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The Effect of Wall Exercises on Isometric Muscle Endurance in Women Aged 50–55 Years

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ABSTRACT: Wall exercises are considered an effective, safe, and economical training method that can contribute to improving muscle strength and enhancing physical fitness, especially among older women. These exercises provide joint support, reduce the risk of falling, and help develop static muscle endurance, which plays an important role in maintaining the efficiency of the muscular system. The study aimed to identify the effect of wall exercises on the static muscle contraction endurance of the most important muscles in women aged 50–55 years.

The experimental method was used through a two-group pre-test and post-test design. The research sample consisted of 18 female trainees aged 50–55 years who were purposefully selected and randomly divided into an experimental group and a control group, with 9 participants in each group. Pre-tests were conducted under standardized conditions. The experimental group performed wall exercises during the main part of the training session for three days per week (Sunday, Tuesday, and Thursday) for one hour per session, including 20 minutes of wall exercises. The training program applied gradual progression, variation between exercises, and alternation of muscle groups according to performance time and stability.

After completing the training program, post-tests were conducted and the data were analyzed. The results showed that the experimental group achieved significant improvement compared with the control group in static muscle contraction endurance tests. This indicates the effectiveness of wall exercises in developing muscular endurance and improving the function of major muscle groups in a balanced manner.

The study recommends adopting wall exercises within training programs for older women and other groups due to their positive effects on physical fitness and health. The study also emphasizes the importance of core, abdominal, and back exercises to enhance overall physical fitness and support healthy aging, contributing to the achievement of the Sustainable Development Goal related to good health and well-being.

1- INTRODUCTION:

With advancing age, particularly around 50, women experience a gradual decline in muscle strength. This can lead to falls during everyday activities such as climbing stairs or walking on uneven ground. As the body ages, it loses muscle mass, and

some nerve reflexes slow down, impacting movement control and stability. Therefore, exercises targeting the core, abdominal, leg, and arm muscles are recommended to support daily mobility. The World Health Organization also recommends that older adults with limited mobility include muscle-strengthening exercises two or more days a week to reduce their risk of falls (Goldberg, L. 2002).

By reviewing the studies conducted by Hussein & Abid (2025), it was found that wall exercises are among the best exercises that strengthen core muscles and promote stable balance and provide a challenge to the supporting muscles in the body through coordination between muscles, and this helps to improve body stability.

Therefore, the importance of this study lies in utilizing wall exercises, as they are an effective and safe method for older women. They provide joint support and reduce the risk of falls while focusing on static muscle endurance, which helps strengthen women's musculoskeletal systems. Static muscle contraction exercises also reduce back pain and improve muscle strength in women, but they require support and assistance from another person or a trainer.

The researchers believe that wall exercises provide a simple, accessible, and supportive training method that can make a change in muscle strength and diagnose topics that have not yet been sufficiently explored. Through the results, future research will be directed to develop relevant strategies and programs on the effect of these exercises on women's health and fitness. Moreover, these exercises can be used to address health and fitness problems of various individuals.

Therefore, the research problem lies in finding safe exercises, such as wall exercises, to address the weakness in women aged 50-55 years in maintaining static muscle contraction for extended periods in the back, abdominal, leg, and shoulder muscles. This weakness can negatively impact daily performance and increase the risk of injury. The researchers also sought to determine the extent to which these exercises contribute to developing static muscle endurance. Thus, the researchers aimed to test wall exercises as a support system for performing static strength exercises targeting the leg, back, abdominal, and shoulder muscles. The study aimed to identify the effect of wall exercises on the static muscle contraction endurance of key muscles in women aged 50-55 years.

2. RESEARCH PROCEDURES:

2-1 Research Methodology:

The experimental method was used to solve the research problem using the two equivalent groups method with a pre-test and a post-test.

2-2 The community and the research sample:

The research population was determined to be the female trainees at the fitness center in Baghdad Al-Karkh (Al-Salihiya Gym Hall), numbering 72 trainees, aged 25-60 years. The research sample was chosen intentionally from the female trainees aged 50-55 years, numbering 18 trainees, as they were more committed to training and had a desire and readiness to achieve health fitness, and their percentage of the population was 25%. They were divided into two groups by the lottery method (an experimental group and a control group, with 9 trainees in each group). Table (2-1) shows the distribution of the sample as a normal distribution, since the values of the skewness coefficient were limited to ±1.

Table (2-1) shows the normal distribution of the research sample

Variables	Unit of Measurement	Mean (Average)	Median	Standard Deviation	Skewness Coefficient
Height	centimeter	165.61	166	3.12	-0.19
Weight	kilograms	91.5	92.5	4.74	-0.69
Age	years	52.77	53	1.55	-0.42

2-3. Devices, tools, and methods of collecting information:

- Electronic stopwatch, type (Casio).

- Personal mobile device (HP laptop calculator).

- A device for measuring height and weight.

- Arabic and foreign sources and references.

- Leather measuring tape (20 m).

- A pull-up device.

- Exercise table (bench) with a height of 30 cm.

- Three smooth walls, each measuring 10 meters in length and 3 meters in height

2-4 Tests used:

2-4-1-Flexed-Arm Hang Test

The purpose of the test: measuring the strength and endurance of the upper body muscles (back, shoulders, and arms).

Performance method: the test subject hangs from the pull-up bar so that her chin is above the level of the pull-up bar and tries to remain in this position for as long as possible. As in Figure (1).

Registration method: Measuring the time that the subject can maintain this position before her chin drops below the level of the bar. (Morrow et al., 2015)

Figure (1) illustrates the hook test

2-4-2- Wall Sit Test

The purpose of the test is measuring the endurance of the flexor and extensor muscles in the lower limb, especially the quadriceps muscle.

Performance method: The test subject leans against the wall with her knees bent at a 90° angle as if she were sitting on an invisible chair, as shown in Figure (2). (Wood, 2008)

Recording method: Measures the maximum time the test subject can maintain the correct position.

Figure (2) illustrates the wall-sitting test

2-4-3-Reliability Test (Plank Test)

The purpose of the test: to measure the endurance of the abdominal and entire trunk muscles.

How to perform: Start in a push-up position, but support yourself on your forearms instead of your palms. Your elbows should be directly under your shoulders, and your body should form a straight line from head to heels. Keep your back straight and avoid raising or lowering your hips. Hold this position for as long as possible while breathing normally, as shown in Figure (3).

Recording method: The time is recorded in seconds and minutes from the moment the correct posture is assumed until the moment balance is lost or the inability to maintain a straight back is overcome (Mackenzie, 2019).

Figure (3) illustrates the Plank Test

2-4-4- Back Extension Test (Biering-Sorensen Test))

The purpose of the test: to measure the endurance of the extensor muscles of the back.

Procedure: The subject lies prone (on her stomach) on an exercise table, with her upper body (from the top of her pelvis onwards) off the table, while her lower limbs (pelvis, knees, and ankles) are firmly fixed to it. The subject then begins to raise her torso until it is parallel to the floor, with her hands crossed on her chest or beside her head, as shown in Figure (4).

Recording procedure: The subject must maintain a horizontal position for as long as possible. The test is stopped if the subject touches the ground, their torso drops below the horizontal level, or they experience severe pain. (Evans, 2007).

Figure (4) illustrates the Biering-Sorensen Test)

2-5- Exploratory Experiment:

The pilot study was conducted on Sunday, January 4, 2026. At4 pm, a preliminary research sample of (4) female trainees from the research community was tested to identify obstacles that may arise when applying the tests and exercises, the efficiency of the tools used, and the method of implementing them.

2-6 The main experiment included:

2-6-1 Pre-test:

The pre-test was conducted on the experimental and control research samples on Sunday, January 11, 2026, at 4:00 PM. Fitness Center in Baghdad, Al-Karkh (Al-Salihiya Gym Hall): After warming up the research participants, all temporal and spatial conditions were fixed to ensure consistency with the pretests. The research samples were then randomly divided into experimental and control groups (even and odd numbers). Equivalence between the two groups was established in the pre-test, as shown in Table (2-2), which indicates the equivalence and homogeneity of the research samples.

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Table (2-2) The equivalence of the two research samples is demonstrated in the t-test, and homogeneity is shown through Levene's coefficient in the pre-test.

Group Statistics		Independent Samples Test						
		Mean	Std. Deviation	Levene's Test	Say	T-Test	Say	Significance
Flexed-Arm Hang Test	Experimental	13.93	1.82	0.186	0.672	0.93	0.366	immaterial
	Control	13.18	1.55					
Wall Sit Test	Experimental	20.68	2.009	3.124	0.096	0.9	0.378	immaterial
	Control	21.39	1.25					
Plank Test	Experimental	18.51	1.54	0.008	0.931	0.54	0.594	immaterial
	Control	18.11	1.61					
Biering-Sorensen Test	Experimental	26.2	1.72	0.253	0.622	1.05	0.306	immaterial
	Control	25.21	2.21					
Significant at a significance level of 0.05								

2-6-2 Applying the exercises using the wall:

After the wall exercises were prepared, they were performed on the experimental group in the main section of the training session over three days a week (Sunday, Tuesday, and Thursday). The training session lasted one hour, and the wall exercises lasted 20 minutes. The system employed a gradual progression and undulation between exercises, sessions, and training weeks, alternating the muscle groups worked between exercises. The training load was structured based on the performance time within this system as follows:

If the performance time is 20 seconds, the repetitions will be 8 times in 2 sets, the workload will be 16 repetitions, and the rest periods will be 1:1.

- If the work time is 30 seconds, the repetition is 6 times in 3 sets, the load size is 18 repetitions, and the rest periods are 1:1.

- If the work time is 40 seconds, the repetition is 4 times in 4 sets, the load is 16 repetitions, and the rest periods are 1:1.

- If the work time is 60 seconds, the repetition should be 4 times in 3 sets, the load should be 12 repetitions, and the rest periods should be 1:1.

- If the working time is 80 seconds, the repetition should be 3 times in 3 sets, the load should be 9 repetitions, and the rest periods should be 1:1.

- If the working time is 100 seconds, the repetition will be 3 times in 3 sets, and the load size will be 9 repetitions, and the rest periods will be 1:1.

The training unit time is 60 minutes, divided into 15 minutes for the preparatory section, 5 minutes for the concluding section, and 40 minutes for the main section, of which 20 minutes are for carrying out the experiment (independent variable), and the rest of the time is for carrying out the remaining components of the unit.

The control group carries out its usual training exercises, but without the wall and for the same duration as the training session.

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The experiment was started on 13-1-2026 and ended on 12-4-2026).

2-6-3 Post-tests:

After completing the main experiment, pretests were conducted on the experimental and control research samples on 4/14/2026 at 4 pm, after warming up the members of the research samples. All time and place conditions were fixed in order to unify them with the pre-tests.

2-7 Statistical methods:

The results were statistically processed using SPSS and the following formulas:

Mean - Std. Deviation, Skewness Coefficient, Levene's Test, Independent Samples Test, and Test Paired Samples.

3. PRESENTING AND DISCUSSING THE RESULTS:

3-1 Showing the results:

(Table 1-3 shows the statistical parameters of the experimental group tests

Group Statistics		Paired Samples Test						
		Mean	Std. Deviation	Paired Differences		T-Test	Say	Significance
				Mean	Std. D			
Flexed-Arm Hang Test	Tribal	13.1	1.9	12	3.6	9.98	0.000	Significant
	Pre-test	25.1	2.71					
Wall Sit Test	Pre-test	20.3	2	10.3	1.5	20.66	0.000	Significant
	Pre-test	30.6	1.32					
Plank Test	Pre-test	18.3	1.58	9.4	2.6	10.88	0.000	Significant
	Pre-test	27.7	1.09					
Biering-Sorensen Test	Pre-test	26	1.73	9.3	1.87	14.96	0.000	Significant
	Pre-test	35.3	1.93					
Significant at a significance level of 0.05								

Table (3-2) shows the statistical parameters of the control group tests

Group Statistics		Paired Samples Test						
		Mean	Std. Deviation	Paired Differences		T-Test	Say	Significance
				Mean	Std. D			
Flexed-Arm Hang Test	Tribal	12.6	1.58	2	0.7	8.48	0.000	Significant
	Pre-test	14.6	1.32					
Wall Sit Test	Pre-test	21.4	1.66	3.4	1.01	10.19	0.000	Significant

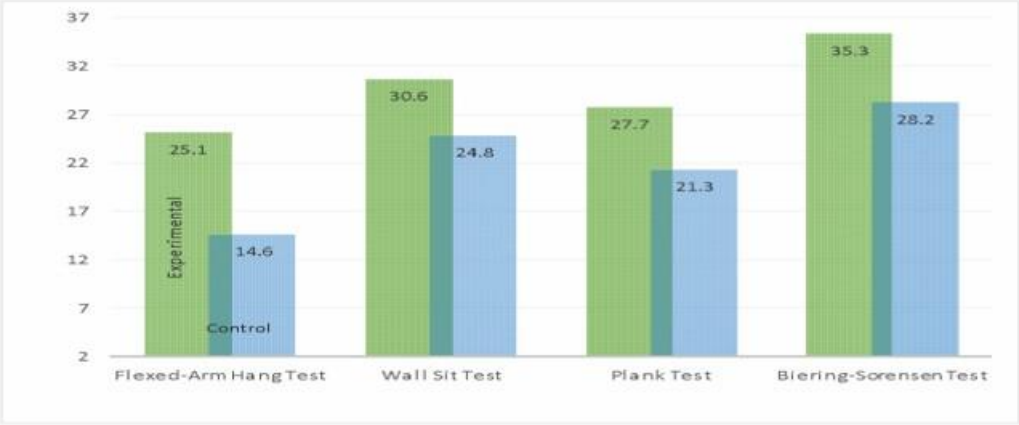
	Pre-test	**24.8**	**0.78**					
Plank Test	**Pre-test**	**17.3**	**2.17**	**4**	**2.82**	**4.24**	**0.003**	**Significant**
	Pre-test	**21.3**	**2.29**					
Biering-Sorensen Test	**Pre-test**	**25.1**	**2.61**	**3.1**	**2.2**	**4.23**	**0.003**	**Significant**
	Pre-test	**28.2**	**0.97**					
Significant at a significance level of 0.05								

Table (3-3) shows the statistical parameters between the experimental and control groups in the post-test

Group Statistics		Independent Samples Test				
		Mean	Std. Deviation	T-Test	Say	Significance
Flexed-Arm Hang Test	Experimental	25.1	2.71	10.38	0.000	Significant
	Control	14.6	1.32			
Wall Sit Test	Experimental	30.6	1.32	11.28	0.001	Significant
	Control	24.8	0.78			
Plank Test	Experimental	27.7	1.09	7.61	0.000	Significant
	Control	21.3	2.29			
Biering-Sorensen Test	Experimental	35.3	1.93	9.84	0.000	Significant
	Control	28.2	0.97			
Significant at a significance level of 0.05						

Figure (1-3) illustrates the differences in pre-test-hoc mean values between the two groups.

Tables (3-1), (3-2), and (3-3) and Figure (3-1) show that the experimental research sample gained the advantage of enduring static muscle contraction better than the control group. The reason is due to the use of wall exercises as an effective and safe training tool, especially for women aged 50-55 years who may suffer from poor physical fitness.



The bar chart illustrates a comparison between the **Experimental group** and the **Control group** across four different physical performance tests: Flexed-Arm Hang Test, Wall Sit Test, Plank Test, and Biering-Sorensen Test.

3-2 Discussion: The results indicate that the experimental group experienced significant physical improvement in their overall body strength and endurance of static muscle contractions across the upper and lower limbs, trunk, and abdominal muscles. This demonstrates the effectiveness of wall exercises compared to the traditional method used with the control group. Therefore, wall exercises are a valuable support tool for older women. When a woman presses her feet or back against the wall, it stimulates the nervous system to increase the recruitment of motor units in the trunk muscles, thus maintaining proper posture. This is because the wall helps stabilize the pelvis and spine, a process achieved through deep contraction of the core muscles. (Kloubec, J. A. 2010)

Graham (2009) stated that placing a stability ball between the back and the wall to reduce direct friction supports the natural curve of the spine, forcing the core muscles to work harder to maintain balance.

Through a study by Cho M. (2013), it was concluded that wall squat exercises, which can be easily performed at any time, positively affected the thickness of the transverse and internal oblique abdominal muscles.

The results of the study (Jung et al., 2019) also showed that the strength of the hip extensor muscles, after adjusting for body weight, is critical for performing the wall squat exercise in both sexes.

Wall exercises reduce the trainee's distraction in trying to maintain balance, allowing her to focus the full muscular effort on the torso area, and this accelerates the muscle-strengthening process.

Panhan, Gonçalves, Eltz, Villalba, Cardozo, and Bérzin (2019))

A study comparing knee and hip flexor strength in two groups performing bodyweight wall squats at low and high levels showed that the ratios of knee and hip flexor strength were better in the high-level wall squat group than in the low-level wall squat group, suggesting that high-level wall squats are more effective for improving knee and hip flexor strength (Jung et al., 2017).

Wall exercises ensure the proper functioning of the transverse abdominis and oblique muscles, as confirmed by electromyography (EMG) studies (Phrompaet et al. 2011).

The researchers also attribute the experimental group's improvement to a factor of psychological and physical safety. Wall exercises are low-impact, which eliminates the fear of injury among the trainees, motivating them to exert more effort during the exercise. This was reflected positively in pretest results. Scientific sources indicate that wall exercises effectively improve core strength and muscular endurance (Isacowitz & Clippinger, 2020).

A study by Zabarmawi et al. (2025) indicated that performing a single, short session of stationary wall squats to voluntary fatigue is a viable and effective therapeutic approach for reducing pain sensitivity in patients with knee osteoarthritis. While the exercise does not reduce the intensity of immediate clinical pain, its ability to raise the pain threshold makes it an excellent introductory strategy that physical therapists can use in clinics before initiating more intensive rehabilitation programs.

Using the wall as an aid has proven effective in improving proprioception of joints and increasing stability (Karahan et al., 2014).

4. CONCLUSIONS AND RECOMMENDATIONS:

4-1 Conclusions

In light of the presentation and discussion of the results, the study reached the following conclusions:

1. Wall exercises proved to be highly effective in improving isometric muscular endurance in the experimental research sample.

2. The experimental group that underwent the application of wall exercises outperformed the control group in tests of isometric muscular endurance, which confirms that the wall exercises were more effective.

3. The results indicate that the wall exercises were comprehensive and had a balanced effect on the major muscle groups in the body, as the improvement was not limited to one part over another.

4-2 Recommendations

Based on the findings, the following is recommended:

1. The necessity of implementing and adopting wall exercises within the training units for the target group, given their proven benefit in developing isometric muscular endurance.

2. Emphasizing the importance of core, abdominal, and back exercises in training programs due to their significant role in raising the level of general physical fitness, as shown by the research results.

3. The necessity of using varied exercises that include bodyweight (calisthenics) for their effectiveness in developing strength without the need for complex equipment, which makes them easier to apply in different environments.

4. Conducting more similar research and studies on different age groups or on other physical and skill variables not covered by the current study to ensure the generalizability of the results.

5. The need to conduct periodic tests to monitor the level of development of health and physical fitness and to adjust training loads in the fitness center.

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Appendix (1) Sample Wall Exercises

Standing on one leg with support against a wall to stabilize the body for the purpose of balance.

- Abdominal and plank exercises using the wall as a support.

- Wall stretching exercises that aim to improve the flexibility of the legs, spine, and thighs.

- Using the wall to support movements such as pushing against the wall or pulling it.

Pushing and shoving against a wall strengthens your arms and chest without putting too much pressure on your wrists.

Chest expansion exercises work to move and stretch all the core muscles.

Stand facing the wall with one foot in front of the other, then extend your arms forward and press your body against the wall.

Stand with your back facing a wall, feet about two feet away from the wall. Then slowly lower your body into a squat position and hold for a set time before returning to the starting position.

- Lie on the floor with your feet facing the wall and your knees bent at a 90-degree angle. Slowly raise your pelvis until your body forms a straight line from your shoulders to your knees and hold, then slowly lower yourself.

- Lie on the floor next to the wall with one leg raised against the wall. Then make wide circles with the raised leg in the air and hold for a specified time.

- Sit on the floor with your legs extended in front of you and your back against the wall. Extend your arms forward and try to touch your feet while keeping your back straight. Maintain this position for a period of time.

- The wall plank is for strengthening the torso and abdomen.

Wall squats to strengthen thigh and knee muscles.