \leq 0.05$).

When the pre-treatment scores of both groups were examined, no statistical difference was found between the two groups, but the NYPR lateral and posterior scores of the adult group were lower ($p = 0.071$).

Discussion

Our study investigated the effectiveness of exercises in resistance-trained males with shoulder immobility. To the best of our knowledge, there has been no study examining the effectiveness of combined exercises in resistance-trained males with shoulder immobility. In resistance-trained males with shoulder immobility in different age groups, to whom we implemented stability and mobility and stretching exercises, improvements were observed in all the evaluation parameters in both adult and young adult groups as a result of the exercise program, except for the results of lateral posture analysis in the young adult group.

Martel et al. investigated the effects of gender and age on muscle fiber adaptation in individuals performing high-intensity resistance training. The effects of the exercises applied three times a week for 9 weeks on the lower extremity extensor muscles were evaluated. It was concluded that there were differences in muscle fibers between males and females (Martel et al., 2006). Unlike this study, we examined the upper extremity muscles. In addition, we included only male participants in our study, as we predicted that there would be differences between males and females.

Staron et al. compared the gender-related cross-sectional areas of various muscle fiber types during the transition from childhood to adulthood. Gender-specific patterns of muscle fiber types were found to develop during this transition (Staron et al., 2000). Bougea et al., on the other hand, examined the relationship between aging and muscle fibers in their autopsy study on individuals aged 24-82 who died due to sudden death. As a result, they observed that the number and volume of muscle fibers decreased with aging (Bougea et al., 2016). Considering the relationship of muscle fibers and structure with age, the participants were divided into two groups as those aged 18-30 and those aged 30-60.

Previous studies investigated injury sites of recreational resistance-trained athletes. Shoulder, upper extremities and spine were found to be the most frequently injured areas. The reason why upper extremity injuries are so common is the mistakes made in exercise programs. The biggest one is that recreational resistance-trained athletes usually do exercises for the upper extremity muscles and neglect the ones for the core region and lower extremity muscles. As a result, biomechanical problems occur. The resistance-trained athletes in our study also developed shoulder immobility problem (Siewe et al., 2014). Moezy et al. investigated the effectiveness of scapular stabilization exercises in individuals with shoulder impingement syndrome. Their study reported that the exercise applications provided improvements in the

Table 3. Evaluation results of the groups before and after treatment

	Group 1			Group 2			P
	Before Treatment	After Treatment	Group p	Before Treatment	After Treatment	Group p	
Shoulder flex left	125.14 ± 12.93	142.29 ± 11.06	0.00	123.29 ± 6.91	134.29 ± 7.52	0.00	0.002
Shoulder flex right	123.14 ± 11.31	141.43 ± 11.49	0.00	118.86 ± 4.94	131.29 ± 4.81	0.001	0.018
Shoulder ext rot left	78.79 ± 7.97	85.21 ± 6.34	0.00	79.21 ± 5.59	83.14 ± 4.96	0.00	0.037
Shoulder ext rot right	81.21 ± 6.40	86.64 ± 4.80	0.002	78.50 ± 6.60	82.86 ± 5.38	0.00	0.417
Shoulder int rot left	62.57 ± 5.65	71.14 ± 5.53	0.00	61.64 ± 3.46	67.14 ± 3.76	0.001	0.018
Shoulder int rot right	61.57 ± 5.65	70.71 ± 5.74	0.002	59.43 ± 2.47	65.64 ± 2.41	0.00	0.002
Body awareness questionnaire	86.29 ± 13.84	98.29 ± 10.63	0.00	89.29 ± 12.44	96.21 ± 11.91	0.00	0.098
NYPR lateral	27.86 ± 3.18	32.29 ± 2.30	0.109	25.14 ± 4.35	29.29 ± 3.50	0.001	0.792
NYPR posterior	27.50 ± 3.30	27.86 ± 3.18	0.00	24.93 ± 3.89	25.14 ± 4.35	0.00	0.667

The values are shown as mean ± SD. $p < 0.05$ was considered statistically significant. NYPR: New York Posture Rating. Flex: Flexion, Ext: External, Int: Internal, Rot, Rotation.

range of abduction and external rotation and posture in the participants (Moezy et al., 2014). Improvements in shoulder flexion, internal and external rotation were noted in both groups as a result of shoulder joint range of motion measurements. However, more differences were observed in the range of motion in the young adult group. Gharisia et al. concluded that stretching exercises increase joint range of motion in athletes with internal deficits in the glenohumeral joint (Gharisia et al., 2021). Goto et al. examined the effects of range of motion exercises performed at different angles in their study on young trained men. Similarly to our study, the participants performed the exercises three days a week for eight weeks. They concluded that range of motion exercises facilitate muscle hypertrophy positively (Goto et al., 2019). Moradi et al. implemented an eight-week exercise program in their study examining male volleyball players with internal rotation deficit in the shoulder. They found that the exercise program they implemented, in which the participants performed stretching exercises for five days and strengthening exercises for three days a week, was an effective treatment method for shoulder internal rotation deficit (Moradi et al., 2020). In accordance with the literature, we planned the exercise program to be performed three days a week for eight weeks. We included stabilization, stretching and strengthening exercises in our exercise program. Similarly to these studies, we recorded improvements in joint range of motion. It is known that bodybuilding training causes muscle damage in the upper extremity in resistance-trained males (Ferreira et al., 2017). It is thought that problems in the alignment of the head and shoulder also affect the muscles around the shoulder (Thigpen et al., 2010). In a study examining the effectiveness of stabilization exercises in individuals with round-shoulder posture, they performed stabilization and stretching exercises. The study indicated that the exercise application was effective in improving posture in individuals (Kim et al., 2018). Similarly, stretching and stabilization exercises were given to bodybuilding athletes with shoulder immobility. When we compared the pre- and post-treatment scores, we observed that the scores of the adult group were lower than the young adult group. This could be because the posture of the individuals in the adult group may

have been affected more negatively than the younger group as a result of the longer-term application of inappropriate exercise prescriptions in the adult group. Another reason could be that postural problems become more common with age. However, on the contrary, improvements were observed in posture analysis in the adult group, while improvements were observed in posture evaluations except for the lateral posture analysis in the young adult group. Lee et al. found that stretching exercises for the pectoralis minor muscle improved the posture of individuals by improving scapular stabilization and alignment (Lee et al., 2015). Ruivo et al. applied strengthening and stretching exercises to individuals with forward head and protracted shoulder posture in their study. As a result, improvement was observed in posture (Ruivo et al., 2017). Similarly, Shiravi et al. reported that scapular stabilization exercises had a positive effect on posture in individuals with forward head and round shoulder problems. In our study, in addition to stabilization exercises, stretching exercises for pectoralis major and minor muscles were given. As a result, improvements were recorded in posture (Shiravi et al., 2019).

Postural awareness is the subjective conscious awareness of body posture based primarily on proprioceptive feedback from the body environment to the central nervous system. Erden and Emirzeoğlu examined body awareness in different sports branches in their study. They concluded that body awareness is similar between different sports branches and different age groups. We observed an increase in body awareness after the exercise applications, but no statistically significant difference was found between the groups (Erden & Emirzeoğlu, 2020).

Tikaç et al. investigated the effects of regular exercise practices on body awareness in young adults. They found that the exercise practices had a positive effect on self-efficacy, self-esteem and body awareness parameters. As a result of the exercise applications in our study, an increase in body awareness score was observed in both groups, but the young adult group achieved better results (Tikac et al., 2022). The effect of physical activity level on life satisfaction and happiness in different age groups was investigated. The age groups were divided into three as young adults, middle-aged adults

and older adults. As a result of the study, it was found that as the age increases, the increasing exercise level increases the happiness level in individuals (An et al., 2020). We observed in our study that the post-exercise happiness level of the adult group was higher than the young adult group.

Conclusions

The study found that the combined exercise program applied to resistance-trained males with shoulder immobility had positive effects. We are of the opinion that various types of exercises should be included while planning the exercise program.

Our study has several limitations. A total of 32 trained males were included in our study. The number of participants could have been higher. In addition, the duration of doing sports was not homogeneously assigned to the participants. We are aiming to design studies by considering these limitations in the future.

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Clinical trials registration number: NCT05450666

Conflict of interest

The authors declare no conflict of interest.

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ЕФЕКТИВНІСТЬ ВПРАВ НА РУХЛИВІСТЬ І СТАБІЛЬНІСТЬ У ЧОЛОВІКІВ, ЯКІ ТРЕНУЮТЬСЯ З ОПОРОМ, З НЕРУХОМІСТЮ ПЛЕЧЕЙ У РІЗНИХ ВІКОВИХ ГРУПАХ

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Авторський вклад: А – дизайн дослідження; В – збір даних; С – статаналіз; D – підготовка рукопису; Е – збір коштів

Реферат. Стаття: 7 с., 3 табл., 30 джерел.

Історія питання. Чоловіки, які тренуються з опором, прагнуть покращити свій загальний рівень здоров'я, сили та фізичної форми. Багато чоловіків, які тренуються з опором, прагнучи збільшити свою силу, нехтують м'язами, які стабілізують лопатковий та гленохумеральний суглоби. Плечовий суглоб є однією з найбільш часто травмованих ділянок у чоловіків, які тренуються з опором. Крім того, силові тренування по-різному впливають на молодих і літніх людей.

Мета дослідження полягала в тому, щоб вивчити вплив вправ на стабільність і рухливість на діапазон рухів, поставу та усвідомлення тіла у чоловіків, які тренуються з опором, з нерухомістю плечей.

Матеріали та методи. Тридцять два чоловіки, які тренуються з опором, у яких була діагностована нерухомість плечей, були розділені на дві групи відповідно до їхніх вікових діапазонів (G1: дорослі, G2: молодь). Програму, що складається із вправ на рухливість і стабільність, застосовували 3 дні на тиждень протягом 8 тижнів. Учасників оцінювали за допомогою універсального гоніометра, тесту «Нью-Йоркський рейтинг постави» та шкали «Опитувальник з усвідомлення тіла» до та після проходження курсу вправ, який тривав 8 тижнів.

Результати. Після 8-тижневого курсу вправ в усіх учасників спостерігалось покращення усвідомлення тіла та діапазону рухів ($p \leq 0,05$). В обох групах спостерігалися покращення в балах тесту «Нью-Йоркський рейтинг постави» та шкали «Опитувальник з усвідомлення тіла», але вони не були статистично значущими ($p \geq 0,05$).

Висновки. До чоловіків, які тренуються з опором, у яких була діагностована нерухомість плечей, застосовували програму вправ, що поєднує вправи на стабільність і рухливість, і було помічено, що вона мала позитивний вплив на діапазон рухів суглоба, усвідомлення тіла та поставу. Ми вважаємо, що під час планування програм вправ слід застосовувати різні види вправ.

Ключові слова: усвідомлення, культуристи, вправа, які тренуються з опором, постава, плече.

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