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Influence of the Diabetes Mellitus Awareness and Knowledge among Diabetic Type 2 in Secondary School Students at Saudi Arabia 2022

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Abstract

Background: Diabetes care behavior plays a crucial role in managing the diabetes effectively and preventing complications. Patients with type 2 diabetes mellitus (T2DM) and health care professionals (HCPs) of rural areas often face unique challenges when it comes to diabetes self-care practices . The Middle East has the highest prevalence of diabetes of any world region, and Saudi Arabia has one of the highest prevalence rates of any country in the Middle East. A reported 18.5 percent of Saudi Arabian adults have diabetes, and the prevalence is increasing. It is a disease with several etiologies. It is one of common diseases in adolescent. Secondary school students with diabetes need special care while they are in school as they may experience problems in glucose levels or other problems. Teachers are persons responsible for students in school, so they should have adequate information and good level of awareness about diabetes to deal with diabetic secondary school students especially in emergency case. 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. Aim of the study: The study aimed to assessment the level of awareness and knowledge of diabetes mellitus among secondary school students at Saudi Arabia . Method: cross sectional study conducted among secondary school students at Saudi Arabia, during the October 2022 to December 2022, the Sample

size of diabetic secondary school students. Our total participants were (800).Results: the participants (59.0%) were in the age group more than 16 years mean ±SD(15.68±1.703), the majority of them were males (60.0%) while female(40.0%),also level of education the majority of participant are secondary level were(64.0%) while intermediate were(33.0%) Conclusion: This review highlights the need for increased awareness and knowledge of diabetes mellitus among diabetic type 2 in secondary school students Saudi Arabia. Raising in secondary school students' awareness about the primary prevention strategies for T2DM should be a public health priority in Saudi Arabia. The means of improving knowledge and awareness of DM needs to be integrated into existing healthcare systems and processes to better inform patients, families, and communities about this chronic disease.

Keywords*: Assessment, diabetes mellitus, awareness, knowledge, secondary school students, Saudi Arabia.*

Introduction

diabetes care practices are essential in diabetes mellitus (DM) treatment for achieving the optimal glycemic target [1], diabetes care practices include healthy eating habits, physical activity, medication adherence, monitoring blood glucose as prescribed, regular follow-ups, foot care and healthy coping [2]. Adults with T2DM who live in resource-constrained health settings face a variety of barriers to diabetes care practices, including restricted access to quality healthcare (lack of medicines, lack of physicians, lack of blood glucose monitoring facilities), cultural (inappropriate dietary behavior's, faith in herbal medication, myths about DM) and socio psychological issues (lack of knowledge and skills, lack of family supports, diabetes-related distress) that have significant social and economic implications [3,4]. Numerous quantitative cross-sectional studies have been conducted in South Asian countries to evaluate DM SCPs, and the findings indicate that patients with T2DM have suboptimal diabetes care practices [5,6]. Diabetes is assessed to increment in excess of 550 million continuously 2030 [8].

Diabetes is a silent disease; many sufferers became aware that they have diabetes only when they develop one of its life-threatening complications. Knowledge of diabetes mellitus can assist in early detection of the disease and reduce the incidence of complications. This can be achieved by improving the knowledge of the school students of the disease at early stage of life. Diabetes is a growing global health problem that affects an estimated 463 million adults worldwide[9]. The Middle East has the highest prevalence of diabetes of any world region, and Saudi Arabia has one of the highest prevalence rates of any country in the Middle East. A reported 18.5 percent of Saudi Arabian adults have diabetes, and the prevalence is increasing [10,11]. As a response to this growing public health concern, the Saudi Arabian Ministry of Health has included a diabetes education and awareness campaign as part of its 2030 Vision initiative [12].

The most prevalence rates of diabetes are concentrated North Africa and Middle East[13]. Diabetes is a difficult issue that Saudi Arabia faces [14], and there is an ascending in diabetes pervasiveness in Saudi Arabia [15]. There are a several danger factors for diabetes development including; weight, eating conduct, active work[16] and socioeconomic factors[17]. In secondary school age student, diabetes is one of the most well-known issues among them[18]. Diabetes can bring about basic difficulties like issues with eyes, bones and joints, teeth and gums, blood vessels, kidneys, nerves, skin and feet [19].

Complications of diabetes can be delayed or prevented by good management and control [19]. Awareness and Knowledge is a factor that derives individuals for certain behavior. Gap in health knowledge can cause health problems [18]. School students with diabetes need knowledgeable personnel to help them in

controlling and managing their diabetes while they are in school and practice their daily activities[20], as they need special health care [21].

Health-care workers play a central role in providing education about diabetes prevention, diagnosis, and management to patients and their families. Identifying possible gaps in knowledge among these rising professionals may enable improved preparation for patient care in the coming years as Saudi Arabia seeks to reduce its epidemiological and economic burden from diabetes.[22]

Low awareness and knowledge about diabetes coupled with high disease prevalence is common in low-resource countries. It is essential to evaluate and update the awareness and knowledge, education and awareness of the diabetes especially among secondary school students; because in future they are going to avoid the diabetic complications and health problem of diabetes [23] the incidence of Type 2 diabetes mellitus has tremendously increased globally in the last 20–30 years. It is basically due to changes in people's lifestyle by introducing fast foods, carbonated and energy drinks, and reduced energy expenditure by manual hard work or regular exercise.[24]

The level of awareness and knowledge regarding the disease among the school students helps to manage it properly both on the prevention and management front. It is very important to target the school students who are or would be involved in the care of diseased persons because if we succeed in creating good awareness and positive attitudes towards the difficulties and miseries of the school students in our future health care, then we can expect positive trends both in planning and management side.[25]

The study aimed to evaluate the level of awareness and knowledge of diabetes mellitus among secondary school students at the Makkah in Saudi. The main objective of this study was to evaluate the level of awareness and knowledge among diabetic secondary school students at Makkah which might require additional educational efforts in secondary school students. This awareness and knowledge would allow improvements of the current programs to address areas of knowledge deficiency and misconceptions, thus achieving maximum efficiencies with the finite resources devoted to secondary school students. The awareness of secondary school students about the disease can be of a great help to reduce the risk of complication developing diabetes in future.

Literature Review

In Saudi Arabia, data are lacking regarding awareness and knowledge about diabetic type 2 among secondary school students. The results of one study in the Kuwait showed that Diabetes is a global issue. Kuwait is among the high prevalence countries (20%) and has been ranked 5th. This suggests that one-fifth of the studied sample would be diagnosed in the future as diabetic. Taking into consideration this high prevalence of diabetes, it is highly recommended to increase the knowledge about diabetes in young ages.[26]

A study conducted at performed in the Al-Qassim region that evaluated more than 2000 citizens of Saudi nationality, which showed that most of the young population had a misconception that diabetes is acurable medical problem [27]

In Bahraini study, it was reported an average knowledge of teachers [28] In a study from Turkey about knowledge and attitude of teachers toward DM complications, it was found that the teachers had adequate knowledge of DM complications [29]

Another study was Tabuk University showed that 55% of the students were unaware of diabetes risk factors. This study included 200 subjects; among them, 103 were males and 97 were females. Their ages ranged from 18 to 24 years, and 16.5% of them were diabetic patients[30].

Another study was carried out in Oman among more than 500 students. It illustrated that knowledge of DM among high school students is suboptimal. In most cases, their knowledge

deficiency was particularly in diabetes complications[31] . Therefore, the present study aimed to assess the level of awareness and knowledge of DM among high school students , Identifying the lack of knowledge or misconception about DM might be a triggering point to increase the awareness by education campaign to ensure early detection and proper management of this chronic disease.

Also a study conducted most diabetes mellitus patients found 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.[32]

Murad et al [33]performed a case-control study in Jeddah to investigate the risk factors of T2DM. They found that smoking, hypertension, increased weight/obesity and age (above 40 years) were significant risk factors for Type 2 diabetes mellitus among the studied population. Alfadhli et al [34] fund that older maternal age, high BMI, high blood pressure, previous gestational diabetes (GDM), history of delivering a malformed child and family history of diabetes were the main risk factors for GDM.

Another study was carried out in KSA found There may be a gap between knowledge of diabetes and perceptions of diabetes among young adults in Saudi Arabia, including secondary school students .[15]

According to Diabetes Atlas published by the International Diabetes Federation (IDF), India was home to 62.4million diabetics in the year 2011 and the incidence is on a continuous rise and this number is predicted to raise to almost70 million people by 2025. The countries with the largest number of diabetic people will be in India, China and USA by 2030. It is estimated that every fifth person with diabetes will be an Indian. While the ICMR study reported that the prevalence was 2.1 per cent in urban and 1.5 per cent in rural areas.[35]

The results of one study in the US showed that secondary school students knowledge in the diabetes was not enough and also knowledge level of different medical groups such as general practitioners, specialists, internal medicine residents and medical students had significant differences with each other[16,17]

Midhet et al[33] performed a case-control study to investigate lifestyle-related risk factors of T2DM in Saudi Arabia. They found a strong association between lifestyle and Type 2 diabetes mellitus, education level, lack of exercise and dietary habits were significant risk factors.

Rationale:

The level of awareness and knowledge of diabetes mellitus of a considerable number of high school students was inadequate and also may be a gap between awareness and knowledge of diabetes and perceptions of diabetes among secondary school students and young adults in Saudi Arabia. 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 awareness and knowledge about diabetes mellitus among school students in Saudi Arabia. Diabetes mellitus which can be treated by a complex regimen of insulin injections, diet and exercise, and which greatly affects the life of patients and their families. The researcher expects low the Knowledge about type 2 diabetes was generally high in our study, also some precautions must be taken for patients with type 2 Diabetes mellitus, this study will add significantly to the limited the knowledge and awareness among diabetic secondary school students toward management of Type 2 diabetes mellitus.

Aim of the study:

The study aimed to evaluate the level of awareness and knowledge of diabetes mellitus among secondary school students at Saudi Arabia .2022

Objectives:

To evaluate the level of awareness and knowledge of diabetes mellitus among secondary school students in Saudi Arabia 2022

Methodology:

Study design:

This study is cross-sectional study was conducted among 800 secondary school students applying a convenience sampling technique.

Study Area

The study has been carried out in Saudi Arabia It is located in the western area in Kingdom of Saudi Arabia and called the Holy Capital. Contains a population around 1.578 million .This study has been conducted in secondary school governorate, in the western region of Saudi Arabia. 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 Saudi Arabia population.

Study Population

The study has been conducted among secondary school students at Saudi Arabia. During the October 2022 to December 2022 .

Selection criteria:

Inclusion criteria

- Secondary school students at Saudi Arabia.
- He speaks Arabic fluently
- All nationalities
- Exclusion criteria:
- No speaks Arabic fluently
- No specific exclusion criteria.

Sample size

Secondary school students at Saudi Arabia.

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 (800) the secondary school students (male and female) after official communication with the school's dean.in the Saudi Arabia and adding 10 more to decrease margin of error. After adding 5% oversampling, the minimum calculated sample has been 800. 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 schools. Also, convenience sampling technique will be utilized to select the participants in the study. By using systematic sampling random as dividing the total students by the required sample size; (800).

Data collection tool

The self-administered questionnaire is designed based on previous studies and frameworks to evaluate the level of awareness and knowledge of diabetes mellitus among secondary school students in Saudi Arabia . The questionnaire has been developed in English. The questions were first pre-tested and were revised and finalized after it has been pilot tested. Before completing the survey, participants were required to indicate their consent using a forced response question followed by the survey questionnaires. The survey is estimated to take 10 min to complete.

To collect the information, a set of questions were constructed and developed. All questions were closed-ended, with tick boxes provided for responses; participants answered the questionnaires from the October 2022 to December the period of study in 2021.

The questionnaire consisted of questions that

First part General and Socio demographic information. These variables included contact data (email or mobile phone number),(age, gender, Sources of information). Other variables were education level, economic level.

A questionnaire has been developed that had Socio demographic data and questions related to awareness and knowledge

respectively. The two senior faculty members checked the questionnaire's validity and comprehension, and it was revised according to their suggestions. A pilot study has been conducted on 20 secondary students to check the questionnaire's understanding and responses further, and its Cronbach's alpha was 0.75. The results of the pilot study were not included in the final analysis.

The level of awareness and knowledge has been categorized into "adequate" and "inadequate" as per each topic/question, and also as per each response/answer. Data entry and analysis were carried out using the Statistical Package for the Social Sciences. Pearson's Chi-square tests were performed to explore if there is any significant association between the awareness and knowledge level of the high school students and their (i) gender, (ii) age, and (iii) level of education.

Data collection technique:

Researcher has been visits the selected secondary school after getting the approval from the ministries of health and education. The researcher has been obtained permission from secondary school director and participants.

After the arrival of the participants has been explained the purpose of the study to all participants attending .

Data entry and analysis:

The Statistical Package for Social Sciences (SPSS) software version 24.0 has been used for data entry and analysis. Descriptive statistics (e.g., number, percentage) and analytic statistics using Chi-Square tests ($\chi 2$) to test for the association and the difference between two categorical variables were applied. A p-value $\leq$ 0.05 will be considered statistically significant.

Pilot study

A pilot study has been conducted in diabetic secondary school students 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 joint program of Saudi pediatric residency program will be obtained. Permission from the Directorate of health and education, 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.

Budget: Self-funded

Results

Table 1 Distribution of demographic data(age, gender, Level of education, economic level, Sources of information) in our study(n=800)

	N	**%**
Age		
12-14.	200	25
14-16	128	16
More than 16	472	59
Range	13-18	
Mean±SD	15.68±1.703	
Gender		
Female	320	40
Male	480	60
Level of education		
Intermediate	264	33
Secondary	512	64
Economic level		
Low	176	22
Medium	304	38
High	320	40
Sources of information about DM		

Booklets and brochures	40	5
Mass media	56	7
Own personal experience	232	29
Educational films	80	10
Medical education in health centers and hospitals	392	49

Table 1 shows that most of the participants (59.0%) were in the age group more than 16 years follow by the (25.0%) were in the age 12-14 years and the data ranged from(13-18) by mean ±SD(15.68±1.703), the majority of them were males (60.0%) while female(40.0%),also regarding level of education the majority of participant are secondary level were(64.0%) while intermediate were(33.0%(. Regarding the economic level the majority of participant high economic level were(40.0%). While sources of information most of participants from Medical education in health centers and hospitals were (49.0%) while Own personal experience were (29.0%)

Table(2) and figure(1) Distribution of the knowledge among diabetic secondary school students

Knowledge			
		N	**%**
Weak		240	30
Average		416	52
High		144	18
Total		800	100
Score	**Range**	2-15.	
	Mean±SD	9.112±2.128	

Table 2 and figure(1) Regarding knowledge of the participant toward diabetes mellitus study results show the majority of participant had average information were(52.0%) while weak knowledge were(30.0%) the data ranged from(2-15) by mean ±SD(9.112±2.128).

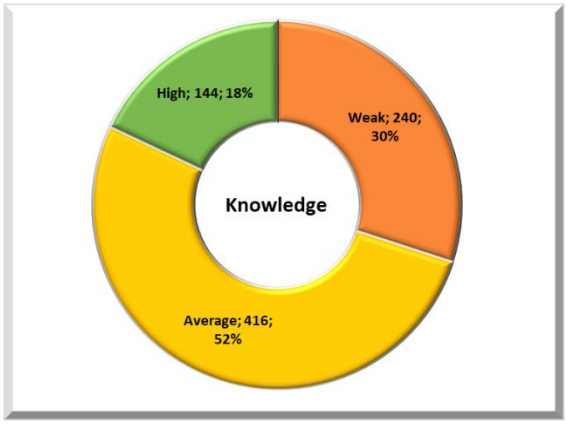


Figure (1) Distribution of the knowledge among diabetic secondary school students

Table(3) and figure(2) Distribution of the awareness among diabetic secondary school students

Awareness			
		N	**%**
Weak		160	20
Average		600	75
High		40	5
Total		800	100
Score	**Range**	9-34.	
	Mean±SD	22.185±4.11	

Table 3 and figure(2) Regarding awareness of the participant toward diabetes mellitus study results show the majority of participant had average information were(75.0%) while weak awareness were(20.0%) the data ranged from(9-34) by mean ±SD(22.185±4.11).

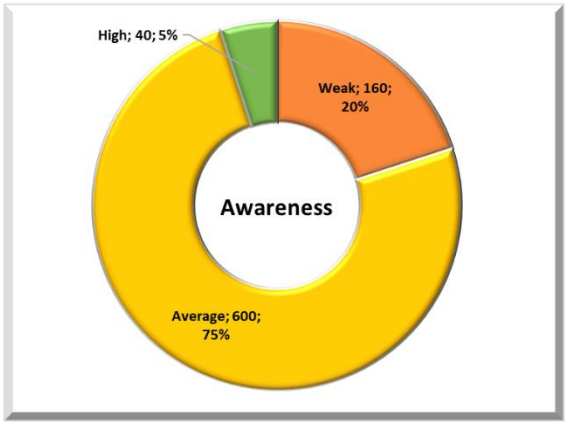


Figure (2) Distribution of the awareness among diabetic secondary school students

Table 4 and figure(3): Correlation between Knowledge and Awareness

Correlations		
	Knowledge	
	r	P-value
Awareness	0.784	<0.001*

Table show that is a significant positive correlation between Knowledge and Awareness were r= 0.784 and p-value =0.001

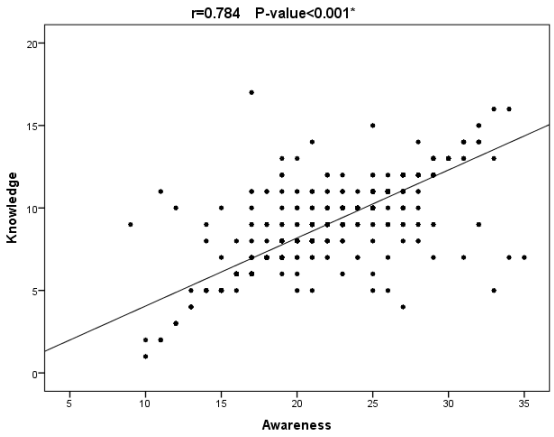


Figure (3): Correlation between Knowledge and Awareness

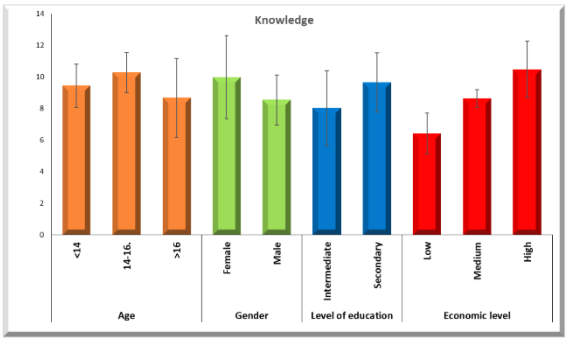
Table (5) and figure (4) Distribution of the knowledge among diabetic secondary school students and the demographic data (age, gender, Level of education, economic level)

Demographic data		N	Knowledge	T or F	ANOVA or T-test	
			Mean ± SD		Test value	P-value
Age	<14	200	9.430 ± 1.358	f	32.317	<0.0001*
	14-16	128	10.258 ± 1.269			
	>16	472	8.661 ± 2.496			
Gender	Female	320	9.975 ± 2.619	t	8.843	<0.0001*
	Male	480	8.531 ± 1.584			
Level of education	Intermediate	264	8.011 ± 2.371	t	-9.840	<0.0001*
	Secondary	536	9.649 ± 1.853			
Economic level	Low	176	6.420 ± 1.298	f	493.396	<0.0001*
	Medium	304	8.627 ± 0.569			
	High	320	10.469 ± 1.783			

Table (5) show that is a significant relation between satisfaction and demographic data regarding age (increase in >55 years follow by35-55 age) where F=137.988 and P-value=<0.001 by mean+ SD (41.930 ± 3.491, 37.324 ±4.288). Regarding gender in our study the majority of our participants were noticed in male more than female with Mean± SD (36.536 ±5.029) with a significant relation between satisfaction and gender were T=3.157 and P-value=0.001. Regarding Level of education show that a significant relation between satisfaction and Level of education (increase in University) were F=157.013 and P-value=0.001 by mean+ SD (43.644±3.295). Also regarding the economic level show that a significant relation between satisfaction and economic level (increase in the high income participants) were F=113.993 and P-value=0.001 by mean+ SD (43.034± 3.134).

Also regarding the Smoked show that a significant relation between satisfaction and Smoked (increase in no smoking) were T=-13.100 and P-value=0.001 by mean+ SD (39.859±5.574). Also regarding the Physical

activity show that a significant relation between satisfaction and Physical activity (increase in the ≥150 min/week) were T=245.236 and P-value=0.001 by mean+ SD (42.030±3.805). Also regarding the Sitting time show that a significant relation between satisfaction and Sitting time (increase in the <10 hours per day) were T=245.236 and P-value=0.001 by mean+ SD (42.727±2.543).



Figure(4) Distribution of the knowledge among diabetic secondary school students and the demographic data(age, gender, Level of education, economic level)

Table(6) and figure(5) Distribution of the awareness among diabetic secondary school students and the demographic data(age, gender, Level of education, economic level)

Demographic data		N	Awareness	T or F	ANOVA or T-test	
			Mean ± SD		Test value	P-value
Age	**<14**	200	22.920 ± 3.387	f	30.086	<0.0001*
	14-16	128	24.297 ± 2.505			
	>16	472	21.407 ± 4.528			
Gender	**Female**	320	23.834 ± 4.770	t	9.313	<0.0001*
	Male	480	21.190 ± 3.262			
Level of education	**Intermediate**	264	20.288 ± 4.594	t	-9.954	<0.0001*
	Secondary	536	23.213 ± 3.522			
Economic level	**Low**	176	17.460 ± 2.402	f	394.396	<0.0001*
	Medium	304	21.270 ± 1.439			
	High	320	24.729 ± 3.608			

Table (6) and figure (5) show that is a significant relation between awareness and demographic data regarding age (increase in 14-16 where follow by age<14) F=30.086 and P-value=<0.001 by mean+ SD (24.297±2.528, 22.920±3.387). Regarding gender In our study the majority of our participants were noticed in female more than male with Mean± SD (23.834±4.770) with a significant relation between awareness and gender were T=9.313 and P-value=0.001. Regarding Level of education show that a significant relation between awareness and Level of education (increase in secondary) were T=-9.954 and P-value=0.001 by mean+ SD (23.213±3.522). Also regarding the economic level show that a significant relation between awareness and economic level (increase in the high income participants) were F=394.396 and P-value=0.001 by mean+ SD (24.729±3.608).

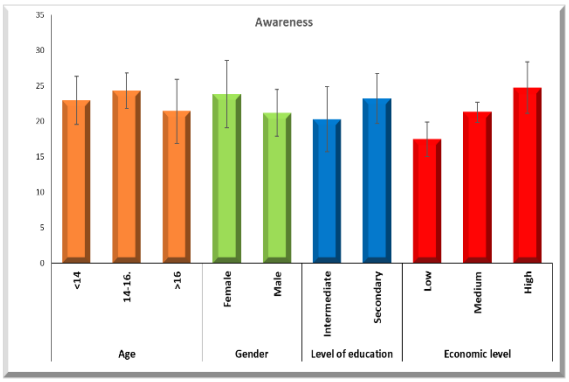


Figure (5) Distribution of the awareness among diabetic secondary school students and the demographic data(age, gender, Level of education, economic level)

Discussion

There might be a hole between awareness on diabetes and knowledge of diabetes all members in our review were the students of secondary school, the review aimed to evaluate the level of awareness and knowledge of diabetes mellitus among secondary school students at Saudi Arabia , objectives of review to evaluate the degree of awareness and knowledge among diabetic secondary school student.

This is the study to evaluate the level of awareness and knowledge of diabetes mellitus among secondary school students at Saudi Arabia. the most of the participants (59.0%) were in the age group more than 16 years follow by the (25.0%) were in the age 12-14 years and the data ranged from(13-18) by mean ±SD(15.68±1.703), the majority of them were males (60.0%) while female(40.0%),also level of education the majority of participant are secondary level were(64.0%) while intermediate were(33.0%), the economic level the majority of participant high economic level were(40.0%). While sources of information most of participants from Medical education in health centers and hospitals were (49.0%) while Own personal experience were (29.0%) (See Table 1).

A study from Ghana[36] [28] showed more prevalence of males and married teachers and those with age of 30-39 years old and 1-5 years of experience. Most of in Ghana study participants showed a moderate level of knowledge not similar to our results reported. In Bahraini study, it was reported an average knowledge and awareness of students[28][18]. In a Jordanian study[19][27] there was dominancy in male and young age participants. A study from Turkey showed that 50% of participant students were males [29][20].

Overall the results showed that more than half knowledge of the participant toward diabetes mellitus study results show the participant had average information were(52.0%) while weak knowledge were(30.0%) the data ranged from(2-15) by mean ±SD(9.112±2.128).(See Table 2)

Our study findings are similar to a number of previous study results that showed an inadequate level of knowledge and awareness of diabetes mellitus among the respondents in Saudi Arabia[37] [29]. Al-Aboudi et al.[32] reported that 15% of the study participants in Riyadh had inadequate knowledge of DM, while 72% had moderate knowledge, the respondents in Dammam were found to obtain low scores regarding knowledge and attitudes toward diabetes mellitus. In another survey by Al Malki et al. [38], the percentage of correct answers to questions about DM was 49%, indicating a gap in diabetes mellitus knowledge among the Saudi population.

On the other hand, a considerable number of the high school students showed an inadequate level of awareness about diabetes mellitus . More than half of the high school students had an average level (75.0) of awareness of the disease in terms of symptoms, complications lifestyle modification, blood sugar control, treatment, and management of hypoglycemia. awareness of the participant toward diabetes mellitus study results show the majority of participant had average information were(75.0%) while weak awareness were(20.0%) the data ranged from(9-34) by mean ±SD(22.185±4.11).(Table 3)

In light of this result, it is interesting to know that a similar study was done in Singapore [39] where the respondents were

randomly selected. Their ages ranged between 16 and 60 years old with different levels of education. The respondents had also similar score this shows that their awareness about diabetes mellitus was not enough as compared to their age and education level. Since early recognition of symptoms may help in early detection of the disease leading to prompt treatment.

A study was conducted among medical students that also reported that the medical students achieved low scores regarding awareness about diabetes mellitus, and 90% of the students were not aware of the correct procedure for administering insulin injections [21]

Essential knowledge and awareness regarding the in students is mandatory for control and proper management and to control the further this disease. In our study show that that is a significant positive correlation between Knowledge and Awareness were r= 0.784 and p-value =0.001.(Table 4), similar a Chinese study reported inadequate knowledge of diabetes and its related factors among college students.[40] in our study about less than half of the respondents have an high knowledge about the DM (18.0%). also our participants require a lot of awareness of this aspect as we observed that a small percentage (5.0%) of our study cohort attained high awareness scores

In a study, Baig et al (2015) revealed similar trends of having poor knowledge regarding DM in KAU students.[41] In a recent survey, Alqahtani et al (2020) in Riyadh, KSA, revealed better knowledge scores among the adult population regarding DM.[15] Alenazi et al (2020) mentioned relatively better (62.6%) knowledge scores in young school children regarding diabetes mellitus.[30]

In relation to variables associated with knowledge significant relation between knowledge and demographic data regarding age (increase in 14-16) where F=32.317 and P-value=<0.0001 by mean+ SD (10.258±1.269). the gender In our study the majority of our participants were noticed in female more than male with Mean± SD (9.975±2.619) with a significant relation between knowledge and gender were T=8.843 and P-value=0.0001. the level of education show that a significant relation between knowledge and Level of education (increase in secondary) were T=-9.840 and P-value=0.001 by mean+ SD (9.649±1.853). Also regarding the economic level show that a significant relation between knowledge and economic level (increase in the high income participants) were F=493.396 and P-value=0.001 by mean+ SD (10.469±1.783). (Table 5, figure 4)

Which was also supported by previous studies conducted in low- and middle-income level . Another study has asserted that students' educational level was a substantial predictor towards their self-care practices[32]. In relation to variables associated with awareness, is a significant relation between awareness and demographic data regarding age (increase in 14-16 where) F=30.086 and P-value=<0.001 by mean+ SD (24.297±2.528). Regarding gender In our study the majority of our participants were noticed in female more than male with Mean± SD (23.834±4.770) with a significant relation between awareness and gender were T=9.313 and P-value=0.001. Regarding Level of education show that a significant relation between awareness and Level of education (increase in secondary) were T=-9.954 and P-value=0.001 by mean+ SD (23.213±3.522). Also regarding the economic level show that a significant relation between awareness and economic level (increase in the high income participants) were F=394.396 and P-value=0.001 by mean+ SD (24.729±3.608). (Table 6, figure 5)

A study by Al-Maskari et al. among patients with diabetes mellitus reported that age and gender were related to diabetes mellitus Practices, and observed a higher Practices score among males than females ($p < 0.001$). That study also found there was a significant difference between knowledge scores of postgraduate (19.67) and undergraduate (14.74) respondent ($p < 0.001$) [39] . Our results were inconsistent with that study. Similarly, a study by Islam et al. showed significant associations for all demographic variables (including diabetes mellitus status) with awareness scores

[31]; similar outcomes were observed in our study a significant association for gender and economic level Significantly knowledge and awareness scores among Age, may be related to a higher level awareness.

Another study was carried out exclusively among secondary school students in Riyadh by Al-Mutairi et al [42]. This study revealed that the awareness about the role of body weight in DM was lower in males($p = 0.037$); males were less likely to recognize the risks for the disease than females, including obesity ($p = 0.030$), heredity ($p = 0.013$), and high-fat intake ($p = 0.001$).

Conclusion

Our study showed that the students had an average level of knowledge of diabetes although there were areas of shortage. Their knowledge of diabetes and management of diabetes is inadequate. Taking into consideration the high prevalence of diabetes in KSA, it is that the level of awareness and knowledge of a considerable number of high school students regarding DM was inadequate, and some of them possessed various misconceptions about this particular chronic disease. Some students may not continue higher education and most of the students will continue their higher education in non-medical fields where no more information about diabetes will be gained. So it is highly recommended that Ministry of Education improves the curriculum to include the areas of weakness. Also encourage students' contribution in different activities related to diabetes such as doing project, posters and seminars. World Diabetes Day should be celebrated in all schools and workshops and lectures given by professionals in collaboration with Ministry of Health on this day are recommended to increase the level of awareness of diabetes.

Reference

1. Paulsamy, P., Ashraf, R., Alshahrani, S. H., Periannan, K., Qureshi, A. A., Venkatesan, K., ... & Krishnaraju, K. (2021, November). Social support, self-care behaviour and self-efficacy in patients with Type 2 diabetes during the COVID-19 pandemic: A cross-sectional study. In Healthcare (Vol. 9, No. 11, p. 1607). MDPI.
2. Vickers, N. J. (2017). Animal communication: when i'm calling you, will you answer too?. Current biology, 27(14), R713-R715.
3. Meo, S. A. (2016). Prevalence and future prediction of type 2 diabetes mellitus in the Kingdom of Saudi Arabia: A systematic review of published studies. JPMA. The Journal of the Pakistan Medical Association, 66(6), 722-725.
4. Williams, R., Karuranga, S., Malanda, B., Saeedi, P., Basit, A., Besançon, S., ... & Colagiuri, S. (2020). Global and regional estimates and projections of diabetes-related health expenditure: Results from the International Diabetes Federation Diabetes Atlas. Diabetes research and clinical practice, 162, 108072.
5. Meo, S. A., Sheikh, S. A., Sattar, K., Akram, A., Hassan, A., Meo, A. S., ... & Ullah, A. (2019). Prevalence of type 2 diabetes mellitus among men in the Middle East: a retrospective study. American journal of men's health, 13(3), 1557988319848577.
6. Abdulaziz Al Dawish, M., Alwin Robert, A., Braham, R., Abdallah Al Hayek, A., Al Saeed, A., Ahmed Ahmed, R., & Sulaiman Al Sabaan, F. (2016). Diabetes mellitus in Saudi Arabia: a review of the recent literature. Current diabetes reviews, 12(4), 359-368.
7. Alwin Robert, A., Abdulaziz Al Dawish, M., Braham, R., Ali Musallam, M., Abdullah Al Hayek, A., & Hazza Al Kahtany, N. (2017). Type 2 diabetes mellitus in Saudi Arabia: major challenges and possible solutions. Current diabetes reviews, 13(1), 59-64.
8. Paudel, G., Vandelanotte, C., Dahal, P. K., Biswas, T., Yadav, U. N., Sugishita, T., &

Rawal, L. (2022). Self-care behaviours among people with type 2 diabetes mellitus in South Asia: A systematic review and meta-analysis. Journal of global health, 12.

9. Saeedi, P., Petersohn, I., Salpea, P., Malanda, B., Karuranga, S., Unwin, N., ... & IDF Diabetes Atlas Committee. (2019). Global and regional diabetes prevalence estimates for 2019 and projections for 2030 and 2045: Results from the International Diabetes Federation Diabetes Atlas. Diabetes research and clinical practice, 157, 107843.

10. Alotaibi, A., Perry, L., Gholizadeh, L., & Al-Ganmi, A. (2017). Incidence and prevalence rates of diabetes mellitus in Saudi Arabia: An overview. Journal of epidemiology and global health, 7(4), 211-218

11. Robert, A. A., & Al Dawish, M. A. (2020). The worrying trend of diabetes mellitus in Saudi Arabia: an urgent call to action. Current diabetes reviews, 16(3), 204-210.

12. Alakhrass, H. (2020). Impact of health-related Twitter messages on rates of diabetes screening in the Saudi Arabian population.

13. Atlas, D. (2015). International diabetes federation. IDF Diabetes Atlas, 7th edn. Brussels, Belgium: International Diabetes Federation.

14. Tabish, S. A. (2007). Is diabetes becoming the biggest epidemic of the twenty-first century?. International Journal of health sciences, 1(2), V.

15. Alqahtani, M., Almutairi, F. E., Albasseet, A. O., & Almutairi, K. E. (2020). Knowledge, attitude, and practice of diabetes mellitus among the saudi population in Riyadh, Saudi Arabia: a quantitative study. Cureus, 12(1).

16. Yach, D., Stuckler, D., & Brownell, K. D. (2006). Correction: Corrigendum: Epidemiologic and economic consequences of the global epidemics of obesity and diabetes. Nature Medicine, 12(3), 367-367.

17. Walker, J. J., Livingstone, S. J., Colhoun, H. M., Lindsay, R. S., McKnight, J. A., Morris, A. D., ... & Scottish Diabetes Research Network Epidemiology Group. (2011). Effect of socioeconomic status on mortality among people with type 2 diabetes: a study from the Scottish Diabetes Research Network Epidemiology Group. Diabetes care, 34(5), 1127-1132.

18. Moawad, S., Badawy, A. S., Al-saffar, Z. A., Al-Hamdan, N., & Awadien, A. M. (2014). Assessment of knowledge among Saudi diabetic children/adolescent at Riyadh city. Am J Nurs Sci, 3(1), 5-12.

19. Tannous, A. G., Khateeb, J. M., Khamra, H. A., Hadidi, M. S., & Natour, M. M. (2012). Jordanian school counselors' knowledge about and attitudes toward diabetes mellitus. International Journal for the Advancement of Counselling, 34(2), 136-142.

20. Tahirović, H., & Toromanović, A. (2006). How much can school staff help children with diabetes type 1 in school?. Medicinski arhiv, 60(4), 222-224.

21. Sajjad, Z. B. M., & Al Saleh, E. M. (2013). The knowledge attitude and practice regarding diabetes and diabetic retinopathy among the final year medical students of King Faisal University Medical College of Al Hasa region of Saudi Arabia: A cross sectional survey. MIDDLE EAST JOURNAL OF FAMILY MEDICINE, 7(10), 14.

22. Abdirahman, H. A., Hassan, T., AbuAlUla, N. A., & Jacobsen, K. H. (2021). Knowledge and Attitudes About Type 2 Diabetes Among Female Nursing Students in Saudi Arabia. World Medical & Health Policy.

23. 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

24. Hoda, M., Hemaiswarya, S., & Doble, M. (2019). Diabetes: Its Implications, Diagnosis, Treatment, and Management. In Role of Phenolic Phytochemicals in Diabetes Management (pp. 1-12). Springer, Singapore.

25. Pinar, A. (2017). What is secondary school students' awareness on disasters? A case study. Review of International Geographical Education Online, 7(3), 315-331

26. Fareed, M., Salam, N., Khoja, A. T., Mahmoud, A. M., & Ahamed, M. (2017). Life style related risk factors of type 2 diabetes mellitus and its increased prevalence in Saudi Arabia: A brief review. International Journal of Medical Research & Health Sciences, 6(3), 125-132.

27. Mohieldein, A. H., Alzohairy, M. A., & Hasan, M. (2011). Awareness of diabetes mellitus among Saudi non-diabetic population in Al-Qassim region, Saudi Arabia. Journal of Diabetes and Endocrinology, 2(2), 14-19.

28. FPC, F. A. L. A. (2003). Assessment of knowledge of diabetes mellitus among Bahraini school teachers. Bahrain Medical Bulletin, 25(4).

29. Elbadawi, A., Mahzari, A., Alshahrani, S., Alawaji, H., Khubrani, A., & Albalawi, A. (2016). Knowledge and Attitude of School Teachers toward DM Complications in Tabuk City. International Journal of Health care Sciences, 4(2), 1742-1745.

30. Alenazi, M. A., Alenezi, S. H., Alhablani, M. N., Alanazi, M. A. M., Alenazi, W. H., AlQahtani, M. S., ... & Mahzari, Q. A. (2020). Knowledge and awareness of diabetes mellitus disease among high school students in King Abdulaziz Military City, Tabuk, Saudi Arabia. Open Access Macedonian Journal of Medical Sciences, 8(E), 91-97.

31. Al-Mahrooqi, B., Al-Hadhrami, R., Al-Amri, A., Al-Tamimi, S., Al-Shidhani, A., Al-Lawati, H., ... & Al-Ghafri, T. (2013). Self-reported knowledge of diabetes among high school students in Al-Amerat and Quriyat, Muscat Governate, Oman. Sultan Qaboos University Medical Journal, 13(3), 392.

32. Al-Aboudi, I. S., Hassali, M. A., & Shafie, A. A. (2016). Knowledge, attitudes, and quality of life of type 2 diabetes patients in Riyadh, Saudi Arabia. Journal of pharmacy & bioallied sciences, 8(3), 195.

33. Murad, M. A., Abdulmageed, S. S., Iftikhar, R., & Sagga, B. K. (2014). Assessment of the common risk factors associated with type 2 diabetes mellitus in Jeddah. International journal of endocrinology, 2014

34. Alfadhli, E. M., Osman, E. N., Basri, T. H., Mansuri, N. S., Youssef, M. H., Assaaedi, S. A., & Aljohani, B. A. (2015). Gestational diabetes among Saudi women: prevalence, risk factors and pregnancy outcomes. Annals of Saudi medicine, 35(3), 222-230.

35. Ramachandran, A., Das, A. K., Joshi, S. R., Yajnik, C. S., Shah, S., & Prasanna Kumar, K. M. (2010). Current status of diabetes in India and need for novel therapeutic agents. Journal of Association of Physicians of India, 58(JUN), 7-9.

36. Amissah, I., Barnes, N. A., Craymah, J. P., & Eliason, S. (2017). Knowledge of diabetes mellitus and management practices among senior high school teachers in Ghana. International Journal of Science and Research, 6(1), 1090-1095.

37. 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.

38. Almalki, T. M., Almalki, N. R., Balbaid, K., & Alswat, K. (2018). Assessment of diabetes knowledge using the Michigan brief diabetes knowledge test among patients with type 2 diabetes mellitus. Journal of Endocrinology and Metabolism, 7(6), 185-189.

39. Mohan, D., Raj, D., Shanthirani, C. S., Datta, M., Unwin, N. C., Kapur, A., & Mohan, V. (2005). Awareness and

knowledge of diabetes in Chennai-the Chennai urban rural epidemiology study [CURES-9]. Journal of the Association of Physicians of India, 53, 283-287.

40. Xu, Y., Zhang, D., Liu, K., Guo, Y., & Yang, Y. (2016). Self-reported knowledge on diabetes and its related factors among Chinese college students: a cross-sectional study. BMJ open, 6(9), e011963.

41. Baig, M., Gazzaz, Z. J., Gari, M. A., Al-Attallah, H. G., Al-Jedaani, K. S., Mesawa, A. T., & Al-Hazmi, A. A. (2015). Prevalence of obesity and hypertension among University students' and their knowledge and attitude towards risk factors of Cardiovascular Disease (CVD) in Jeddah, Saudi Arabia. Pakistan journal of medical sciences, 31(4), 816.

42. Al-Mutairi, R. L., Bawazir, A. A., Ahmed, A. E., & Jradi, H. (2015). Health beliefs related to diabetes mellitus prevention among adolescents in Saudi Arabia. Sultan Qaboos University Medical Journal, 15(3), e398.