

The Impact of Physical Activity on Some Physical, Physiological and Psychological Variables from the Point of View of Women with Type 2 Diabetes Who Engage in Physical Activity.

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Abstract

The current research aims to identify the impact of physical activity on some physical, physiological, psychological variables from the point of view of women with type 2 diabetes who engage in physical activity in the sports halls in the city of Djelfa. The descriptive method was used, and an electronic questionnaire was applied to measure the impact of physical activity on some of the three-axis variables (physical, physiological, psychological) and applied to the research sample of 33 women with type 2 diabetes. It was ascertained that the questionnaire had the necessary psychometric characteristics of validity and reliability. After collecting, statistically processing, presenting, analyzing, interpreting, and discussing the data based on theoretical treatment and previous research, the present study attained several results, the most important of which were: - Women with type 2 diabetes considered that the physical activity used had improved some of their physical, physiological, and psychological variables between positive and acceptable, by the areas of the degree of variables proposed for the total degree of the questionnaire. -The psychological variables come first with a positive impact, followed by physiological variables second with a positive impact. And the last with the physical variables with an acceptable impact on physical activity.

1. Introduction

Diabetes has become a widespread epidemic, primarily because of the increasing prevalence and incidence of type 2 diabetes. (Sherir Colberg et al, 2010 147), According to the World Health Organization diabetes is a chronic, metabolic disease characterized by elevated levels of blood glucose (or blood sugar), which leads over time to serious damage to the heart, blood vessels, eyes, kidneys and nerves. The most common is type 2 diabetes, usually in adults, which occurs when the body becomes resistant to insulin or doesn't make enough insulin, about 422 million people worldwide have diabetes, the majority living in low-and middle-income countries, (World Health Organization 2023).

Type 2 diabetes mellitus (DM2) is a heterogeneous polygenic disease strongly associated with genetic susceptibility. The occurrence of DM2 may be related to poor eating habits and physical inactivity, the association of which can lead to obesity, which is the main risk factor for the disease. DM2 is associated with excess weight and other components of the metabolic syndrome in 80- 90% of cases (Guilherme Gonçalves, et al, 1: 2022). Type 2 diabetes is characterized by the body resisting the effect of insulin or insufficient insulin production. Insulin is a hormone that regulates blood glucose levels. High blood glucose levels over a prolonged period can cause damage to the eyes, heart, nerves, and kidneys (Marshall Schwartz, 2019: 19). Physical activity plays a vital role in leading a healthy lifestyle. Research has demonstrated that regular physical activity can decrease the risk of developing diseases such as developing numerous chronic conditions and diseases including cardiovascular disease, hypertension, type 2 diabetes mellitus, osteoporosis, obesity, anxiety, and depression. (Chodzko-Zajko, et al, 2009: 1515.), and it is one of the factors that affect glycemic management. Exercise-induced glycemic control is mostly explained by an increase in whole-body insulin sensitivity. (Mulu Asfaw, Kassahun Dagne, 2022:2).

In the present study, we identified the problem research to determine the extent to which physical activity affects some physical, physiological, and psychological variables from the point of view of women with type 2 diabetes. We posed the following question:

Does physical activity have a positive impact on some variables (physiological, physical, and psychological) from the point of view of women with type 2 diabetes who engage in physical activity in the sports halls of Djelfa City? And we hypothesized that physical activity has a

positive impact on some variables (physiological, physical, and psychological) from the point of view of women with type 2 diabetes. The purpose of our study is to construct a questionnaire and ensure that the measurement tool used in the current study has the psychometric characteristics necessary for the instrument's validity and determine the extent to which physical activity affects certain variables (physiological, physical, and psychological) from the point of view of women with type 2 diabetes.

Definition of Terms:

- **Physical Activity:** Physical activity is often defined as any bodily movement produced by skeletal muscles that require energy expenditure. Physical activity also means a multidimensional behaviour defined as “the behaviour that involves human movement, resulting in physiological attributes including increased energy expenditure and improved physical fitness. (Marie Alricsson. 2013.1).
- **Physiological Variables:** These are those associated with multiple body systems, their effect on ordinary sugar and cumulative sugar, and some physiological variables such as systolic and diastolic blood pressure, cholesterol, and triglycerides.
- **Physical Variables:** Or Anthropometric variables or bodily measurements, those related to weight, chest surroundings, middle, abdomen, and pelvis.
- **Psychological Variables:** We mean to reveal certain psychological problems such as fear, depression, and boredom. Feeling calm and reassuring enhances self-confidence, also raising self-esteem improves mood and reduces anxiety.
- **Type 2 Diabetes Mellitus:** Type 2 diabetes mellitus is a progressive disorder characterised by chronic hyperglycaemia (elevation of blood glucose levels), with disturbances of carbohydrate, fat and protein metabolism. Type 2 diabetes mellitus results from a defect in the secretion of the hormone insulin by the pancreas (relative insulin deficiency), or the decreased sensitivity of peripheral tissue to the action of insulin (insulin resistance), or both (David Brinson 2007 .18).

1.1. Literature Review

1.1.1. A study by Amina Al-Dherat, 2015 - Jordan, Titled: The Impact of a Training Program on some Physiological and Anthropometric Variables for Type 2 Diabetes Patients.

The study aimed to build a proposed training program for type 2 diabetes patients to improve the physiological and anthropometric aspects associated with multiple body systems, as well as the impact of this proposed program

on regular and cumulative sugar, and some physiological variables such as systolic and diastolic blood pressure, cholesterol, and triglycerides. The study adopted the experimental method of the one-group pretest-posttest design. The study sample included eight males patients with type 2 diabetes aged 36 to 54 years, selected deliberately. The results showed that the applied training program had a positive impact and had worked to bring about statistically significant changes to ordinary FBS sugar and HBA1C cumulative sugar in the blood. Additionally, the training program applied had a positive effect on some physiological variables such as systolic blood pressure, LDL cholesterol, and triglycerides, although it was not statistically significant in the diastolic pressure variable and the HDL variable. The training program applied also made positive changes that were statistically significant in improving multiple physical measurements by affecting weight loss and body circumference.

1.1.2. A study by Samira Orabi; Hiba Al-Damiri, 2014. Jordan, Titled: The Effect of Aqua Aerobic Exercise on some Anthropometrical, and Physiological Variables upon Women with Diabetic Type 2 In Jordan.

This study aimed to identify the effect of aquatic exercise on some physical, physiological, and blood sugar variables in people with type 2 diabetes. It adopted the experimental method of the one-group pretest-posttest design. The sample was selected deliberately and consisted of twelve women with type 2 diabetes frequenting the National Centre for Diabetes and Endocrinology. The results showed statistically significant differences between pre- and post-measurements in the following variables: weight, body mass index, waist circumference, hip circumference, fat percentage, and cumulative sugar. The study has recommended applying an aquatic exercise program for women with type 2 diabetes due to its positive effects on physiological and physical variables.

1.1.3. A study by Ajediran I Bello et al, 2011, Ghana. Titled: Effects of Aerobic Exercise on Selected Physiological Parameters and Quality of Life in Patients with Type 2 Diabetes Mellitus.

The aim of this study was to evaluate the effects of an 8-week aerobic exercise program on physiological parameters and quality of life in patients with type 2 diabetes mellitus. This study utilized the experimental method of the one-group pretest-posttest design. A systematic random sampling was selected, involving 18 individuals with type 2 diabetes. The results of the study showed an improvement in type 2 diabetes in fasting blood sugar, low-density lipoprotein, high-density lipoprotein, and quality of life

following 8 weeks of aerobic exercise training, but these improvements was not reflected by statistically significant differences.

1.1.4. A study by Timothy S. Church, et al, 2010. USA Titled: Effects of Aerobic and Resistance Training on Hemoglobin A1c Levels in Patients With Type 2 Diabetes.

The study aimed to examine the benefits of aerobic training alone, resistance training alone, and a combination of both on hemoglobin A1c (HbA1c) in individuals with type 2 diabetes, and relied on the experimental method. The sample consisted of 262 type 2 diabetes patients of both genders, selected deliberately. The sample was divided into four groups three of them were experimental groups: (aerobic training only, resistance training only, and a combination of aerobic and resistance training), and one was a nonexercise control group.

The results of the study showed that there was an improvement in the level of cumulative sugar in all groups compared to the control group. However, the control ratio of the aerobic exercise group and resistance exercise group combined was higher than the other groups. Which means the combination of aerobic exercise and resistance exercise improved the level of hemoglobin in patients with type 2 diabetes.

1.1.5. A study by Amar Al-Husseini, 2008., Iraq, Titled: "The Effect of Sports Exercise Programming and Nutrition on Some Physiological Variables in People with Diabetes,

The aim of this study was to design a sports program and a special diet for people with diabetes, and to assess the effect of this program on low sugar, high-density cholesterol (HDL), and viscosity of blood (PCV) neural signals from the upper and lower limbs. The study relied on the experimental method one-group pretest-posttest design. The sample consisted of 10 individuals, and the researcher used employed testing, measurement, and interview. The results of the study showed that the sports and food program had a positive effect on low sugar, high-density cholesterol (HDL), and viscosity of blood (PCV) and a positive effect on neural signals from the upper and lower limbs.

1.1.6. A study by Al-Shetawi Sittan, 2008. Jordan, Titled: "The Impact of an Aerobic Training Program on the Variables of Sugar and Some Physical Measurements in Non-Insulin Diabetics,

The study aimed to determine the impact of the proposed training program, which included a set of aerobic exercises, on some biochemical variables (cholesterol, triglyceride, HBalc-conditioned hemoglobin) and some physical variables (body weight, body circumferences: chest, middle, abdomen, pelvis). This study relied on the experimental method by one-

group pretest-posttest design. The study sample included volunteers male with non-insulin-dependent diabetes at Mutah University. The sample consisted of 10 males and showed that the proposed training program had contributed to reducing diabetes complications. Through its positive impact in lowering blood sugar by adjusting the intoxicant hemoglobin (HBalc), cholesterol, and triglyceride, the program also contributed to the amelioration of different physical measurements through its impact on weight loss and different body circumferences.

1.1.7. A Study by Arshidat Ghadeer, 2006. Jordan, Titled: The Effect of Physical Activity and Diet upon Type 2 Diabetic Patients.

The study aims to identify the impact of physical and motor activity, diet in blood sugar control in type 2 diabetes patients, as well as the impact of this program on obesity. This study relied on the experimental method by one-group pretest-posttest design. The study sample included diabetic volunteers, and the sample consisted of 10 males ranging in aged from (35-50) workers at the University of Yarmouk. The results of the study showed that the practice of walking and diet had a significant effect on improving blood sugar. The practice of walking and diet did not contribute to the loss of weight in patients. There were statistically significant differences in the effect of the practice of walking on obesity.

1.1.8. Commentary on Previous Studies:

By reviewing the results of previous studies, it has found that they had agreed on the impact of training programs: (Aquatic Exercise Effect - Aerobic Exercise - Resistance Exercise - Physical Activity) to improve physiological, physical, psychological, and blood sugar levels HBalc and HDL high-density cholesterol and blood viscosity PCV and obesity and avoidance of certain complications and delays in diabetes type 2 patients and all studies relied on the experimental method, Previous studies used varying samples of type 2 diabetes patients. The most important results of previous studies were that the training programs applied had a positive impact on low sugar and high-density cholesterol HDL and viscosity PCV blood - Weight loss in patients - blood sugar fasting, low-density protein, and high-density protein - Physiological variables such as systolic blood pressure, LDL cholesterol, and triglycerides - Improve multiple physical measurements by affecting weight loss and the body circumferences. They had been used in the methodology and the design of the current study tool, as well as the interpretation and linkage of the results and the amelioration of the validity of the study's findings.

2. Method and Materials

2.1. Participants: The sample was chosen intentionally and consisted of 33 individuals women with Type 2 diabetes who engage in physical activity in the year 2023 in the sports halls of the city of Djelfa.

2.2 Research Method: To achieve the research objectives, an analytical descriptive method was used.

2.3 Design and Procedure:

- **Research Tool:** A questionnaire for women with type 2 diabetes who engage in physical activities was build. It contained 36 items, 26 of which were positive and 10 of which were negative, divided into three axes (physiological variables, physical variables, psychological variables) to find out the impact of physical activity on some physiological, physical, and psychological variables from the point of view of women with type 2 diabetes.

Table No. (01): Search Tool Axis.

Axis	Questionnaire on the Impact of Physical Activity on Certain Physiological, Physical, and Psychological Variables	Number of Items
Axis 1	psychological variables	14
Axis 2	Physical variables	09
Axis 3	psychological variables	14

With the suggestion of three alternatives to answer (entirely applicable, fairly applicable, and not entirely applicable) and grades are given in the following order: two degrees, one degree for positive items. Negative items are opposite one degree, two degrees, and three degrees.

Psychometric Conditions:

- Validity of the Tool:

- Validation of the Experts:** To confirm the validity of the questionnaire submitted to a group of experienced and competent arbitrators, and request them to study the questionnaire and express an opinion on the clarity of the items, The extent to which items belong to the questionnaire, language of the items, and other observations The experts agreed to accept the items 80%, and all the opinions and guidance of the experts were taken into account.
- Intrinsic validity:** This means internal validity of the test, which is the test trial scores attributable to the real grades free of measurement errors; measured by calculating the square root of the instrument's reliability factor (Nasruddin Radwan, 2006: 226); consider the questionnaire stability factor is equal to = 0.75 and Intrinsic validity

coefficient = $\sqrt{0.78}$ then the Intrinsic validity = 0.88, And this is a good result and very acceptable.

- c. **Internal consistency validity:** Internal consistency validity was calculated by extracting Pearson's correlation coefficient between each item and the degree of its axis, on the one hand, and between each axis and the total degree of the questionnaire on the other hand. Each item with a very weak or statistically irrelevant link to the axis to which it belonged was deleted. The results were as shown in the following table.

Table No. (02): Correlation Factors Between the Items of the Questionnaire of the Impact of Physical Activity on Certain Physiological, Physical and Psychological Variables and the Degree of the Axis to which they Belong.

(n = 30)

Axis 1 Physiological Variables Items			Axis 2 Physical Variables Items			Axis 3 Psychological Variables Items		
01	,714**		01	,074*	delete	01	,741**	
02	,338*	delete	02	,405**		02	,309*	delete
03	,549**		03	,476**		03	,429**	
04	,543**		04	,643**		04	,418**	
05	,416**		05	,420**		05	,571**	
06	,343*	delete	06	,432**		06	,262*	delete
07	,461**		07	,493**		07	,524**	
08	,567**		08	,300*	delete	08	,430**	
09	,375*	delete	09	,454**		09	,556**	
10	,390*	delete				10	,321*	delete
11	,482**					11	,256*	delete
12	,321*	delete				12	,398*	delete
13	,690**					13	,481**	
14	,291*	delete				14	,420**	

* Significant at 0.05 levels.

** Significant at 0.01 levels.

The results of Table No (2) show that the correlation factors of most of the three-axis items to the total axis degree are statistically significant at the level of 0.01. The correlation factors of the first axis (physiological variables) range from 0.29 to 0.71; The second axis items (physical variables) range from 0.07 to 0.64; The third axis (psychological variables) range from 0.25 to 0.74; The results of the correlation calculation between all questionnaire items and the interlocutor's scores also resulted in some poorly correlated items and were therefore permanently deleted from the questionnaire, 13 of which were deleted.

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Table No. (03): Internal Consistency Between the Grades of each Axis and the Total Degree to Determine the Impact of Physical Activity on Certain Physiological, Physical and Psychological Variables.

(n = 30)

N	Axis	All Questionnaire	**Significant at 0.01 Levels.
1	Physiological Variables	,876**	
2	Physical Variables	,835**	
3	Psychological Variables	,846**	

The validity of the hypothetical composition was calculated by extracting the Pearson correlation coefficient between the three axes and the total degree of the questionnaire. Table 3 shows that the value of the coefficient between the axes and the total degree of the questionnaire ranged from 0.83 to 0.87 and all correlation factors were significant at the 0.01 level. This indicates internal homogeneity (consistency) of the questionnaire, that the instrument's axes measure the impact of physical activity on certain physiological, physical and psychological variables of the research sample, and that all internal consistency values (coefficients between the axis of the questionnaire and the total grade) were statistically significant.

- **Reliability of the Tool:** After confirming the validity of the questionnaire and excluding 13 items from it, consider the questionnaire could not be applied twice to the same sample, the questionnaire stability factors for all reconnaissance sample data were calculated using the Cronbach-Alpha formula. Cronbach prepared his equation, known as Coefficient Alpha, to estimate the internal consistency of multi-choice tests and metrics when the odds of answering are not zero, not two-dimensional (Nasruddin Radwan, 2006: 138-139). The coefficient of stability was calculated for each axis of the study tool and the total degree of the tool. The results are shown in the following table.

Table No. (04): Reliability Factor of the Physical Activity Impact Questionnaire on Some Physiological Variables:

Axis	Coefficient) (∞) (Cronbach-Alpha	Number of Items
physiological variables	,660	08
Physical Variables	,775	07
Psychological variables	,621	09
Total degree of questionnaire	,789	24

Through the results of reliability factors ranging from 0.62 to 0.77 for each area of the study tool and the total degree to determine the impact of physical activity on some physiological, physical, and psychological variables with a constant of 0.78, it the tool can that be said has a good degree of persistence. The conclusion from the study of validity and reliability factors (validity ranging from 0.80 to 0.86; between 0.63 and

0.72), it can be said that there is statistical significance between all the axis phrases and the total degree of the axis they represent, and all three axes of the questionnaire are linked to the total degree of the questionnaire; The questionnaire also has an acceptable degree of reliability. Therefore, it can be judged that the questionnaire has an acceptable degree of validity and fortitude, which suggests that it can be relied upon to measure the impact of physical activity on some physiological, physical and psychological variables of type 2 diabetes. In light of the results of the psychometric study of the impact of physical activity on certain physiological, physical, and psychological variables of both the honesty and stability factor, the questionnaire was amended in its initial form, excluding phrases not associated with the total degree of its axis, so that the questionnaire would contain a final form of 24 phrases. The table below shows the number of phrases for each of the questionnaire's three axes before the deletion of unrelated phrases, as well as the number of phrases deleted from each dimension.

Table No. (05): Items and Axes of the Questionnaire on the Impact of Physical Activity on some Physiological Variables and Physical and Psychological in its Final Form.

Axis		N of items before delete	N of items after delete	N of deleted items
1	Physiological Variables	14	08	06
2	Physical Variables	09	07	02
3	Psychological Variables	14	09	05
Total		37	24	13

The Study Areas:

- **Temporal Area:** This questionnaire was conducted in December 2022. The field study began in January 2023, where the questionnaire was sent via the following link:

https://docs.google.com/forms/d/e/1FAIpQLSeQm-uVcmCZD4zIKzcric220Eqiu0a_uvBl6tnSFRKV4DWOJQ/viewform / by scanning on the code QR:

On 07/01/2023, the questionnaire was unloaded and the findings were drawn from 20/01/2023.

- **Spatial Area:** This research was conducted in the sports halls of the city of Djalfa and its 04 halls.

2.4. Statistical Analysis:

After the implementation phase (sending the e-questionnaire link), Questionnaire data valid for the study's purposes and up-to-date responses were processed for analysis and processing through the statistical package program (SPSS), in order to discuss hypotheses in the light of the research

objectives, and we have used the following statistical methods: The arithmetic mean and standard deviation - The median - Coefficient of Skewness and coefficient of kurtosis - Cronbach's alpha reliability coefficient - Pearson correlation coefficient - One Sample (T-Test).

- Statistical Characteristics of the Search Tool:

Table N (06) shows the normality test for the distribution of data of the questionnaire of the impact of physical activity on certain physiological, physical, and psychological variables. The table shows that the median is roughly equivalent to the arithmetic mean, and the values of the coefficient of skewness and the coefficient of kurtosis and their proximity to zero are indicative of moderate distributions, or in other words, close to a normal distribution. The table below also shows that the Shapiro-Wilk test value results ranged from (0,974 ~ 0,979), as they were not statistically relevant to each of the questionnaire's axes, as all Sig values are larger than the approved indicator level (0,266) > 0.05 ~ P = (0,148).

Table No. (06): Normality Test for the Impact of Physical Activity Questionnaire On some Physiological, Physical and Psychological Variables

N	Axis Statistical Statement	Descriptive Statistics				Shapiro-Wilk	
		arithmetic mean	Median	Skewness	Kurtosis	Test value	statistical significance
1	physiological variables	3,43	3,47	,36	,88	,979	,266
2	Physical Variables	3,45	3,49	,32	,18	,974	,148
3	Psychological variables	3,15	3,21	,24	,016	,978	,247
	Total degree of questionnaire	3,25	3,28	,23	,52	,978	,249

Table N (06) shows that the arithmetic mean near to the median (3.25; 3,28) respectively, the factors (Skewness and Kurtosis) are close to zero indicate the moderate distribution of data; The Shapiro-Wilk test value (0.978), which is not statistically significant, has been proven because the statistical indicator value (Sig) is greater than the approved indicator level (P=0.249>0.05). The result is that the distribution of questionnaire data on the impact of physical activity on certain physiological, physical and psychological variables is normal, or belongs to a society close to moderation; We will therefore use parametric statistics tests.

3. Results

Analysis of the Results of the Research Hypothesis:

-Physical activity has a positive impact on some physiological variables from the point of view of women with type 2 diabetes who engage in physical activity. To verify the validity of hypothesis and explain the

response to the questionnaire on the impact of physical activity on certain physiological, physical, and psychological variables, and to determine the degree to which physical activity affects physiological, physical, and psychological variables of type 2 diabetes patients, we calculated the arithmetic means of the computational averages of the axes of physiological, physical, and psychological variables as well as the total degree of the axis. The weighted arithmetic averages of Three-Point Likert Scales were adopted according to the following test.

Table 7: Key Areas of Physical Activity Impact on Certain Physiological, Physical and Psychological Variables

Effects of physical activity	Weighted arithmetic average
Negative	1.66 - 1
Accepted	2.33 - 1.67
Positive	3 – 2.34

Note that the length of the period used = 0.66.

To validate this hypothesis statistically, we used the T-test for a single sample to test the indication of differences between the calculation averages of the total degree to determine the impact of physical activity on certain physiological, physical and psychological variables and its three dimensions of physiological, physical, psychological and medium-hypothetical variables of the responses of study members; The following table shows our findings.

Table No. (08): Effect of Physical Activity on some Physiological, Physical and Psychological Variables.

(d. h = 32; n = 33, hypothetical average = 3)

N	Axis Statistical Tatement	Statistical Mean	Standard Deviation	Rank	Effects Degree	T-test	Statistical Significance	
							Sig	Decision
01	Physiological Variables	2,43	,051	02	positive	2,99	,004**	Significant
02	Physical Variables	2,15	0,41	03	accepted	3,22	,002**	Significant
03	Psychological Variables	2,45	0,52	01	positive	7,38	,000**	Significant
Total Degree of Questionnaire		2.37	,390	positive		5,22	,000**	Significant

**** significant at 0.01 levels**

Computational averages and standard deviations of the total grade are calculated in the previous table No (08). The level of each axis has also been established; The T-test was then calculated to reflect the differences

between the arithmetic mean of the questionnaire and the hypothetical average. The results are detailed as follows:

From the previous table, it is clear that women with type 2 diabetes consider that physical activity in some of their physiological, physical and psychological variables has improved between a positive and acceptable degree, according to the areas of degree of variables proposed. At the total degree of the questionnaire, where the psychological variable came first with a positive effect, With an average calculation of 2.45, followed by physiological variables in second place by a positive effect of physical activity from the point of view of women with type 2 diabetes with an average calculation of 2.43, At the end of the arrangement were the physical variables with an acceptable effect of physical activity, with an average calculation of 2.15.

Applying the test (T) to the physical activity impact questionnaire shows that it is a statistical function at a level of indication ($P = 0.000$) on the total score of the questionnaire and its three axes; values ranged from (2.99) to (7.38). All of which are statistically relevant, as the value of the indicator (Sig) is less than the approved indicator level of 0.01α ; $<0, 01 P = 0, 00$.

From the previous table (08), it is clear that by exercising physical activity, women with type 2 diabetes consider it as having a positive impact, both on the total degree of the questionnaire and on the axis of physiological variables. The physical variables have affected them to an acceptable degree from the point of view of women with type 2 diabetes,

Thus, as a result of Table No (08), we accept the assumption that physical activity has a positive impact on certain variables (physiological, physical and psychological) from the point of view of women with type 2 diabetes who engage in physical activity in the sports halls of the city Djelfa. Thus, from the foregoing, we can say that the research hypothesis is realized.

4. Discussion

Women with Type 2 diabetes consider physical activity to have a positive impact on various physiological, physical, and psychological variables. The focus of the psychological variables came in the first order, a statistical function with a positive impact, as from their point of view physical activity helped them:

- relieving stress.
- Achieve psychological balance; such as feeling happy.
- Help them get rid of some psychological problems (such as fear, depression, and boredom).
- Good mood.

- Help them to remove negative thoughts.
- The feeling of psychological comfort.

We agree with the study by Amar Al-husseini (2008), in Iraq. The results of his study showed that the sports and nutritional program had a positive effect on low sugar and high-density cholesterol (HDL) and viscosity (PCV) of blood, and a positive impact on neural signals from the upper and lower limbs.

The axis of physiological variables then came second in the degree of impact and is statistically significant, whereas physical activity impacted physiological variables through:

- Blood sugar control.
- Alteration of LDL cholesterol in the body.
- Secretion of good cholesterol HDL in the body.
- Alteration of cumulative sugar in HBA1C blood.

Our study is consistent with the study by Amina Al-Dherat, (2015) in Jordan. The results of her study showed that the applied training program had a positive impact and had worked to bring about statistically significant changes in normal FBS sugar, cumulative sugar, and blood HBA1C. Additionally, the applied training program had a positive impact on some physiological variables such as systolic blood pressure, LDL cholesterol, and triglycerides. We also agree with the study by Ajediran I Bello, et al, (2011), in Ghana, whose results showed an improvement in blood sugar fasting, low-density protein, and high-density protein. Furthermore, we agree with the study by Timothy S Church et al, (2010), in USA, whose results showed that combining aerobic and resistance exercises improved the level of hemoglobin in patients with type 2 diabetes.

In the third order, the physical variables are statistically significant and to an acceptable degree of impact. The physical activity of women with type 2 diabetes affects the following aspects:

- Maintaining fitness - The body has become more flexible - The look has become more attractive - Acquisition of a strong body.

We agree with the study by Samira Arabi and Hiba Al-Damiri (2014) in Jordan, which showed the existence of statistically significant differences in the variables of weight, body mass index, center circumference, pelvic circumference, and the study by Al-shetawi Sittan (2008) in Jordan. This has shown that the proposed training program has contributed to reducing the complications of diabetes, through its positive effect on lowering blood sugar, cholesterol, and triglyceride, and has also contributed to improving various physical measurements, through its impact on weight loss and

various body circumferences. The study by Archidat Ghadir (2001), in Jordan, which showed significant impact of walking practice and diet in improving blood sugar, did not contribute to the loss of weight in patients, and the study by Amina Al-Dahirat (2015), in Jordan. The results of the training program showed that the implementation of the training program had made positive changes that were statistically significant in improving multiple physical measurements by affecting weight loss and the body circumferences.

5. Conclusions

- Physical activity has an effective and positive impact on women with type 2 diabetes improving their psychological, physiological, and physical aspects from their point of view.
- Physical activity affects women with type 2 diabetes primarily on psychological variables and then physiological variables and finally physical variables from their point of view.

Through the study's finding, and based on the conclusions, we recommend the following:

- The need to pay attention to the medical examination of individuals periodically in order to maintain public health.
- Using other sports programs such as aquatic exercise, aerobic exercise, resistance exercise, and physical and motor activity for people with type 2 diabetes of other ages.
- Developing sports programs for diabetes patients.
- Attention to the physical activities of type 2 diabetes patients in terms of programming, planning, and implementation.
- Awareness of diabetes patients about the importance of physical and sporting activities in their daily lives.
- Make similar studies on different samples and other variables and the same type of sports program.

References:

1. Chodzko ZWJ, Proctor ND, et al. (2009) *Exercise and Physical Activity for Older Adults*. *Med Sci Sports Exerc.* 41(7).
DOI: [10.1249/MSS.0b013e3181a0c95c](https://doi.org/10.1249/MSS.0b013e3181a0c95c)
2. Sheri Colberg et al; (2010) *Exercise and Type 2 Diabetes; The American College of Sports Medicine and the American Diabetes Association: joint position statement*. DOI: [10.2337/dc10-9990](https://doi.org/10.2337/dc10-9990)
3. World Health Organization (2023).
<https://www.who.int/teams/noncommunicable-diseases/updating-appendix-3-of-the-who-global-ncd-action-plan-2013-2030>

4. . Schwartz, M. (2019). **Impact of Physical Activity on Type 2 Diabetes Mellitus**. The Science Journal of the Lander College of Arts and Sciences, 13(1)., Retrieved from: <https://touroscholar.touro.edu/sjlcas/vol13/iss1/3>
5. Mulu Shiferaw Asfaw, Kassahun Dagne (2022) ; **Physical Activity Can Improve Diabetes Patients' Glucose Control**. .Journal CellPress,,
<https://doi.org/10.1016/j.heliyon.2022.e12267>.
6. Alricsson M, (2013) **Physical Activity Why and How?** J Biosafety Health Educ 1: e111. doi:[10.4172/2332-0893.1000e111](https://doi.org/10.4172/2332-0893.1000e111).
7. David Brinson; (2007) **The Self-Management of Type 2 Diabetes: Changing Exercise Behaviours for Better Health**; University of Canterbury; Master's Thesis,.
8. Ajediran I Bello et al; (2011:4) **Effects of Aerobic Exercise on Selected Physiological Parameters and Quality of Life in Patients With Type 2 Diabetes Mellitus**; International Journal of General Medicine.
9. Timothy S. Church et al, (2010) **Effects of Aerobic and Resistance Training on Hemoglobin A1c Levels in Patients With Type 2 Diabetes**, The Journal of the American Medical Association· 2010. doi:[10.1001/jama..1710](https://doi.org/10.1001/jama..1710)
10. Amena Ali Theeb Al-Dherat. (2014) **The Impact of the Training Program on some Physiological and Anthropometrical Variables for Type2 diabetes Patients**. Master's Thesis. Yarmouk University. Jordan.
11. Orabi S; AL Damiri, H (2014), **The Effect of Aqua Aerobic Exercise on some Anthropometrical, and Physiological Variables upon Women with Diabetic Type 2 In Jordan**, DIRASAT EDUCATIONAL SCIENCES. Vol 41 no 1.
12. Arshidat Ghadeer, (2006) **The Effect of Physical Activity and Diet upon Type 2 Diabetic**. Master's Thesis unpublished. Yarmouk University. Jordan.
13. Amar Hamza Hadi Al-husseini, (2008) **The Effect of Sports Exercise Programming and Nutrition on Some Physiological Variables in People with Diabetes**, Journal of Sports Education Sciences, vol. II, No. 1, Iraq.
14. Al-Shetawi Mu'tasim Mahmoud Sittan, (2008) **The Impact of an Aerobic Training Program on the Variables of Sugar and Some Physical Measurements in Non-Insulin Diabetics**. Published research, Mutah Journal of Research and Studies, Humanities and Social Sciences Series, vol. XXIII, No. 1, Mutah University, Jordan.
15. Gonçalves, G.C.V.; Santos, A.T.S et al;(2022) **Aquatic Exercise on Brain Activity in Type 2 Diabetic: Randomized Clinical Trial**. Int. J. Environ. Res. Public Health, 19. <https://doi.org/10.3390/ijerph192214759>
16. Mohammed Nasir Uddin Radwan (2006) **Introduction to Measurement in Physical and Sports Education**. First Edition, Book Publishing Center, Cairo - Egypt.