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Analysis of Some Therapeutic Methods for Improving the Morphological Profile of Male Patients with Type 2 Diabetes Aged 40–60 Years

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Abstract :

This study aimed to determine the effect of walking at the "LIPOXmax" point on some morphological variables in male patients with type 2 diabetes aged 40–60 years, through several morphological indicators, namely body mass, body fat percentage, and abdominal fat percentage. To achieve this, a specific and carefully designed training program was developed in line with the needs and characteristics of this group. The program included walking exercises at the "LIPOXmax" point and lasted long enough to show its effectiveness. The results of the statistical analysis showed statistically significant differences for each variable in the study, which indicates that the implemented program produced positive results and highlights the importance of walking for this group. The analysis of these results showed that walking at the "LIPOXmax" point in patients with type II diabetes aged 40–60 years leads to a reduction in overall body fat percentage, as well as a decrease in abdominal fat percentage. It also has a positive effect on reducing body mass.

Key words: Type 2 Diabetes; Morphological Profile; LIPOXmax; Physical activety program.

Introduction

Throughout human history, people have never been as sedentary and as physically inactive as they have become over the past fifty years. This decline in physical activity has coincided with the rapid development of technology and the comforts enjoyed by humanity, particularly in the fields of communication and transportation. Although this modern progress has brought many advantages, it has also contributed to the emergence and spread of what are commonly referred to as "diseases of the age" or "lifestyle diseases," such as obesity, diabetes, cardiovascular diseases, myocardial and cerebral infarction, hypertension, osteoporosis, cancers, and others. These problems are becoming increasingly widespread in a manner that is cause for concern, not only because they affect a large proportion of the population, but also because they are now appearing at earlier ages, whereas they should occur during the most productive stage of human life.

More than 36 million people in the Middle East and North Africa region suffer from diabetes, and six of the ten countries with the highest diabetes prevalence by population are Arab countries. This region has the highest comparative prevalence rate in the world, estimated at 11%. Rapid economic development, together with population ageing, has led to a very significant increase in the prevalence of diabetes, and the same situation applies to impaired glucose tolerance, which places individuals at greater risk of developing type 2 diabetes. Type 2 diabetes is widespread throughout the world, placing a substantial financial and physical burden on governments, especially in developing countries.

In Algeria, more than 11% of the population is affected by diabetes, which has prompted physicians and specialists to sound the alarm, particularly because the complications and side effects of this disease can place the patient's life at serious risk. Reports have also indicated that Algeria has been ranked first worldwide in terms of the complications associated with the disease, while the Middle East ranks first in terms of the number of patients.

Health at the individual level may be viewed as a reserve that can be increased or depleted by human behavior. When a person habitually burdens the body with fatty and sugary foods and adopts poor sleep habits, they are drawing down their health reserve. Conversely, when a person consumes a balanced diet and obtains sufficient rest and good sleep, they increase their health reserve. If a person wishes to improve this reserve, it cannot be fully achieved without practicing one of the most important health-enhancing behaviors: physical activity, due to its many benefits and advantages.

Researchers and specialists in human health have accumulated substantial knowledge regarding the most appropriate forms of physical activity for individuals according to age and health status. Scientific evidence has shown that adults should engage in moderate-intensity physical activity for at least 30 minutes per day, on most days of the week, if not every day. Moderate-intensity physical activities include brisk walking, recreational swimming, and riding a stationary or regular bicycle.

Among the various forms of physical activity, walking stands out as the ideal exercise that can be recommended for everyone. Compared with other sports, walking is easy to practice at any time and in any place, and it is suitable for all age groups. Despite the fact that most people are aware of the benefits of physical activity, they still remain distant from walking as both a practice and a culture. The culture of walking and physical activity remains weak in our societies, and there is a clear need to promote this culture and encourage its practical adoption.

In light of the foregoing, the introductory part of this research was designed to establish a methodological framework for the research problem. It addressed the theoretical background of the study and formulated the research problem, given its importance in this investigation, which seeks to determine the effect of walking on certain blood variables that may contribute to the onset of type 2 diabetes, and to identify the most effective means of preventing this disease.

The growing understanding of the underlying relationship between behavior and health has led to major shifts during the last three decades of the twentieth century in the way health is understood and promoted, as well as in the possibility of influencing it at the individual level. Health is no longer viewed as a passive concept that can be achieved under all circumstances; rather, it has come to be understood as a dynamic concept that requires effort from individuals in order to attain and maintain it. For this reason, studying and understanding health-damaging and health-promoting behavioral practices, as well as attitudes toward health and healthy behavior, constitutes the first step toward identifying health-promoting resources and working to develop them, while also determining the factors and attitudes that hinder health in order to modify them. Ultimately, this contributes to health development, the planning of health promotion, and the design of appropriate and specific preventive programs. This is consistent with the World Health Organization's call to develop psychological and health programs aimed at identifying health risk factors and the behavioral and structural causes of disease that can be influenced and overcome through social action.

Walking is among the practices that have emerged as a means of achieving a better lifestyle, as it reflects the health of the heart and lungs. Improved cardiorespiratory fitness indicates better functioning of these organs, protection against related diseases, the elimination of negative behavioral habits, increased feelings of happiness, improved sleeping habits, and enjoyment of nature. Regular walking is also supported by evidence showing benefits for glycemic control, cardiovascular risk, and the prevention of type 2 diabetes.

Research Problem

Diabetes associations have confirmed that diabetes is the second leading cause of death in Algeria and the fifth worldwide. Statistics also indicate that type 2 diabetes accounts for 90% of cases among Algerians, whose number exceeds three million people living with diabetes.

It is well known that several factors contribute to the increased prevalence of type 2 diabetes, including obesity, a strong family history of the disease, hypertension, changes in lifestyle, and other related conditions. These problems are spreading at an alarming rate, not only because they affect a large proportion of the population, but also because they are now appearing at younger ages, whereas these ages are supposed to be the most productive period in human life.

It is important for individuals to become aware of this critical health stage, which may completely alter their health profile. A persistently elevated blood glucose level, even if it remains within the upper normal range, may indicate the eventual onset of diabetes. At the same time, it offers a rare opportunity for prevention before the disease fully develops. Diabetes is also known to cause slow and progressive changes in all body cells and tissues, sometimes over many years before

symptoms appear. Detecting it at this stage may provide hope for controlling it and possibly changing its course in favor of human health.

Lack of physical activity has become an increasingly widespread problem, especially in contemporary societies where human beings have become highly dependent on machines and less dependent on bodily movement. In this way, people have lost one of their most important functions as living beings who move from place to place through their own effort.

There are several treatment methods for reducing blood glucose levels, including dietary restriction of foods rich in fats, the use of medications that lower blood glucose, and walking, which is considered one of the easiest and most effective methods because it is a natural, simple, and accessible form of therapy and prevention, with no side effects comparable to those of medication. Despite the importance of walking in relation to this disease, studies in this field remain limited, since patients often turn directly to medication. For this reason, there is a need for more field-based studies that demonstrate the benefits of walking as a scientific contribution to maintaining community health. From here, the research problem emerges.

Research Question

Can a therapeutic training program be proposed to contribute to improving the morphological profile of male patients with type 2 diabetes?

Sub-Questions

1. Do cardio exercises affect the level of fat in the hips and waist of male patients with type 2 diabetes?
2. Do speed exercises contribute to improving the morphological profile and reducing abdominal fat in male patients with type 2 diabetes?
3. Do general endurance exercises contribute to improving body mass index in male patients with type 2 diabetes?

Hypothesis

It is possible to propose a therapeutic training program based on cardio and speed exercises that contribute to improving the morphological profile of male patients with type 2 diabetes.

1. Cardio exercises affect the level of fat in the hips and waist of male patients with type 2 diabetes.
2. Speed exercises contribute to improving the morphological profile and reducing abdominal fat in male patients with type 2 diabetes.
3. General endurance exercises contribute to improving body mass index in male patients with type 2 diabetes.

Importance of the Study

Many people do not realize the danger to their health until their body weight exceeds the normal range considerably. However, the greater problem lies in the increase in body fat, which may not be visible in body shape. This is strongly linked to inactivity, sedentary behavior, and unhealthy nutrition, and it can lead to several health problems. Some of these problems, such as the prediabetic stage or impaired glucose tolerance, may not show symptoms during that period, making laboratory tests the only reliable means of diagnosis.

Walking helps reduce body fat. With simple steps, the body can burn approximately 60 calories per 1.2 km compared with the resting state. If a person increases walking speed and covers 8.2 km in 30 minutes, the body may burn about 200 calories.

The importance of this study lies in the following points:

- Early identification of individuals with unhealthy eating habits and a tendency toward inactivity.
- Promoting a culture of movement and physical activity in society, and raising awareness of the risks of unhealthy dietary habits, sedentary lifestyles, obesity, and the protective role of early physical activity against diabetes at different stages of life.
- Encouraging regular monitoring at later ages, with emphasis on adequate physical activity and avoiding high-calorie foods of low nutritional value, such as sweets, chocolate, fast food, soft drinks, and industrial juices.

- Supporting the slogan “Sport for all” and “Sport for health” through intensive media coverage and by providing opportunities for physical activity, especially for older adults, as well as by making playgrounds and public parks available to create a suitable environment for walking outdoors and in public spaces.

Objectives of the Study

The aim of this study is to examine physical activity, specifically walking, as a practice that has physical and psychological health benefits. By its very nature, walking is suitable for different ages and genders, and it can be performed at any time and in any place at low cost. In this way, any person can benefit from the health advantages of exercise through a simple and accessible program that ensures regular movement of many parts of the body over a specific period of time. This study will also address walking as a global phenomenon that is widespread in many countries and receives considerable attention. It will highlight the health benefits of walking, the mechanical aspects of walking in order to identify the best way to practice it correctly, and some of the healthy steps that help prevent the health complications associated with type 2 diabetes.

Key Terms

Diabetes Mellitus

Diabetes mellitus is defined as a chronic metabolic disease syndrome characterized by high blood glucose resulting from partial or complete impairment of insulin secretion.

Type 2 Diabetes

Type 2 diabetes is distinguished from type 1 diabetes by the presence of insulin resistance, in addition to reduced insulin secretion. The insulin receptors on the cell membranes of various body tissues do not respond properly to insulin.

Walking

Walking is a forward progression of successive steps without losing contact with the ground. It is a means of locomotion based on leverage, ground contact, and arm balance. In competition, walking has specific technical elements and clearly defined rules. Rule 191 of the International Association of Athletics Federations is the main reference defining the technique of walking. Its core requirements are that the front knee must not be bent during ground contact, the foot must remain in contact with the ground, the legs must not leave the ground simultaneously, and the shoulders must not be excessively raised while walking.

Previous and Similar Studies

1. Study by Chang, Hsien-Kuo (2012):

This study included 34 “Bolin Nantu” pupils from the primary school stage who were severely obese from the second stage of education. The results showed that after 15 weeks of walking, changes were observed in the values of biochemical blood variables.

a) It was found that there was an improvement in the physical fitness components of the experimental group, including flexibility, muscular strength, and muscular endurance. Heart function also improved, and body weight, body mass index, cholesterol, triglycerides in the blood, and glucose index were reduced.

2. Study of the National Institutes of Health, USA:

The study conducted on methods for preventing type 2 diabetes produced impressive results. The research carried out by the National Institutes of Health (NIH) in the United States showed that walking is sufficient; there is no need to run a marathon or “starve to death” in order to prevent diabetes in people with risk factors for the disease.

The participants in the study reduced their weight by an average of 6.75 kg. The study included 3,234 Americans at high risk of developing diabetes, after glucose tolerance testing showed that they were not processing sugar properly. After three years, in the group that lost weight and walked, the risk of developing diabetes decreased by 58%. Interestingly, among older adults over 60 years of age, the risk decreased by 71%.

Main Experiment

1. Research Method:

Scientific research is characterized by the plurality of its methods. Method, in linguistic terms, refers to the clear and straight path.

The selection of the research method is considered an important stage in the scientific research process, as it determines how data and information about the studied topic are collected. Therefore, the research method is directly related to the subject of the study and to the research problem, since the nature of the topic determines the choice of the method used. Based on the topic of our study, the problem required the use of the experimental method.

2. Main Study

1) Study Population:

Our research population consists of all diabetes patients (Type II) present at the level of Laghouat Municipality. According to the diabetes patient service, the population was estimated at 120 Type II patients.

2) Study Sample:

A sample is a model that includes part of the units of the original population concerned with the research, and it is similar to it in that it shares its common characteristics.

The sample consists of 12 individuals, selected randomly, all of whom suffer from Type II diabetes.

In our research, we chose a simple random sample representing 10% of the total research population, which consisted of 12 individuals, all males with Type II diabetes, aged between 40 and 60 years.

The sample members shared the following characteristics:

- Patients with Type II diabetes residing in Laghouat Municipality.
- Adults aged between 40 and 60 years.
- Non-athletes (they do not practice sports regularly or daily).
- Only individuals who completed the pre-tests and post-tests, as well as all instructional sessions.

The researcher applied the program to 20 male patients, but at the end of the program, 8 individuals were excluded because they had missed the program several times; that is, anyone with more than 3 absences was excluded from the study.

Devices Used

TANITA scale:

This device measures:

- The percentage of body fat, that is, the proportion of body weight made up of fat.
- Fat mass, meaning the total weight of fat in the body in kilograms.

Measurement procedure: The examinee stands on the BIA scale and remains still, distributing body weight evenly over both feet placed on the electrodes. The results appear after a few seconds, provided that the previously mentioned conditions are respected. The TANITA body composition monitor is used to measure body fat percentage relative to total body weight.

Heart rate measurement:

KALENJI device:

- This device consists of two connected parts: a watch and a chest strap that measures heart rate, with the watch displaying the heart beats.
- It measures heart rate during physical activity. KALENJI heart rate monitors use a chest strap with electrodes and a transmitter to capture and display heart rate.

Test Scheduling

We carried out the pre-tests one day before implementing the program. The participants were gathered and the procedure for the measurements and the program was explained to them. The same measurements were then applied to the 12 patients, and the sample also underwent the post-tests one day after a rest period following the program, that is, after three months.

The tests were conducted in a room with a temperature of 22°C. The participants wore short sports clothing (shorts) and were measured at 8:00 a.m., before breakfast, while fasting for at least eight hours before the measurements. The patient also had to use the bathroom before the measurement in order to eliminate waste, as required for impedance measurements.

Design of the Training Program

Proposed training program:

The researcher designed a walking program for patients with type 2 diabetes. Based on several scientific references and sources, both Arabic and foreign, old and recent, related to walking exercise, aerobic endurance, work at the lipoxmax point, and diabetes, the walking program included the following:

During the preparatory phase of the sample, the proposed program was applied:

Progressive cycle 1:

This cycle consisted of 4 mini-cycles: 1 normal, 1 intense, 1 recovery, and 1 normal.
The total number of sessions reached 14 sessions for the progressive cycle, at an average of 3 + 4 sessions for each mini-cycle. All sessions had varying volume but the same walking rhythm.
The total training time for progressive cycle 1 reached 6.33 hours.

Progressive cycle 2:

This cycle consisted of 4 mini-cycles: 1 normal, 1 intense, 1 recovery, and 1 normal.
The total number of sessions reached 15 sessions for the progressive cycle, at an average of 3 + 5 sessions for each mini-cycle. All sessions had varying volume but the same walking rhythm.
The total training time for progressive cycle 2 reached 7.58 hours.

Progressive cycle 3:

This cycle consisted of 4 mini-cycles: 1 normal, 1 intense, 1 recovery, and 1 normal.
The total number of sessions reached 16 sessions for the progressive cycle, at an average of 3 + 5 sessions for each mini-cycle. All sessions had varying volume but the same walking rhythm.
The total training time for progressive cycle 3 reached 8.33 hours.

In addition, there were two standardized measurement sessions for the study sample: one before the beginning of the program and the second after its completion.

Program duration:

The proposed walking training program was applied for 12 weeks, at a rate of 3 training sessions per week and 5 training sessions per week, depending on the program requirements and the characteristics and conditions of the sample patients.

Statistical Tools

To verify the hypotheses, a statistical study was conducted using SPSS software, through which the obtained data were processed. The analysis included the arithmetic mean and the standard deviation. The arithmetic mean is the sum of the values of the group's elements divided by their number. The standard deviation measures how spread out the values are around the mean.

Presentation and Analysis of the Pre-Test and Post-Test Skill Results of the Experimental Group

Variable	Pre-test	Post-test
Sample size (n)	12	12

Mean	5.31	6.88
Standard deviation	1.48	1.60
Mean difference	1.75	
Calculated t-value	-28.22	
Significance level (p)	0.00	
Degrees of freedom	22	
Difference significance	Statistically significant	

Table of Significance of the Differences for the Body Fat Level Test Between the Pre-Test and the Post-Test

From the results presented in Table No. (01), it can be seen that the mean score of the pre-test for body fat level in the experimental group was **5.31**, with a standard deviation of **1.48**. The mean score of the post-test for the same group and variable was **6.88**, with a standard deviation of **1.60**. The mean difference between the pre-test and the post-test was **1.75**, which indicates that there are differences between the two tests. This was confirmed by the **t-test** value, which reached **-28.22** at a significance level of **0.00**, which is lower than **0.05**. This result proves that there are statistically significant differences between the pre-test and post-test scores for body fat level.

Table No. (02): Presentation and Analysis of the Pre-Test and Post-Test Skill Results of the Experimental Group

Body Mass Index

Variable	**Pre-test**	**Post-test**
Variable	**Pre-test**	**Post-test**
Sample size (n)	12	12
Mean	24.31	27.00
Standard deviation	1.94	1.82
Mean difference	2.69	
Calculated t-value	-22.5	
Significance level (p)	0.00	
Degrees of freedom	22	
Difference significance	Statistically significant	

Test — Experimental Group

From the results presented in Table No. (02), it is observed that the mean score of the pre-test for body mass index in the experimental group was **24.31**, with a standard deviation of **1.94**. The mean score of the post-test for the same group was **27.00**, with a standard deviation of **1.82**. The mean difference between the pre-test and the post-test was **2.69**, which indicates that there are differences between the two tests. This was confirmed by the **t-test** value, which reached **-22.5** at a significance level of **0.00**, which is lower than **0.05**. This result proves that there are statistically significant differences between the pre-test and post-test scores for body mass index in the experimental group.

Table No.(03): Presentation and Analysis of the Pre-Test and Post-Test Skill Results of the Experimental Group

Abdominal Fat Percentage Index Test — Experimental Group

Variable	Pre-test	Post-test
Sample size (n)	12	12
Mean	25.41	31.92
Standard deviation	4.11	4.18
Mean difference	6.51	
Calculated t-value	-73.70	
Significance level (p)	0.00	
Degrees of freedom	11	
Difference significance	Statistically significant	

Table: Significance of the Differences in the Abdominal Fat Percentage Index Test Between the Pre-Test and the Post-Test in the Experimental Group

From the results presented in the table, the mean score of the pre-test for the abdominal fat percentage index was **25.41**, with a standard deviation of **4.11**, while the mean score of the post-test was **31.92**, with a standard deviation of **4.18**. The mean difference between the pre-test and post-test scores was **6.51**, which indicates clear differences between the two measurements. This was confirmed by the **t-test** value of **-73.70** at a significance level of **0.00**, which is lower than **0.05**. Therefore, the differences between the pre-test and post-test scores are statistically significant.

Discussion of the First Hypothesis

The first hypothesis assumed that walking at the LIPOXmax point has a positive effect on reducing body fat percentage in patients with type II diabetes. The statistical analysis showed significant differences between the pre-test and post-test in body fat percentage for the experimental group. This result suggests a reduction in total body lipids, which may be due to the content of the training program, based mainly on walking exercises that stimulate the aerobic system and increase the use of oxygen in energy production.

Walking according to a well-structured program is beneficial for the heart and lungs, improves blood circulation, helps maintain fitness, and burns excess energy. It also strengthens muscles and reduces risks associated with obesity, diabetes, cardiovascular disease, and other chronic conditions. Scientific studies have shown that regular aerobic exercise helps reduce body fat and improves metabolic health, especially in people with type II diabetes.

Discussion of the Third Hypothesis

The third hypothesis assumed that walking at the "LIPOXmax" point has a positive effect on reducing body mass in patients with type II diabetes. The statistical analysis showed significant differences between the pre-test and post-test measurements of body mass in the experimental group, which indicates that the training program had a positive effect on this variable.

This reduction in body mass may be explained by the content of the training program, which was based mainly on regular walking exercises for patients with type II diabetes. Regular physical activity increases oxygen consumption and contributes to changes in anthropometric measures, especially when the activity is performed in a structured and sustained manner. Studies have shown that walking programs can improve aerobic fitness, reduce BMI, and decrease central body fat in people with diabetes.

The results are also consistent with research showing that visceral fat cells produce large amounts of cytokines, which interfere with normal insulin action in muscle and fat cells and contribute to systemic insulin resistance in people with

visceral obesity. Physical activity, especially aerobic exercise, helps reduce body fat and improves insulin sensitivity, thereby lowering the risks associated with obesity and type II diabetes.

In addition, several studies have reported that regular walking improves cardiorespiratory fitness, reduces body weight, and positively affects blood glucose control and lipid profile in patients with type II diabetes. Chang Hsien-Kuo's study (2012) also showed that walking improved flexibility, muscular endurance, heart function, and reduced body weight and BMI, which supports the findings of the present study.

Overall, the statistical results indicate that walking at the LIPOXmax point among men aged 40–60 years with type II diabetes leads to a decrease in total body fat, abdominal fat, and body mass. Therefore, the general hypothesis of the study is supported: walking at the LIPOXmax point has a positive effect on the morphological side in male patients with type II diabetes aged 40–60 years.

Conclusion

Through this research work in the field of physical education, the study was designed as an attempt to reduce the rates and risk factors associated with type 2 diabetes, a disease whose spread has increased dramatically in recent years and now represents a major public health concern worldwide. Current evidence shows that physical activity, including walking, is associated with a lower risk of type 2 diabetes, and even moderate walking can meaningfully reduce diabetes risk in sedentary populations.

By reviewing previous studies, scientific references, and available online and library resources, and through contact with specialists, we sought to contribute to practical solutions in physical education and sport science. The present study therefore aimed to test the effectiveness of a preventive walking program and to examine its impact on individuals most exposed to this disease. Research has shown that regular walking improves glucose control, body weight, cardiorespiratory fitness, and overall metabolic health in people at risk of or living with type 2 diabetes.

The results of the study showed that walking alone, without the need for running or other vigorous aerobic activities, is sufficient to help prevent type 2 diabetes in people at high risk. This aligns with current evidence indicating that reducing sedentary time and replacing it with light or moderate walking can improve insulin sensitivity and lower diabetes risk.

The primary goal of this study was therefore to promote a healthy lifestyle that helps limit the spread of type 2 diabetes, especially among young people, where sedentary habits have become increasingly common. Today's students spend much of their time sitting in classrooms, in front of screens, or using digital entertainment devices, which makes health-oriented interventions increasingly necessary. Public health guidance also emphasizes the importance of breaking up sedentary time and encouraging regular physical activity as part of diabetes prevention.

This also highlights the need for specialized training in physical culture and health education. Scientific research must continue to expand in this field so that teachers are not only providers of lessons, but also active contributors to health awareness and prevention among students and their families. In this way, physical education becomes a tool for building a more informed generation capable of meeting the health challenges of the present era.

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