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Effects of Some Physical Exercises with a Diet using artificial intelligence on Some Morphological Variables Related to Health in Obese Persons

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Abstract: - The current research aims to identify the effects of physical exercises accompanied by a diet on some health-related body morphology variables and weight loss among obese persons. The researcher used the experimental approach (one-group design) with pre- and post-measurements. The researcher purposefully chose (16) obese persons, (12) of them were recruited as a main sample while (4) were recruited as a pilot sample. Results indicated that:

1. The recommended exercise program with diet had positive effects on health-related physical fitness variables (speed – endurance – agility – power – strength – cardiorespiratory strength) among obese persons.
2. The recommended exercise program with diet had positive effects on weight reduction variables (body weight – BMI – Fat percentage) among obese persons.
3. Exercise with diet helped decrease weight among obese persons.
4. There are statistically significant differences between the pre-and post-measurements of health-related physical fitness variables (among obese persons in favor of post-measurements.
5. There are statistically significant differences between the pre-and post-measurements of weight decrease among obese persons in favor of post-measurements.

Keywords: Physical Exercise – Diet – Body Morphology – Health – Obesity

Introduction:

Arab individuals are typically obese. This makes them more vulnerable to developing physical diseases and functional disorders caused by careless overeating. Such a thing requires programs of physical activity to prevent obesity and its consequences. To achieve its objectives, such programs should be science-based at first. Although there are many physical and sports programs in the Arab world, they only concentrate on increasing physical fitness levels. According to the researcher's knowledge, obese individuals did not receive this therapeutic mix of physical and dietary variables that mix of body morphology and diet that includes correct nutrients despite a crucial case of obesity as a health risk that may lead in the long run to many diseases. Health is related to food. We can recognize the individual from his nutritional behavior (tell me what you eat and I tell you who you are) as health depends on the quality of food we eat, which differs according to age group (**Ruamsup, J. 2010**). Food gathers pleasure and need. It is food that provides the body's needs for growth, reproduction, and regeneration. Food was, and still is, the core of life. Nutrition plays a basic role in human health as many contemporary diseases, including cardiac diseases, cancer, and obesity, have direct relations to the quality of food. The secret behind correct nutrition is moderation of food consumption and variation among different available kinds of food in addition to balance between nutrients as no one type of food can include all necessary nutrients (**Peak 2012**).

Scientific research during the past 20 years indicated the importance and benefits of correct nutrition and its positive effects on athletic performance. There is no doubt that what an athlete eats or drinks affects his/her health, weight, body morphology, and energy sources during and after exercises even more than competitions. Therefore, ideal nutrition improves physical activity and athletic performance (**Hongu & Sachan 2003**).

Good health, physical balance, and good physiological and motor functions are the main factors that make human beings feel satisfied, safe, and confident in their bodies and their abilities to exert the required effort. This is a major quality of a normal personality as it means body image satisfaction (**Thompson 2015**).

Through this research, the researcher tried to increase the awareness of athletic exercises in general, and specifically obese individuals, about the correct rules of exercises according to the physical requirements of male/ female individuals. Therefore, the researcher designed a training program with a diet and tested its effects on health-related body morphology and weight loss in obese individuals. Policies supporting athletic participation, healthy habits, and good nutritional behavior and the programs that support this trend pave the way towards improving these healthy behaviors among women. Researchers indicated that programs aiming at promoting healthy behavior among women affect greatly the formation of a set of positive trends and healthy habits that maintain healthy behaviors and prevent chronic diseases (**Frasa et al 2014**).

Obesity is a major and individual indicator of death among many men and women as obesity causes many diseases including insulin resistance, metabolism disorders, and cardiovascular diseases. One of the most serious kinds of fats is visceral fats (**Swainson et al 2017; Koster et al 2015; Direk et al 2013; Kishida et al 2012**).

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Accordingly, and in addition to the researcher's experience as he works in rehabilitating obese individuals to reduce their weight, he noticed that most programs delivered in specialized centers lack many things concerning the nutrition of obese persons while practicing exercises to complete their programs. Furthermore, those persons may have to reduce weight very quickly by preventing or decreasing food consumption that may include some important nutrients that help build muscles and burn fats. This led the researcher to perform this study to direct obese individuals towards decreasing their weight correctly while maintaining their physical function to perform daily tasks.

Aim:

The current research aims to identify the effects of physical exercises accompanied by a diet on some health-related body morphology variables and weight loss among obese persons. These variables include:

1. Strength – endurance – flexibility – cardiorespiratory endurance – body morphology
2. Weight decrease

Hypotheses:

1. There are statistically significant differences between the pre-and post-measurements of health-related physical fitness variables (speed – endurance – agility – muscular power – muscular strength – cardiovascular endurance) among obese persons in favor of post-measurements.
2. There are statistically significant differences between the pre-and post-measurements of weight decrease among obese persons in favor of post-measurements.
3. There are statistically significant differences in change rate between the pre-and post-measurements of health-related physical fitness variables and weight decrease among obese persons in favor of post-measurements.

Methods:

Approach:

The researcher used the experimental approach (one-group design) with pre- and post-measurements.

Participants:

The researcher purposefully chose (16) obese persons, (12) of them were recruited as a main sample while (4) were recruited as a pilot sample. The researcher homogenized participants on growth factors (age – height – weight) and other variables as seen in tables (6) and (7).

Table (1): Data Normality among Participants on Growth Factors (n=16)

Variables	Measurement	Mean	SD (±)	Median	Skewness
Age	Year	35.06	5.86	35	0.122
Height	Cm	161.89	6.82	161	0.165
Weight	Kg	91.34	90.18	2.6	1.19

Table (1) indicated that Squewness values ranged from (0.122) to (1.19). these values are between (±3) and under the normality curve, indicating data normality.

Table (2): Data Normality among Participants on weight and fitness (n=16)

Variables		Measurement	Mean	SD (±)	Median	Skewness
Weight	Weight	Kg	91.34	90.18	2.6	1.19
	MBI	Degree	31.6	31.4	2.8	0.84
	Fat percentage (%)	Kg/100	25.6	25.7	3.1	0.6
Physical fitness	*50 yards running*	*Sec*	9.125	1.356	9.00	0.97
	Sit-up	*Rep*	17.625	1.996	17.0	0.96
	4x30 yards rebound run	*Sec*	18.375	0.744	18.30	0.378
	Wide jump	*Cm*	133.750	7.906	13.75	0.760
	Pull up	*Rep*	3.750	0.463	3.00	0.361
	600 yards run	*Min*	1.478	0.036	1.47	0.488

Table (2) indicated that Squewness values ranged from (0.35) to (1.25). these values are between (±3) and under the normality curve, indicating data normality.

Data collection tools:

The researcher reviewed related literature to identify data collection tools as follows: Anthropometric measurements were used to identify the degree of obesity and body fat percentage using the following equations:

- **The degree of obesity** using Body Mass Index (BMI) is as follows:

$$\text{BMI} = \frac{\text{Body weight (BW)}}{\text{Square height (Ht}^2\text{)}}$$

- **Fat percentage (F%)** using the relation between body fats and BMI as follows:

$$\text{Fat percentage (F\%)} = \frac{\textbf{Body weight (BW)}}{\textbf{Square height (Ht}^2\textbf{)}} \textbf{ X 100}$$

(Perrella 1999)

Body Morphological Formation was measured to identify fat weight (FW) and fat-free weight (LBW).

- **Fat-free weight (LBW)** = 10.26 + (0.7927x BW) – (0.3676 x abdominal skinfold thickness).
- **Fat weight (FW)** = BW – LBW

Where fat-free weight refers to the weight of muscles, bones, and internal vital organs while fat weight refers to fat quantity relative to total body weight. (**Perrella 1999).**

- **Body weight** was measured using medical balance.
- **Body height** was measured as the individual stood upright on a wooden box with his back flat and touched the graded bar. The knob is lowered till it touches the top of the head.
- **Skinfold thickness** (down shoulder girdle bones – abdominal): this measurement was taken using skinfold caliper according to Heath-Carter methodology (to closest 0.1 cm) (**Hassanain 2003**)

Physical fitness variables were measured using the American Youth Physical Fitness Test Battery developed by the American Union for Health, Physical Fitness and Recreation. The test battery includes the following tests: pullup – sit-up – knee bending – rebound running (4x30 yards) – wide jump – running (50 yards) – running (600 yards).

A study performed in Egypt used that test battery under the title of "Egyptian Youth Physical Fitness Test". This study was performed on (19000) boys and girls (9-18 years) from (7) governorates: Cairo – Giza – Sharquia – Gharbia – Alexandria – Al-Minia – Asiut. This is to represent all geographical zones in Egypt (Jokal 2007).

This test battery is easy to apply and suitable for the age group under investigation as it includes all health-related physical qualities. In addition, it proved high reliability and validity in the Egyptian environment. Therefore, the researcher chose to apply it in pre- and post-measurements for both experimental and control groups.

Harvard Step Test: in this test, we use a 50cm high chair, a stopwatch for measuring pulse, and a metronome (for controlling performance tempo and number). To evaluate physical efficiency, the researcher used the following method:

$$\text{Physical efficiency indicator} = \frac{\text{Time for continuing tests x 100}}{\text{The sum of three pulse measurements x 2}}$$

(**Swainson et al,2017؛Koster et al,2015 ؛ Direk et al.,2013 ؛ Kishida et al,2012**)

Tools and Equipment:

A medical balance for measuring weight (kg) – a restameter for measuring height (cm) – a measuring tape and sticky markers – medicine balls.

Physical exercises:

To design the physical exercises and the diet, the researcher reviewed related literature and designed the program according to the following:

Aims of exercises:

- Improving health-related physical fitness measurements (under investigation).
- Decreasing overweight.

Principles of designing exercises:

- All exercises should achieve their objective; that is increasing health-related physical fitness and decreasing weight in obese persons.
- Suitability of the program to participants (obese persons)
- Suitability of content to duration and number of units.
- Continuity of all parts of the program.
- Progression of exercises in a manner that helps the progression of work in muscular groups and body vital systems.
- Exercises should be exciting to add joy and attract participants.
- Considering safety measures.

Aspects of Diet:

The researcher reviewed related literature to identify components and nutrients of meals (breakfast – lunch – dinner) that obese people can consume before, during, and after the program. All participants were instructed to strictly follow the diet to gain positive effects of the program.

Table (3): Experts' opinions about the duration of the program (n=10)

S	Duration	Repetition	Percentage %
1	**3 months**	**10**	**100%**
2	**14 weeks**	**10**	**100%**
3	**3 meals**	**10**	**100%**

Table (3) presented experts' opinions about the duration of the program and the number of meals (breakfast – lunch – dinner).

Pilot Study:

The researcher performed the pilot study to discover any difficulties that may arise during the main application. The pilot study aimed to:

- Identify any difficulties that may arise during the main application.
- Validate tools and equipment.
- Train assistants on measurement and recording.
- Calculating validity and reliability of tests

All tools and equipment proved valid and assistants understood measurement protocols.

Validity and Reliability of Tests:

The researcher calculated the validity and reliability of tests from 27-1-2023 to 4-2-2023 as follows:

Validity of Physical Tests:

The researcher calculated distinct validity using (4) participants in two groups (distinct – and non-distinct).

Table (4): Validity of Physical Tests (n1 = n2 = 4)

Tests	*Measurement*	*Distinct Group*		*Non-distinct group*		*(t) value*
		Mean	*SD±*	*Mean*	*SD±*	
50 yards running	*Sec*	*6.875*	*0.354*	*9.125*	*1.356*	*4.541**
Sit-up	*Rep*	*31.250*	*1.832*	*17.625*	*1.996*	*14.225**
4x30 yards rebound run	*Sec*	*14.750*	*0.463*	*18.375*	*0.744*	*11.701**
Wide jump	*Cm*	*189.375*	*4.955*	*133.750*	*7.906*	*16.862**
Pull up	*Rep*	*6.375*	*0.518*	*3.750*	*0.463*	*10.693**
600 yards run	*Min*	*1.370*	*0.043*	*1.478*	*0.036*	*5.455**

(t) table value of freedom degree of (14) and P ≤0.05 = 2.145

Table (4) indicated statistically significant differences between the distinct and non-distinct groups on P≤0.05 in all tests in favor of the distinct group. This proves the validity of tests.

Reliability of Physical Tests:

The researcher applied a test/retest procedure with (7) day intervals to calculate the reliability of physical tests. The test took place on 27-1-2023 while the retest took place on 4-2-2023 on a pilot sample (n=4). Correlation between test and retest) Pearson's correlation Coefficient) was calculated as seen in Table (5).

Table (5): Reliability of Physical Tests (n=4)

Tests	*Measurement*	*Test*		*Retest*		*R-value*
		Mean	*SD±*	*Mean*	*SD±*	
50 yards running	*Sec*	*10.333*	*1.709*	*9.967*	*1.497*	*0.894**
Sit-up	*Rep*	*17.300*	*2.562*	*18.033*	*2.189*	*0.871**
4x30 yards rebound run	*Sec*	*21.333*	*1.863*	*20.833*	*1.783*	*0.889**
Wide jump	*Cm*	*128.333*	*11.695*	*131.500*	*10.352*	*0.833**
Pull up	*Rep*	*2.667*	*0.661*	*2.733*	*0.691*	*0.855**
600 yards run	*Min*	*1.648*	*0.121*	*1.588*	*0.099*	*0.767**

(R) table value of freedom degree of (28) and P ≤0.05 = 0.306

Table (5) indicated statistically significant correlations between test and retest on P≤0.05 in all tests as R calculated values ranged from (0.767) to (894.0). this proves the reliability of tests.

Identification of Health Aspects:

The researcher reviewed related literature to identify major health aspects related to obese persons. The researcher explored experts' opinions about these aspects to identify the suitability of health objectives to the recommended program as seen in Table (6).

Table (6): Experts' Opinions About Health Aspects Objectives

S	Objective	Point	Percentage
1	Providing obese persons with health aspects that can decrease weight	65	100%
2	Reinforcing awareness about concepts that affect individual life (postural – health)	65	100%
3	Providing obese persons with health concepts related to physical activity	59	90.76%
4	Improving health-related and weight-control physical fitness components	59	70.76%
5	Maintaining good body formation through practicing different types of physical exercises for all body parts correctly.	65	100%
6	Providing obese persons with information about body weight and body parts related to movement and good posture	63	96.92%
7	Providing obese persons with preventive exercises during physical performance.	65	100%
8	Informing obese persons about the importance of body parts and body awareness	63	96.99%
9	Practicing some good health habits by obese persons.	63	96.92%
10	Increasing awareness of obese persons about body awareness and the surrounding environment.	63	96.92%

Table (6) indicated that the percentage of agreement among experts ranged from (92.96%) to (100%). Therefore, they were all accepted.

Main Study:

The researcher calibrated all tools and equipment to avoid measurement mistakes.

Pre-measurements:

Pre-measurements of physical tests using the American Youth Test Batter took place on 5-2-2023.

Main application:

The researcher applied the recommended program to participants from 6-2-2023 to 14-4-2023.

Post-measurements:

Post-measurements of physical tests and weight decrease took place on 15-4-2023.

Statistical Analysis:

The researcher used SPSS software to calculate the following: mean – SD – median – Squatness – Pearson's correlation coefficient – (t) test – percentage.

Results:

Health-related Physical Fitness:

Table (7): Difference Significance Between Pre- and Post-measurements of health-related physical fitness tests (n=12)

Tests	Measurement	Pre-		Post-		(t) value
		Mean	*SD±*	*Mean*	*SD±*	
50 yards running	Sec	10.567	1.716	7.967	1.066	11.163 *
Sit-up	Rep	17.533	2.713	25.267	5.801	8.232 *
4x30 yards rebound run	Sec	21.067	1.837	16.600	1.380	12.261 *
Wide jump	Cm	127.000	12.290	164.000	23.650	11.007 *
Pull up	Rep	3.067	0.944	4.867	0.973	14.840 *
600 yards run	Min	1.633	0.131	1.415	0.051	10.034 *

(t) table value on P ≤0.05 = 2.201

Table (12) indicated statistically significant differences between pre-and post-measurements of health-related physical fitness tests on P ≤0.05 in favor of post-measurements.

Table (8): Variance Rate between pre- and post-measurements of participants on physical fitness tests (n=12)

Tests	Measurement	Pre-measurement mean	Post-measurement mean	Means difference	Variance rate %
50 yards running	Sec	10.367	9.133	1.233	11.897
Sit-up	Rep	17.767	21.400	3.633	20.450
4x30 yards rebound run	Sec	21.433	19.367	2.067	9.642
Wide jump	Cm	129.000	148.667	19.667	15.245
Pull up	Rep	2.933	3.867	0.933	31.818
600 yards run	Min	1.622	1.509	0.133	6.948

Table (8) indicates the difference in variance rates between pre- and post-measurements of physical fitness tests in favor of post-measurements.

Weight Reduction:

Table (9): Difference Significance Between Pre- and Post-measurements of Weight Reduction (n=12)

Tests	*Measurement*	*Pre-*		*Post-*		*(t) value*
		Mean	*SD±*	*Mean*	*SD±*	
Total Body Weight	*Kg*	*89.15*	*2.9*	*80.74*	*1.6*	*12.1**
BMI	*Degree*	*30.98*	*1.7*	*24.61*	*0.7*	*14.8**
Fat percentage	*Kg/100*	*25.6*	*3.4*	*21.11*	*2.5*	*13.5**

(t) table value on P ≤0.05 = 2.201

Table (9) indicated that (t) calculated values ranged from (21.1) to (14.8) which are higher than its table value. This indicates statistically significant differences between pre-and post-measurements of weight reduction in favor of post-measurements.

Table (10): Variance Rate between pre- and post-measurements of participants on weight reduction (n=12)

Tests	*Measurement*	*Pre-*		*Post-*		*Variance rate %*
		Mean	*SD±*	*Mean*	*SD±*	
Total Body Weight	*Kg*	*89.15*	*2.9*	*80.74*	*1.6*	*23.61*
BMI	*Degree*	*30.98*	*1.7*	*24.61*	*0.7*	*20.9*
Fat percentage	*Kg/100*	*25.6*	*3.4*	*21.11*	*2.5*	*21.52*

Table (10) indicates the difference in variance rates between pre- and post-measurements of weight reduction in favor of post-measurements.

Discussion:

Health-related Physical Fitness:

Table (7) indicated statistically significant differences between pre-and post-measurements of health-related physical fitness variables in favor of post-measurements. This indicates that the recommended program with diet had positive effects on these variables. Table (8) indicated statistically significant variance rates between pre- and post-measurements of health-related physical fitness variables with the highest value of (31.818) for muscular strength.

The researcher thinks that this is due to the recommended exercise program that included various exercises directed to all body parts in addition to a diet that all participants committed to all along the duration of the program as it helped them improve health-related physical fitness variables. Health and prevention in sports have become major fields of sports medicine as athletes make use of it in all sports. Prevention in sports medicine concentrates on preventing diseases and injuries that may happen as a result of physical effort that puts massive requirements and adaptations over the human body. They can also result from variances in temperature and other metabolic factors that affect body susceptibility to pathogens (**Oliver et al 2018**). Obesity resulting from fat increase due to the lack of motor activities is closely related to cardiac diseases, stress, diabetes, gout, and biliary vesicle disorder. (**Baumgartner & Jackson, 1998)**

Food can prevent, and even heal many diseases like diabetes, hypertension, obesity, anemia, and pellagra.

Special categories like children, teenagers, pregnant and breastfeeding women, and elderly people depend on good nutrition for their health, aging, intelligence, activity, and adaptation to the environment (**Hawkes et al 2013**). These differences are the results of the recommended program with its physical exercises and diet as the program included various motor experiences that improved physical fitness (speed – muscular endurance – flexibility – agility – cardiorespiratory endurance). These elements help obese persons to get rid of unwanted fats. Therefore, body organs (muscular–vital) can work normally and make the person feel comfortable in movement. This is reflected greatly in his/her health condition. This is consistent with a previous study that indicated the importance of physical fitness programs as they improve the physical abilities of individuals and make them more active. Physical fitness programs should be supervised so that individuals can control their physical activity levels and develop positive attitudes towards the programs that improve physical fitness levels for all age groups (**Derri et al 2004**).

This study indicated that the recommended physical exercise program with diet had positive effects on health-related physical fitness variables among obese persons. This proves the first hypothesis.

Weight Reduction:

Table (9) indicated statistically significant differences between pre-and post-measurements of weight reduction variables in favor of post-measurements as (t) calculated values ranged from (21.1) to (14.8) which are higher than its table value. It is noteworthy here that obese persons should practice exercises and stick to a diet so that they can reduce their weight. Table (10) indicated that variance rates in weight reduction between pre- and post-measurements ranged from (20.9%) to (23.61%). These differences are due to the effects of the recommended program with a diet that improved weight, BMI, and fat percentage. This is consistent with another study indicating that exercise programs reduced body mass (Marlin Meredith 2007). Fitness gram is used in US schools as a base for practicing sports activities in all age groups. It is a set of physical and physiological abilities for motor requirements that can be practiced as a pattern of physical performance. It can be tested by aerobic capacity, body composition, muscular strength, endurance, and flexibility. Body composition can be changed significantly through sports practice for a long time continuously as this increases fat-free body mass. These changes depend greatly on the type of exercises used in the program (Ibrahim 2016).

Sports activities are very effective in eliminating fats from muscles and thus reducing weight. At the same time, the muscle becomes less fatty and this changes metabolism automatically as the person consumes more calories without knowing that. The ideal way to get rid of overweight is to exercise so that you can burn excessive fats in the body (Galal El-Din 2004).

This is consistent with the results of another study indicating that exercises caused weight reduction with a significant change in protein fats and reduction in body fats, glucose, triglycerides, cholesterol, and free fatty acids. (Bandech & Eder 2002).

The researcher thinks that the recommended program with diet helped participants burn more fats while decreasing caloric consumption through the diet. This had positive effects on decreasing weight and improving body mass index BMI and fat percentage. This proves the second and third hypotheses.

Conclusions:

According to this research aims, hypotheses, methods, and results, the researcher concluded the following:

1. The recommended exercise program with diet had positive effects on health-related physical fitness variables (speed – endurance – agility – power – strength – cardiorespiratory strength) among obese persons.
2. The recommended exercise program with diet had positive effects on weight reduction variables (body weight – BMI – Fat percentage) among obese persons.
3. Exercise with diet helped decrease weight among obese persons.
4. There are statistically significant differences between the pre-and post-measurements of health-related physical fitness variables (among obese persons in favor of post-measurements.
5. There are statistically significant differences between the pre-and post-measurements of weight decrease among obese persons in favor of post-measurements.

Recommendations:

According to these conclusions, the researcher recommends the following:

- Using the recommended exercise program with diet in improving physical fitness among obese persons.

- Using the recommended exercise program with diet in reducing weight among obese persons.
- Media should increase awareness about practicing sports and decreasing food consumption.
- Using the recommended exercises program with diet for persons willing to reduce weight and practice good nutrition habits.

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