

Assessment of Knowledge, Attitudes, and Practices of Type 2 Diabetes Patients about Physical Activity Attending in Primary Health Care Center in Makkah Al-Mokarramah in Saudi Arabia 2021

**Hanin Fayeze Alluhaybi¹, AbeerAqeel Mutwalli², HaninHakem Alsharif³,
NehalAbdulrahman Koshak⁴, AbduAzizMarshad ALalwani⁵, Abdullah Farag Al
juhani⁶, RamezSaad Allehyani⁷, SafiyaHilal ALHarbi⁸, HaneenJameel Rizq⁹, Ahmed
Mohamedsaleh Alzibali⁸, Hashemiah Salem Alabdulaziz⁸, HananOmar almandeel¹⁰,
EsraaSaleh Yankusari⁸**

¹Family medicine specialist, Khalidiya Health Center, Makkah, Saudi Arabia.

²Doctor of Pharmacy King Faisal Hospital, Makkah, Saudi Arabia.

³Medical physics, Environmental Health and Occupational Health Administration - Radiation Protection Program, Saudi Arabia.

⁴Nursing Specialist, Khalidiya Health Center, Makkah, Saudi Arabia.

⁵Physiotherapy technician, King Abdulaziz Hospital, Makkah, Saudi Arabia.

⁶Anesthesia technician, Hira Hospital, Makkah, Saudi Arabia.

⁷Hospital and health services specialist, King Abdulaziz Hospital, Makkah, Saudi Arabia.

⁸Nursing technician, King Abdulaziz Hospital, Makkah, Saudi Arabia.

⁹Specialist-clinical nutrition, King Abdulaziz Hospital, Makkah, Saudi Arabia.

¹⁰Physiotherapy technician, King Abdulaziz Hospital, Makkah, Saudi Arabia.

Abstract:

Background

In Saudi Arabia, the rise in the prevalence of type 2 diabetes mellitus started to gain attention years after rapid industrialization took place in the country . Saudi Arabia is among top ten countries of the world with the highest prevalence (23.9%), followed by Kuwait (23.1%) and Qatar (22.9%). Diabetes mellitus (DM) is a major metabolic disorder currently affecting over 350 million people worldwide. Also, another one billion people in the world are pre-diabetic, who may eventually end up with full- blown diabetes. Type 2 diabetes mellitus is fast becoming a global epidemic and the number of individuals with diabetes in the world is expected to reach 330 million by 2030. It is well demonstrated that physical activity is an effective non-pharmacological intervention to improve diabetes control and should be an integral component of the care strategy of diabetic patients. Obesity plays a central role in

morbidity and mortality of diseases of multiple organs and systems, and it is a major contributor to the growing incidence of type 2 diabetes. **Aim of the study:** To assess knowledge, attitude and practice of type 2 diabetes mellitus patients attending primary healthcare centers (PHCCs) in makkah al-mokarramah 2021 regarding physical activity. **Methods:** A cross-sectional study was conducted from primary health care center in makkah al-mokarramah 2021 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 (200) type 2 diabetic patients. The remaining socio-demographic characteristics are summarized in Males represent 66% of the participants. Majority were Saudi nationals (92.0%). Most of them Intermediate school were (35.0%). Regarding the Job majority Retired were (21.0%) regarding the Marital status were (66.0%) married. The income of 34.0% of the participated patients ranged between 5000 and 10000 SR/month. **Conclusion:** Knowledge about physical activity of type 2 diabetics is overall acceptable. Their attitude towards physical activity is encouraging. However, their physical activity practice is deficient.

Keywords: Knowledge, Attitudes, Practices, type 2 diabetes, physical activity, primary health care center, makkah al-mokarramah

Introduction

International Diabetes Federation stated that people with diabetes is expected to increase from 171 million in 2000 to 578 million in 2030 globally. In July 2020, the number of people with diabetes is calculated to be almost 463 million worldwide. (1) Saudi Arabia is considered to be one of the highest countries in the Middle East for the incidence of diabetes mellitus. Data are lacking regarding Knowledge about the Risk of Type 2 Diabetes among Adults with Visiting the Outpatient Clinics at PHC in makkah al-mokarramah at Saudi Arabia (2) Most diabetics had poor Knowledge about the Risk of Type 2 Diabetes among Adults (DM) assessing 120 DM Pakistani Patients (3)

Diabetes is a silent disease; many sufferers became aware that they have diabetes only when they develop one of its life-threatening risk. Knowledge of diabetes mellitus can assist in early detection of the disease and reduce the incidence of risk. This can be achieved by improving the knowledge about the Risk of Type 2 Diabetes among Adults (4). Diabetes mellitus (DM) is one of the fastest-growing health problems, which has reached epidemic

proportions in several countries. It is mainly due to the consequence of lifestyle, such as lack of exercise, unhealthy diet, obesity and overweight (5). If the prevalence of type 2 diabetes mellitus continues to increase at the current rate, the global burden of this disease will rise to reach 466 million patients in 2030 (6)

stated that patients who have diabetes usually take oral anti-hyperglycemic medications either to enhance insulin secretion from the pancreas or to improve insulin action in metabolically active tissues (7). While medications can acutely reduce average blood glucose levels and improve HbA1c, they do not stop metabolic dysfunction from progressing over time. Another strategy for controlling blood glucose levels is through increasing physical activity (8,9)

It has shown that improvements in fasting blood glucose levels, average 24-hour blood glucose level, as well as the post-prandial glycemic response after moderate-intensity exercise training (10,11). 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" (12)

Physical activity is considered one of the main preventive measures against many diseases which now correlated with an increasing prevalence on the global scale (13). On the other hand, physical inactivity is one of the main risk factors for non-communicable diseases around the world, thus representing a significant burden on health care (14)

The increasing prevalence of physical inactivity and poor diet are the major causes of worldwide epidemics of overweight and obesity and consequently type 2 diabetes. When the balance is disturbed, and energy intake is higher than its expenditure throughout a certain period, overweight and obesity develop (15). Physical activity is effective in reducing abdominal fatness and protects against the weight gain typical of middle age (16)

Physical activity might delay or prevent glucose intolerance turning into diabetes and produce significant improvements in blood sugar level (16). Moreover, physical activity is useful in the management of several diseases including type 2 diabetes (17). It is well demonstrated that physical activity is an effective non-pharmacological intervention to improve diabetes control. It should be an integral component of the care strategy. However, in clinical practice, many patients with known type 2 diabetes, do not achieve recommended levels of physical activity, i.e., at least 30 minutes of moderate physical activity five times a week (18)

Literature Review

The most of systematic review has shown that there is generally low Knowledge about the Risk of Type 2 Diabetes among Adults with Visiting the Outpatient Clinics at Tertiary Hospital also about the risk factors and its complications among the Saudi population in particular. Most diabetes mellitus patients had low to moderate knowledge scores in Riyadh, Jeddah, Al Hasa, Al-Khobar, and Mecca. Also unexpectedly, health professionals in Saudi Arabia also had low knowledge scores about diabetes mellitus especially type 2.(16,17)

In Tabuk City, Saudi Arabia, Al-Mountashiri et al. conducted a case-control study at the Diabetes Center among 100 patients with type 2 diabetes and 150 control subjects to assess their dietary habits, physical activity, and diabetes perception. Participants were interviewed to collect demographic data regarding, breakfast skipping, late dinner intake, and fruit, vegetables, sweet food, and fast food consumption. Diabetic patients' perception of their disease also assessed. Results: of the study showed that body mass index (BMI) ($p<0.001$), fast food consumption ($p<0.001$), fruit consumption ($p=0.004$), and breakfast skipping ($p<0.001$) were higher among patients with diabetes compared to controls. No significant differences observed regarding the level of exercise, smoking, late dinner intake and diabetes perception. A significant statistical difference found between poor and accepted control regarding sweet food intake ($p=0.046$) and exercise ($p=0.017$). They concluded that patients with type 2 diabetes had higher BMI, and were more likely to skip breakfast, consume less fast food and more fruits than control subjects. More physical activity and less sweet food consumption detected among patients with accepted glycemic control(19,20).

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 knowledge, attitudes, 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. In addition to KAP, we collected socio-demographic data that included gender, age, occupation, marital status, educational level, income, family history of diabetes, duration of diabetes and medications. The questionnaire translated into Arabic. Results of the study showed that 31% of patients had poor knowledge of diabetes, 72% had negative attitudes toward having the disease, and 57% had HbA1c levels reflecting poor glycemic control. Only 17% had adequate blood sugar control, while 10% admitted non-compliance with their medications. Knowledge, practice and attitude scores were all significantly positively associated, but none of these scores associated with HbA1c. They concluded that programs to increase patients' awareness about diabetes are essential for all diabetic's patients in the

United Arab Emirates to improve their understanding, compliance and management and, thereby, their ability to cope with the disease (12).

Rationale

Although more intense and longer durations of PA correlate directly with improved outcomes, even small amounts of PA provide protective health benefits. the authors focus on “healthy PA” with the emphasis on the pathophysiological effects of physical inactivity and PA on the cardiovascular 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, 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.

Aim of the study:

To assess knowledge, attitude and practice of type 2 diabetes mellitus patients attending primary healthcare centers (PHCCs) in makkah al-mokarramah 2021 regarding physical activity

Methodology:

Study design:

This study is descriptive cross-sectional study was conducted among **200** of the Type 2 diabetes among adults, has be applying a convenience sampling technique.

Study Area

The study has been carried out in the city of Makkah Al-MokarramahMakkah is the holiest spot on Earth. It is the birthplace of the Prophet Mohammad and the principal place of the pilgrims to perform Umrah and Hajj. It is located in the western area in Kingdom of Saudi Arabia and called the Holy Capital. Contains a population around 2 million. This study was conducted at a tertiary care hospital in Makkah, Saudi Arabia. During the April to June, 2021, participants were a tertiary care hospital in Makkah, and it reflects a diversified demographic profile with a considerable portion of the population comes from rural descent, while others come from an urban one. This difference translates into biological, socioeconomic and lifestyle differences in the Makkah population.

Study Population

The study has been conducted regarding the type 2 diabetes among patients about physical activity attending in primary health care center Makkah City, Saudi Arabia in 2021 During the April to June, 2021 the period of study in 2021.

Selection criteria:

Inclusion criteria

adult patients.

diagnosis of Type 2 diabetes.

attending in primary health care center.

Resident in Makkah province.

sound cognitive abilities

All nationalities

Both males and females.

Exclusion criteria :

Pediatric patients.

Patients with severe cognitive impairment such as dementia or delirium.

Patients unwilling to give written consent to participate.

Sample size

Type 2 diabetes among adults with attending in primary health care center Makkah City, Saudi Arabia in 2021. The sample size has been calculated by applying Raosoft sample size calculator based on (The margin of error: 5%, Confidence level: 95%, and the response distribution was considered to be 20%) accordingly the Sample size is (200) of the Type 2 diabetes among adults with attending in primary health care center Makkah City, Saudi Arabia in 2021 (male and female) after official communication with the Tertiary Hospital Makkah City, and adding 10 more to decrease margin of error. After adding 5% oversampling, the minimum calculated sample has been 200. Computer generated simple random sampling technique was used to select the study participants.

Sampling technique:

Systematic random sampling technique is adopted. After that, by using random number generator, then simple random sampling technique has been applied to select the participant. Also, convenience sampling technique will be utilized to select the participants in the study. By using systematic sampling random as dividing the total Adults by the required sample size; (200).

Data collection tool

The data was collected through a questionnaire that was developed by the researchers after reviewing the related literature. It was translated into simple Arabic language to suit the understanding level of the entire study subjects. Self-administrated questionnaire was used. The questionnaire contains four sections. First section: containing items related to demographic data as age, sex, marital status, and occupation. The second section comprising questions to assess the general information regarding diabetes mellitus and Knowledge about the **physical activity**. The third section consisted of questions to assess the habitual factors associated of the studied participated.

Data collection technique:

Researcher has been visiting the Outpatient Clinics at Tertiary Hospital Makkah City, Saudi Arabia in 2021 after getting the approval from the ministries of health . The researcher has been obtained permission from participants. After the arrival of the participants has been explained the purpose of the study to all participants attending .

Data entry and analysis:

The data were coded and introduced to the Statistical Package of Social Sciences (SPSS, version 24). The data were analyzed to present the findings in descriptive and inferential statistics. The descriptive statistics include frequencies and percentages for categorical variables, while means, median and standard deviations were used to summarize numerical data. The significant associations between demographic and background variables were detected at < 0.05 significance level.

Pilot study:

A pilot study has been conducted in the same sector due to the similarity to the target group using the same questionnaire to test the methodology of the study. As a feedback, the questionnaire has been clear and no defect has been detected in the methodology

Ethical considerations:

Permission from the Directorate of health , verbal consents from all participants in the questionnaire were obtained. All information was kept confidential, and results will be submitted to the department as feedback. The researcher described the aim and objectives of the study for the residents. No names were required to assure confidentiality of data, and all information was kept confidential only for this study's purposes.

Budget: Self-funded

Table 1: Socio-demographic characteristics of type 2 diabetic patients, primary healthcare centers, Makkah City, Saudi Arabia in 2021(n=200)

	N	%
Gender		
Male	132	66
Female	68	34
Nationality		
Saudi	184	92
Non-Saudi	16	8
Educational level		
Primary school/below	28	14
Intermediate school	70	35
High school	44	22
University	40	20
Postgraduate	18	9
Job		
Governmental employee	40	20
Private sector employee	22	11
Professional worker	12	6
House wife	32	16
	42	21
Student	20	10
Business/trading	18	9
Others	8	4
Not working	6	3
Marital status		
Single	38	19
Married	132	66
Divorced	24	12
Widowed	6	3
Monthly family income (SR)		
<5000	56	28

5000-10000	68	34
>10000	76	38

The study included (200) type 2 diabetic patients. The remaining socio-demographic characteristics are summarized in Males represent 66% of the participants. Majority were Saudi nationals (92.0%). Most of them Intermediate school were (35.0%). Regarding the Job majority Retired were (21.0%) regarding the Marital status were (66.0%) married. The income of 34.0% of the participated patients ranged between 5000 and 10000 SR/month.

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

knowledge	Correct answer	
	No.	%
Diabetic patient should have physical exercise session of continuous 30 minutes per time. (√)	195	91
Diabetic patient should practice physical activity most days of the week. (√)	184	88
Practicing physical activity provides health benefits. (√)	197	78.5
Patients with type 2 diabetes should be physically active at least 5 days a week. (√)	158	72
Patients with type 2 diabetes should avoid exercising in the evening. (√)	99	60
Regular exercise or being physically active helps to control your diabetes. (√)	178	72
Patients with type 2 diabetes should have resistance training that involves all major muscles groups. (√)	147	61
Resistance training can improve insulin resistance and increase insulin sensitivity. (√)	101	55
Greater health benefits can be achieved by increasing the amount (duration, frequency, or intensity) of physical activity. (√)	146	73
Performing physical activities only on weekend is enough to achieve health benefits. (X)	154	79
Performing vigorous physical activities for 3 hours once a week is	165	71

enough to experience health benefits. (X)		
Which of following physical activities do you believe will provide health benefits?		
Aerobics class (√)	173	89
Biking (√)	103	37
Prayer (X)	80	42
Household cleaning (√)	76	67
Jogging / running (√)	103	68
Preparing meals (X)	164	43
Swimming (√)	136	61
Weightlifting (√)	65	65

Table 3 show the **Knowledge about physical activity**

responses of the type 2 diabetic patients to knowledge statements about physical activity. Majority of them knew correctly that practicing physical activity provides health benefits (87.5%), diabetic patient should have physical exercise session of continuous 30 minutes per time (91.0%) and diabetic patient should practice physical activity most days of the week (88.0%). However, less than half of them could recognize that patients with type 2 diabetes should avoid exercising in the evening (60.0%) and resistance training can improve insulin resistance and increase insulin sensitivity (61.3%). Regarding the types of physical activities, most of the participants believed that aerobics class (89.0%) and swimming (61%) provide health benefits and most of them (73.5% knew that preparing meals does not provide health benefits. Only 65.0% could recognize that weightlifting provide health benefits.

Table 3: Attitude of the participants towards statements concerning physical activity

Items		Attitude			% of agreement	Chi-square	
		Agree	Disagree	I don't know		X ²	P-value
Physical activity helps to relieve anxiety and stress.	N	160	22	18	89.67	196.12	<0.001*
	%	80	11	9			

Physical activity is beneficial for the human body.	N	164	24	12	90.00	214.24	<0.001*
	%	82	12	6			
Regular vigorous exercise is necessary for good health.	N	120	26	54	82.33	69.88	<0.001*
	%	60	13	27			
Participation in physical recreation is satisfying and enriching use of leisure time	N	158	24	18	89.00	243.162	<0.001*
	%	79	12	9			
Associating with others in physical activity is fun.	N	162	16	22	91.00	204.76	<0.001*
	%	81	8	11			

Attitude towards physical activity

From Table 5, it is realized that majority of type 2 diabetic patients Agreed that physical activity helps to relieve anxiety and stress and it is beneficial for the human body (80.0%). Also majority of them agreed that associating with others in physical activity is fun (81.0%) and participation in physical recreation is satisfying and enriching use of leisure time (79.60%), the respectively χ^2 (196.12, 243.162 and 204.76) and all items a significant relation between statements concerning physical activity and Attitude were P-value =0.001

Table 4 Distribution of the knowledge and attitude physical activity score among the participants

		Data		Chi-square	
		N	%	X²	P-value
Knowledge	Weak	56	28	3.64	0.162
	Average	78	39		
	High	66	33		
Attitude	Negative	38	19	75.645	<0.001*
	Positive	162	81		

Regarding the knowledge participant toward physical activity the majority of the participant knowledge average were (39.0%) X^2 3.64 and no significant relation were the P-value=0.001. Regarding attitude of the participant toward physical activity the majority of the participant Positive were (81.0%) X^2 75.645 and a significant relation were the P-value=0.001.

Figure (1) Distribution of the knowledge physical activity score among the participants

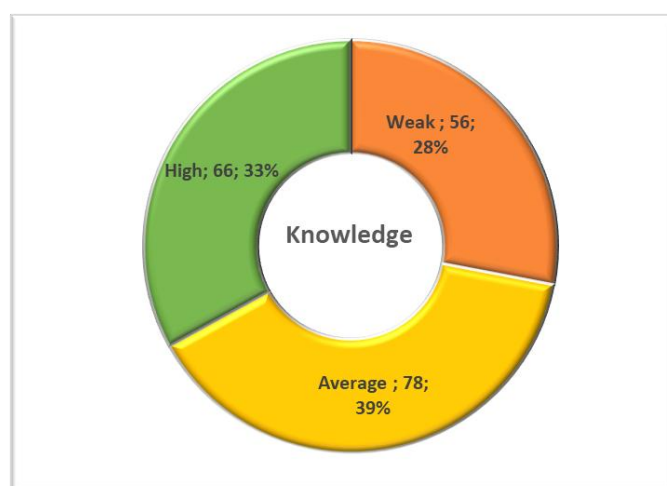


Figure (2) Distribution of the attitude physical activity score among the participants

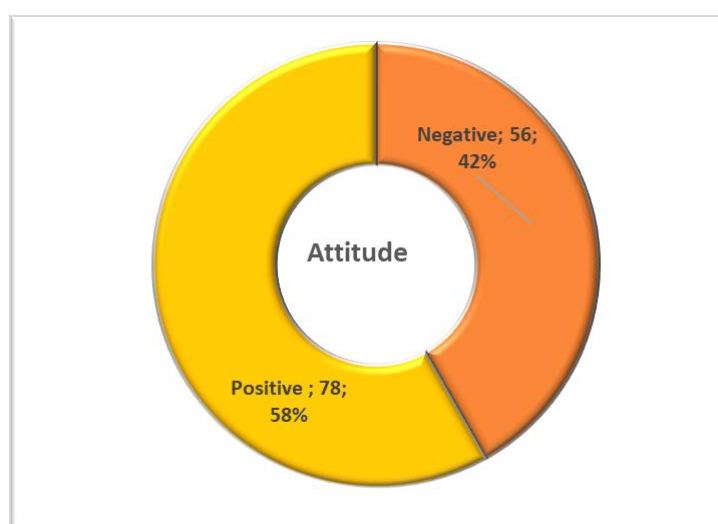


Table 5 Distribution the relation between knowledge and Socio-demographic characteristics of the activity participants

	Knowledge						Chi-square	
	Weak		Average		High		X^2	P-value
	N	%	N	%	N	%		

Gender	Male	132	23	41.07	51	65.38	58	87.88	29.600	<0.001*
	Female	68	33	58.93	27	34.62	8	12.12		
Nationality	Saudi	184	50	89.29	70	89.74	64	96.97	3.315	0.191
	Non-Saudi	16	6	10.71	8	10.26	2	3.03		
Educational level	Primary school/below	28	15	26.79	10	12.82	3	4.55	60.458	<0.001*
	Intermediate school	70	23	41.07	36	46.15	11	16.67		
	High school	44	11	19.64	22	28.21	11	16.67		
	University	40	5	8.93	6	7.69	29	43.94		
	Postgraduate	18	2	3.57	4	5.13	12	18.18		
Job	Governmental employee	40	18	32.14	11	14.10	11	16.67	46.716	<0.001*
	Private sector employee	22	9	16.07	6	7.69	7	10.61		
	Professional worker	12	7	12.50	3	3.85	2	3.03		
	House wife	32	11	19.64	8	10.26	13	19.70		
	Retired	42	10	17.86	17	21.79	15	22.73		
	Student	20		0.00	15	19.23	5	7.58		
	Business/trading	18	1	1.79	11	14.10	6	9.09		
	Others	8		0.00	6	7.69	2	3.03		
	Not working	6	0	0.00	1	1.28	5	7.58		
Marital status	Single	38	22	39.29	6	7.69	10	15.15	30.494	<0.001*
	Married	132	30	53.57	58	74.36	44	66.67		
	Divorced	24	1	1.79	11	14.10	12	18.18		
	Widowed	6	3	5.36	3	3.85	0	0.00		

Regarding gender show a significant relation between knowledge and gender were X^2 and 29.600 P-value=0.001 increase in male the high (87.88%) while female majority in weak (58.93%). Regarding Nationality show no significant relation between knowledge and Nationality were X^2 3.315 and P-value=0.191. Regarding Level of education there is a significant relation between knowledge and Level of education were X^2 and 60.458 P-value=

0.082, increase (Intermediate school in weak were 41.07%), Regarding Job is a significant relation between knowledge and Job were $X^2=46.716$ and $P\text{-value}=0.001$. Regarding Marital there is a significant relation between knowledge and Marital were $X^2=30.494$ and $P\text{-value}=0.001$, (increase in the average).

Table 6 Distribution the relation between Attitude and Socio-demographic characteristics of the activity participants

			Attitude				Chi-square	
			Negative		Positive		X^2	P-value
			N	%	N	%		
Gender	Male	132	12	31.58	120	74.07	24.770	0.000
	Female	68	26	68.42	42	25.93		
Nationality	Saudi	184	30	78.95	154	95.06	10.860	0.001
	Non-Saudi	16	8	21.05	8	4.94		
Education level	Primary school/below	28	10	26.32	18	11.11	11.234	0.024
	Intermediate school	70	15	39.47	55	33.95		
	High school	44	9	23.68	35	21.60		
	University	40	2	5.26	38	23.46		
	Postgraduate	18	2	5.26	16	9.88		
Job	Governmental employee	40	16	42.11	24	14.81	28.764	0.000
	Private sector employee	22	8	21.05	14	8.64		
	Professional worker	12	3	7.89	9	5.56		
	House wife	32	4	10.53	28	17.28		
	Retired	42	1	2.63	41	25.31		
	Student	20	1	2.63	19	11.73		
	Business/tradin	18	2	5.26	16	9.88		

	g							
	Others	8	1	2.63	7	4.32		
	Not working	6	2	5.26	4	2.47		
Marital status	Single	38	12	31.58	26	16.05	46.94 5	0.000
	Married	132	9	23.68	123	75.93		
	Divorced	24	15	39.47	9	5.56		
	Widowed	6	2	5.26	4	2.47		

Regarding the relation between Attitude and Socio-demographic characteristics of the activity participants show all item a significant relation between Attitude and Socio-demographic respectively were X^2 24.770, ,10.860 , 28.764, 46.945 and P-value=0.001 regarding Level of education were X^2 11.234 no significant relation were P-value= 0.024.

Discussion

The role of practicing physical activities on regular basis in 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 (22)

The importance of early recognition of the modifiable risk factors for diabetes mellitus such as physical inactivity is very essential in primary prevention (23). Despite of that, relatively few studies have been conducted in Saudi Arabia to attending primary healthcare centers (PHCCs) in makkah al-mokarramah regarding physical activity .

In the current study, majority of the type 2 diabetic patients were not between weak and average knowledgeable regarding the health benefits, duration and frequency of physical activities. However, they were less knowledgeable regarding the fact that they should avoid exercising in the evening as well as regarding benefits of resistance training in improve insulin resistance and increase insulin sensitivity. In a similar study carried out earlier in China (24), 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 of patients could identify aerobics class and swimming, however only 24.2% of them could recognize that weightlifting provide health benefits. In China, little knowledge has been reported regarding physical activities that are associated with improved

health (25). Therefore, further studies are recommended to explore the role of types, frequencies, intensities, and durations of physical exercise to get benefits to diabetic patients. In the present study, professional workers and those with higher income had the highest physical activity knowledge score. Other studies observed a significant role of patients' educational level on the physical activity knowledge (26, 27)

In the present study, attitude of the type 2 diabetic patients towards physical activity is encouraging as majority of them agreed that physical activity helps to relieve anxiety and stress and it is beneficial for the human body, associating with others in physical activity is fun and participation in physical recreation is satisfying and enriching use of leisure 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 (28)

In the current study, attitude of the Saudi type 2 diabetic patients towards physical activity was higher than that of non-Saudi patients. Further study could be needed to explain this finding. In the current study, using the General Practice Physical Activity Questionnaire, moderately active patients represent of the type 2 diabetic patients whereas active and inactive patients weak (%) , respectively. Recently in Saudi Arabia, (29) reported that 38.4%.of type 2 diabetic patients were physically inactive (29). In Lebanon, nearly 10% of type 2 diabetic patients were physically active (28). In Oman, diabetic patients had good practice regarding DM except for adherence to regular exercise (30). In India, 74% of diabetic patients reported regular physical activity (29). In South Africa, approximately 41% of diabetic patients reported practicing physical exercise while 15% did not believe in physical activity (30). In the USA, NHANES III study included 1,480 adults with type 2 diabetes revealed that 31% of patients reported no regular physical activity and another 38% reported less than suggested levels of physical activity (21). However, in Senegal, 81% of diabetic patients were physically active (30). Difference in rate of physical activity between various studied could be explained by using different tools in assessing physical activity as well as variation in demographics of the participants.

Conclusion

Knowledge about physical activity of type 2 diabetics registered at primary healthcare centers in makkah al-mokarramah is overall acceptable. The presence of multidisciplinary intensive education programmers targeting type 2 DM patients, might be help for the higher levels of knowledge among our study population. Thus, increasing the efforts towards the education of

patients will improve the Knowledge about the Risk of Type 2 Diabetes among Adults, including risk knowledge. 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 improve insulin resistance and increase insulin sensitivity. On the other hand, the attitude of the type 2 diabetic patients towards physical activity is encouraging. Regarding physical activity practice, most of them were moderately active whereas a relatively small proportion was active.

References

1. Al-Rubeaan, K., Bawazeer, N., Al Farsi, Y., Youssef, A. M., Al-Yahya, A. A., AlQumaidi, H., ... & Al Rumaih, F. I. (2018). Prevalence of metabolic syndrome in Saudi Arabia-a cross sectional study. *BMC endocrine disorders*, 18(1), 1-9.
2. Afaya, R. A., Bam, V., Azongo, T. B., Afaya, A., Kusi-Amponsah, A., Ajusiyyine, J. M., & Abdul Hamid, T. (2020). Medication adherence and self-care behaviours among patients with type 2 diabetes mellitus in Ghana. *PloS one*, 15(8), e0237710.
3. Abedin, T., Al Mamun, M., Lasker, M. A., Ahmed, S. W., Shommu, N., Rumana, N., & Turin, T. C. (2017). Social media as a platform for information about diabetes foot care: a study of Facebook groups. *Canadian Journal of Diabetes*, 41(1), 97-101
4. Mandal, A. (2020). *Foot Care Knowledge and Practices and the Prevalence of Diabetic foot related complications among People with Diabetes Attending a Tertiary Care Hospital in Southern India: Foot Care Knowledge in Diabetes (FCKD) study* (Doctoral dissertation, Christian Medical College, Vellore).
5. Centers for Disease Control and Prevention. (2017). National diabetes statistics report, 2017 Atlanta. GA: *Centers for Disease Control and Prevention, US Dept of Health and Human Services*.
6. Abdurahman, A. A., Chaka, E. E., Nedjat, S., Dorosty, A. R., & Majdzadeh, R. (2019). The association of household food insecurity with the risk of type 2 diabetes mellitus in adults: a systematic review and meta-analysis. *European journal of nutrition*, 58(4), 1341-1350.
7. Seif-Farshad, M., Bazmi, S., Amiri, F., Fattahi, F., & Kiani, M. (2016). Knowledge of medical professionalism in medical students and physicians at Shahid Beheshti University of Medical Sciences and affiliated hospitals—Iran. *Medicine*, 95(45).
8. Household Health Survey 2018. Available online: (accessed on 15 May 2020).

9. Garg, S. K., Rewers, A. H., & Akturk, H. K. (2018). Ever-increasing insulin-requiring patients globally. *Diabetes technology & therapeutics*, 20(S2), S2-1.
10. Magliano, D. J., Sacre, J. W., Harding, J. L., Gregg, E. W., Zimmet, P. Z., & Shaw, J. E. (2020). Young-onset type 2 diabetes mellitus—Implications for morbidity and mortality. *Nature Reviews Endocrinology*, 16(6), 321-331.
11. Al Otaibi, H. F., Al Otaibi, A. F., Anbatawi, S. N., Hussain, S. M., Bashir, A. S., & Shareef, M. A. A. (2020). Knowledge, Attitude, And Practice of Type-2 Diabetic Patients About Physical Activity at Primary Health Care Centers.
12. Fletcher, G. F., Landolfo, C., Niebauer, J., Ozemek, C., Arena, R., & Lavie, C. J. (2018). Promoting physical activity and exercise: JACC health promotion series. *Journal of the American College of Cardiology*, 72(14), 1622-1639.
13. Saklayen, M. G. (2018). The global epidemic of the metabolic syndrome. *Current hypertension reports*, 20(2), 1-8.
14. Anderson, E., & Durstine, J. L. (2019). Physical activity, exercise, and chronic diseases: A brief review. *Sports Medicine and Health Science*, 1(1), 3-10.
15. Kivipelto, M., Mangialasche, F., & Ngandu, T. (2018). Lifestyle interventions to prevent cognitive impairment, dementia and Alzheimer disease. *Nature Reviews Neurology*, 14(11), 653-666.
16. Alanazi, F. K., Alotaibi, J. S., Paliadelis, P., Alqarawi, N., Alsharari, A., & Albagawi, B. (2018). Knowledge and awareness of diabetes mellitus and its risk factors in Saudi Arabia. *Saudi medical journal*, 39(10), 981.
17. Jalal, S. A. M., Alamri, R. I. A., & Albarakati, M. S. H. (2021). Diabetes Mellitus Knowledge and Awareness among Diabetic Secondary School Students at Makkah in Saudi Arabia 2021. *Annals of the Romanian Society for Cell Biology*, 25(7), 115-137
18. Ozemek, C., Laddu, D. R., Lavie, C. J., Claeys, H., Kaminsky, L. A., Ross, R., ... & Blair, S. N. (2018). An update on the role of cardiorespiratory fitness, structured exercise and lifestyle physical activity in preventing cardiovascular disease and health risk. *Progress in cardiovascular diseases*, 61(5-6), 484-490.
19. Al-Mountashiri, N. A., Al-Zhrani, A. M., Ibrahim, S. F. H., & Mirghani, H. O. (2017). Dietary habits, physical activity and diabetes perception among patients with type 2 diabetes mellitus in Tabuk City, Saudi Arabia. *Electronic Physician*, 9(9), 5179.
20. Gillani, A. H., Amirul Islam, F. M., Hayat, K., Atif, N., Yang, C., Chang, J., ... & Fang, Y. (2018). Knowledge, attitudes and practices regarding diabetes in the general

- population: A cross-sectional study from Pakistan. *International journal of environmental research and public health*, 15(9), 1906.
21. Gazzaz, Z. J. (2020). Knowledge, attitudes, and practices regarding diabetes mellitus among university students in Jeddah, Saudi Arabia. *Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy*, 13, 5071.
 22. Kerrison, G., Gillis, R. B., Jiwani, S. I., Alzahrani, Q., Kok, S., Harding, S. E., ... & Adams, G. G. (2017). The effectiveness of lifestyle adaptation for the prevention of prediabetes in adults: a systematic review. *Journal of diabetes research*, 2017.
 23. Kiren, J., Priya, V. V., & Gayathri, R. (2017). Awareness of balanced diet among diabetic patients: A survey. *Journal of Pharmaceutical Sciences and Research*, 9(2), 245.
 24. Sai-ChuenHui S, Pui-SzeHui G, Yao JieXie YJ. Association between physical activity knowledge and levels of physical activity in Chinese adults with type 2 Diabetes. *PLoS One*. 2014; 9(12): e
 25. Djiby S, Demba D, Assane NM, Mané DI, Mahecor D, Marie KC, et al. The Knowledge, Attitudes and Practices of Diabetics on Physical Activity at the Marc Sankale Center of Dakar. *Open Journal of Internal Medicine* 2018; 8:33-41. [1https://doi.org/10.4236/ojim.2018.81005](https://doi.org/10.4236/ojim.2018.81005)
 26. Shilubane H, Netshikweta L, Ralineba T. Beliefs and practices of diabetes patients in Vhembe District of Limpopo Province. *African Journal of Primary Health Care & Family Medicine* 2016; 8:949-55
 27. Alzahrani AM, BinSadiqAlbakri SB, Alqutub TT, Alghamdi AA, Rio AA. Physical activity level and its barriers among patients with type 2 diabetes mellitus attending primary healthcare centers in Saudi Arabia. *J Family Med Prim Care*. 2019 Aug; 8(8): 2671–2675.
 28. . Sibai AM, Costanian C, Tohme R, Assaad S, Hwalla N. Physical activity in adults with and without diabetes: From the ‘high-risk’ approach to the ‘population-based’ approach of prevention. *BMC Public Health*. 2013;13:1002.
 29. . Rathod GB, Rathod S, Parmar P. Study of knowledge, attitude and practice of General Population of Waghodia towards Diabetes Mellitus. *International Journal of Current Research and Review* 2014;6: 63-68.
 30. Shilubane H, Netshikweta L, Ralineba T. Beliefs and practices of diabetes patients in Vhembe District of Limpopo Province. *African Journal of Primary Health Care & Family Medicine* 2016; 8:949-55

