Effect of a Plant-Based Diet Program Combined with Aerobic Exercise on Blood Lipids and Body Composition in Obese Women

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Abstract:

The study aims to investigate the effect of a plant-based diet combined with aerobic exercise on blood lipids and body composition in obese women. The objectives are as follows: to design an aerobic exercise program and a plant-based diet for obese women; to assess the impact of the plant-based diet combined with aerobic exercise on blood lipids in obese women, including (cholesterol, high-density lipoprotein, low-density lipoprotein, and triglycerides); and to evaluate the effect of the plant-based diet combined with aerobic exercise on body composition in obese women, including (body fat, muscle mass)

The researchers used an experimental method and found that the plant-based diet combined with aerobic exercise had a positive effect on improving and developing some anthropometric characteristics (weight, body mass index, fat mass, and muscle mass). The results showed a statistically significant decrease in fat mass and a statistically significant increase in muscle mass. The study also indicated that the plant-based diet combined with aerobic exercise positively affected (total cholesterol, triglycerides, and low-density lipoprotein cholesterol), with a notable and statistically significant decrease in pre- and post-intervention measurements. Moreover, the plant-based diet combined with aerobic exercise positively influenced high-density lipoprotein cholesterol, showing a statistically significant increase.

The plant-based diet combined with aerobic exercise contributed to reducing harmful lipid levels in the blood of obese women. The researchers recommended applying the plant-based diet combined with aerobic exercise for obese women and using the aerobic exercise program as a method for weight reduction and improving various anthropometric, physiological, and biochemical measurements. They also emphasized the importance of not neglecting high-density lipoprotein cholesterol levels as an indicator of cardiovascular health.

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Introduction and Research Problem:

The global rise in obesity, especially among women, has necessitated urgent preventive strategies. According to the World Health Organization (WHO, 2023), over 2.5 billion adults are now overweight, with 16% classified as obese. Obesity significantly increases the risk of cardiovascular diseases, type 2 diabetes, and certain cancers. Diet and physical inactivity are the two most critical modifiable factors.
Plant-based diets—rich in fruits, vegetables, legumes, and whole grains—are increasingly recognized for their role in managing weight and improving metabolic health. When paired with regular aerobic exercise, such dietary patterns can produce substantial improvements in lipid metabolism and body composition. [1]

In recent years, the field of nutrition has garnered significant attention both globally and nationally due to the increasing population density and the insufficient production of food, particularly in developing countries. Consequently, nutritional literacy is a crucial factor for individuals, as selecting appropriate food and consuming it in specific quantities that match the level and type of daily activities is vital across all social and economic levels and age groups. It serves as a fundamental pillar of preventive medicine and a cornerstone of health safety. [2-4]

Multiple scientific experiments have unequivocally demonstrated the substantial impact of nutrition on the human body, foremost among which are body growth, movement ability, productivity, and disease resistance. The value of food for humans is not measured by the quantity consumed or the extent of individual satisfaction but by the nutritional compounds it contains, which are essential for bodily growth and disease prevention. Proper nutrition provides the necessary elements for antibody formation and prevents malnutrition diseases such as anemia.[7-5]

Global economic changes in food lead to shifts in dietary patterns, such as increased consumption of energy-dense foods high in fats, especially saturated fats, but low in unrefined carbohydrates. These patterns are accompanied by reduced energy expenditure linked to sedentary lifestyles. Due to these changes in dietary patterns and lifestyles, chronic non-communicable diseases—including obesity, diabetes, cardiovascular diseases, hypertension, stroke, and certain types of cancer—have become leading causes of disability and death.[8]

Researchers have indicated that current evidence suggests that consuming plant-based diets significantly reduces the risk of obesity, supporting the necessity of plant-based meals over animal-derived foods. [9]

Previous studies have revealed that diets rich in fruits and vegetables reduce the risk of heart disease, stroke, Alzheimer's, cancer, type 2 diabetes, and asthma in children, and improve mood. Obesity, high cholesterol, and blood lipids are major nutritional issues worldwide, whether in developed or developing countries.

Better to be revised on new figures:

- In 2022, 2.5 billion adults (18 years and older) were overweight. Of these, 890 million were living with obesity.

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- In 2022, 43% of adults aged 18 years and over were overweight and 16% were living with obesity.
- In 2022, 37 million children under the age of 5 were overweight.
- Over 390 million children and adolescents aged 5–19 years were overweight in 2022, including 160 million who were living with obesity. [10]

The latest World Health Organization statistics indicate that about 1.55 billion adults worldwide are overweight, with 3 million children under five being overweight in 2010. Overweight has severe health effects that gradually worsen with increasing weight, leading to heart disease, diabetes, and certain types of cancer. As obesity is a precursor to numerous chronic diseases and their psychological and social consequences, treating obesity requires nutritional interventions and behavioral modifications accompanying physical activity.[11]

Kamal Abdul Hamid and Abu Al-Ala Abdul Fattah (2009) noted that high-fat intake leads to obesity and incomplete oxidation residues (ketone bodies), necessitating reduced fat consumption, especially among women. [12]

Despite media efforts and activities in the Arab community to provide some nutritional awareness programs, they are insufficient, requiring more attention since the relationship between diet and health is clear and scientifically established. [13]

Aerobics are exercises that involve repetitive movements of body muscles, especially large ones like leg muscles, at a light to moderate intensity for a relatively long duration. These exercises are called aerobics because they rely on using oxygen as a medium to create the energy needed for exercise. Activities include walking, cycling, swimming, and rhythmic exercises similar to dancing, often performed under an instructor's supervision. [6]

Aerobic exercises, performed to music, are among the most popular sports in clubs. They aid in weight loss, fat reduction, body toning, improving circulatory efficiency, strengthening the immune system, and enhancing muscle and bone strength. They also have psychological benefits, contributing to mental health. [3]

For women who do not engage in regular physical activity, exercise should be within the limits of their health status and physiological and physical capabilities, considering the ability of functional systems to withstand the physical exertion that might pose health risks and lead to decreased performance and physical health. [14]

By observing the prevalence of obesity among women and the lack of adherence to healthy diets despite the proliferation of various dietary programs, both regulated and unregulated, this study aims to investigate the effectiveness of a low-calorie plant-based diet combined with aerobic exercises on blood fats and body composition in women. This motivated the researcher to conduct this study to understand the impact of a plant-based diet along with aerobic exercises on blood fats and body composition in women.

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Research Objectives:

The research aims to explore the impact of a vegetarian diet combined with aerobic exercises on blood lipids and body composition in women through the following objectives:

1. **Designing an Aerobic Exercise Program and Low-Calorie Vegetarian Diet for Women**
2. **Determining the Impact of the Low-Calorie Vegetarian Diet with Aerobic Exercises on Blood lipids in Women, Represented by:**
    - Cholesterol
    - High-Density Lipoproteins (HDL)
    - Low-Density Lipoproteins (LDL)
    - Triglycerides
3. **Examining the Impact of the Low-Calorie Vegetarian Diet with Aerobic Exercises on Body Composition in Women, Represented by:**
    - Fat mass
    - Muscle Mass

Research Hypotheses

1. There are statistically significant differences between the pre-test and post-test measurements of blood lipids in women.
2. There are statistically significant differences between the pre-test and post-test measurements of body composition in women.

Research Methodology

The experimental method was used with pre-test and post-test measurements for the research sample, as it is appropriate for the nature of the research.

Research Fields

Spatial Field:

- Pre-test and post-test measurements were conducted at a certified fitness center.
- Analyses related to the research variables were performed in a certified laboratory in Alexandria.

Temporal Field:

- Pre-test measurements were taken from February 15, 2022, to February 18, 2022.
- The proposed program was implemented from February 20, 2022, to April 15, 2022.
- Post-test measurements were taken from April 17, 2022, to April 20, 2022.

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Human Field:

- The research community consisted of obese women, and the researcher selected 27 women intentionally.

Research Sample

- The sample was intentionally selected from women aged between 30 and 40 years.
- The sample size included 27 obese women who participated in the experiment.
- Eight women dropped out of the sample due to health reasons and inability to perform the exercises.
- The final sample size consisted of 19 obese women.

Sample Selection Criteria

1. Women aged between 30 and 40 years.
2. Obese women not suffering from severe chronic diseases.
3. The sample had no prior engagement in sports activities.
4. Willingness to participate in the research experiment and adhere to the program schedule.
5. Each participant signed a collaborative protocol ensuring their agreement to undergo the training program, dietary plan, and necessary laboratory tests, measurements, and analyses throughout the study period.
6. Participants did not engage in other research studies to avoid affecting the research results.

Table (1)

Statistical Description of Basic Measurements for the Sampled Women (N = 19)

No.	Measurements	Min Value	Max Value	Mean	Std. Deviation	Skewness	Kurtosis
1	Age (years)	30	40	36.21	3.293	-0.636	-0.938
2	Height (meters)	1.48	1.72	1.62	0.064	-0.405	-0.181

Table (3/1) shows the minimum and maximum values, the mean, and the standard deviation for the basic measurements (age and height) of the sampled women. The skewness values are close to zero, and the kurtosis values range between (±3), indicating normal distribution and homogeneity of the obese women in the sample.

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Table (2)

Statistical Description of Blood Lipids for the Sampled Women Before Intervention (N = 19)

No.	Blood Lipids	Min Value	Max Value	Mean	Std. Deviation	Skewness	Kurtosis
1	Cholesterol (mg/dl)	164	301	229.63	46.709	0.045	-1.439
2	Triglycerides (mg/dl)	51	263	114.95	57.620	1.351	1.243
3	HDL (High-Density Lipoprotein) (mg/dl)	34	61	48.11	7.031	-0.248	-0.604
4	LDL (Low-Density Lipoprotein) (mg/dl)	63	205.8	137.09	34.874	-0.168	-0.228

Table (2) shows the minimum and maximum values, the mean, and the standard deviation for blood lipids for the sampled women before the intervention. The skewness values are close to zero, and the kurtosis values range between (±3), indicating normal distribution and homogeneity of the obese women in the sample.

Table (3)

Statistical Description of Body Composition Measurements for the Sampled Women (N = 19)

No.	Body Composition Measurements	Min Value	Max Value	Mean	Std. Deviation	Skewness	Kurtosis
1	Weight (kg)	67.4	143.5	91.73	14.407	2.513	10.059
2	BMI (Body Mass Index)	30.56	53.35	34.93	5.261	2.621	8.366
3	Fat Percentage (%)	41	54	47.35	3.781	0.266	-1.113
4	Muscle Percentage (%)	25.3	32.9	28.89	2.242	-0.130	-1.172

Table (3) shows the minimum and maximum values, the mean, and the standard deviation for body composition measurements for the sampled women. The skewness values are close to zero, and the kurtosis values range between (±3) except for (weight and BMI) due to the nature of the obese women in the sample, indicating normal distribution and homogeneity of the sample.

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Data Collection Tools:

Anthropometric Measurements

- Measurement of body height (Ht)
- Measurement of body weight (Wt)
- Calculation of Body Mass Index (BMI)
- Measurement of body fat percentage (% Fat)
- Measurement of muscle percentage (%)

Biochemical Measurements

1. Measurements related to blood lipids including:
    - Total Cholesterol (TC) (mg/dl)
    - Triglycerides (TG) (mg/dl)
    - Low-Density Lipoprotein (LDL) (mg/dl)
    - High-Density Lipoprotein (HDL) (mg/dl)

Measurements were taken for the sample (before and after) the application of the aerobic exercise program and diet.

Tools and Equipment Used

- Restameter for measuring body height in cm.
- Medical scale for measuring body weight in kg.
- Blood sample collection tubes containing EDTA (anticoagulant).
- Ice box for preserving blood samples until transferred to the laboratory.
- Set of sterile disposable syringes (3ml) for drawing blood samples.
- Medical cotton, adhesive strips (plaster), topical antiseptic solution.

Basic Study:

1. Conducting pre-measurements for the variables under study.
2. Applying the vegetarian diet and aerobic exercises for two consecutive months.
3. Conducting post-measurements for the variables under study.
4. Statistically analyzing the data, discussing it, and drawing conclusions and recommendations.

Pre-measurements: Pre-measurements for the research sample were conducted for all the variables under study from 20/02/2022 to 18/02/2022. These measurements included:

- Data collection form – height, weight, body mass index – fat percentage – muscle mass measurement.
- Blood lipid measurements:
    - Total Cholesterol (TC)
    - Triglycerides (TG)
    - Low-Density Lipoprotein (LDL)
    - High-Density Lipoprotein (HDL)

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The basic study was conducted on 20/02/2022. The sports and diet program was conducted from 20/02/2022 to 15/04/2022.

Aerobic Exercises Used:

The researcher developed aerobic exercises after analyzing reference studies and scientific research. The exercises aim to:

1. Determine exercise intensity.
2. Vary the exercises.
3. Determine appropriate rest periods.
4. Include rest periods between exercises.
5. Enhance flexibility and agility during exercises.

Points to consider during the implementation of aerobic exercises:

1. Use simple and easy-to-understand phrases to explain the exercises to the participants.
2. Announce the exercises in a clear and audible voice.
3. Ensure freedom of movement in the area.
4. Avoid surprises in announcements, execution, or expressions.
5. Consider rest periods between each exercise.

Proposed Aerobic Training Program:

Based on a review of specialized scientific references and previous studies, the sports program was developed and included the following elements:

1. General Objectives of the Sports Program:

- The proposed aerobic training program and diet aim to improve the body composition of women.
- The program aims to reduce fat levels.

Considerations:

1. Consider individual differences among the research sample.
2. Ensure the safety and security of the research sample.
3. The duration of the experiment was set at 8 weeks.
4. The number of weekly units was set at three times per week.
5. Each session duration was set at (60 minutes).
6. Gradually increase the load according to each individual's capacity.
7. Apply one unit per week to be repeated three times a week.

2. Foundations for Program Development: The basic principles for developing the program were determined as follows:

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1. A set of aerobic exercises was selected to strengthen and lengthen the main working muscles to achieve the general goal of the program, which included:
    - Arm muscles:
        - Triceps brachii
        - Biceps brachii
    - Abdominal muscles:
        - Rectus Abdominus
        - Obliques (Internal and External)
        - Transverse Abdominus
    - Thigh muscles:
        - Quadriceps femoris
        - Biceps femoris
    - Calf muscles:
        - Tibialis Anterior
        - Gastrocnemius
2. The program was designed to match the characteristics of the research sample in terms of age and performance capacity.
3. The principle of gradual progression was considered in the content of the program units from easy to difficult in terms of intensity and duration of the exercises.

3. Content of the Exercise Program: The content of the aerobic training program was determined after reviewing scientific studies and research conducted by the researcher. The program included units consisting of the following parts:

1. Introductory part: The general goal and number of exercises (22) were included. Warm-up exercises help effectively prepare the muscles for work, increase flexibility, and prepare the circulatory system for work. The warm-up consisted of:

- General warm-up (3 minutes): light walking and jogging for a short distance.
- Specific warm-up (7 minutes): exercises to prepare and stretch large muscles (arms, shoulders, trunk, abdomen, and legs).

2. Main part: The main part included (85) exercises focusing on large muscle groups. These exercises aimed to improve strength, muscle extension, and functional efficiency of different body systems using large muscle groups. This part is the main section of the training unit to achieve the required goal. It should include:

- Using modern forms of exercise like circuit training.
- Varying and changing exercises according to the working muscle groups to avoid long-term strain on specific muscles.
- Including relaxation and cool-down exercises during the performance of sports activities.

3. Cool-down part: The cool-down included (10) exercises to help eliminate the effects of training and return the body to its normal state before starting the work. These exercises also help regulate

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breathing and remove nervous fatigue. The researcher used walking, swinging, and light jogging exercises. The goal of this part is to:

- Gradually bring heart rates back to their resting state (recovery phase).
- Choose exercises that keep women engaged and willing to perform them again independently.

Table (4): Training Session Content

Part	Duration	Objective	Content
Preparatory	10 min	Preparing all body muscles, joint flexibility, and muscle stretching	Exercises including warming up the arms, shoulders, trunk, abdomen, and legs
Main	40 min	Aerobic exercises for all body parts, interspersed with flexibility and muscle stretching exercises	Bodyweight exercises, step box exercises, free weight exercises
Cool-down	10 min	Relaxing various body muscles	Relaxation exercises to cool down body muscles

General Framework for Implementing the Program

The program included 24 training sessions, with 3 sessions per week over two months. Each session lasted 60 minutes, with gradual increases throughout the program. The program was applied through all parts of the training session according to the time distribution.

Table (5): Number of Training Sessions and Program Duration

No.	Data	Time Distribution	Unit of Measurement
1	Total program duration	2	Months
2	Number of weeks	8	Weeks
3	Number of sessions per week	3	Training sessions
4	Total number of sessions	24	Training sessions
5	Duration of each session	60	Minutes

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Emphasis was placed on gradual progression, respecting individual differences among participants. Clear and simple instructions were used, with loud and audible calls for exercises, freedom of movement, and avoiding surprise elements in execution.

Dietary Program

The following points were considered in designing the vegetarian diet program:

- Designed based on the height and weight of each participant.
- Calorie calculations for each participant.
- Meals based on legumes, vegetables, eggs, and dairy products.
- The calorie intake used in the dietary program ranged from 1100 to 2000 calories.

Statistical Treatments

Data were processed using the IBM SPSS Statistics 20 software to obtain the following statistical treatments:

- Percentage
- Arithmetic mean
- Standard deviation
- Skewness coefficient
- Kurtosis coefficient
- Pearson's correlation coefficient "r"
- Independent samples t-test
- Eta squared
- Effect size

Discussion of Results

Table (6): *Significance of Differences Between Pre and Post Measurements in Blood Lipid Levels of obese Women (N = 19)*

No.	Blood Lipid Measurements	Pre Measurement	Post Measurement	Difference	Computed "t" Value	Improvement Percentage
		M	±SD	M	±SD	M
1	Cholesterol (mg/dl)	229.63	46.71	165.89	47.03	-63.74
2	Triglycerides (mg/dl)	114.95	57.62	94.37	30.54	-20.58
3	HDL (mg/dl)	48.11	7.03	64.79	13.16	16.68
4	LDL (mg/dl)	137.09	34.87	118.76	35.09	-18.34

- Significance of "t" at 0.05 level = 2.101, at 0.01 level = 2.878

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The results indicate significant differences between pre and post measurements in all blood lipid variables, demonstrating the effectiveness of the vegetarian diet program and aerobic exercises in improving blood lipid levels in the female participants.

Interpretation of Results

Table (6): Significance of Differences Between Pre and Post Measurements in Blood Lipid Levels of Women

From Table (6), it is evident that there are significant differences in the calculated "t" values between the pre and post measurements of blood lipid levels in women, favoring the post-measurement results. Specifically: **Cholesterol** decreased by 27.76% ,**Triglycerides** decreased by 17.90% , **Low-Density Lipoprotein (LDL)** decreased by 13.38% , **High-Density Lipoprotein (HDL)** increased by 34.68%

This indicates a positive impact of the vegetarian diet and aerobic exercises on blood lipid levels in obese women.

Table (7): *Effect Size of the Vegetarian Diet and Aerobic Exercises on Blood Lipid Measurements*

No.	Blood Lipid Measurements	Computed "t" Value	Correlation Coefficient "r"	Eta Squared	Effect Size Value	Magnitude of Effect
1	Cholesterol (mg/dl)	6.249	0.550	0.684	1.360	High
2	Triglycerides (mg/dl)	2.849	0.927	0.311	0.250	Weak
3	HDL (mg/dl)	5.168	0.132	0.597	1.562	High
4	LDL (mg/dl)	4.685	0.881	0.549	0.524	Moderate

- **Eta Squared**: Less than 0.09 is weak, greater than 0.14 is high
- **Effect Size**: 0.2 is weak, 0.5 is moderate, 0.8 is high

The results show:

- **High Effect Size** for Cholesterol and HDL, indicating a significant impact of the intervention on these measures.
- **Moderate Effect Size** for LDL, suggesting a moderate impact.
- **Weak Effect Size** for Triglycerides, indicating a minor impact.

These findings reflect the effectiveness of the vegetarian diet and aerobic exercises in improving various aspects of blood lipid profile in obese women.

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Interpretation of Results

Table (7): Effect Size of the Vegetarian Diet and Aerobic Exercises on Blood Lipid Measurements

From Table (7), the effect of the vegetarian diet and aerobic exercises on blood lipids for obese women varies from weak to moderate to high. The effect size values ranged from 0.250 to 1.562, and the Eta Squared values ranged from 0.311 to 0.684, which are considered high (greater than 0.14). This indicates that the vegetarian diet combined with aerobic exercises has a significant impact on blood lipid levels in obese women.

Table (8): Significance of Differences Between Pre and Post Measurements in Body Composition of Obese Women

From Table (8), the following observations are made:

• No.	Body Composition Measurements	Pre-Test Measurement	Post-Test Measurement	Difference	Calculated "T" Value	Improvement Percentage (%)
		Mean ± SD	Mean ± SD	Mean ± SD		
1	Weight (kg)	91.73 ± 14.41	88.44 ± 14.35	-3.29 ± 1.08	13.255**	3.58
2	Body Mass Index (BMI)	34.93 ± 5.26	33.68 ± 5.29	-1.25 ± 0.39	13.963**	3.57
3	Fat Percentage	47.35 ± 3.78	44.93 ± 4.77	-2.43 ± 2.56	4.130**	5.12
4	Muscle Percentage	28.89 ± 2.24	29.42 ± 2.93	+0.52 ± 1.47	1.544	1.80

**Significance of "t" values: 0.05 = 2.101, 0.01 = 2.878

Interpretation:

- **Significant Improvement**: Weight, BMI, and body fat percentage showed significant improvements between pre and post measurements, indicating effective changes in body composition due to the vegetarian diet and aerobic exercises.
- **No Significant Change**: Muscle percentage did not show a significant change, suggesting that while there were improvements in weight, BMI, and body fat, the impact on muscle mass was less pronounced.

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Interpretation of Results

From Table (8), there are statistically significant differences in body composition measurements between pre and post assessments, except for muscle percentage. Specifically:**Weight** decreased with a percentage improvement of 3.58%. , **Body Mass Index (BMI)** improved by 3.57% , **Body Fat Percentage** decreased by 5.12% , **Muscle Percentage** increased by 1.80%.

Table (9): *Effect Size of the Vegetarian Diet and Aerobic Exercises on Body Composition of Obese Women*

No.	Body Composition Measurements	Calculated "t" Value	Correlation Coefficient "r"	Effect Size (Eta Squared)	Effect Size Value	Effect Size Magnitude
1	Weight (kg)	13.255	0.997	0.907	0.228	Weak
2	Body Mass Index (BMI)	13.963	0.997	0.915	0.236	Weak
3	Fat Percentage	4.130	0.845	0.487	0.527	Moderate
4	Muscle Percentage	1.544	0.871	0.117	0.180	Weak

From Table (9), the effect size of the vegetarian diet combined with aerobic exercises on body composition is analyzed as follows:

Interpretation:

- **Weak Effect**: Weight, BMI, and muscle percentage show weak effect sizes, indicating that while there were significant changes, the practical significance of these changes is relatively modest.
- **Moderate Effect**: Body fat percentage shows a moderate effect size, reflecting a more substantial impact of the intervention on reducing body fat compared to other measures.

Overall, while the intervention showed significant improvements in body composition, the effect sizes suggest that the most notable impact was on body fat percentage.

Discussion of the Results

Discussion of the First Hypothesis

Hypothesis: There are statistically significant differences between pre- and post-measurements of blood lipids in women.

From Table (6), significant differences in the calculated "t" value between pre- and post-measurements of blood lipids in women were observed. Specifically:

- **Cholesterol** decreased by 27.76%.
- **Triglycerides** decreased by 17.90%.
- **Low-Density Lipoprotein (LDL)** decreased by 13.38%.
- **High-Density Lipoprotein (HDL)** increased by 34.68%.

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Table (7) indicate that the effect size of the vegetarian diet combined with aerobic exercises on blood lipids ranged from weak to high, with effect sizes between 0.250 and 1.562 and Eta Squared values between 0.311 and 0.684, which are considered high and greater than 0.14. This suggests the effectiveness of the vegetarian diet and aerobic exercises on improving blood lipid profiles in obese women.

These findings align with several studies: **Chang et al. (2022)** found significant reductions in LDL cholesterol levels in groups following a vegetarian diet combined with exercise ,**Alan Espinosa et al. (2020)** and **Campos et al. (2016)** reported decreases in cholesterol and unsaturated fatty acids, with minimal effects on triglyceride levels , **De Biase et al. (2007)** observed significant reductions in LDL, HDL, and triglycerides. , **Abdullah et al. (2016)** found that regular aerobic exercise improved body composition and physiological measurements, including blood lipids , **Amal Hussein Said Mohamed (2003)** showed increased HDL levels and decreased LDL levels, though the changes in LDL were more significant , **Fatima Saad Abdel Fattah (2016)** noted that the proposed training program positively affected blood lipids and body composition , **Abbas Fadel Jaber and Maher Abdul Latif Aref (2019)** observed that a combined physical and dietary program was more effective in reducing LDL levels compared to either intervention alone , **Butler et al. (2006)** reported that rhythmic dance reduced fat and lipoprotein levels, indicating its effectiveness in modifying lipid profiles , **Khadra (2019)** noted weight loss and improved blood lipid profiles with the proposed movement program. [15-24]

The results support the first hypothesis that there are statistically significant differences between pre- and post-measurements of blood lipids in women.

Discussion of the Second Hypothesis

Hypothesis: There are statistically significant differences between pre- and post-measurements of body composition in women.

From Table (8), significant differences were found in body composition measurements between pre- and post-assessments, except for muscle percentage. Specifically:

- **Weight** decreased by 3.58%.
- **Body Mass Index (BMI)** decreased by 3.57%.
- **Body Fat Percentage** decreased by 5.12%.
- **Muscle Percentage** increased by 1.80%.

Table (9) show that the effect size of the vegetarian diet combined with aerobic exercises on body composition ranged from weak to moderate, with effect sizes between 0.180 and 0.527, and Eta Squared values between 0.117 and 0.915, which are considered high and greater than 0.14. This suggests that the intervention effectively impacted body composition in obese women.

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The study showed improvements in anthropometric variables and decreases in body weight and BMI, which the researcher attributes to the positive effects of aerobic exercises and the low-calorie vegetarian diet.

These results align with: **Gedamu et al. (2021)**, who found significant reductions in blood pressure and BMI with a vegetarian diet , **Fernandes et al. (2013)**, who observed no change in BMI with an ovo-lacto-vegetarian diet., **Al-Sayed Antar (2016)**, who highlighted that aerobic activity increases fat utilization as an energy source once glycogen stores are depleted , **Fatima Saad Abdel Fattah (2016)** found positive effects of aerobic exercises and calorie reduction on body composition and biochemical variables , **Huang (2016)**, which emphasized the effectiveness of a vegetarian diet in preventing weight gain and promoting weight loss. [21, 25-28]

The results support the second hypothesis that there are statistically significant differences between pre- and post-measurements of body composition in women.

Conclusions:

Based on the study results and statistical analyses:

1. The vegetarian diet combined with aerobic exercises positively impacted anthropometric characteristics (weight, BMI, fat, and muscle), showing reductions in fat and increases in muscle mass.
2. The intervention improved overall lipid profiles, including total cholesterol, triglycerides, and LDL.
3. HDL levels increased significantly with the intervention.
4. The combined diet and exercise program reduced harmful fat levels in the blood of obese women.

Recommendations

1. Implement the vegetarian diet combined with aerobic exercises for obese women.
2. Utilize the aerobic exercises included in the program as a method for weight reduction and improvement in anthropometric and biochemical measurements in obese women.
3. Pay attention to HDL levels in blood analyses, as they are indicators of cardiovascular health and vitality.

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References

[1] O. WHO, "overweight, Available online: https://www. who. int/en/news-room/fact-sheets/detail/obesity-and-overweight," ed: Accessed, 2023.

[2] Y. Cui, Q. Qi, Y. Sun, R. Liu, W. Yin, and H. Liu, "Nutrition literacy is associated with general obesity, abdominal obesity, and body fat percentage obesity," *Frontiers in Nutrition,* vol. 12, p. 1555725, 2025.

[3] J. Wen, X. Zhang, X. Yin, G. Ma, and J. Wang, "Development and Validation of Nutrition Literacy Questionnaire for Chinese Pre-School Children," *Nutrients,* vol. 17, no. 10, p. 1704, 2025.

[4] E. L. Sherer, S. Conroy, C. Bateson, A. Storts, and P. Gonzalez, "Nutrition literacy among women participating in a community kitchen program in Antioquia, Colombia: A cross-sectional study," *Open Health,* vol. 5, no. 1, p. 20230052, 2024.

[5] Q. Rachmah *et al.*, "The effectiveness of nutrition and health intervention in workplace setting: a systematic review," *Journal of public health research,* vol. 11, no. 1, p. jphr. 2021.2312, 2022.

[6] T. Shao *et al.*, "Physical activity and nutritional influence on immune function: an important strategy to improve immunity and health status," *Frontiers in physiology,* vol. 12, p. 751374, 2021.

[7] D. Skolmowska, D. Głąbska, A. Kołota, and D. Guzek, "Effectiveness of dietary interventions to treat iron-deficiency anemia in women: a systematic review of randomized controlled trials," *Nutrients,* vol. 14, no. 13, p. 2724, 2022.

[8] A. Siiba, J. Kangmennaang, L. Baatiema, and I. Luginaah, "The relationship between climate change, globalization and non-communicable diseases in Africa: A systematic review," *PLoS One,* vol. 19, no. 2, p. e0297393, 2024.

[9] S. R. Bassin, J. F. De Carvalho, and M. Gulati, "A Review of Plant-Based Diets for Obesity Management," *Endocrine Practice,* 2024.

[10] A. Okunogbe *et al.*, "Economic impacts of overweight and obesity: current and future estimates for 161 countries–Supplementary materials."

[11] G. M. Turner-McGrievy *et al.*, "Effect of a plant-based vs omnivorous soul food diet on weight and lipid levels among African American adults: a randomized clinical trial," *JAMA network open,* vol. 6, no. 1, pp. e2250626-e2250626, 2023.

[12] N. H. A. Hamid, M. M. Kamal, and F. H. Yahaya, "Application of PID controller in controlling refrigerator temperature," in *2009 5th International Colloquium on Signal Processing & Its Applications*, 2009: IEEE, pp. 378-384.

[13] A. Shalabi, A. El-Mahdy, K. M. Eid, M. Kamel, and A. El-Barbary, "Glasner-Tompkins relation and reorientation of U centers in LiF crystals," *Physical Review B,* vol. 60, no. 13, p. 9377, 1999.

[14] A. Abdel-Fattah, F. S. Abou-Taleb, and G. H. Moustafa, "Behavior of air jet impinging on curved surfaces," *Journal of Aerospace Engineering,* vol. 27, no. 5, p. 04014029, 2014.

[15] N. Wang *et al.*, "Intensive LDL cholesterol-lowering treatment beyond current recommendations for the prevention of major vascular events: a systematic review and meta-analysis of randomised trials including 327 037 participants," *The lancet Diabetes & endocrinology,* vol. 8, no. 1, pp. 36-49, 2020.

[16] F. Espinosa-Lagunes *et al.*, "Copper nanoparticles suitable for bifunctional cholesterol oxidation reaction: harvesting energy and sensor," *Materials for Renewable and Sustainable Energy,* vol. 11, no. 2, pp. 105-114, 2022.

ISSN (Print): 2805-2749

ISSN(ONLINE): 2805-2943

[17] A. M. Campos *et al.*, "Lipidomic investigation of eggs' yolk: Changes in lipid profile of eggs from different conditions," *Food Research International,* vol. 89, pp. 177-185, 2016.
[18] S. G. De Biase, S. F. C. Fernandes, R. J. Gianini, and J. L. G. Duarte, "Vegetarian diet and cholesterol and triglycerides levels," *Arquivos brasileiros de cardiologia,* vol. 88, pp. 35-39, 2007.
[19] M. R. Abdullah, V. Eswaramoorthi, R. M. Musa, A. B. H. M. Maliki, N. A. Kosni, and M. Haque, "The effectiveness of aerobic exercises at difference intensities of managing blood pressure in essential hypertensive information technology officers," *Journal of Young Pharmacists,* vol. 8, no. 4, p. 483, 2016.
[20] M. Amal, M. S. Hussein, E. M. Rageh, H. E. Hamouda, A. A. Wagih, and R. G. Ismail, "Effect of Atorvastatin on Inflammation and Modification of Vascular Risk Factors in Rheumatoid Arthritis," *The Journal of Rheumatology,* 2010.
[21] S. Fatima, A. Ijaz, T. B. Sharif, D. A. Khan, and A. Siddique, "Accuracy of non-fasting lipid profile for the assessment of lipoprotein coronary risk," *J Coll Physicians Surg Pak,* vol. 26, no. 12, pp. 954-7, 2016.
[22] A. F. Jaber, A. Mezher, and M. K. Dagger, "The effectiveness of special exercises and supplements L-Arginine and CoQ10 in some physical capacities for middle-distance runners," *journal mustansiriyah of sports science,* vol. 1, no. 3, 2019.
[23] M. J. Butler, *Unlocking the groove: Rhythm, meter, and musical design in electronic dance music*. Indiana University Press, 2006.
[24] D. Khadra, L. Itani, H. Tannir, D. Kreidieh, D. El Masri, and M. El Ghoch, "Association between sarcopenic obesity and higher risk of type 2 diabetes in adults: a systematic review and meta-analysis," *World journal of diabetes,* vol. 10, no. 5, p. 311, 2019.
[25] D. K. Gedamu and W. Sisay, "Prevalence of hypertension and associated factors among public servants in North Wollo Zone, Amhara Region, Ethiopia, 2020," *Vascular health and risk management,* pp. 363-370, 2021.
[26] N. M. d. S. Fernandes *et al.*, "Body size and longitudinal body weight changes do not increase mortality in incident peritoneal dialysis patients of the Brazilian peritoneal dialysis multicenter study," *Clinics,* vol. 68, pp. 51-58, 2013.
[27] D. Al-Sayed Antar and A. Gomaa Shehata, "Effect of a program of aerobic exercise accompanying dietary guidance on the rate of obesity and heartbeat for women aged 30-45 years," *Assiut Journal of Sport Science and Arts,* vol. 316, no. 3, pp. 215-232, 2016.
[28] R.-Y. Huang, C.-C. Huang, F. B. Hu, and J. E. Chavarro, "Vegetarian diets and weight reduction: a meta-analysis of randomized controlled trials," *Journal of general internal medicine,* vol. 31, no. 1, pp. 109-116, 2016.
[29] NaderShalaby M, Liu JY, Heshmat H, Shalaby NM, Salah M. The Effect of Aerobic and Anaerobic Exercise Bouts on CD34+ Stem Cells and Some Physiological Parameters. Life Sci J. 2012;9(2):1037-1043.
[30] Shalaby MN, Sakoury MMA. The Role of Physical Activity on the Support and Enhance the Natural Behavior of Stem Cells and Chosen Physiological Variables for Players Athletics. DRASSA J Dev Res Sport Sci Act. 2018;4(1):74-92.
[31] Shalaby MN, Sakoury MM, Kholif MA, Alsayed NI. The role of Amino Acids in improving immunity and growth factors of Volleyball players. J Adv Pharm Educ Res Oct-Dec. 2020;10(4):141.

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