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Original Article

Developing the Level of Health-Related Strength and Its Relationship with Body Mass Index (BMI) Among Women Aged 35-40 Years

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Abstract

The purpose of this study was to assess the degree of health-related strength and investigate how it relates to body mass index (BMI) in women between the ages of 35 and 40. Over the course of two months, a sample of ten women participated in a strength-training program that consisted of two sessions per week for a total of sixteen sessions. To fit the study's objectives, the researcher employed both descriptive and experimental methodologies. The results showed that health-related strength had increased, and there was a non-significant inverse relationship between body mass index and the growth of health-related strength.

1. Introduction

The first-ever technical and modernist revolution that is now impacting the world has largely shaped the lifestyle and health-related behaviors of people. Sedentary lifestyles and the decrease in exercise have resulted in modern diseases such as obesity, cardiovascular disease, diabetes, and hypertension, which are all related to the reliance of people on technology and machines for everyday tasks (Hazzaa, 2004). Obesity has emerged as a major worldwide public health concern, especially in women, because of considerably increasing rates over the last few decades, according to the World Health Organization (2023).

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Biological and hormonal factors render women more susceptible to obesity compared to men. Increased rates of chronic disease have a direct relationship with women having a higher body mass index (BMI) (Alkhalaileh et al., 2021). The significance of strength training and other regular physical exercise is evident due to the numerous health benefits they confer, including reduced body fat percentage, proper posture, quicker metabolism, and resistance to mental diseases like depression and anxiety (Westcott, 2012; Schoenfeld et al., 2021). The results have been affirmed by many Arab researches.

The research conducted by Abdel-Azim and Abdel-Aziz (1993) indicated that exercise activities had a positive influence on treating obesity and weight reduction in males and females. Abdel-Amir (1998) concluded that constant exercise reduced fat buildup in women students of physical education. Aerobic training effectively reduces body fat, as it was discovered by Bouhali (2013), whereas exercises in fitness enhance total fitness, as concluded by Traji (2010). Shihab Ahmed et al. (2014) highlighted the impact of augmented arm and shoulder muscle on physical performance in female students. Moreover, women can lose weight and enhance muscular endurance through circuit training, as indicated by Mrakchi and Mrabet (2021).

International research has also come up with the same. Westcott (2012) argues that strength training helps individuals preserve muscle mass and reduce fat in old age. Resistance training with changing weights can enhance body composition and body mass index (BMI), as postulated by Schoenfeld et al. (2021). Exercise enhances indicators of health and reduces obesity among middle-aged females (Alkhalaileh et al., 2021).

Consequently, there is increased scientific evidence demonstrating the role of strength training and other physical activity in combating obesity as well as enhancing women's physical and psychological well-being. This raises issues regarding the correlation between the BMI of women and the advancement of strength-related health for the age category of 35–40.

The following hypotheses may be formulated from the research problem and earlier findings demonstrating the effectiveness of strength training in enhancing body composition and decreasing fat mass: it is hypothesized that, in women in their thirties and forties, enhanced health-related strength will result in a reduction in body mass index (BMI). Moreover, exercise regimen is expected to raise the muscle to fat ratio, which would positively affect the entire posture and lead to physical as well as psychological comfort. Strength training and body mass index (BMI) are therefore expected to have a negative correlation. It is assumed that more effective exercise program will lead to improved results in the prevention of obesity as well as in loss of surplus weight. Evidence from Arab research and international research in this field corroborates this result.

2. Material and methods

*The sample:*This research utilized a purposive sample consisting of ten physically active women from the city of Oum El Bouaghi. The subjects were deliberately selected to represent the research population concerning age (35–40

years), body mass index (BMI), and frequency of physical exercise. The experimental approach, being most appropriate for examining the effects of training programs, was utilized to achieve the research objectives. The accuracy and scientific validity are ensured by executing a controlled modification of the study variables and analyzing the outcomes. The field study was conducted over a two-month period, from February 1, 2024, to April 2, 2024, at the women's sports hall "Salle Sultan" in Oum El Bouaghi. Due to the temporal and spatial limitations of the study, a total of sixteen training sessions were executed, occurring biweekly. These sessions encompassed general strength training exercises.

The two major components of the fieldwork were conducted. We conducted a pilot study on January 25, 2024, in the sports hall to assess the appropriateness of equipment and venue, determine the representativeness of our sample in relation to the population, and record any difficulties that could be encountered during the conduct of the study. This stage revealed issues such as the participants' poor response to the tests and lack of adequate knowledge of the objectives of the study. Nevertheless, it was an important first step that facilitated the execution of the main inquiry. The proposed training program was conducted, and the pre-tests were given on 2 January 2024 to start the second phase, the main survey. Having concluded the training sessions according to schedule, the post-tests were given on 4 February 2024. The research design of the study was thus completed.

The Variables:

The data for this research was obtained from two primary sources. The variable that was found to influence the result was the proposed training program, and it acted as the independent variable. The dependent variable was body mass index (BMI), influenced by change caused by the program. Application of one-group experimental design with pre- and post-tests enabled us to measure the effect of the independent variable on the dependent variable. Before introducing the training program, pre-tests were carried out among the sample. Post-tests were later given. This served to help us ascertain the impact of the training intervention on the BMI of the participating women and the differences. By the year 2025, we can implement the most recent findings in environmental management control.

Research Tools

Anthropometric Measurement Tools:

For the anthropometric measurements applied in this study, we used the following tools before and after the implementation of the training program:

- Stadiometer**:** for measuring height.
- Medical scale: for measuring body weight.

Criteria for Selecting Tests:

•They have to be standardized and validated.

•They should be appropriate to the trained physical activity.

• They have to be agreed upon by several scholars.

•They should be easy to apply with available tools.

Following a review of several specialized texts on physical fitness, we selected a battery of tests that give the optimal evaluation of total muscular strength. The main

tests used in this research were:

1. Upper Limb Strength Test

- Objective: To measure the upper body strength of adults.
- Duration: 2 minutes.
- Location: A quiet area, indoors or outdoors, on a solid, stable floor.
- Tools: Gym mat, stopwatch, sheet with participants' names, pen for recording results.
- Description: From the inclined push-up position, the participant places feet and palms on the floor, hands shoulder-width apart, keeping the body aligned. She performs as many push-ups as possible, with elbows extended and chest touching the ground.
- Results: The number of correctly performed push-ups within 2 minutes is recorded.

Table 1. *Standards for the Inclined Push-Up Test*

Age Group					**Indicator**
21–30 yrs	**31–40 yrs**	**41–50 yrs**	**51–60 yrs**	**61+ yrs**	
>38	>36	>35	>32	>25	5 = Much above average
33–37	30–35	29–34	27–31	22–24	4 = Above average
30–32	26–29	25–28	24–26	19–21	3 = Average
27–29	24–25	22–24	21–23	17–18	2 = Below average
05–26	02–23	01–21	01–20	01–10	1 = Much below average

2. Trunk Strength Test

- Objective: To measure abdominal and trunk muscle strength.
- Duration: 1 minute.
- Location: Quiet place with a solid and stable floor.
- Tools: Gym mat, stopwatch, pen and paper for recording results.
- Description: The participant lies on her back, legs extended, with a partner holding them down. She rises until elbows touch thighs, performing as many sit-ups as possible without bending knees.
- Results: The maximum number of sit-ups performed in 1 minute is recorded.

3. Lower Limb Strength Test (Standing Long Jump)

- Objective: To measure the muscular strength of the lower body.
- Location: Quiet area with a flat, solid, and stable floor.
- Tools: Starting line marker, measuring tape.
- Description: The participant stands behind the start line, feet slightly apart, bends knees, and swings arms to jump forward with both feet together. Landing must be stable without falling backward.
- Results: The distance is measured from the starting line to the nearest point of contact. Three attempts are allowed; the best result is recorded.

Table 2. *Reading Results of the Long Jump Test (Broussal-Dorval, 2022)*

Women (cm)	Men (cm)	Classification
>210	>255	Excellent
191–209	242–254	Very Good
181–190	231–240	Good
171–181	221–230	Average
161–171	211–220	Mediocre
131–160	180–210	Insufficient
<130	<179	Very Insufficient

4. Device-Based Tests

Such tests are used in examinations or diagnoses during scientific research and experiments (Mohsen Ali Al-Sa'dawi & Salman Al-Hayani, 2012,). According to the objectives of our study, we adopted the following tests:

- Height Test: Measured in a standing upright position, heels together, head straight, arms at sides, eyes and ears aligned horizontally. Measurement taken from floor to the top of the head.
- Weight Test: The participant stands on a medical scale with light clothing, upright posture, arms at sides, feet slightly apart. The displayed weight is recorded.
- Body Mass Index (BMI): Calculated as body weight (kg) divided by height squared (m^2). This provides an accurate classification of obesity levels.

Table 3. *BMI Classification*

BMI (kg/m^2)	Result
<18.5	Underweight
18.5–24.9	Normal
25–29.9	Overweight
30–39	Obese
≥40	Morbid Obesity

Procedural Steps of the Study

Pre-Measurements:

Pre-tests were conducted on 01/04/2024, under standardized conditions using the same anthropometric tools and physical tests to ensure consistency with the post-tests.

Proposed Training Program

After reviewing previous studies, consulting specialized scientific books on sports training and health, and seeking the opinions of experts in the field, we designed our training program based on the following principles:

- Adapted to the characteristics of the research sample.

- Respecting safety and security measures.
- Flexible and adjustable (increase or decrease as needed).
- Application of progressive overload principle.
- Transition from easy to difficult exercises.
- Achieve the study's objectives.

Program Specifications:

- Duration: 8 weeks.
- Frequency: 2 sessions per week.
- Session duration: 90 minutes each.
- Training method: Circuit training.
- Intensity: Gradually increases and varies across sessions.
- Exercises: Carefully selected and varied to serve the research objectives.

Statistical Analysis

This study employed a statistical method using Excel and SPSS program to analyze and manipulate the data. Arithmetic means and standard deviations were computed to summarize the characteristics of the sample. Frequency histograms were employed to outline the distribution of the data. A paired-samples T-test was used to examine the significance of pre- to post-test change measurement, assuming normal data distribution. The strength of the correlations between variables was tested using Pearson's univariate correlation coefficient. The statistical method provided a valid test of study assumptions and ensured that results obtained were reliable.

3. Results and discussion

Table 4. *Significance of Differences between Pre- and Post-Tests of Upper* Limb Strength

Test	Mean	SD	Mean Difference	t-value	Sig.	Significance Level
Pre-test	30.90	7.264				
Post-test	74.30	15.246	-43.40	8.425	.000	Significant

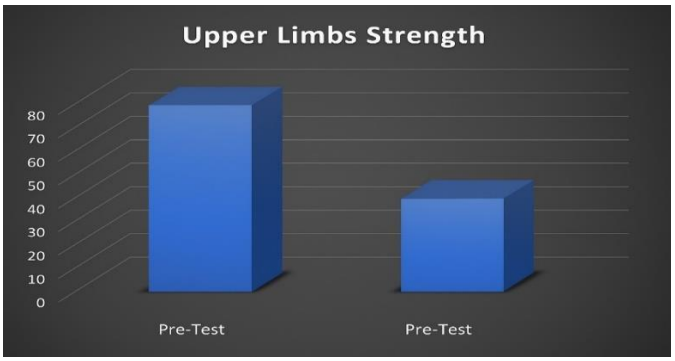

Figure 1. *Illustrates the difference between the pre- and post-test means of upper limb strength.*

From the table, the pre-test mean and standard deviation of upper limb strength were (30.90 ± 7.264), while the post-test values reached (74.30 ± 15.246). The difference between means was (-43.40) in favor of the post-test. The calculated t-value was (8.425), with a significance value (Sig = .000), which is less than 0.05.There are statistically significant differences between the two tests in favor of the post-test.

Table 5. *Significance of Differences between Pre- and Post-Tests of Trunk Strength*

Test	Mean	SD	Mean Difference	t-value	Sig.	Significance Level
Pre-test	30.60	4.377				
Post-test	39.30	4.029	-8.70	7.469	.000	Significant

The pre-test mean and SD of trunk strength were (30.60 ± 4.377), while the post-test reached (39.30 ± 4.029). The mean difference was (-8.70), in favor of the post-test. The calculated t-value was (7.469) with (Sig = .000 < 0.05). Statistically significant differences exist in favor of the post-test.

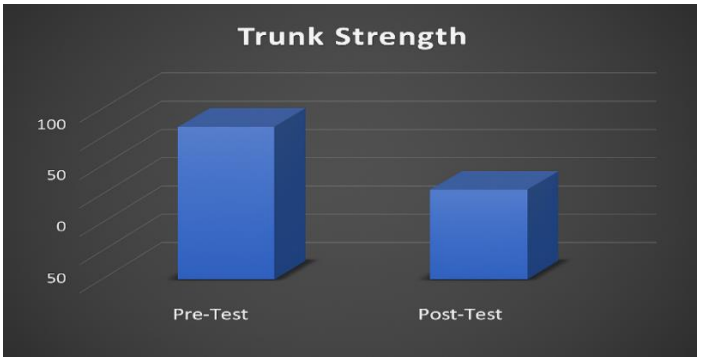

Figure 2. *shows the difference between pre- and post-test means of trunk strength.*

Table 6. *Significance of Differences between Pre- and Post-Tests of Lower Limb Strength*

Test	Mean	SD	Mean Difference	t-value	Sig.	Significance Level
Pre-test	1.57	0.129				
Post-test	1.69	0.097	-0.12	5.279	.001	Significant

The pre-test mean and SD of lower limb strength were (1.57 ± 0.129), while the post-test reached (1.69 ± 0.097). The mean difference was (-0.12), in favor of the post-test. The t-value was (5.279) with (Sig = .001 < 0.05). Significant differences exist in favor of the post-test.

Figure 3. *Illustrates the difference between pre- and post-test means of lower limb strength.*

Table 7. *Significance of Differences between Pre- and Post-Tests of Body Weight*

Test	Mean	SD	Mean Difference	t-value	Sig.	Significance Level
Pre-test	88.90	11.120				
Post-test	82.90	10.619	6.00	10.757	.000	Significant

Body weight in the pre-test averaged (88.90 ± 11.120), while in the post-test it decreased to (82.90 ± 10.619). The difference was (6.00) in favor of the post-test, with t = 10.757 and (Sig = .000 < 0.05). Significant differences exist in favor of the post-test.

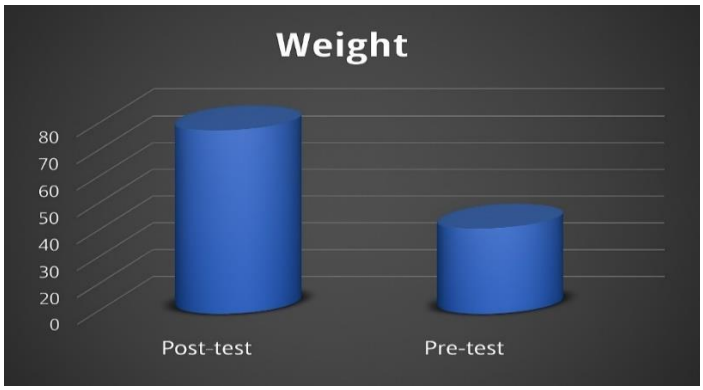

Figure 4 *shows the differences between pre- and post-test means of body weight.*

Table 8. *Significance of Differences between Pre- and Post-Tests of Body Mass Index (BMI)*

Test	Mean	SD	Mean Difference	t-value	Sig.	Significance Level
Pre-test	31.93	3.718				
Post-test	29.78	3.686	2.15	11.325	.000	Significant

The BMI mean and SD in the pre-test were (31.93 ± 3.718), while in the post-test they decreased to (29.78 ± 3.686). The mean difference was (2.15) in favor of the post-test, with t = 11.325 and (Sig = .000 < 0.05). Significant differences exist in favor of the post-test.

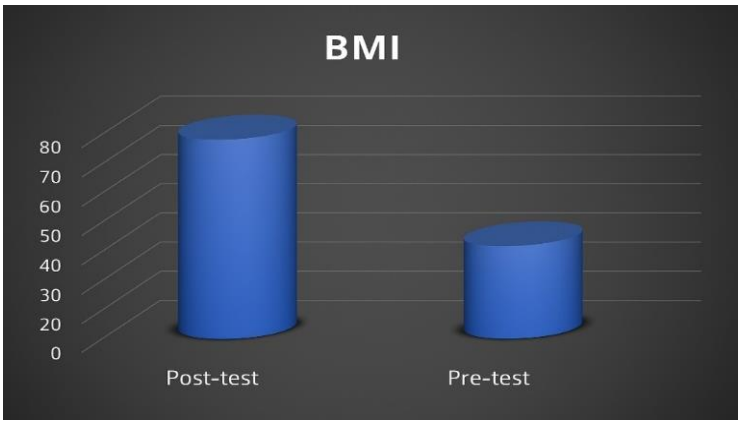

Figure 5. *Illustrates the difference between pre- and post-test means of BMI.*

Table 9. *Correlation between Muscular Strength and Body Mass Index (BMI)*

Variable	R	Sig.	Interpretation
Upper limb strength	-0.347	.326	Non-significant negative correlation
Trunk strength	-0.520	.123	Non-significant negative correlation
Lower limb strength	-0.407	.243	Non-significant negative correlation

The results show:

- A negative but non-significant correlation between upper limb strength and BMI (R = -0.347, Sig = .326).
- A negative but non-significant correlation between trunk strength and BMI (R = -0.520, Sig = .123).
- A negative but non-significant correlation between lower limb strength and BMI (R = -0.407, Sig = .243).

Discussion

The results of this study showed statistically significant differences between pre- and post-tests in all muscle strength indices (upper limbs, trunk, and lower limbs), suggesting that the suggested training regimen improved physical performance levels. Strength training is effective in improving body composition and reducing obesity rates in women between the ages of 35 and 40, as evidenced by the results, which showed a significant drop in body weight and Body Mass Index (BMI).

These findings are consistent with those of Abdel Azim and Abdel Aziz (1993), who highlighted the impact of training programs on weight loss and obesity treatment, as well as Abdel Amir's (1998) study, which highlighted the importance of consistent physical activity in preventing fat accumulation in female students. The present results support those of Merakchi & Merabet (2021) and Bouhali (2013), who confirmed the effectiveness of circuit training and aerobic exercises in lowering body fat percentage and increasing muscle strength.

Internationally, the results are consistent with Schoenfeld et al. (2021), who demonstrated how resistance training can improve body composition and lower BMI, and Westcott (2012), who highlighted the importance of strength training for maintaining muscle mass and decreasing fat during ageing. Consistent physical exercise reduces obesity and enhances health metrics in middle-aged women, according to research by Alkhalaileh et al. (2021), which is consistent with the findings of the current study.

Although it was not statistically significant, the study found a negative correlation between physical strength and BMI. This can be explained by a number of factors, such as the small sample size (only 10 women) and the short program duration (8 weeks), which might have limited the statistical power of the correlations. Moreover, weight attributed to muscle mass is not distinguished by BMI. According to Heymsfield et al. (2015), fat mass is a less reliable indicator for strength training than other measurements like body fat percentage or waist circumference.However, the empirical findings demonstrated notable improvements in physical strength and notable reductions in body weight and BMI, supporting the effectiveness of the recommended training program as a practical approach to combating obesity and improving the physical and mental health of middle-aged women.

The focus on women between the ages of 35 and 40, a critical life stage that often marks the onset of fat accumulation and increased health risks associated with inactivity, sets this study apart. This gives the suggested program a great deal of relevance in the field of public health. The findings support the inclusion of regular strength training programs in women's health and preventative strategies, which is in line with the World Health Organization's (WHO, 2023) advice to increase physical activity levels in order to reduce obesity and chronic illnesses.

Despite the positive outcomes, this study has many limitations that should be noted when attempting to extrapolate the data. Because there were only ten women in the sample, there was less room for broader generalisation. The eight-week program's short duration might make it impossible to track long-term changes in body composition. Moreover, BMI was the only metric used to assess body composition, ignoring more accurate measurements like body fat distribution or a percentage. The ability to rule out any external factors is limited by the absence of a control group. Because the study only looked at women between the ages of 35 and 40, it is difficult to extrapolate the results to other age groups or to men.

5. Conclusions

According to the study's findings, middle-aged women can effectively improve their physical strength, lose weight, and lower their body mass index by participating in a training program centred around muscular strength exercises. The findings validate earlier research and highlight the significance of including strength training into preventative health initiatives, albeit certain methodological flaws. Therefore, the study encourages future research to include larger samples, longer durations, and more accurate measures of body composition, and suggests implementing frequent strength-based training programs aimed at women in important age groups.

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