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KNOWLEDGE, ATTITUDE, AND PRACTICE OF TYPE-2 DIABETIC PATIENTS ABOUT PHYSICAL ACTIVITY AT PRIMARY HEALTH CARE CENTERS

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ABSTRACT

Background: It is properly established that physical activity is a powerful non-pharmacological interference to enhance diabetes manipulation and should be an integral component of the care strategy of diabetic patients. Aim Of The Study: To explore a potential strategy for diabetes control and avoidance of diabetes-related complications through the encouragement of physical activity about style two diabetes mellitus. Objectives: To evaluate knowledge, attitude, and practice of style two (DM) patients attending primary healthcare centers (PHCCs) in Jeddah city, regarding physical activity. Methods: A cross-sectional descriptive study was carried out among a multistage random sample of type-2 diabetic patients registered at "Al-Rehab" and "Al-Safa-2"PHCCs in Jeddah city, Saudi Arabia. The data collection tool included four parts; socio-demographic and medical data, nineteen True/False questions on knowledge regarding physical activity, five statements related to attitude toward physical activity, and the General Practice Physical Activity Questionnaire (GPPAQ) to assess the practice of physical exercise among the participants. Results: The study included 223 types, 2 diabetic patients. Their age ranged between 18 and 87 years (47.6±14.1 years). Their total knowledge score about physical activity ranged between 11 and 17 with a median (IQR) of 12 (10-14). Professional workers (p=0.022) and patients with higher income p=0.034) were more knowledgeable than their counterparts. Saudi patients expressed more positive attitude than non-Saudis, p-0.001. The commonest reported barriers for practicing physical exercise were not having energy which helps to do exercises (43.9%). Conclusion: Awareness about the physical activity of style two diabetics is overall acceptable. Their attitude toward physical activity is encouraging. However, their physical activity practice is deficient.

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Introduction

Background

Diabetes mellitus (DM) is one of the quickest developing medical issues problems, which has reached epidemic proportions in several nations. It is for the most part because of the result of the way of life, such as lack of exercise, unhealthy diet, obesity, and overweight[1, 2] If the prevalence of type-2diabetes mellitus to growth and flow rate, the worldwide burden of this sickness will upward push to attain 366 million sufferers in 2030 [3-5]

In Saudi Arabia, the ascent in the commonness of type-2 diabetes mellitus began to pick up consideration years after fast industrialization occurred in the nation[6]. Saudi Arabia is about pinnacle ten nations of the world with the most noteworthy incidence (23.9%), trailed by Kuwait (23.1%), and Qatar (22.9%) [7]. The epidemic of diabetes has been explaining by the fact that, during the last 4 decades, significant socio-economic changes have happened in KSA. The development and success have acquired visible changes in the way of life of the individuals. Most remarkably, dietary patterns are much less healthful, and the degree of physical activity has declined. Technological advances, e.g., vehicles, lifts, elevators, controllers, and so forth, have prompted a stamped decline in levels of physical activity [1]. Mikus et al. [8] stated that patients who have diabetes usually take oral anti-hyperglycemic medications either to upgrade insulin discharge from the pancreas or to enhance insulin activity in metabolically active tissues. While drugs can intensely decrease normal blood glucose levels and enhance HbA1c, they don't prevent metabolic brokenness from advancing after some time [9]. Another technique for

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controlling blood glucose levels is through expanding physical activity [10-12]. It has shown that enhancements in fasting blood glucose levels, normal 24-hour blood glucose level, in addition to the post-prandial glycemic reaction after moderate-force exercise training [12, 13]. Physical activity has been defined as: "any bodily movement produced by the contraction of skeletal muscles that would increase energy expenditure above the basal level" [14]. Physical activity is considered one of the main preventive measures against many diseases which now correlated with an increasing prevalence on the global scale [15]. On the other hand, physical inactivity is one of the core dangerous reasons for non-communicable illnesses about the world, thus expressive a significant load on wellbeing care [16]. The increasing incidence of physical inactivity and bad diet are the main reasons for worldwide epidemics of overweight and obesity and consequently type-2 diabetes [17]. Physical activity is an effect in decreasing abdominal fatness and keeps against the weight increase usual of average age [18]. Physical activity might delay or avoid glucose intolerance turning into diabetes and make important enhancements in blood sugar level [19]. Moreover, physical activity is useful in the administration of several diseases including type-2diabetes [20]. It is well showed that physical activity affects non-drug interposition to develop diabetes control [21]. Management of DM to a great extent relies upon patients' capacity to self-care in their day by day lives, and in this way, patient education is constantly viewed as a fundamental component of DM management [22]. Little is understood about the obstructions to physical activity about the Saudi people. These may be environmental (external barriers) [23]. In the other context, perceived barriers may relate to the individual (personal, internal barriers). Several studies on adolescents showed that perceived obstructions were conversely identified with the degree of physical activity [24]. Achieving suggested levels of physical activity is a community health priority, and the first-line measure in the administration of a few chronic diseases, particularly, type-2 diabetes [25, 26].

Review of literature

In Tabuk City, Saudi Arabia, Al-Mountashiri et al. conducted a case-control study at the Diabetes Center among100 patients with style two diabetes mellitus and a hundred and fifty control subjects to assess their dietary habits, physical activity, and diabetes perception. Participants were met to gather demographic information relating to breakfast skipping, delayed supper admission, and natural product, vegetables, sweet food, and fast meal utilization. Diabetic patients' belief in their illness was also assessed. Results: the study showed that body mass index (BMI) ($p<0.001$), fast food utilization ($p<0.001$), natural product utilization ($p=0.004$), and breakfast skipping ($p<0.001$) were higher among patients with diabetes contrasted with controls. No significant differences were seen regarding the degree of activity, smoking, delayed supper admission, and diabetes belief. A significant statistical alteration was found about poor and acknowledged control for sweet food consumption ($p=0.046$) and work out ($p=0.017$). They concluded that patients with type-2 diabetes had higher BMI, and had been much moreto skip breakfast, expend less fast food, and a greater number of fruits products than control subjects. More physical activity and less sweet food utilization stayed detected about patients with acknowledged glycemic control [27].In the Eastern District of Abu Dhabi Emirate (Al-Ain Region), the United Arab Emirates, Al-Maskari, et al. carried out a cross-sectional survey at the outpatient departments of two major government hospitals (i.e., Tawam and Al-Ain hospitals) to evaluate information, perspectives, and practices (KAP) of 575 diabetic patients. A modified Arabic-translated instrument, adapted from the Diabetes Research Training Center of Michigan used for data collection. Also, KAP, we gathered socio-demographic information that included sexual orientation, age, occupation, conjugal status, instructive level, salary, family ancestry of diabetes, a term of diabetes, and drugs. The survey was translated into Arabic. Results of the study showed that 31% of patients had lowly information on diabetes, 72% had bad mentalities to having the disease, and 57% had HbA1c levels reflecting lowly glycemic control. Just 17% had sufficient glucose control, while 10% conceded rebelliousness with their drugs. Knowledge, practice, and disposition marks were all significantly positively emphatically related, however, none of these marks were associated with HbA1c. They concluded that projects to expand patients' mindfulness about diabetes are fundamental for every one of diabetic patients in the United Arab Emirates to improve their understanding, compliance, and management and, accordingly, their capacity to adapt to the disease [22]. In the Muscat Region of the Sultanate of Oman, Al Bimani et al. conducted a cross-sectional search to evaluate the diabetes mellitus type-2-associated knowledge and practices (KP) of Omani adult patients. Diabetic patients were found utilizing the helpful inspecting strategy from the outpatient diabetes facility of different primary health care centers and private hospitals in the Muscat region of the Sultanate of Oman. KP of patients who consented to share an interest in the search was evaluated by regulating a self-designed questionnaire containing 15 close-ended or multiple-choice type questions in face-to-face interviews. Results showed that 106 patients with diabetes mellitus type-2 patients were involved in the most share of them were; wedded (83%), over 50 years (64.2%), on oral hypoglycemic (56.6%), having a family ancestry of diabetes (66%). The mean ± SD information score of members was seen as 4.92 ± 1.22 out of the most extreme conceivable mark of 8. The study concluded that Omani diabetic patients seemed to be aware and displayed satisfying diabetes information and great practices except for adherence to ordinary exercise. They recommended to plan and create diabetes instruction programs that could help Omani patients in diabetes organization and development of the quality of life [28].In the USA, Nelson et al. conducted their study to describe diet and exercise practices from a nationally representative sample of American grown-ups with type-2 diabetes. They evaluated information from 1,480 grown-ups with a self-detailed identification of type-2 diabetes in the Third National Health and Nutrition Examination Survey (NHANES III). Fruit and vegetable eating were gotten from a food recurrence questionnaire; the rates of complete calories from fat and saturated fat were acquired from a 24-h food review. Physical activity depended on self-report during the month before the study showed of the investigation demonstrated that of patients with type-2 diabetes, 31% revealed no normal physical activity, and another 38% detailed not exactly proposed suggested levels of

physical activity. Sixty-two percent of respondents ate under five servings of products of the soil every day. Almost two-thirds of the respondents disbursed >30% of their day by day calories from fat and >10% of all-out calories from saturated fat. Mexican Americans and individuals beyond 65 a year old consumed a larger amount of fruits and vegetables and a lower level of all-out calories from fat. Lower pay and expanding age were identified with physical idleness. Thirty-six percent of the examples were overweight, and another 46% were obese. They concluded that most patients with type-2 diabetes did not participate in the recommended physical activity, and didn't follow dietary rules for fruit, vegetables, and fat consumption. Further measures are expected to empower ordinary physical activity and change dietary propensities in this populace [29]. In the USA, Van Vrancken et al. conducted their study to decide the commonness of recreation time physical action about South Carolinians with and without diabetes and to compare the physical activity of those with diabetes. Data from the South Carolina Behavioral Risk Factor Surveillance System were applied to characterize grown-ups with and without diabetes into categories of physical activity. Results showed that physical idleness was higher among South Carolinians with diabetes (42%) than in those without (27%). A correlation of physical action in diabetic patients somewhere in the range of 1990 and 2000 showed a slight diminishing (2%) in physical inertia inactivity. They concluded that a reduction decrease in physical dormancy among diabetic patients is empowering; in any case, further advancement of physical movement is prescribed to urge diabetic patients to take part in physical activity all the time [30]. In Sri Lanka, Ranasinghe et al. evaluated the examples of physical activity and the commonness of physical inactivity among grown-ups with diabetes mellitus. Information was gathered as a feature of a more extensive cross-sectional national examination on diabetes in Sri Lanka. Physical movement during the previous week was surveyed utilizing the short form of the International Physical Activity Questionnaire. Results indicated that the general predominance of physical inactivity was 13.9%. Females (3091 ± 2119) had an essentially higher mean week after week absolute MET-minute than guys (2506 ± 2084) ($p < 0.01$). Dormancy of those living in urban (17.2%) territories was higher than provincial (12.6%) in all grown-ups. Members from Moor ethnicity were more inert contrasted with others. who were physically active had an altogether low waist and hip circumferences, body mass index, and systolic circulatory strain [31]. In North India, Ahmad and Ahmad carried an observational, descriptive, outpatient department-based study among 124 diabetes type-2 patients, attending the Urban Health and Training Centre to assess their knowledge, attitude, and practice. A detailed history and physical assessment were done. The level of information, disposition, and practice towards diabetes mellitus were evaluated. A pre-structured meeting plan was utilized for information assortment. Results demonstrated that 75 (60.5%), 88 (71.0%), and 98 (79.0%) had a helpless score of information, demeanor, and practice of diabetes individually. They inferred that satisfactory information, inspirational demeanor, and great practices are fundamental for sufficient control of diabetes mellitus. Patients need continuous support from family members to make a change in lifestyle. Also, people must be educated through mass media on diabetes mellitus and its risk factors for its effective control in the community [32]. In Nepal, Gautam et al. conducted an institutional-based cross-sectional study on 244 diabetic patients to determine the level of diabetes-related health knowledge, attitude, and practice (KAP) among diabetic patients and factors associated with KAP. Data were collected by face to face interviews using structured interviewer rater questionnaires. Results showed that diabetes-related hazard factors were basic among diabetic patients; 9.8% smoker, 16% liquor drinking, and 17.6% detailed low or no physical movement. The middle score for information, mentality, and practice was 81, 40, and 14 separately. Among all patients, 12.3%, 12.7%, and 16% had profoundly good information, disposition, and practice respectively. Using exceptionally lacking information as the benchmark, the probability of having a degree of profoundly adequate information was multiple times higher among patients who graduated or more the level of education compared to those who were illiterate. Although this value was relatively lower an inadequate degree of information. The likelihood of having an adequate degree of training among diabetic patients with a past filled with smoking was 0.10 occasions lower than in a patient with no history of smoking. Their study revealed a variation between diabetes-related health information, attitude, and practice in Nepal about the individuals who are influenced by diabetes. Our results show the potential diabetes health education needs to be improved or developed for better health promotion [33]. In West Godavari District of the Indian State of Andhra Pradesh, Konduru et al. conducted prospective and observational research to survey the mindfulness and information in regards to diabetes mellitus among 100 diabetic and 50 non-diabetic subjects. All in-patients and out-patients either gender orientation, age 20-80 years were involved in the research. Result of the examination characterized that, 46% of diabetic patients had helpless information, 45% had reasonable information, and 9% had great information about diabetes mellitus while 64% of non-diabetics had helpless information, 34% of non-diabetics had reasonable information, and 2% of non-diabetics had great information regarding diabetes mellitus [34].In Bangladesh, Fatema et al. conducted a cross-sectional study to explore knowledge, attitude, and practice regarding diabetes mellitus among 6780 non-diabetic and 11,917 type-2 diabetes mellitus patients in Bangladesh. Participants were selected purposively from the outpatient department of 19 healthcare centers in and around Dhaka and in northern parts of Bangladesh. Knowledge, attitude, and practice were assessed by a pre-structured, interviewer-administered questionnaire. Results showed that the proportion of poor, average, and good knowledge scores among type-2 diabetes mellitus patients were 17%, 68%, and 15% respectively. The corresponding values for attitude scores were 23%, 67%, and 10% respectively. The knowledge, attitude, and practice regarding diabetes were found to be better among people who were living with diabetes compared to their counterparts. Diabetic males showed better knowledge and practice regarding diabetes, compared to non-diabetic counterparts (Mean±SD; 44.18 ± 16.13 vs 40.88 ± 15.62, $p = <0.001$; 66.00 ± 29.68 vs 64.21 ± 31.79, $p<0.001$, respectively). Females showed a better attitude score compared to males. The overall practice was significantly higher ($p<0.001$) in middle-aged (31–50 years) participants in each group. Participants from urban residents, higher educational background, and upper socio-economic class, demonstrated significantly greater

score regarding knowledge, attitude, and practice in both non-diabetic and typed two diabetes mellitus groups ($p<0.001$). On linear regression analysis, knowledge scores are associated strongly with education, income, residence, diabetic state, BMI, and attitude. They concluded that the overall level of knowledge and practice concerning diabetes among the Bangladeshi population is average, but the overall level of attitude is good both in non-diabetic and type-2 diabetes mellitus patients. To prevent diabetes and its complications, there is an important need for coordinated educational campaigns with a prioritized focus on poorer, rural, and less educated groups [35].

Rationale

- Understanding the main barriers against patients' knowledge, attitude, and practice of physical activity will enable primary care physicians to provide proper health education and counseling to their diabetic patients, which will reflect into better diabetes control and prevention of diabetes-related complications. Moreover, "diabetes and its control" is currently the main topic of personal interest to the researcher.
- The researcher noticed that most diabetic patients wrongly think that physical activity is harmful to them and tend to avoid exercise for fear of hypoglycemia.
- It is, therefore, crucial to assess the prevalence of physical inactivity among type-2 diabetics and identify barriers against physical activity so that to be able to allow primary care physicians to design appropriate exercise strategies for effective management of diabetes.

Aim of study

To explore a possible plan for diabetes control and prevention of diabetes-related complications through the encouragement of physical activity among type-2 diabetes mellitus.

Objectives

- To assess knowledge, attitude, and practice of type-2 diabetes mellitus patients attending PHCCs in Jeddah City, regarding physical activity.
- To determine the proportion of positive attitude toward physical activity abouttype-2 diabetes mellitus patients attending PHCCs in Jeddah City.
- To identify barriers to physical activity among type-2 diabetes attending PHCCs, Jeddah City.

Methodology (Materials and Methods)

Study Design: Cross-sectional descriptive study design

Study Area: Jeddah is a Saudi city. Its population is estimated at around 3.4 million, and it is the second-largest city after Riyadh.

According to Jeddah Directorate of Health [36], there are 48 primary health care centers in Jeddah City distributed into five geographical areas around to the nearest hospital (Table 1).

Table1: Health care centers in Jeddah City distributed

Nearest hospital	No. of primary health care centers
King Abdullah Medical Compound	11
King Fahad Hospital	13
East of Jeddah Hospital	10
King Abdul-Aziz Hospital	8
Al-Thagr Hospital	6
Total	48

Study Population

The study population constitutes all type-2 diabetic patients registered at “Al-Rehab” and “Al-Safa-2” PHCCs in Jeddah City.

Eligibility Criteria

Inclusion criteria

- Type-2 diabetic patients who registered for the study PHCCs.
- Type-2 diabetic patients with any associated chronic diseases.
- Both genders.
- All nationalities.

Exclusion criteria

- Type-2 diabetic patients who are not registered at PHC.

- Patients with paralysis.

Sample size and technique

The sample size for this study was determined by applying the "Raosoft" statistical program for sample size calculation [37]. The researcher calculated the minimum sample size for this study to be 224 according to the following data:

- Accepted margin of error: 5%
- Confidence level: 95%
- Population size: 535
- Response distribution: 50%

Following a multistage random sampling technique that included all 5 clusters (corresponding to the five geographical areas of Jeddah City), the "King Fahad Hospital" area was randomly selected. Next, among all 13 PHCCs around the selected cluster, two PHCCs were selected by simple random sampling (i.e., "Al-Rehab" and "Al-Safa-2" were selected to conduct this study.

There are 194 type-2 diabetic patients registered at "Al-Rehab" PHCC, while there are 341 type-2 diabetic patients registered at "Al-Safa-2" PHCC. Therefore, the total number of patients registered for both study PHCCs was 535. Since the calculated minimum sample size for this study was 224, hence the sampling fraction was 224/535.

Consequently, with proportionate allocation, the total number of patients from Al-Rehab PHCC was 81 patients, while those from Al-Safa-2 were 143 patients.

Data collection tool (instrument)

The data collection tool included the following four parts (See Annex 1):

1. Socio-demographic and medical data: Age, gender, educational status, occupation, monthly income, smoking status, duration of diabetes, and associated co-morbidity.
2. Nineteen True/False questions on knowledge regarding physical activity, which was adapted and translated into the Arabic Language by the researcher from the English version constructed by Hui et al. [38]. Little modifications were done and validated by three family medicine consultants.
3. Five statements related to attitude toward physical activity, which was adapted and translated into the Arabic Language by the researcher from the English version constructed by Terry et al. [39]. Possible responses were Agree, Disagree, and Don`t know. Validation of the selected statements was done by the same three family medicine consultants.
4. The General Practice Physical Activity Questionnaire (GPPAQ) was utilized to assess the practice of physical exercise among the participants. It is a validated and reliable tool screening tool used to assess adult physical activity levels [40] and provides a simple, 4-level Physical Activity Index (PAI) of Active, Moderately Active, Moderately Inactive, and Inactive [41]. Its utilization in primary care is supported by the National Institute for Health and Care Excellence[42].

Data collection technique

- Before starting data collection, the researcher trained nurses in the Diabetes Clinics at PHCCs on using the study questionnaire in data collection.
- Since the study questionnaire is in the Arabic language, participated patients were allowed to personally fill it, under the supervision of the researcher and/or the clinic's nurse who was ready to explain or answer any question to participants.
- Illiterate patients were helped by the researcher and/or the clinic's nurse to fill the study questionnaire.
- Three weeks were needed for data collection.

Scoring of responses:

a) Knowledge:

A correct answer was assigned a score of (1) while an incorrect answer was assigned a score of (0). The total score was computed for each participant, tested for normality, and utilized for comparisons.

b) Attitude:

Agreement with a positive attitude statement was assigned a score of (2), a neutral response was assigned a score of (1) while a disagree was assigned a score of (0). For a negative attitude statement, the reverse was done, i.e., 2 for disagree, and 0 for agree.

c) Practice:

Accordingly, participants were classified into four categories based on the general practice physical activity questionnaire.

Study Variables

a) **Dependent variables**

- Knowledge of type-2diabetic patients about physical exercise
- The attitude of type-2diabetic patients towards physical exercise
- The practice of physical exercise among type-2 diabetic patients.

b) **Independent variables**

Age, Gender, Nationality, Educational status, Occupation, Monthly income, Smoking, status, duration of diabetes, Associated comorbidity

Data entry and analysis

Collected data were verified and coded before computerized data entry. The researcher utilized the Statistical Package for Social Sciences (SPSS version 25.0) for data entry and analysis. Descriptive statistics (i.e., frequencies, percentage, mean median, interquartile range "IQR" and standard deviation "SD") were applied according to the type of the variable and its distribution. Shapiro-Wilk test was applied to test for the distribution of continuous variables. Tests of significance (e.g., the chi-square test, one-way analysis of variance "ANOVA" test, Mann-Whitney test, and Kruskal-Wallis test)were adopted according to the purpose of the analysis and distribution of the variables. Statistically significant differences were decided at $p<0.05$.

Pilot study/pretesting

Before starting data collection, the researcher conducted a pilot study on ten patients to test the wording and clarity of statements included in the first three parts of the questionnaire and the necessary time to complete it. As a feedback, the questionnaire was clear and required almost 12 minutes to be completed. Results of the pilot study were used to reach the final form of the study questionnaire and not included in the main study.

Ethical considerations:

All required official approvals were fulfilled. Before interviewing patients for data collection, they were fully and briefly informed about the objectives of the study and they had the full right to accept or refuse to participate in this study. All participants were notified that the collected data will be kept strictly confidential and will be used only for research.

Relevance &expectations

Physical inactivity is a significant risk factor for type-2diabetes[16]. Moreover, physical exercise has been shown to improve diabetes control [9-11]. Hence, this research was designed to explore an essential factor both in the prevention and control of type-2 diabetes, i.e., physical activity.

The results of this study are expected to enable proper planning for diabetes control and prevention of diabetes-related complications through the encouragement of physical activity among people with type-2 diabetes.

Budget

No funding in this study, as the researcher personally covered all its costs.

Results

The study included 223 type-2 diabetic patients. Their age ranged between 18 and 87 years with a mean ± standard deviation of 47.6±14.1 years. The remaining socio-demographic characteristics are summarized.

Table 2: Socio-demographic characteristics of type-2 diabetic patients, primary healthcare centers, Jeddah (n=223)

	Frequency	Percentage
Gender		
Male	116	52.0
Female	107	48.0
Nationality		
Saudi	184	82.5
Non-Saudi	39	17.5
Educational level (n=221)		
Primary school/below	28	12.7
Intermediate school	31	14.0
High school	75	33.9
University	74	33.5
Postgraduate	13	5.9

Job		
Governmental employee	53	23.8
Private sector employee	22	9.9
Professional worker	10	4.5
Housewife	45	20.2
Retired	39	17.5
Student	19	8.5
Business/trading	11	4.9
Others	9	4.0
Not working	15	6.7
Marital status		
Single	31	13.9
Married	150	67.2
Divorced	18	8.1
Widowed	24	10.8
Monthly family income (SR) (n=216)		
<5000	70	32.4
5000-10000	88	40.7
>10000	58	26.9

Table 2 Show males represent 52% of the participants. The majority were Saudi nationals (82.5%). Most of them were either high school educated (33.9%) of university graduated (33.5%). Almost a quarter of them (23.8%) were governmental employees whereas 20.2% were housewives. About two-thirds (67.2%) were married. The income of 40.7% of the participated patients ranged between 5000 and 10000 SR/month.

Knowledge about physical activity

Table 3: Responses of type-2 diabetes mellitus patients to knowledge statements concerning physical activity

	Correct answer	
	No.	%
The diabetic patient should have a physical exercise session of continuous 30 minutes per time. (√)	195	87.4
The diabetic patient should practice physical activity on most days of the week. (√)	184	82.5
Practicing physical activity provides health benefits. (√)	197	88.3
Patients with type-2 diabetes should be physically active at least 5 days a week. (√)	158	70.9
Patients with type-2 diabetes should avoid exercising in the evening. (√)	99	44.4
Regular exercise or being physically active helps to control your diabetes. (√)	178	79.8
Patients with type-2 diabetes should have resistance training that involves all major muscle groups. (√)	147	65.9
Resistance training can improve insulin resistance and increase insulin sensitivity. (√)	101	45.3
Greater health benefits can be achieved by increasing the amount (duration, frequency, or intensity) of physical activity. (√)	146	65.5
Performing physical activities only on the weekend is enough to achieve health benefits. (X)	154	69.1
Performing vigorous physical activities for 3 hours once a week is enough to experience health benefits. (X)	165	74.0
Which of the following physical activities do you believe will provide health benefits?		
Aerobics class (√)	173	77.6
Biking (√)	103	46.2
Prayer (X)	80	35.9
Household cleaning (√)	76	34.1
Jogging / running (√)	103	46.2
Preparing meals (X)	164	73.5
Swimming (√)	136	61.0
Weightlifting (√)	54	24.2

Table 3 summarizes the responses of type-2 diabetic patients to knowledge statements about physical activity. The majority of them knew correctly that practicing physical activity provides health benefits (88.3%), diabetic patients should have physical exercise sessions of continuous 30 minutes per time (87.4%) and the diabetic patient should practice physical activity maximum days of the week (82.5%). However, less than half of them could recognize that patients with type-2 diabetes should avoid exercising in the evening (44.4%), and struggle training can improve insulin resistance and increase insulin sensitivity (45.3%). Regarding the types of physical activities, most of the participants believed that aerobics class (77.6%) and swimming (61%) provide health benefits, and most of them (73.5% knew that preparing meals does not provide health benefits. Only 24.2% could recognize that weightlifting provides health benefits.

Table 4: Factors associated with total physical activity knowledge score of the participants

	Total physical activity knowledge score			p-value
	Median	IQR	Mean rank	
Gender				
Male (n=116)	12	10-14	112.47	
Female (n=107)	12	10-13	111.5	0.910*
Nationality				
Saudi (n=184)	12	10-14	113.74	
Non-Saudi (n=39)	12	9-13	103.77	0.377*
Educational level (n=221)				
Primary school/below (n=28)	12	10-13	101.89	
Intermediate school (n=31)	12	11-14	127.21	
High school (n=75)	11	10-13	101.01	
University (n=74)	12	10-14	114.15	
Postgraduate (n=13)	12	11-14	131.69	0.197**
Job				
Governmental employee (n=53)	12	11-13.5	114	
Private sector employee (n=22)	12	9.75-14	109	
Professional worker (n=10)	14	11.75-16	155.8	
House wife (n=45)	12	10-13	108.74	
Retired (n=39)	10	9-13	88.44	
Student (n=19)	11	10-13	104.55	
Business/trading (n=11)	14	11-15	150.73	
Others (n=9)	12	9-14	108.8	
Not working (n=15)	13	12-14	151	0.022**
Marital status				
Single (n=31)	12	11-14	128.23	
Married (n=150)	12	10-14	109.8	
Divorced (n=18)	11.5	9.75-13.25	100.86	
Widowed (n=24)	11.5	10-14.75	113.13	0.437**
Monthly income (n=216)				
<5000 (n=70)	11	9-13	93.22	
5000-10000 (n=88)	12	10.25-14	112.91	
>10000 (n=58)	12	11-14	120.25	0.034**
Smoking status				
Smoker (n=73)	12	10-14	112.09	
Non-smoker (n=127)	12	10-13	110.96	
Ex-smoker (n=23)	12	10-14	117.48	0.904**
Duration of type-2 diabetes				
≤one year (n=15)	11	10-13	100.23	
>one year-5 years (n=55)	12	10-14	111.06	
>5 years-10 years (n=69)	12	11-13.75	114.65	
>10 years (n=85)	12	10-14	112.56	0.887**
Obesity				
No (n=172)	12	10-14	112.39	
Yes (n=51)	12	10-14	110.69	0.867*
Hypertension				
No (n=120)	12	10.25-14	115.69	
Yes (n=103)	12	10-14	107.7	0.353*
Heart disease				
No (n=182)	12	10-14	114.5	
Yes (n=41)	12	9-13.5	100.89	0.219*
Osteoarthritis				
No (n=165)	12	10-14	115.3	
Yes (n=58)	12	10-13	102.3	0.180*

* Mann-Whitney test ** Kruskal-Wallis test

Table 4. The highest knowledge about physical activity score was reported among professional workers (mean rank was 155.8) whereas the lowest was reported among retired patients (mean rank was 88.44), p=0.022. Knowledge score was significantly associated with the income as the mean rank of the score as highest among participants whose income exceeded 10000 SR/month (120.25) and lowest among those whose income was lower than 5000 SR/month (93.22), p=0.034. Others studied factors were not significantly associated with physical activity knowledge score.

Attitude towards physical activity

Table 5: Attitude of the participants towards statements concerning physical activity

Statements	Agree	Disagree	I don`t know
Physical activity helps to relieve anxiety and stress.	206 (92.4)	6 (2.7)	11 (4.9)
Physical activity is beneficial for the human body.	206 (92.4)	12 (5.4)	5 (2.2)
Regular vigorous exercise is necessary for good health.	108 (48.5)	75(33.6)	40 (17.9)
Participation in physical recreation is satisfying and enriching use of leisure time	182 (81.6)	23(10.3)	18 (8.1)
Associating with others in physical activity is fun.	192 (86.1)	13 (5.8)	(18 (8.1)

Table 5, it is realized that the majority of type-2 diabetic patients Agreed that physical activity helps to relieve anxiety and stress and it is beneficial for the human body (92.4%). Also, the majority of them agreed that associating with others in physical activity is fun (86.1%) and participation in physical recreation is satisfying and enriching the use of leisure time (81.6%).

Table 6: Factors associated with total physical activity attitude score of the participants

	Total physical activity attitude score			p-value
	Median	IQR	Mean rank	
Gender				
Male (n=116)	8	8-9	110.19	
Female (n=107)	8	8-10	113.96	0.645
Nationality				
Saudi (n=184)	8	8-10	118.13	
Non-Saudi (n=39)	8	7-8	83.10	0.001
Educational level (n=221)				
Primary school/below (n=28)	8	8-10	123.52	
Intermediate school (n=31)	8	7-9	100.48	
High school (n=75)	8	8-10	114.47	
University (n=74)	8	8-9	105.27	
Postgraduate (n=13)	9	7.5-10	121.69	0.486
Job				
Governmental employee (n=53)	9	8-10	128.51	
Private sector employee (n=22)	8	6.75-8.25	94.80	
Professional worker (n=10)	8	7-9.25	99.50	
House wife (n=45)	8	8-9	104.76	
Retired (n=39)	8	8-10	115.50	
Student (n=19)	8	7-9	104.95	
Business/trading (n=11)	8	8-10	123.18	
Not working (n=15)	8	7-8	88.44	
Others (n=9)	8	8-10	114.73	0.360
Marital status				
Single (n=31)	8	7-9	104.05	
Married (n=150)	8	8-10	112.02	
Divorced (n=18)	8	8-10	123.83	
Widowed (n=24)	8	8-9.75	113.29	0.750
Monthly income (n=216)				
<5000 (n=70)	8	8-9	103.46	
5000-10000 (n=88)	8	8-9	104.66	
>10000 (n=58)	8.5	8-10	120.41	0.200
Smoking status				
Smoker (n=73)	8	8-9	106.60	
Non-smoker (n=127)	8	8-10	114.57	
Ex-smoker (n=23)	8	7-10	114.93	0.653
Duration of type-2 diabetes				
≤one year (n=15)	8	7-10	117.87	
>one year-5 years (n=55)	8	8-9	115.51	
>5 years-10 years (n=69)	8	8-10	114.71	
>10 years (n=85)	8	8-9	106.53	0.768
Obesity				
No (n=172)	8	7-9	101.89	
Yes (n=51)	8	8-9.75	115.0	0.178
Hypertension				
No (n=120)	8	8-9	108.74	
Yes (n=103)	8	8-9.75	114.80	0.460
Heart disease				

No (n=182)	8	8-10	120.43	
Yes (n=41)	8	8-9	110.10	0.328
Osteoarthritis				
No (n=165)	8	8-10	119.71	
Yes (n=58)	8	8-9	109.29	0.264

Table 6The attitude of Saudi type-2 diabetic patients towards physical activity was significantly higher than that of non-Saudi patients (mean ranks were 118.13 and 83.10, respectively), p-0.001. Others studied factors were not significantly associated with physical activity attitude score.

The practice of physical activity

Table 7: Factors associated with the level of practice of physical activity about the participants

	Level of physical activity				p-value
	Inactive N=30 N (%)	Moderately inactive N=55 N (%)	Moderately active N=105 N (%)	Active N=33 N (%)	
Gender					
Male (n=116)	16 (13.8)	38 (32.8)	47 (40.5)	15 (12.9)	
Female (n=107)	14 (13.1)	17 (15.9)	58 (54.2)	18 (16.8)	0.026[F]
Age (years) Mean±SD	54.4±14.8[*†]	52.0±14.0[°‡]	44.8±12.3[*‡]	42.8±15.3[†°]	<0.001[**]
Nationality					
Saudi (n=184)	25 (13.6)	44 (23.9)	87 (47.3)	28 (15.2)	
Non-Saudi (n=39)	5 (12.8)	11 (28.2)	18 (46.2)	5 (12.8)	0.943[F]
Educational level (n=221)					
Primary school/below (n=28)	6 (21.4)	8 (28.6)	9 (32.1)	5 (17.9)	
Intermediate school (n=31)	4 (12.9)	10 (32.3)	14 (45.2)	3 (9.7)	
High school (n=75)	10 (13.3)	18 (24.0)	34 (45.3)	13 (17.3)	
University (n=74)	9 (12.2)	16 (21.6)	39 (52.7)	10 (13.5)	
Postgraduate (n=13)	1 (7.7)	2 (15.4)	9 (69.2)	1 (7.7)	0.770[F]
Job	2 (3.8)	10 (18.9)	33 (62.3)	8 (15.1)	
Governmental employee (n=53)	6 (27.3)	6 (27.3)	9 (40.9)	1 (4.5)	
Private sector employee (n=22)	1 (10.0)	1 (10.0)	6 (60.0)	2 (20.0)	
Professional worker (n=10)	8 (17.8)	8 (17.8)	21 (46.7)	8 (17.8)	
House wife (n=45)	10 (25.6)	15 (38.5)	12 (30.8)	2 (5.1)	
Retired (n=39)	1 (5.3)	4 (21.1)	10 (52.6)	4 (21.1)	
Student (n=19)	0 (0.0)	4 (36.4)	7 (63.6)	0 (0.0)	
Business/trading (n=11)	2 (13.3)	2 (13.3)	5 (33.3)	6 (40.0)	
Not working (n=15)	0 (0.0)	5 (55.6)	2 (22.2)	2 (22.2)	0.033[F]
Others (n=9)					
Marital status					
Single (n=31)	2 (6.5)	6 (19.4)	19 (61.3)	4 (12.9)	
Married (n=150)	23 (15.3)	39 (26.0)	68 (45.3)	20 (13.3)	
Divorced (n=18)	1 (5.6)	5 (27.8)	5 (27.8)	7 (38.9)	
Widowed (n=24)	4 (16.7)	5 (20.8)	13 (54.2)	2 (8.3)	0.110[F]
Monthly income (n=216)					
<5000 (n=70)	10 (14.3)	18 (25.7)	31 (44.3)	11 (15.7)	
5000-10000 (n=88)	9 (10.2)	25 (28.4)	44 (50.0)	10 (11.4)	
>10000 (n=58)	8 (13.8)	12 (20.7)	28 (48.3)	10 (17.2)	0.847[F]
Smoking status					
Smoker (n=73)	7 (9.7)	26 (35.6)	33 (45.2)	7 (9.6)	
Non-smoker (n=127)	17 (13.4)	25 (19.7)	62 (48.8)	23 (18.1)	
Ex-smoker (n=23)	6 (26.1)	4 (17.4)	10 (43.5)	3 (13.0)	0.077[F]
Duration of type-2 diabetes					
≤one year (n=15)	0 (0.0)	2 (13.3)	10 (66.7)	3 (20.0)	
>one year-5 years (n=55)					

>5 years-10 years (n=69)	5 (9.1)	16 (29.1)	25 (45.5)	9 (16.4)	
>10 years (n=85)	10 (14.7)	15 (22.1)	36 (52.9)	7 (10.3)	
	15 (17.6)	22 (25.9)	34 (40.0)	14 (16.5)	0.388[F]
Obesity					
No (n=172)	20 (11.6)	46 (26.7)	82 (47.7)	24 (14.0)	
Yes (n=51)	10 (19.6)	9 (17.6)	23 (45.1)	9 (17.6)	0.308[F]
Hypertension					
No (n=120)	10 (8.3)	32 (26.7)	57 (47.5)	21 (17.5)	
Yes (n=103)	20 (19.4)	23 (22.3)	48 (46.6)	12 (11.7)	0.079[F]
Heart disease					
No (n=182)	17 (9.3)	44 (24.2)	93 (51.1)	28 (15.4)	
Yes (n=41)	13 (31.7)	11 (26.8)	12 (29.3)	5 (12.2)	0.001[F]
Osteoarthritis					
No (n=165)	16 (9.7)	44 (26.7)	81 (49.1)	24 (14.5)	
Yes (n=58)	14 (24.1)	11 (19.0)	24 (41.4)	9 (15.5)	0.041[F]
Knowledge score					
Median	11	12	12	12	
IQR	9-12.25	10-14	11-14	10-13	
Mean rank	89.73	108.22	123.82	100.92	0.039[F-F]
Attitude score					
Median	8	8	8	8	
IQR	8-9.25	8-10	8-9	5.5-10	
Mean rank	109.60	117.42	116.20	91.80	0.205[F-F]

SD: Standard deviation ** ANOVA test [F] Chi-square test
[*‡] p=0.001 [°‡] p=0.002 [F-F] Kruskal-Wallis test

Table 7. Females were more active than males (16.8% versus 12.9%), p=0.026. The age of active patients was significantly lesser than that of inactive patients (42.8±15.3 versus 54.4±14.8 years), p=0.001. Regarding participants` jobs, the highest rate of physical activity was observed among not working participants (40%) while the lowest rate was observed among those working in business and trading (0%), p=0.033. Physical inactivity was more reported among patients with heart diseases than those without (31.7% versus 9.3%), p=0.001, and patients with osteoarthritis compared to those without (24.1% versus 9.7%), p=0.041. Knowledge about physical activity score was significantly associated with the practice of physical activity, p=0.039. Other studied factors were not significantly associated with the practice of physical activity.

Barriers to physical activity

Table 8: Obstructions to physical activity abouttype-2 diabetes attending PHCCs, Jeddah City in 2018

	Frequency	Percentage
I think physical activity is very difficult and exhausting	85	38.1
I don't have energy which helps me to do exercises	98	43.9
My friends and I do recreational activities other than exercise	66	29.6
I fear others will ridicule me when I exercise	34	15.2
I am not sure I can do the exercise properly	75	33.6
There is no gymnear my home	80	35.9
I don't have sports tools to use it	74	33.2
My family and friends do not encourage me to exercise	45	20.2
I do not have free time to an exercise because of my family, social or study commitments	93	41.7
I don't have enough money	56	25.1

Table 8 Barriers to practice physical activity among T2DM patients are presented in. The commonest was not having energy which helps to do exercises (43.9%), not having free time to an exercise because of family, social or study commitments (41.7%), thinking that physical activity is very difficult and exhausting (38.1%), there is no gym near to home (35.9%) and being not sure they can do the exercise properly (33.6%).

Discussion

The role of practicing physical activities regularly in the prevention and postponing the progression from pre-diabetes to overt diabetes mellitus and consequently preventing complications of the disease is confirmed in numerous randomized clinical trials [43].

The importance of early recognition of the adaptable danger issues for diabetes mellitus such as physical inactivity is very essential in primary prevention [44]. Despite that, relatively few consider having been led in Saudi Arabia to investigate the information, disposition, and practice of physical activity about type-2 diabetic patients. In this way, this study was done in Jeddah city for this goal. In the current research, most of the type-2 diabetic patients were proficient for the medical advantages, span, and recurrence of physical activities. However, they were less knowledgeable regarding the fact that they should avoid exercising in the evening as well as regarding the benefits of resistance training to improve insulin resistance and increase insulin sensitivity. In a similar study carried out earlier in China [45], type-2 diabetic patients lacked knowledge of the benefits of resistance training. Regarding the types of physical activities that are associated with improved health, in the current study, most patients could identify aerobics class and swimming, however only 24.2% of them could recognize that weightlifting provides health benefits. In China, little knowledge has been reported regarding physical activities that are associated with improved health [46]. Therefore, further studies are recommended to explore the role of forms, frequencies, strengths, and periods of physical exercise to get benefits to diabetic patients. In the present study, professional workers and those with higher incomes had the highest physical activity knowledge score. Other studies observed a significant role of patients` educational level on physical activity knowledge [45, 46]. In the present study, the attitude of the type-2 diabetic patients towards physical activity is encouraging as the majority of them agreed that physical activity helps to relieve anxiety and stress and it is beneficial for the human body, partner with others in physical activity is fun and support in physical entertainment is fulfilling and improving utilization of recreation time. However, this positive attitude is not translated into practice in the present study. In South Africa, 44% of diabetic patients had no information on whether they could benefit from physical exercise [47]. In the current study; the attitude of the Saudi type-2 diabetic patients towards physical Activity was higher than that of non-Saudi patients. Further researches could be expected to clarify this finding. In the current research, utilizing the General Practice Physical Activity assessment, tolerably dynamic patients speak to 47.1% of the type-2 diabetic patients whereas active and inactive patients represent 14.8% and 13.5% of them, respectively. Recently in Saudi Arabia, Alzahrani et al. [48] reported that 38.4%. of type-2 diabetic patients were physically inactive. In Lebanon, nearly 10% of type-2 diabetic patients were physically active [49]. In Oman, diabetic patients had good practice regarding DM except for adherence to regular exercise [28]. In India, 74% of diabetic patients reported regular physical activity [50]. In South Africa, approximately 41% of diabetic patients reported practicing physical exercise while 15% did not believe in physical activity [51]. In the USA, the NHANES III study included 1,480 grown-ups with type-2 diabetes revealed that 31% of patients detailed no standard physical action and another 38% announced less than suggested degrees of physical activity [29]. However, in Senegal, 81% of diabetic patients were physically active [46]. The difference in the rate of physical activity between various studies could be explained by using different tools in assessing physical activity as well as variation in demographics of the participants. In the current survey, female diabetic patients were more physically active than males. This agrees with what has been reported by Saibai et al in Lebanon [49].However, in a similar recent Saudi study, the rate of physical inactivity showed no significant gender difference as being 40% for males and 37.4% for females [48].As expected, younger patients were also more physically active. The same has been reported by Thomas et al. who suggested that inactivity in older patients is attributed to a lack of self-motivation and distraction by attractive television programs [52]. Also, in Lebanon, the mean age of physically active patients was suggestively lesser that of physically inactive [49]. In the USA, physical inactivity rate improved with growing age [29]. Contrary to that, in research accepted out in China, older participants reported higher levels of physical activity [45]. Physical activity is essential for older persons in the prevention of disease, maintenance of independence, and improvement of quality of life [53].In the present study, the lowest rate of physical activity was observed among patients working in business and trading; mostly because of their sedentary life induced by their job nature. As quite expected, physical inactivity rate was advanced about patients with heart diseases and osteoarthritis than their counterparts, as a nature of their disease. However, for the natural world of the study design (cross-sectional), we could not know which lead to another (i.e. heart disease and osteoarthritis are risk factors or outcomes of physical inactivity). A longitudinal survey might be needed to explore that. Following Sai-ChuenHui et al. [45], the present study observed an association between knowledge about physical activity and practice of physical exercise abouttype-2 diabetic patients. Therefore, health education for diabetic patients is very important in promoting physical activity about them. Murano et al. [54] observed a significant improvement of physical activity about form 2 diabetic patients next to an impatient educational program for them. Barriers to practice physical activity among T2DM patients in the current research were having no enough energy to do exercises, having no enough free time to an, having no enough free time to an exercise because of family, social or study commitments, thinking that physical activity is very difficult and exhausting, absence of gym near to home and being not sure they can do the exercise properly. In another recent Saudi study [48], the significant barriers to practice physical activity were lack of social support, fear of injury, lack of energy, and lack of skills. In other studies that were carried out in Saudi Arabia among people attending primary care [55], and Oman, among patients with non-communicable diseases [56], lacks energy and social and social help were the main barriers to physical activity. Pain, lack of energy, and poor health were the main barriers among type-2 diabetic patients in the USA to practice physical activity [52].

Strengths and limitations

About the strengths of the prevailing research examining an essential subject as up to our knowledge very limited research was available on physical activity about diabetic patients. However, the study has some important limitations included the cross-sectional design and its disadvantages, utilizing modified tools to assess knowledge and attitude. However, they were

validated by three consultants before their application in the study. Finally, the use of a self-reported tool to evaluate physical activity practice could be subjected to bias, however, we used a valid tool applied in many similar studies.

Conclusion

Knowledge about the physical activity of type-2 diabetics registered at primary healthcare centers in Jeddah is overall acceptable. However, deficient knowledge was observed regarding the types of physical activities that provide health benefits, the disadvantage of practicing exercise in the evening for type-2 diabetic patients, and the role of resistance training in improving insulin struggle and expansion insulin compassion.
The commonest barriers to practice physical activity among T2DM patients were not having an energy which helps to do exercises, not having free time to an exercise because of family, social or study commitments, thinking that physical activity is very difficult and exhausting, there is no gym near home and not sure if they can do the exercise properly.

Recommendations
Based on the study`s findings, the following are recommended:
1. Implementing health education activities in the form of lectures, posters, and brochures at primary care settings for patients regarding physical activity and its essential role in glycemic regulator and stoppage of complications.
2. Also, physicians, diabetic educators, and nurses should encourage, in each visit, diabetic patients to practice physical activities, even at home.
3. More attention should be given to males, older patients, and those with heart or osteoarthritis problems to let them engage in suitable physical activities.
4. Additional review is required to determine the role of forms, incidences, powers, and times of physical activities in getting benefits to diabetic patients.
5. Further investigation of the impact of the intervention program to support physical activity should be done.
6. Further investigation of the impact of the intervention program to promote physical activity should be done.

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