Cross-Sectional Study about Assessment of the Diabetes Mellitus Awareness and Knowledge among Diabetic Type 2 in Secondary School Students in Makkah at Saudi Arabia

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Abstract:
Background:
Diabetes mellitus was defined by World health Organization as a growing global health problem that affects an estimated 463 million adults worldwide. Diabetes mellitus is a major public health problem in KSA .

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 evaluate the level of awareness and knowledge of diabetes mellitus among secondary school students in the Makkah at Saudi Arabia. **Method:** cross sectional study conducted among secondary school students at Makkah, during the July to October

2021, 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 in Makkah . 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 mellitus (Type 1 and Type 2) is a serious, persistent, and long lasting condition. Its commonness is expanding worldwide because of the fast-changing in way of life and modernization [1,2]. Its frequency is all the more commonly found in Arab world nations, particularly the Gulf Cooperation Council nations, including the Kingdom of Saudi Arabia [1,3].

Worldwide Diabetes Federation expressed that individual with diabetes is relied upon to increase from 171 million of every 2000 to 578 million out of 2030 universally. In July 2020, the quantity of individuals with diabetes is determined to be right around 463 million around the world.[4]. Saudi Arabia is viewed as probably the most elevated country in the Middle East for the frequency of diabetes mellitus. Information are missing in regards to knowledge and awareness about Diabetes mellitus among secondary school students in Saudi Arabia [5].

The World Health Organization assessed that around 7 million Saudis are diabetic and around 3 million are pre-diabetic [6,7]. 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. [33]

2.1 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.

2.2 Aim of the study:

The study aimed to evaluate the level of awareness and knowledge of diabetes mellitus among secondary school students in the Makkah at Saudi Arabia .2021

2.3 Objectives:

To evaluate the level of awareness and knowledge of diabetes mellitus among secondary school students in Makkah

3. Methodology:

3.1Study design:

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

3.2. **Study Area**

The study has been carried out in the city of Makkah Al-Mokarramah Makah is the holiest spot on Earth. It is the birthplace of the Prophet Mohammad and the principal place of the pilgrims to perform Umrah and Hajj. It is located in the western area in Kingdom of Saudi Arabia and called the Holy Capital. Contains a population around 1.578 million .This study has been conducted in Makkah 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 Makkah population.

3.3 Study Population

The study has been conducted among secondary school students at Makah Mokarramah . During the July to October 2021.

3.4.1 Selection criteria:

3.4.1 Inclusion criteria

- Secondary school students at Makkah.
- He speaks Arabic fluently
- All nationalities

3.4.2Exclusion criteria:

- No speaks Arabic fluently
- No specific exclusion criteria.

3.5Sample size

Secondary school students at Makkah around .

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 Makkah 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.

3.6 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).

3.7 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 Makkah . 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 July to October 2021 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.

3.8 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 .

3.9 Study Variables

Variables of the study

Dependent variable .

- Awareness and knowledge of diabetic secondary school students.

Independent variables .

- Age, gender, Sources of information, other variables were education level, economic level.

3.10 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 ≤ 0.05 will be considered statistically significant.

4. 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

5. Ethical considerations

Permission from the Makkah 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 .

6. Relevance & Expectations:

Awareness and knowledge among diabetic secondary school students . The researcher expects from the study, low level of Awareness and knowledge among diabetic secondary school students

7. Budget: Self-funded

8. Results

Table 1Distribution 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
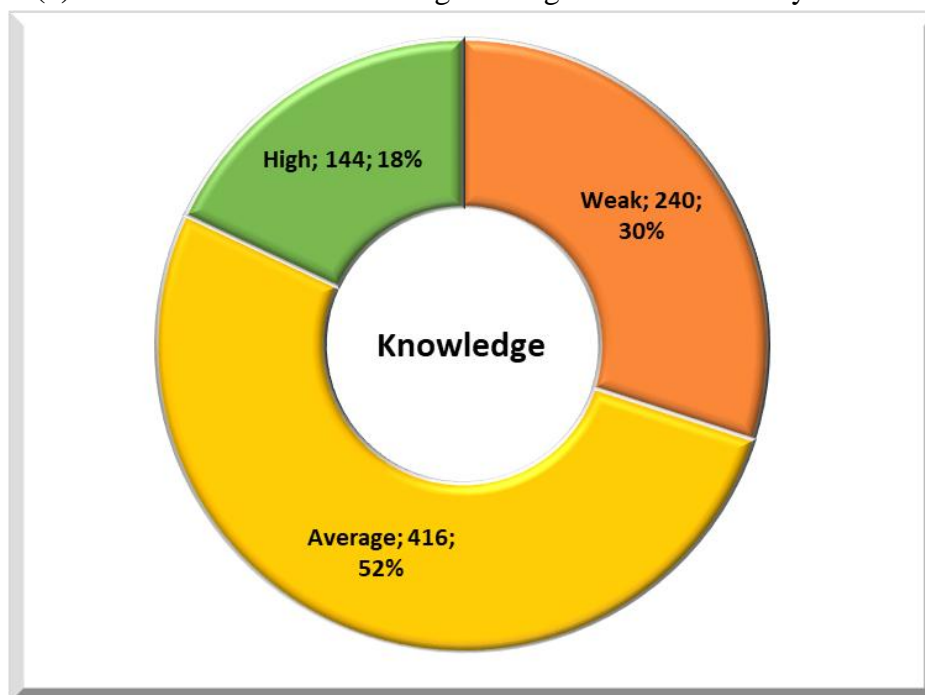
Table(3) and figure(2) Distribution of the awarenessamong diabetic secondary school students

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).

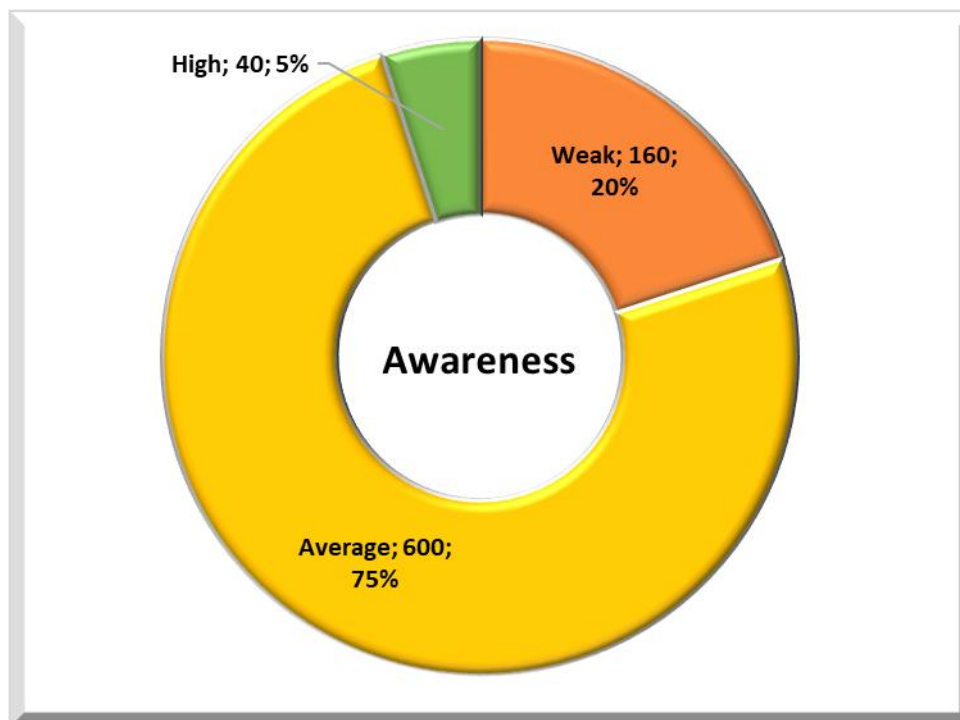**Figure (2)** Distribution of the awareness among diabetic secondary school students

Table 4and 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 Awarenesswere r= 0.784 and p-value =0.001

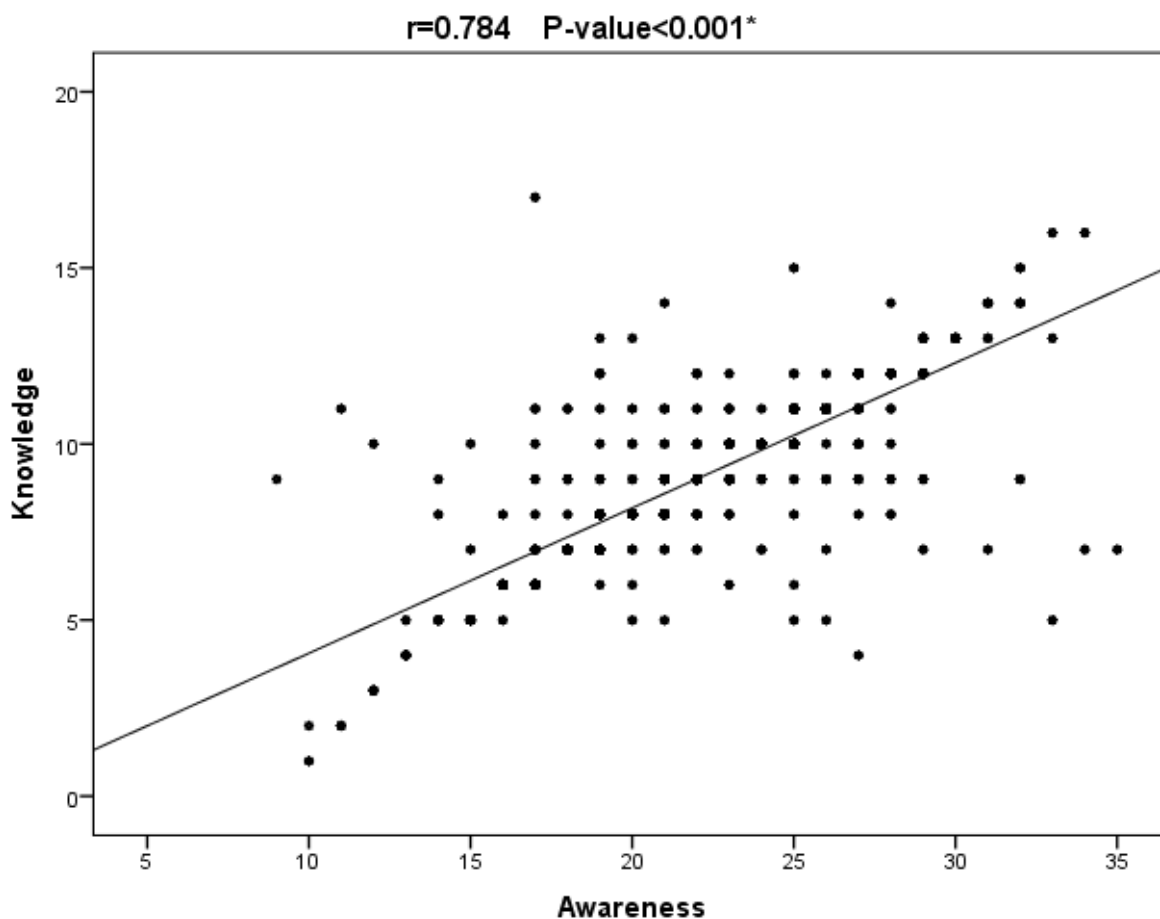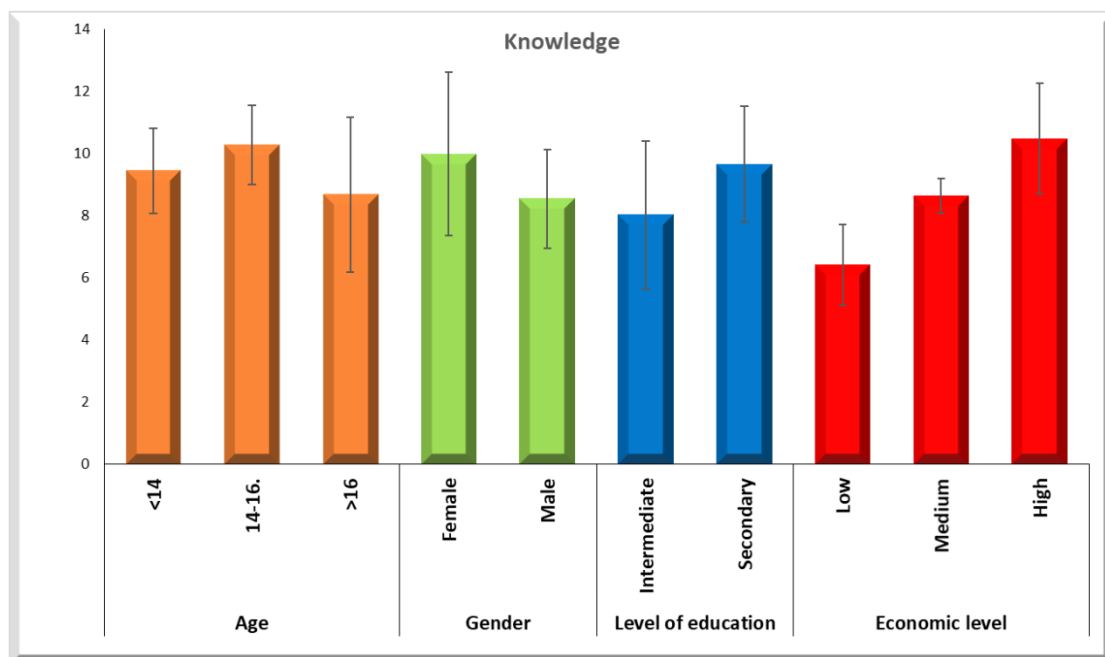**Figure (3):**Correlation between Knowledge and Awareness

Table (5) and figure (4) Distribution of the knowledge among diabetic secondary school studentsand 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) and figure(4)show that is a significant relation between knowledge and demographic data regarding age (increase in 14-16follow by<14 age) where F=32.317 and P-value=<0.0001 by mean+ SD (10.258±1.269, 9.430±1.358). Regarding 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. Regarding 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).

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

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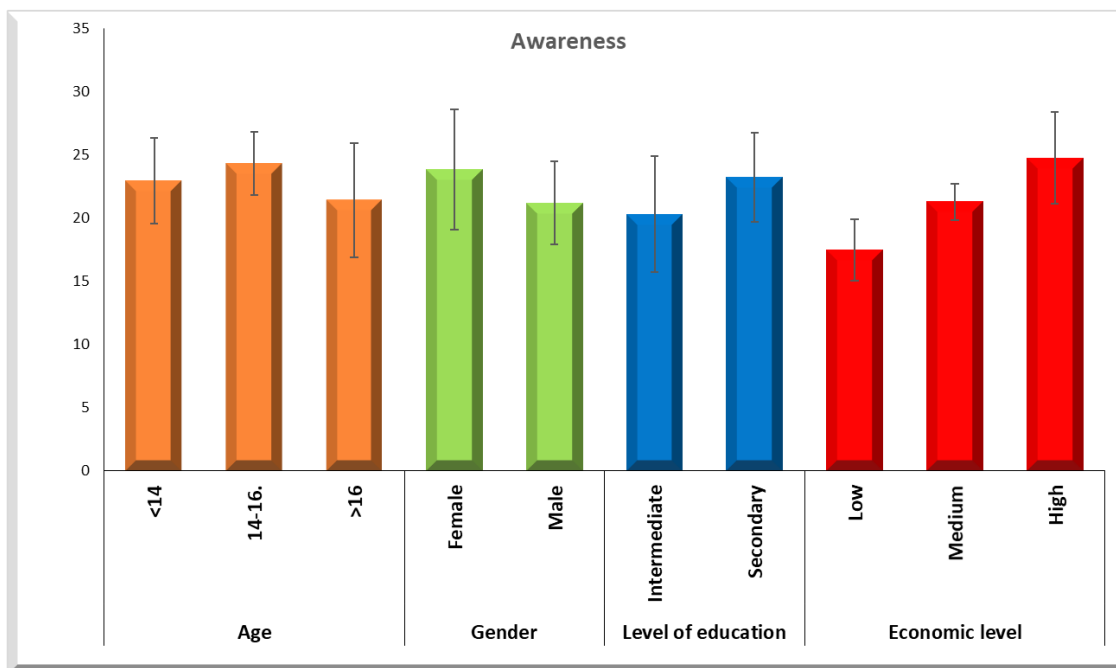
9.Discussion

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 in the Makkah at Saudi Arabia , objectives of review to evaluate the degree of awareness and knowledge among diabetic secondary school student.

This is the study to to evaluate the level of awareness and knowledge of diabetes mellitus among secondary school students in the Makkah 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 ($p = 0.001$).

10. 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 increasethe level of awareness of diabetes.

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