Knowledge of complications of Type 2 diabetes mellitus among patients visiting the Diabetes Centers in the Western Region of KSA

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Abstract

Background: To reduce morbidity and mortality, awareness regarding diabetes and its complications is necessary. This study aimed to assess the level of knowledge regarding complications of diabetes mellitus among patients with type 2 diabetes in the Western Region of KSA.

Methods: A cross-sectional study was conducted recruiting patients with diabetes from the Diabetes Centers at Prince Mansoor Military Hospital in Taif and Al-Noor, Hera hospital in Makkah. Overall, 571 patients with diabetes were enrolled in this study. The interviewer filled out a pretested questionnaire with face-to-face interviews. Levels of knowledge were determined by calculating the scores.

Results: (n=570) agreed to be included in the study. We found that over seventy-six percent of the participants were knowledgeable about diabetes complications, as conveyed by their treating physician. Although knowledge about hyperglycemia symptoms was quite good among our participants, their knowledge about hypoglycemia symptoms was less impressive. Knowledge about diabetes complications was affected positively by a range of factors, including living in Taif, college education, and family history of diabetes.

Discussion: We confirmed, in this work, that knowledge about diabetes complications is suboptimum, superficial, and lacking among Saudi patients.

Recommendations: Knowledge about diabetes complications remains suboptimum among Saudi individuals. Makkah city needs to be targeted by effective educational interventions to help improve its residents' knowledge level about diabetes complications. Educational interventions should focus on systematic complications of diabetes, particularly highlighting how diabetes causes cerebrovascular accidents and neurological problems. Future research should be longitudinal and attempt to assess the link between better knowledge of diabetes complications and their preventability.

Key words: Knowledge, diabetes complications, risk factors, Saudi Arabia.

Introduction

Diabetes mellitus (DM) appears to be a global epidemic and an increasingly significant non-communicable disease threatening both affluent and non-affluent societies (Obirikorang et al., 2016).

Diabetes is one of the major causes of early illness and death worldwide. Type 2 diabetes affects approximately 13 percent of the United States population, and the worldwide prevalence is estimated at 9.3 percent in adults, equivalent to 463 million people (Centers for Disease Control and Prevention. 2020; Yuen et al., 2019). Type 2 diabetes accounts for over 90 percent of patients with diabetes (Yuen et al., 2019).

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. It is estimated that around 7 million of the population are diabetic, and almost 3 million have pre-diabetes. Even more worrying, perhaps, is the increasing pattern of diabetes noted in Saudi Arabia in the recent past. In fact, diabetes has approximately registered a ten-fold increase in the past three decades in Saudi Arabia.

Diabetes mellitus (DM) has been found to be related to high mortality, morbidity, and vascular complications, accompanied by poor general health and lower quality of life. In Saudi Arabia, DM is quickly reaching disturbing proportions and becoming a significant cause of medical complications and even death (Abdulaziz Al Dawish et al., 2016).

Most diabetics had poor knowledge of their disease and are unaware of its complications in a study about knowledge and awareness in patients about type 2 diabetes mellitus (DM) assessing 120 DM Pakistani Patients (Habib& Aslam., 2003). Several studies confirmed a low level of awareness among diabetic patients regarding long-term and short-term complications such as ischemic heart disease and stroke (O'Sullivan et al., 2009; Murugesan et al., 2007).

They also supported that many sufferers become aware that they have diabetes only when they develop one of its life-threatening complications. Based on this issue, healthcare professionals, as well as public policymakers, must be well aware of the public health impact of diabetes. Much effort has been devoted to educating the public about diabetes through various forms of media. Therefore, this study aimed to assess the level of knowledge regarding complications of diabetes mellitus and associated factors among type 2 diabetic patients and determine their needs to provide adequate care for patients.

Secondary objectives:

1. To estimate the level of overall knowledge in Makkah and Taif regions about diabetes complications.
2. To estimate the level of knowledge in the Makkah region about macro and microvascular complications of diabetes.
3. To estimate the frequencies of different sources of knowledge about diabetes complications.
4. To estimate the level of knowledge about hypoglycemic and hyperglycemic symptoms.
5. To estimate the impact of background sociodemographic and clinical factors on knowledge level about diabetes complications.

Material and Methods

Materials:

Study design: a cross-sectional study was utilized to conduct the study.

Setting: The study was conducted in Diabetes Centers at (Prince Mansoor Military Hospital (PMMH) in Taif) and (Al-Noor, Hera hospital in Makkah).

Study subjects: all adult diabetes patients attending Diabetic Centre clinics in Taif and Makkah region from February to April 2021.

Inclusion criteria:

1. adult patients.
2. diagnosis of diabetes.
3. attending Diabetic Centre.
4. Resident in Makkah province.
5. literate with sound cognitive abilities.

Exclusion criteria:

1. Pediatric patients.
2. Patients with severe cognitive impairment such as dementia or delirium.
3. Patients unwilling to give written consent to participate.

Tools: The data was collected through an interview questionnaire that was developed by the researchers after reviewing the related literature (Sabri et al., 2007; Mohieldein et al., 2011). It was translated into simple Arabic language to suit the understanding level of the entire study subjects. 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 complications such as heart diseases and stroke. The third section consisted of questions to assess the knowledge of complications of diabetes mellitus that result from hyperglycemia. The fourth section added questions to assess the knowledge about hypoglycemia complications.

Method:

- Approval to carry out the study was obtained from the responsible authorities after explaining the purpose of the study and the date and time of data collection.
- The study tool was developed by the researchers after a thorough review of relevant literature (Sabri et al., 2007; Mohieldein et al., 2011) and translated into the Arabic language.

• The study tool was tested for content validity by five (5) experts in the field of the study. Their opinions were elicited regarding the format, layout, consistency, accuracy, and relevancy of the tool.
• The study tool was tested for reliability using Cronbach's coefficient alpha reliability method. The reliability result was = 0.881.
• The pilot study was carried out on 25 participants in order to test the clarity and applicability of the constructed tool and who were excluded from the study. The pilot study also served to estimate the time needed for each subject to fill in the questionnaire.
• A simple random sampling scheme was adopted when choosing participants for the current study. The sampling frame was constructed using data of all diabetic patients attending specialist diabetes clinics. Random tables were used to identify whether a particular parent would be included in the study. All included patients were approached by a member of the research team and invited to participate.
• Data was collected by the researcher by interviewing each patient to clarify the questions. Each interview lasted from 15-30 minutes.
• Data collection started from the mid of Feb to April 2021.

Statistical analysis: The data were coded and introduced to the Statistical Package of Social Sciences (SPSS, version 22). 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.
Ethical considerations: The researcher described the aim and objectives of the study for the residents and asked them to provide written consent. No names were required to assure confidentiality of data, and all information was kept confidential only for this study's purposes.

Results

The total number of participants who agreed to participate in the survey was (n = 570). For a detailed account of demographic results, see Table 1.

Among those who agreed to participate, there were (n = 252, 44.2%) men and (n = 318, 55.8%) women, most of whom had a family history of DM (n = 385, 67.5%), with more than 10 years duration of Diabetes Mellitus (n= 282, 49.5%).

The mean age for the participating individuals was 59.8 years (SD = 13.9 years). The age variable ranged between 18 and 95 years. The median age was 60 years old.

As per Table 2, the majority (n = 436, 76.5%) of the participants reported being told by their doctors about potential DM complications, compared to (n = 134, 23.5%) who did not. Information given by diabetologists was the most frequent source of diabetes complications knowledge as indicated by (n = 187, 32.8%), followed by family physicians (n = 147, 25.8%). Social media played a tiny part as a knowledge source about diabetes complications (n = 42, 7.4%), followed by books and papers (n = 14, 2.5%).

This table revealed that the majority of study participants have general knowledge about complications of DM, complications due to hyperglycemia, and complications due to hypoglycemia.

The most heard of complications were poor wound healing (n = 552, 96.8%), amputation (n = 531, 93.2%), and vision loss (n = 529, 92.8%). The least heard of complications were heart disease (n = 444, 77.9%) and stroke (n = 391, 68.6%).

Knowledge about hyperglycaemia symptoms was quite good, (n = 537, 94.2%) identifying increased urination frequency and (n = 398, 69.8%) recognized weight loss as important symptoms.

The knowledge of the symptoms of hypoglycemia was less impressive. Loss of consciousness was recognized by (n = 450, 78.9%) and dizziness by (n = 509, 89.3%).
Table 3 gives a comprehensive display of the effect on knowledge about diabetes complications for participants' sociodemographic and clinical factors.

Living in Taif was associated with better knowledge about diabetes complications than living in Makkah (OR = 1.88, p = 0.011). See Figure 1. Also, older age was linked to better knowledge about diabetes complications among the participants (OR = 1.025, p = 0.033). See Figure 2.

Additionally, sub-college education was associated with worse knowledge about diabetes complications among our participants. For illiterate individuals it was (OR = 0.150, p < 0.001), for primary school graduates (OR = 0.234, p < 0.0001), and for high school graduates (OR = 0.255, p < 0.001). See Figure 3.

In terms of employment, we found retired individuals lacking considerably in their knowledge about diabetes (OR = 0.324, p = 0.004) compared to employed individuals. See Figure 4.

Individuals with a family history of diabetes were far more knowledgeable than individuals without. OR = 1.726, p = 0.016). See Figure 5.

Table 1: Baseline demographics of the study participants

Factor	Count (n)/ mean	Percentage /SD
Age	59.8 years	13.9 years
Gender		
Male	252	44.2%
Female	318	55.8%
Nationality		
Saudi	548	96.1%
Yemeni	22	3.9%
Residence		
Makkah	307	53.9%
Taif	263	46.1%
Education		
University	117	20.5%
High School	97	17%
Illiterate	182	31.9%
Intermediate	70	12.3%
Primary	104	18.2%
Occupation		
Employee	91	16%
Freelancer	11	1.9%
Retired	180	31.6%
Unemployed	285	50%
Marital Status		
Divorced	34	6.0%
Married	443	77.7%
Widowed	69	12.1%
Single	24	4.2%
DM Family History	385	67.5%
DM Duration		
Under one year	11	1.9%
one-five years	147	25.8%
six to ten years	130	22.8%
Over ten years	282	49.5%

Table 2: Description of the knowledge level about diabetes complications among the study participants.

Knowledge about DM Complications	Count	Percentage
Told by doctor	436	76.5%
Source of information		
Books and papers	14	2.5%
Diabetologist	187	32.8%
Family physicians	147	25.8%
Other doctors	28	4.9%
Relatives	63	11.1%
Social media	42	7.4%
Stroke	391	68.6%
Heart disease	444	77.9%
Vision loss	529	92.8%
Renal disease	510	89.5%
Peripheral neuropathy	477	83.7%
Amputation	531	93.2%
Poor wound healing	552	96.8%
Dental problems	474	83.2%
Sexual impairment	220	38.6%
Symptomatology of hyperglycaemia		
Increased thirst	522	91.6%
Increased urination	537	94.2%
Blurred vision	510	89.5%
Fatigue	525	92.1%
Weight loss	398	69.8%
Symptoms of hypoglycaemia		
Palpitations	471	82.6%
Tremors	504	88.4%
Sweating	495	86.8%
Dizziness	509	89.3%
Hunger	500	87.7%
Loss of consciousness	450	78.9%

Table 3: Adjusted impact of sociodemographic variables on the knowledge level of diabetes complications among the study participants.

	Estimate	OR	95% CI	P value
Town: Taif	0.631	1.880	1.159 to 3.049	0.0105861 *
Age in Years	0.024	1.025	1.002 to 1.048	0.0327235 *
Sex: Male	-0.089	0.915	0.399 to 2.096	0.8333408
Marital Status: Married	0.800	2.226	0.932 to 5.320	0.0717068
Marital Status: Single	1.486	4.418	0.915 to 21.324	0.0643310
Marital Status: Widow	0.267	1.306	0.494 to 3.452	0.5897613
Nationality: Saudi	0.873	2.393	0.875 to 6.547	0.0892335
Education: High School	-1.368	0.255	0.113 to 0.573	0.0009388 ***
Education: Illiterate	-1.899	0.150	0.061 to 0.367	3.318e-05 ***
Education: Intermediate	-1.059	0.347	0.141 to 0.856	0.0215741 *
Education: Primary	-1.453	0.234	0.102 to 0.538	0.0006226 ***
Employment: Freelancer	0.173	1.189	0.206 to 6.865	0.8469494
Employment: Retired	-1.126	0.324	0.150 to 0.700	0.0041515 **
Employment: Student	12.442	$2.5*10^5$	0.000 to Infinity	0.9799176
Employment: Unemployed	-0.026	0.974	0.382 to 2.485	0.9561145
Family History	0.546	1.726	1.105 to 2.695	0.0163606 *
DM Duration: Over ten years	0.901	2.461	0.602 to 10.064	0.2100728
DM Duration: one to five	0.122	1.129	0.278 to 4.590	0.8649839
DM Duration: six to ten	0.573	1.774	0.422 to 7.460	0.4343107

Figure 1: Town Effect on knowledge about diabetes complications

Figure 1 shows that living in Taif was associated with better knowledge about diabetes complications than living in Makkah (OR = 1.88, p = 0.011).

Figure 2: Age Effect on knowledge about diabetes complications

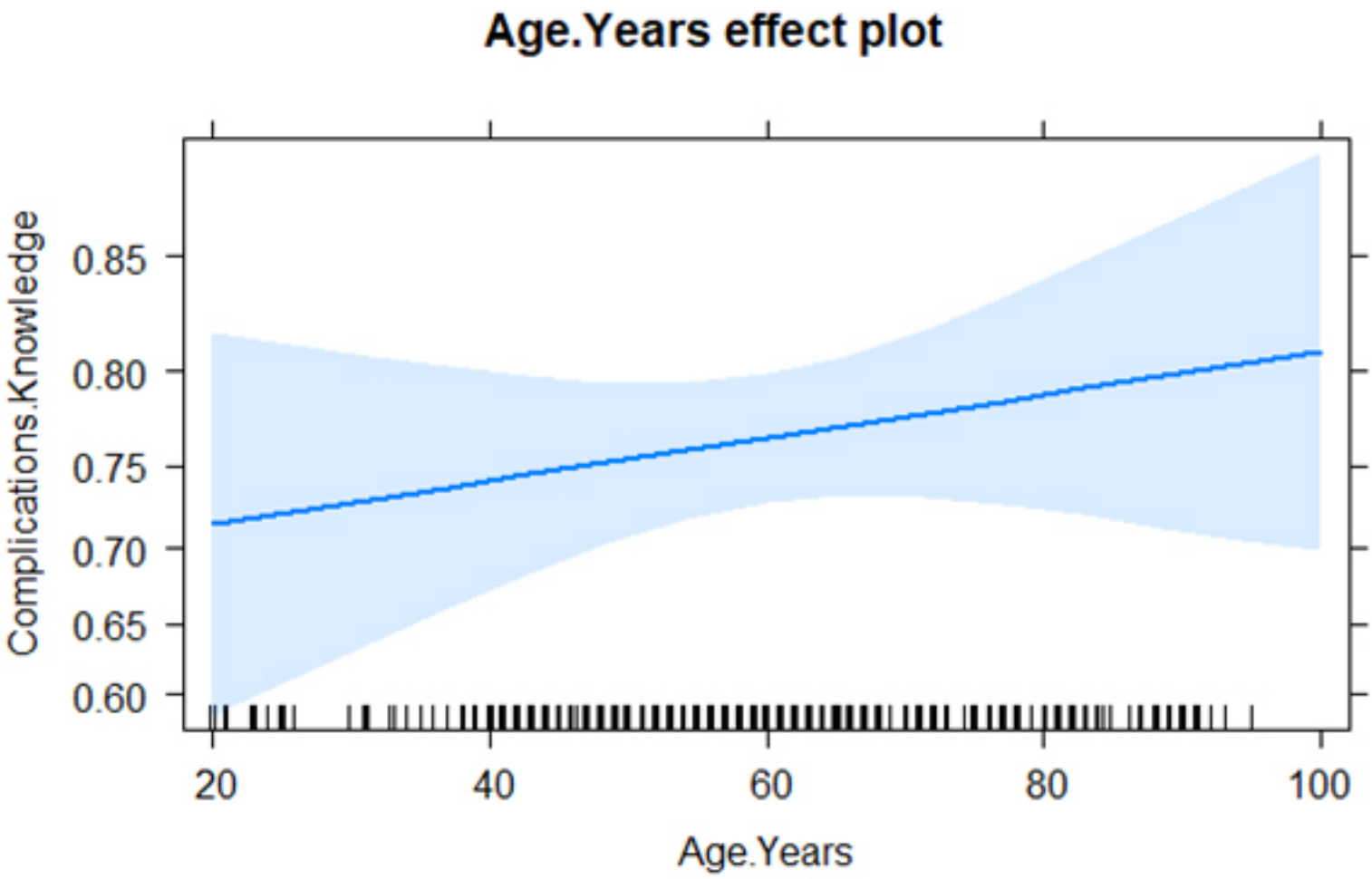

Figure 2 indicates that older age was linked to better knowledge about diabetes complications among the participants (OR = 1.025, p = 0.033).

Figure 3: Education Effect on knowledge about diabetes complications

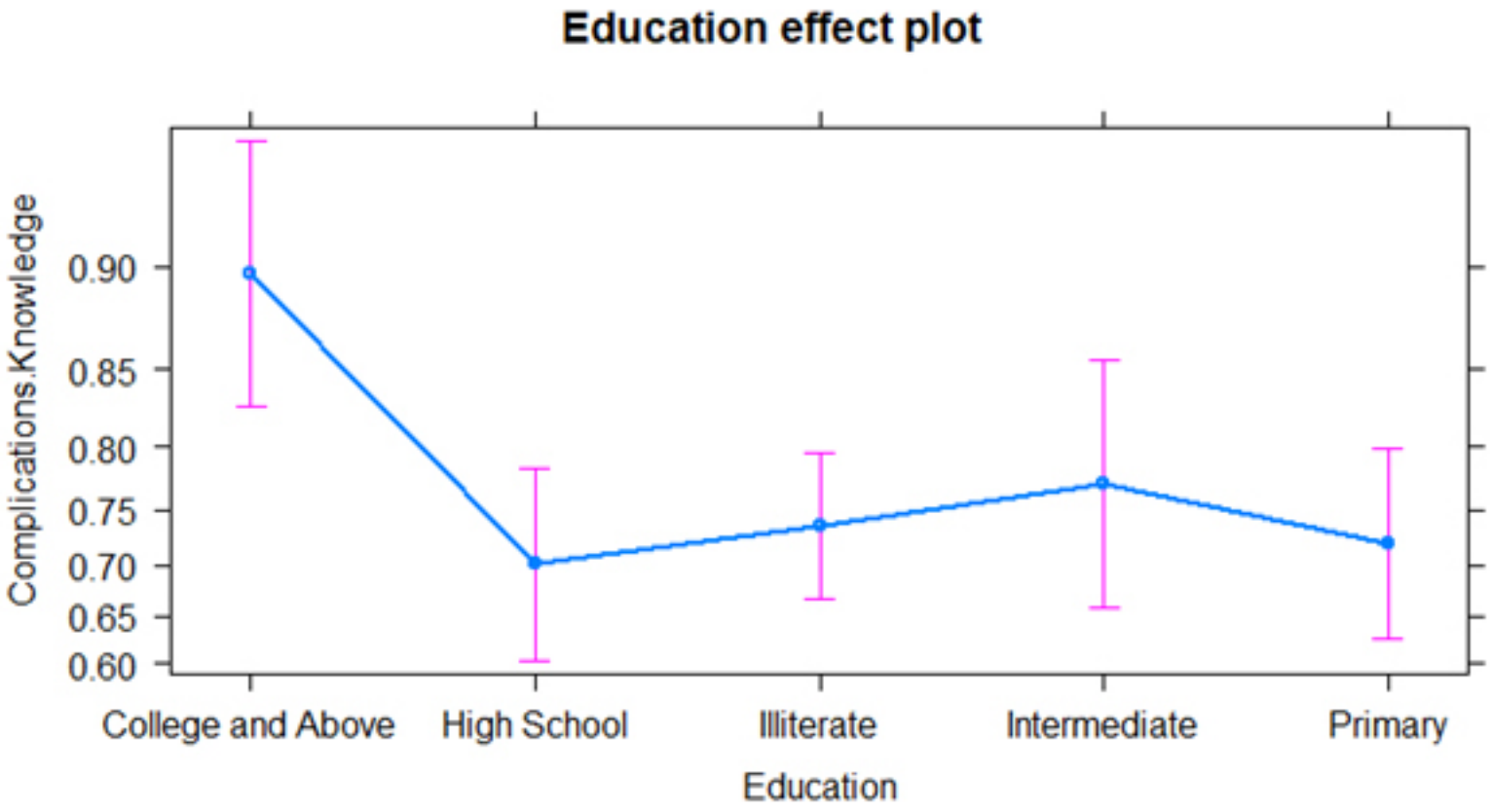

Figure 3 displays that sub-college education was associated with worsening knowledge about diabetes complications among our participants. For illiterate individuals (OR = 0.150, $p < 0.001$), for primary school graduates (OR = 0.234, $p < 0.0001$), and for high school graduates it was (OR = 0.255, $p < 0.001$).

Figure 4: Employment effect on knowledge about diabetes complications

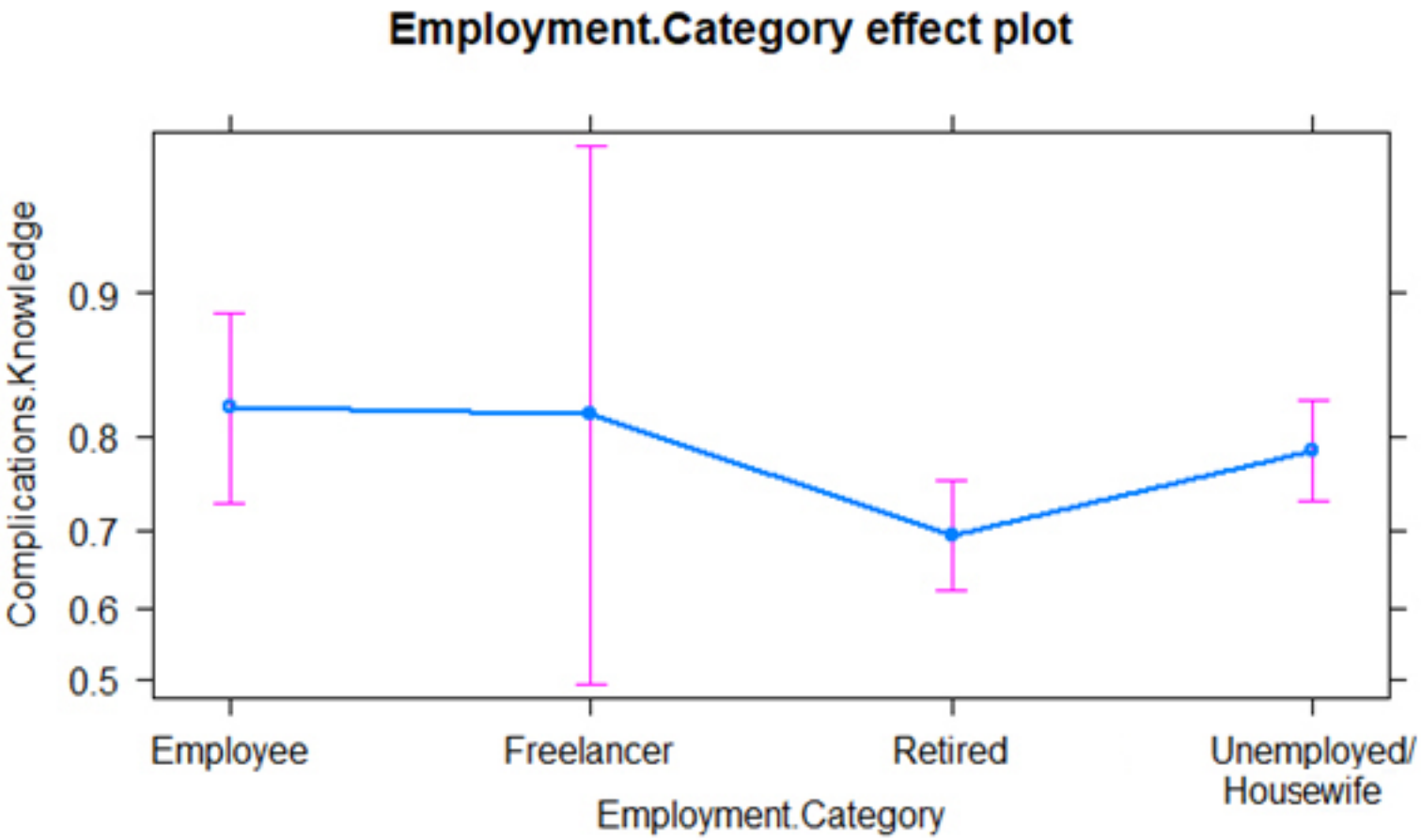

Figure 4. In terms of employment, we found retired individuals lacking considerably in their knowledge about diabetes (OR = 0.324, p = 0.004) compared to employed individuals.

Figure 5. Family history effect on knowledge about diabetes complications

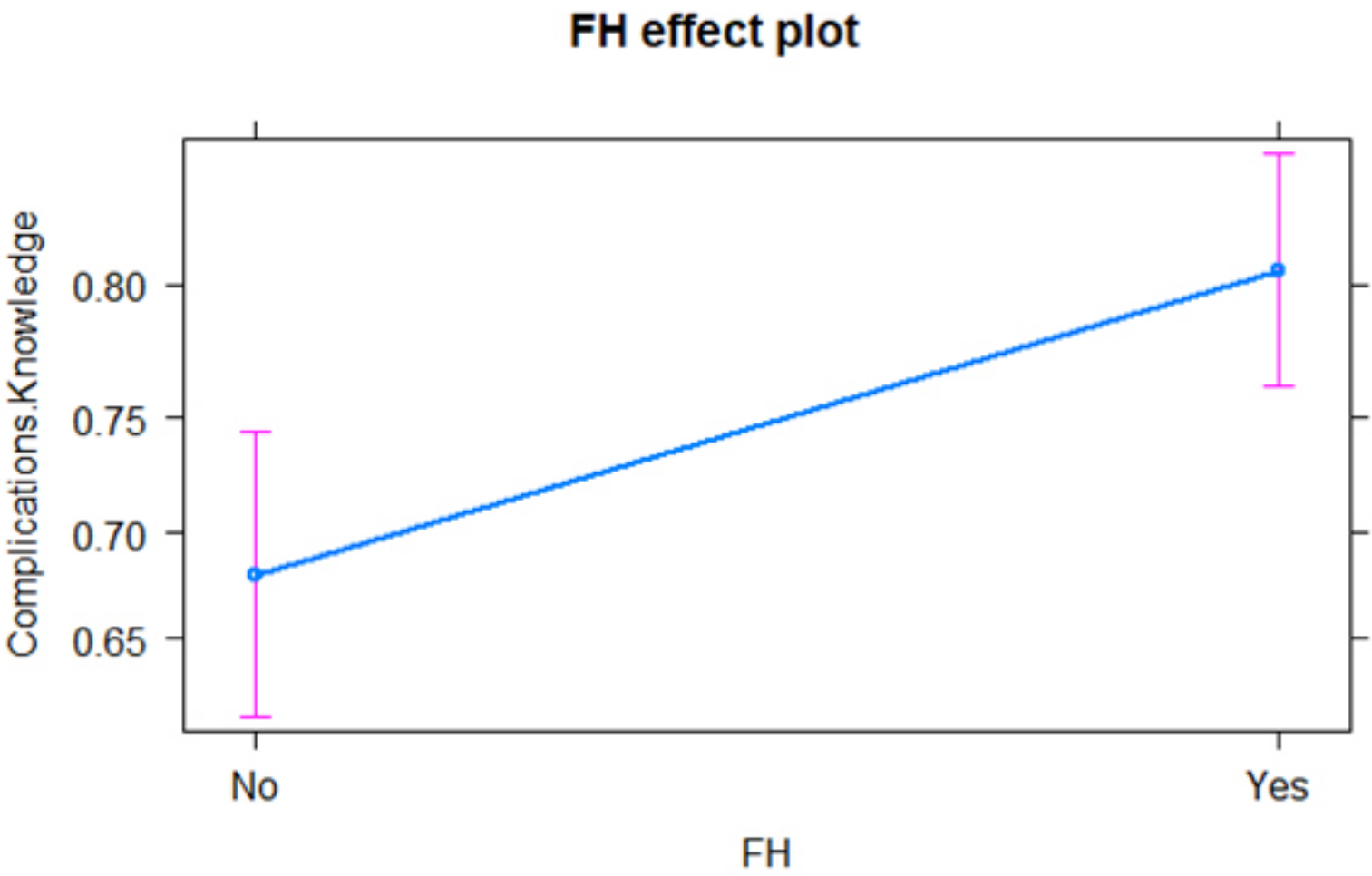

Figure 5. Individuals with a family history of diabetes were far more knowledgeable than individuals without. (OR = 1.726, p = 0.016

Discussion

The current investigation surveyed a large number of participants, namely, five hundred and seventy participants, in order to estimate the current level of knowledge about diabetes complications in the western part of Saudi Arabia.

Although the prevalence of diabetes mellitus (DM) is high among populations in the Middle East and Gulf countries, patients often lack the knowledge and skills to self-manage their condition (Almalki et al., 2018).

Almost three decades ago, the population of the Kingdom of Saudi Arabia had considerable changes in lifestyle, primarily leading to decreased physical activity and unhealthy eating habits. These changes have had a considerable negative impact on the health of society. Indeed, this lifestyle transformation is believed to be responsible for the epidemic of non-communicable diseases and their complications in the country. It is thought that effective diabetes education and knowledge can improve self-management skills and glycemic control for patients with type 2 diabetes mellitus (T2DM) and positively affect the health system. However, there is still a lack of studies that have assessed awareness and knowledge among diabetic patients in Saudi Arabic despite the high prevalence. Cross-sectional studies have suggested that the prevalence of T2DM in Saudi ranges from 10% to 30% (Almalki et al., 2018).

These governmental efforts are explained in our study finding that showed a high level of general knowledge, knowledge about the complications due to hyperglycemia and hypoglycemia among the study population. These results are not in line with (Almalki et al., 2018 and Rahaman et al., 2017), who found that the majority of the screened T2DM patients had poor knowledge about diabetes.

We found a majority of over seventy-six percent of the participants were knowledgeable about diabetes complications, as conveyed by their treating physician. This estimate agrees with previous research results in the region and somewhat exceeds estimates from some under-developed countries (Afaya et al., 2020). This is partly reassuring. It meant nearly a quarter of subjects living in the western part of Saudi Arabia could be ignorant of the vast majority of debilitating complications of diabetes. This highlights that diabetic patients in Saudi Arabia were only partially aware of diabetes complications' extent. Such superficial awareness

about diabetes complications was replicated among surveys conducted in many other developing countries and was shown to be unhelpful in ensuring adherence to the management of diabetes (Obirikorang et al., 2016).

As per our findings, patients' own diabetologist was the primary source of diabetes complications knowledge, as indicated by nearly a third of participants. A further quarter of participants' source of information was their family physician. This is indeed reassuring. It nonetheless adds responsibility for proper training of family physicians and diabetologists on effective communication with Saudi patients to dispense accurate knowledge about diabetes complications. However, social desirability bias may have been contributing to such results.

It was reassuring to see that unofficial social media played a tiny part as a knowledge source about diabetes complications in just over seven percent of all participants in the current survey.

A recent survey found that over half of Facebook posts in specialized groups about diabetes foot were unhelpful (Abedin et al., 2017). Also, a third of Youtube videos regarding diabetic complications of the foot were found to be misleading and useless (Smith et al., 2019).

The most heard of complications, as per our findings, were poor wound healing, amputation, and vision loss. The results we found are indeed consistent with published estimates from past surveys. Three-quarters of the patients surveyed by (Al Zarea 2016) were aware of eye-related diabetes complications. Two-thirds of diabetic patients in Saudi Arabia were found to have excellent eye care (Al-Alawi et al., 2016). The knowledge about other complications of diabetes, however, was found to be suboptimum in recent surveys, with Saudi patients harboring many myths about the etiology and management of diabetes (Alanazi et al., 2017). On the other hand, the least heard of complications were heart disease and stroke. This should be particularly worrying as proper knowledge about potential complications would lead to a better lifestyle and stringent adherence to management regimes (Christie et al., 2009; Murugesan et al., 2007).
A clear link was established between individuals who were illiterate about the complications of diabetes and heightened risk of getting those complications (Yeh et al., 2018).

Although knowledge about hyperglycemia symptoms was quite good among our participants, their knowledge about hypoglycemia symptoms was less impressive. Limited knowledge about hypoglycemia was shown to be rife among diabetic patients, particularly in developing countries (Chu et al., 2021).

Knowledge about diabetes complications was affected positively by a range of factors, including living in Taif, college education, and family history of diabetes. Many previous studies showed a link between tertiary level education and better knowledge about diabetes complications (Obirikorang et al., 2016; Rahaman et al., 2017; Afaya et al., 2020). Indeed, a college education will help self-directed learning and will open multiple avenues for the acquisition of knowledge about disease course and disease complications (Belsti et al., 2016). It remains that knowledge should be obtained from the right resources, such as reliable health education sites and materials.
Based on specific diabetic complications such as diabetic neuropathy, a study done by (Almalki et al., 2018) found that almost two-thirds of screened T2D were considered to have good knowledge about diabetic neuropathy. The excellent knowledge group tends to have a longer duration of T2D, is more likely to have a college degree, and tends to have non -significantly better A1c control. These results are supported by our study findings.

It is difficult to explain why residents in Taif were more knowledgeable than residents of Makkah in terms of diabetes complications. Previous studies showed that urban centers residents have superior knowledge of diabetes complications than their rural counterparts (Hoque et al., 2009; Afaya et al., 2020).

Clearly caring for a family member with diabetes in a cohesively knit society like Saudi Arabia would improve the experience with complications first-hand. This is not ideal, however!

There was no substantial difference between men and women in Saudi Arabia with regards to their diabetes complications' knowledge level. This was an unexpected finding, as previous studies carried out in similar cultural contexts indicated that men's knowledge outperformed women's knowledge because of men's ability to get outside the house more freely and obtain more knowledge (Belsti et al., 2019; Nisar et al., 2008; Gulabani et al., 2008). This could point to the overall technological changes that allow Saudi women to acquire knowledge even when staying at home.

Another study was done by (Amankwah-Poku, M 2019) and concluded that knowledge and awareness were higher about diabetes, with females having more knowledge and awareness than males. Significant differences were also found in the level of knowledge and awareness of students based on their discipline of study but not the number of years of study in the university. Also, students who engaged in physical exercise showed a higher level of general knowledge and awareness of type 2 diabetes.

We note many strengths to the current survey. We included an extensive data set that included information from over 570 participants.

One significant limitation in the current research is the cross-sectional design that gives only a snapshot of the levels of knowledge about diabetes complications among the surveyed individuals. Also, better results would have been obtained by running a knowledge test rather than asking participants to rate themselves in terms of their knowledge level.

Future research should attempt to investigate knowledge levels using multiple-choice items at different time points. Also, assessment of how effective educational intervention

(preferably nurse-led!) is in boosting knowledge level is an important avenue to explore. There is a clear knowledge gap of how awareness about diabetes complications affects diabetes care and the chronic course of the disease. Such a gap requires focused longitudinal research.

Conclusion

In conclusion, almost the majority of screened T2D were considered to have a good level of knowledge of complications due to hyperglycemia, hypoglycemia, and overall knowledge of diabetes complications. The excellent knowledge group tends to be females, single, highly educated, has a longer duration of T2D, is more likely to have a positive family history of DM, and has previous knowledge from the doctor.

Recommendations

Other educational programs are to be established in order to increase public awareness and diabetic patient information in order to enhance positive attitudes and maximize the level of compliance.

1. Knowledge about diabetes complications remains suboptimum among Saudi individuals.
2. Makkah city needs to be targeted by effective educational interventions to help improve the knowledge level about diabetes complications among its residents.
3. Educational interventions should focus on systematic complications of diabetes, particularly highlighting how diabetes causes cerebrovascular accidents and neurological problems.
4. Future research should be longitudinal and attempt to assess the link between better knowledge of diabetes complications and their preventability.
5. Better results would have been obtained by running a knowledge test rather than asking participants to rate themselves in terms of their knowledge level.
6. Health educational programs should focus on hypoglycemia symptomatology and susceptibility as these are clearly lacking among the majority of diabetic patients.

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