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Original Article

The knowledge, attitude and practice among diabetic patient in central region of Saudi Arabia

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ABSTRACT

Background: Diabetes mellitus is a common chronic disease with increasing prevalence world wide; it leads to devastating human, social and economic impact.
Aims: this study were to determine the level of diabetes-related knowledge, attitude, and practice among adult diabetic patients in central region and finding correlation between knowledge, attitude and practice regarding diabetes.
Method: A descriptive study was conducted on 300 diabetic patients on internet using Monkey Survey from 7th to 24th April 2015. A questionnaire was filled out. SPSS version 22 was used for data analysis. Descriptive statistics were comprising percentages, and frequency in order to describe knowledge, attitude, and practice. Correlations between main outcomes variables were calculated by means of Pearson product-moment correlation coefficient (r) that measures the linear relationship between two variables. P-value ≤ 0.05 were regarded as statistically significant.
Results: In the studied sample, 47% were age more than 45 years. About 71.4% of cases were females. The level of knowledge and attitude had 'good' in 73.6%, and 87.7% respectively but level of practice had poor in 45% of patients. There were good correlations between knowledge, attitude and practice. Significant positive linear correlation between knowledge and attitude ($r = 0.503$, $P < 0.001$), knowledge and practice ($r = 0.337$, $P < 0.001$), and statistically significant linear correlation between attitude and practice ($r = 0.235$, $P < 0.001$).
Conclusions: The overall knowledge and attitude were good, while diabetes-related practice were poor. However results indicate that an increase in knowledge will increase attitude, and practice. A better educational program on diabetes should be conducted to improve patients' attitude, and practice towards diabetes.

1. Introduction

Diabetes mellitus (DM) is a chronic metabolic disorder of multiple etiologies characterized by chronic hyperglycemia with disturbance of carbohydrate, fat and protein metabolism resulting from insulin deficiency, resistance or both [1].

DM is one of the top ten diseases which cause death [2]. Diabetes killed 1.6 million people in 2016, up from less than 1 million in 2000. Deaths due to dementias more than doubled between 2000 and 2016, making it the 5th leading cause of global deaths in 2016 compared to 14th in 2000 [2]. The total number of diabetics is predictable to go up from 285 million in 2010 to 438 million in 2030, while in developing countries the prevalence is expected to double between 2000 and 2030 [3].

Diabetes mellitus is a disease affecting nearly 10% of the global population above age 20 years of age. Type 2 DM is the most prevalent form of diabetes. It accounts for about 90%–95% of all DM cases and particularly affects overweight individual usually over 40 years of age [4]. Although a disease of a dults, type 2 DM is now being diagnosed more frequently in children and adolescents [4].

In the Kingdom of Saudi Arabia (KSA), diabetes became an increasing health burden too. It seems that Saudis have an inherited trait for type 2 diabetes, especially with increased incidence of obesity, consanguinity marriages, and insulin resistance

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susceptibility. In addition, the sedentary life style changes adopted during the last four decades associated with the oil bonanza, accentuated the situation leading the KSA to become the third country in the world regarding diabetes prevalence for the year 2010 on the IDF list. According to the most recent study in the KSA, diabetes prevalence is 14.1% out of the total population for all age groups with 28% prevalence in the age group over 30 years (Saudi [5].

Diabetes and its associated complications have become a public health problem of considerable magnitude. Cardiovascular disease causes most of the excess morbidity and mortality in diabetes mellitus. Adults with diabetes are at a 2- to 4-fold increased risk of cardiovascular events relative to those without diabetes [6]. Cardiovascular disease accounts for up to 80% of premature excess mortality in diabetic patients [7].

Many studies conducted elsewhere in the world have shown that the knowledge and awareness about the disease can have positive influence on attitude and practices of patients that could lead to better management of diabetes and eventually good quality of life [8–11]. However, a knowledge, attitude and practice gap exists in type 2 diabetes mellitus management that does not allow patients and healthcare professionals to implement life style changes that could reduce the morbidity and mortality associatedwith diabetes [12].

It is recognized that living normally with diabetes requires knowledge and experience built up over time. The education on self-care in people with diabetes is an essential part of their management as it has been proved through studies that receiving education will build skills on self care among diabetics, and good control of diabetes cannot be assured unless the requirement for education is met [13].

Lack of satisfactory patient education about diabetes and allied health subjects leads to accumulation of unanswered questions, fear, mistrust and resentment. It has been demonstrated that receiving education is effective for improving clinical outcomes and quality of life among diabetic patients [14] There is no single best education program or approach; however, programs incorporating behavioral and psychosocial strategies demonstrate improved outcomes. Ongoing support and periodic reassessments are critical to sustain progress madeby patients after receiving education [15].

Knowledge, Attitude, and Practice (KAP) study measures the knowledge, attitude and practice of patients. It serves as an educational diagnosis. There is evidence that people having diabetes often have inadequate knowledge about its nature, risk factors, associated complications, and this lack of awareness may be the underlying factor affecting attitudes and practices towards diabetes self-care [16]. KAP studies are effective in providing baseline for intervention programs; it has also been demonstrated to reveal aspects of education that need to be reinforced and support in the future development of programs and techniques for effective health education. Lack of understanding of patients' characteristics and diabetes-related knowledge, practiceand attitude will lead to high probability of improper guidance and defective education program. Diabetes-related KAP studies define patient's characteristics and factors affecting patient's level of diabetes-related knowledge, attitude and practice.

The main objective of this study is to evaluate level of KAP among diabetic patients in Central region of Saudi Arabia and finding correlation between knowledge, attitude and practice regarding diabetes.

2. Material and methods

This is a descriptive study. It's a questionnaire-based cross sectional analysis. Data were collected from a sample of 300 patients, who answered questionnaire online by using Survey Monkey website from 7th to 20th April 2015. The patients selected were diabetic patients, aged over 18 years, and Saudi national from central region (Riyadh and Qassim (. The exclusion criteria for this study included patients who were non-Saudi and outside central region.

2.1. Study instrument

Data collection tool was a structured questionnaire, which was designed by making use of other published studies based on extensive literature review [17] and adding questions that were considered of value based on local diabetes related attitude and practice. The questionnaire was prepared in English but prior to use in the study, was translated from its original English version to Arabic. Web based survey was carried out by collection of data through self-administer electronic set of questions through a survey Monkey web link.

The first part of the questionnaire included questions regarding patients' demographic characteristics as region area, gender, age, education, smoking history. It also included questions regarding patients'medical backgrounds as duration of having diabetes, type of diabetic disease, type of diabetic medication used, source of health information about diabetes and information was provided during educations programs.

The second part of the questionnaire was KAP specific questionnaire. It consisted of 24 questions: twelve knowledge-related questions covering various aspects of DM as causes, blood glucose level, symptoms and signs, complications, method to check and control of blood glucose level, symptoms and causes of hypoglycemia, and regular examinations and few other questions. There were six diabetes-related attitudes, various questions on effect of exercise on diabetes, and insulin storage and effect of smoking on diabetes. Seven diabetes related practice questions included following diet, exercise, and frequency of forgetting medication, missing dose, management of hypoglycemia and attending an education program about diabetes in a year.

Each knowledge, attitude and practice question was scored as one (1) for a correct answer and as zero (0) for an incorrect answer.

Two categories were defined on the bases of the score obtained by each participant:

Good knowledge: when patients respond greater than or equal to eight, the mean score of knowledge questions.

Poor knowledge: when patients respond less than eight the mean score of knowledge questions.

Good attitude: when patients respond to greater than or equal to four, the mean score of attitude questions.

Poor attitude: when patients respond less than four, the mean score of attitude questions.

Good practice: when patients respond to greater than or equal to five, the mean score of practice questions. Poor practice: when patients respond less than five, the mean score of practice questions.

2.2. Data collection

After validation of the questionnaire by a group of experts, the questionnaire was filled by diabetic patients using Survey Monkey website on diabetic patients on central region of Saudi Arabia.

2.3. Statistical analysis

The data of this study was analyzed by using Statistical Package for Social Science (SPSS) version 22.0 software program. First, data

were entered to Monkeys readsheet and coded then transferred to SPSS for analysis.

Standard methods were used to obtain descriptive statistics comprising means, percentages to describe demographic variables, knowledge, attitude, and practice. Correlations between main outcomes variables were calculated by means of Pearson product-moment correlation coefficient (r) that measures the linear relationship between two variables. P-value of 0.05 and less were regarded as statistically significant.

3. Results

3.1. Demographic characteristic

Table (1) shows the socio-demographic characteristics of the participants in this study in which among 300 participants who were answered questionnaires from central region. 215 (71.67%) were female and 85 (28.33%) were male diabetics, 81 (27%) were aged between 18 and 24, 55 (15%) were aged between 25 and 34, and 139 (47.8%) patients more than 45 years. Concerning the education level, 156 (52%) were higher level of education and 23 (7.67%) were non-educated, 266 (88.7%) patients were non-smoker. 101 (33.7%) patients had DM for a duration longer than 10 years. 98 (32.7%) patients had type I diabetes.

Majorty of patients were on oral diabetic tablets only 120 (40%), on insulin only 97 (32.33%), while others were on antidiabetic tablets plus insulin 37 (12.33%) or diet only 46 (15.33%

Table 1
Socio-demographic characteristics and medical background of diabetic patients (n = 300).

Variables	n (%)
Region	
Riyadh	165 (55%)
Qassim	135 (45%)
Gender	
Male	85 (28.33)
Female	215 (71.67)
Age (years)	
18–24 years	81 (27)
25–34 years	45 (15)
35–44years	35 (11.67)
45–55 years	72 (24.5)
> 55 years	67 (22.33)
Level of education	
Non-education	23 (7.67)
Primary school	39 (13)
Preparatory school	23 (8)
Secondary school	58 (19.33)
Higher level of education	156 (52)
Smoking History	
Current smoker	15 (5)
Previous smoker	19 (6.33)
Never smoked	266 (88.67)
Diabetes duration (years)	
Don't know	56 (18.67)
Less than 2 years	33 (11)
2–5 years	54 (18)
6–10 years	56 (18.67)
More than 10 years	101 (33.67)
Type of diabetes	
Type 1	98 (32.67)
Type 2	84 (28)
Don't know	118 (39.33)
Type of medication used	
Tablet	120 (40)
Insulin	97 (32.33)
Tablet and insulin	37 (12.33)
On diet	46 (15.33)

3.2. Source of health information about diabetes and health care professional provide information

Most of patients 187 (62.33) received information from internet and most of information was provided in the education program about diet medication and self-test, and monitoring (see Table (2)).

3.3. Knowledge on basic aspects of diabetes mellitus

Table (3) shows knowledge on basic aspects of diabetes among patients. More than half of cases 155 (51.67%) considered heredity, life style, and food high in sugar as cause of diabetes. 243 (81%) of participants knew frequent urination, increase hunger and delayed wound healing a symptom of diabetes. Diet, regular exercise and medication adherence were reported by 267 (89%) of study subjects as control of blood glucose level.

Regarding complications of diabetes, majority 246 (82%) of study participants knew the diabetes complication such eye, kidney, foot and heart problems if left untreated, but 34 (11.33%) of patients did not know the complications of diabetes.

Table (4) shows participants' answer regarding the definitions of diabetes, and normal level of blood glucose; 250 (83.33%), 195 (65%) correctly answered those two questions, respectively. The correct responses on testing glucose level using blood sample were 221 (73.67%). Majority 267 (89%) of cases correctly answered questions regarding recommended controlled blood glucose level included diet, regular exercise and medications adherence.

3.4. Diabetes-related attitude, and practice

Majority of respondents, 270 (90%), knew that food rich in sugar is carbohydrate. Fatigue, sweating and blurred vision consider as symptoms of hypoglycemia by 231 (77%) of participants while only 82 (27.3%) of participants correctly answered cause of hypoglycemia caused by all of them (high insulin dose, they did not eating for

Table 2
Source of health information about diabetes& Health care professional provide information.

Variable	n (%)
Source of health information about diabetes	
Tv/radio	91 (30.3)
Internet	187 (62.3)
Book	78 (26)
Magazine/newspaper	47 (15.7)
Family/friend	137 (45.7)
Health professional	132 (44)
Health care professional provide information	
No	17 (5.5)
Physician	211 (70.3)
Pharmacist	6 (2)
Nurse	11 (3.7)
Physician, pharmacist and nurse	15 (5)
Physician and pharmacist	40 (13.3)
Information was provided in the education program about exercise performance	
Yes	87 (29)
No	213 (71)
Information was provided in the education program about diet	
Yes	94 (31.33)
No	206 (68.67)
Information was provided in the education program about medication	
Yes	93 (31)
No	207 (69)
Information was provided in the education program about self test and monitoring	
Yes	94 (31.33)
No	206 (68.67)

Table 3
Frequency distribution of knowledge on basicaspects of diabetes among participants (N = 300).

Variables	n (%)
Causes of diabetes	
Heredity	55 (18.33)
Life style	30 (10)
Food high in sugar	10 (3.33)
All the above	155 (51.67)
Symptoms of diabetes	
Frequent urination	37 (12.33)
Increased hunger	3 (1)
Delayed wound healing	3 (1)
All the above	243 (81)
Don't know	14 (4.67)
Control of blood glucose level	
Diet	9 (3)
Regular exercise	2 (0.67)
Medication adherence	16 (5.33)
All the above	267 (89)
Don't know	6 (2)
Complication of diabetes	
Eye problem	5 (1.67)
Kidney problem	10 (3.33)
Foot problem	1 (0.33)
Heart problem	4 (1.33)
All the above	246 (82)
Don't know	34 (11.33)

Table 4
Frequency distribution of patients by various questions relatedto knowledge on diabetes (N = 300).

Variables	Correct answers n (%)
What is diabetes?	250 (83.33)
What is the normal level of blood glucose?	195 (65)
What is the most accurate method to check blood glucose level?	221 (73.67)
How could you control blood glucose level?	267 (89)
What is the food rich in sugar?	270 (90)
What are the symptoms of hypoglycemia?	231 (77)
What are the causesof hypoglycemia?	82 (27.3)
What are the examination that should be done regularly?	251 (83.67)
If a hypertension concurrently with diabetes will increase risk of?	168 (56)

long time and they doing heavy exercise).and 251 (83.67) aware about the regular examination of eye, teeth and fee, More than half 168 (56%) were knew about the complication like heart attack, stroke, eye and kidney problems when hypertension concurrently with diabetes.

3.4.1. Attitude of diabetic patient

Table (5) shows diabetes-related attitude among the participants. Majorityof participants 262 (87.33%) thought the insulin should be stored in a refrigerator. Only 5 (1.67%) didn't think the exercise benefit diabetic patients and smoking affected negatively on diabetes were reported by 202 (67.3%) of respondents.

Table 5
Frequency distribution of diabetes-related attitude among participants (n = 300).

Variable	Corrected answers n (%)
Effect of exercise on diabetesisto stay healthy	229 (76.33)
Effect of exercise on diabetesisto prevent diabetes complication	200 (66.67)
Effect of exercise on diabetesisto lose weight	140 (46.67)
Do you think the exercise benefit diabetic patients?	5 (1.67)
Insulin should be stored?	262 (87.33)
Effect of smoking on diabetes?	202 (67.3)
Effect negatively on blood glucose level	

3.4.2. Practice of diabetic patients

Table (6) shows one hundred fifty five (51.67%) of the participants did not follow good diet for diabetes. Majority 207 (70%) of the respondents did not followed exercise.

The majority 240 (80%) stated they rarely or never forgot their medication when they asked about frequency of forgetting medicationand 170 (56.67%) stated they took the medication when they forgot and for management of hypoglycemia 253 (84.33%) ate a source of sugar to counteract hypoglycemia. More than half 198 (66%) of study subject never attended any educational program about diabetes while only 23 (7.67%) attended three times in a year.

3.5. Level of diabetes-related knowledge, attitude, and practice among participants

Table (7) shows the frequency distribution of participants diabetes related knowledge, attitude, practice and beliefs level, where 221 (73.6%) of cases had good knowledge scores while majority of the cases, 236 (87.7%), had good attitude scores and more than half of cases 165 (55%)had poor practice scores.

3.6. Correlations between knowledge, attitude, practice and beliefs

Table (8) shows that there were significant positive linear correlation between knowledge and attitude ($r = 0.503$, $P < 0.001$), knowledge and practice ($r = 0.337$, $P < 0.001$), and statistically significant linear correlation between attitude and practice ($r = 0.235$, $P < 0.001$).

Table 6
Frequency distribution of diabetes-related practice among participants (N = 300).

Variable	n (%)
Following diet	
Yes	145 (48.33)
No	155 (51.67)
How many do you exercise weekly	
Less than 3 h weekly	79 (26.33)
About 3 h weekly	47 (15.67)
More than 3 h weekly	46 (15.33)
I don't exercise	128 (42.67)
Frequency of forgetting medication	
Almost (more than 2 times/week)	32 (10.67)
Sometimes (once every 2 week)	28 (9.33)
Rarly	115 (38.33)
Never	125 (41.67)
If a dose missed	
Take it now	170 (56.67)
Wait and take double with next dose	9 (3)
Wait and take the next dose	63 (21)
Do not take any dose	8 (2.67)
I don't know	50 (16.67)
Management of hypoglycemia	
Eating sugar source	253 (84.33)
Avoid using medication	1 (0.33)
Additional insulin dose	2 (0.67)
Visiting a physician	24 (8)
I don't know	20 (6.67)
How many times you attending an education program about diabetes in a year	
Never	198 (66)
Once	57 (19)
Twice	22 (7.33)
three times or More	23 (7.67)

Table 7
Distribution of participants according to the level of diabetes relatedknowledge, attitude, and practice.

Variable	n (%)
Knowledge	
Good[a](8–12)	221 (73.6)
Poor[b](0–7)	79 (26.3)
Attitude	
Good[a] (4–6)	236 (87.7)
Poor[b] (0–3)	64 (21.3)
Practice	
Good[a] (5–7)	135 (45)
Poor[b] (0–4)	165 (|55)

[a] Good: > 66.6% of the maximum possible scores.
[b] Poor: <66.6% of maximum possible scores.

Table 8
Correlation between knowledge, attitude and practice.

Variables	Pearson Correlation coefficient (r)	P value
Knowledge and attitude	0.503	<0.001
Knowledge and practice	0.337	<0.001
Attitude and practice	0.235	<0.001

4. Discussion

4.1. Knowledge on various aspect of diabetes

Diabetes mellitus is a major public health problem in Saudi Arabia, causing significant morbidity and mortality. The World Health Organization (WHO) has reported that Saudi Arabia ranks the second highest in the Middle East, and is seventh in the world for the rate of diabetes [18]. A local cross sectional study by Alqurashi et al., [19] stated that 30% of Saudi population are diabetic where the men are higher percent (34.1) than female.

It is well established that patient education and patient involvement can lead to better control over this disease [20,21]. American Diabetes Association (ADA) has also stressed upon the importance of clinical care, self care practices, patient education in the management and prevention of chronic complications of such a community health problem [22].

In this study, questions were asked to cover various basic aspects of diabetes. Fifty one percent of patients knew that heredity, life style and food high in sugar could be etiological factors for diabetes. These results were near to those reported in a study done by Hashmi et al. [23],

Very high percentages of cases 81% gave correct answer concerning symptoms and signs of diabetes: frequent urination, increased hunger, and delayed wound healing, whereas in a study doneby Upadhyay et al. [11], only 37.9% reported the correct answers. It could be explained by higher percentage of educated participants.

Majority ofthe patients 89% have regarded diet, regular exercise and medications adherence as an important measure to control blood glucose level. Studies conducted in Malaysia and United Arab Emirates [24,25] showed that participants had better knowledge regarding those questions about exercise, while a study done by Ref. [23] showed only 9% of cases knew that weight reduction is an important control measure.

Regarding the complications majority 82% of cases were aware that diabetes could lead to complications such as eye, kidney, foot and heart problems higher than (73.4%), (65.1) and (60%) reported by studies done by (Al Bimani et al., 2013 and [26] respectively.

More than 83% of cases, were aware of what is meant by diabetes, and the number was higher as compared with [27,28] where 74.1% and 46.63% respectively of the cases gave the correct answer. Normal level of blood glucose was answered correctly by 65% of study participant which was higher than (57.5%) study done by Al Bimani et al. (2013).

In this study 73.67% reported blood test as an accurate method for blood glucose testing. This finding was lower than the study conducted by Al Bimani et al. [9], which was (81.1%).

Great majority of cases 89% were aware of the recommended target fasting plasma glucose for diabetics which is of great importance in self monitoring. It was higher than study done by Ghada El-Khawaga [29] where only one third of the participants knew the normal fasting blood glucose level and in another study two-third of participants Gulabani et al., [30]. This lack of understanding of plasma glucose levels leads to a poor prognosis in terms of complications [31] and point to over dependence on physician and lack of empowerment of patients.

About 77% of patients in current study knew signs and symptoms of hypoglycemia and only 27% of patients gave corrects answer about causes hypoglycemia. It is higher than in study done by Ghada El-Khawaga [29] where only 48.1% of them were aware about symptoms of hypoglycemia and about one quarter of them were knowledgeable about causes of hypoglycemia. This could be due to the variation in sample size and methods between two studies.

More than half of the cases 56% were aware of importance of regular blood pressure checking and know that high blood pressure could worsen diabetic complications. This result is higher than study conducted by Upadhyay et al. [11], that reported only 28% of patients knew increase blood pressure worsen diabetic complications.This lack of knowledge regarding hypertension and itsconsequences among diabetics should be alarming since diabetes can be managed well with adequate patient involvement.

The current study revealed that 85% of studied patients were knowledgeable about management of diabetes, whereas 40% knew orally taken tablets and 32.3% knew insulin and 12.3 knew orally taken tablets with insulin.This agreed with study by Solomon et al. [32], only knew about insulin but 71.3% knew orally taken tablets.

4.2. Diabetes-related attitude and practice among the studied sample

Majority of patients in our study had positive attitude toward exercise which was relatively high if compared to a study in Egypt [33]. This could be explained by sampling variability.

In this study more than 87% of patients stored insulin appriopriatly. It is higher than in study in Ethiopia done by Abyot& Fitsum (2014). This is a very worrisome situation as it will affect the proper treatment of the patients if the medication is not stored properly. Appropriate storage was also shown to be different between patients of different education levels.

In the current study 67% of the cases said that effect of smoking negatively on blood glucose level. This result was far more than the result reported in Malaysia (Ambigapathyet al.,2003) where only 1% of participants mentioned the correct answer.These differences in various studies may be due to variations in the studied cases, the education they had received and the availability of information on diabetes.

Cigarette smoking is associated with poor control of blood glucose level and strongly casually related to hypertension and heart diseases in people with diabetes by Ref. [34] in Our study 67.67% of the study participants were aware by the negative effect of smoking on diabetes.

Regarding the practice less than half percentage of participants were following modified diet and thirty percent performing exercise in this study. Similar finding was noticed by (Al Bimani et al.,

2013) where 38.7% of participants were doing exercise but more than half percentage 56.6% of the participants were following planned diet. A study conducted by Ref. [11] showed that higher proportion of cases followed modified diet and carried out exercise regularly, although those proportions were not as high as the desired level [31].

A majority of the participants in this study knew that exercise is beneficial for diabetes and the figure was higher than that reported in a Nigerian study [35] (76.1% vs. 52.1%), but lower than the 92.6% reported among Pakistani diabetics [36]. However, the number of participants who exercised regularly in this study was higher than those reported by Tham et al. (47.3% vs. 40%) and Okolie et al. (47.3% vs. 7.3%).

These results would probably portray that knowledge may not necessarily lead to good practice or performance; because even though they knew the benefits of exercise many of them did not participate in regular exercises. This may however be due to a number of factors that can either be modifiable (self efficacy and time managment) or non-modifiable (age, sex, and race)

About 80% are not often forgetting medication and more than half said they take it immediately if they a dose missed.This finding was higher than study done by (Al Bimani et al., 2013) in Oman were 60.4% of the participants were not forgetting their medication. This may be due to the education programs that were offered in central region. A study done in geatric reported that only 40.1% forgetting their medication [37].

Regarding management of hypoglycemia more than 84% knew eating sugar source to management of hypoglycemia. This finding was higher than that reported in studies done by Refs. [9,16] were 76.9%, 60.4% renew taking sugar for hypoglycemia respectively.

4.3. Levels of diabetes-related knowledge, attitude, and practice scores among participants and correlation between knowledge, attitude and practice

More than 70% of the cases had good knowledge scores, whereas about 87% of subjects had good attitude, practice score which is quite unsatisfactory. The prevalence of knowledge was approximated same as study done by Saadia et al. [10], in Saudi which was 77% but higher compared to studies done in Pakistan (60%) [38] This difference might be due to less devoted time with the patients by physicians, lack of organized diabetic education facilities and less participation of media.

One hundred thirty five (45%) participants had good practice regarding diabetes. This finding was lower compared to study conducted in Saudi [10]. This difference may be due to lack of health care access, poor patient attendance at health clinics. Another explanation might be physician's barriers like constrain of time and facilities and focus on acute rather than preventive care and competing care demands [34].

In spite of this result, there were significant correlations between knowledge scores and attitude and practice scores, since higher knowledge scores were associated with higher attitude and practice scores.

In this study the main sources of information was health professional (90%) which include physicians, pharmacists and nurses. This study was supported by study in Pakistan and Saudi which reported that health professionals was the main source of information in 78% and 68% of participants [10,38].

Significant positive correlation between patient's scores of knowledge and attitude was reported ($r = 0.5$ and $p < 0.01$). About similar finding was detected by al-Maskari et al.., [39]. On the other hand, statistically significant linear correlation between knowledge and practice ($r = 0.337$, $P < 0.001$) but different about the same study al-Maskari et al.., [39], revealed a negative weak significant correlation between patients' knowledge and practice ($r = -0.45$ and $p < 0.01$). The results indicate that an increase in knowledge may approve attitude, and practice.

5. Conclusions

Majortity of patients have good knowledge and attitude scores, but less than good practice scores. Good knowledge level is associated with better attitudes and practice and good attitude level is associated with practice. A better structured educational program on diabetes should be conducted to improve patients' attitude, and practice towards diabetes.

5.1. Limitation of the study

Lack of blood glucose parameters or HbA1c values did not allow the study to discover the effect of knowledge, attitudes, and practice on diabetes control. This study was done using monkey Survey online sample and does not represent diabetics patients in clinics.

5.2. Strength of the study

The study covered various aspects of patient's knowledge, attitude and practice on diabetes. The questionnaires were done in one region so the risk of observer bias is minimized.

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