DIABETES MELLITUS KNOWLEDGE AND AWARENESS AMONG DIABETIC SECONDARY SCHOOL STUDENTS AT MAKKAH IN SAUDI ARABIA 2022

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Abstract:

Background: Diabetes mellitus (DM) is a major metabolic disorder currently affecting over 350 million people worldwide. Also, another one billion people in the world are pre-diabetic, who may eventually end up with full- blown diabetes. Type 2 diabetes mellitus is fast becoming a global epidemic and the number of individuals with diabetes in the world is expected to reach 330 million by 2030. The rate of T2DM is rapidly increasing in developing countries, particularly among younger age groups A cross-sectional study indicated that Saudi adolescents exhibited more health-related knowledge than the older population; the majority of the adolescents believed that obesity was dangerous and that regular exercise was beneficial for their health. According to the International Diabetes Federation. Saudi Arabia is a developing country with a young population (53% ≤24 years old). Saudi adolescents are at a high risk of developing diabetes as many suffer from obesity, a sedentary lifestyle and hereditary diabetes. In 2004, almost a quarter (23.7%) of the Saudi population was diagnosed with T2DM; this was 10 times the number of diabetic individuals in 1980.6 The occurrence of T2DM has been linked to the high rate of overweight adults (35.5%) in the Saudi population and the number of overweight and obese Saudi adolescents is high among both genders.

Aim of the study: The study aimed to assess the level of knowledge and awareness of DM among secondary school students at the Makkah in Saudi Arabia 2022.

Method: cross sectional descriptive study conducted among secondary school students at Makkah, during the April to June, 2021, the Sample size of diabetic secondary school students. Our total participants were (600). Results: a significant positive correlation between Knowledge and Awareness were r= 0.670 and p-value =0.001, the participants (58.33%) were in the age group more than 16 years the data ranged from(12.5-18) by mean ±SD(14.849±2.035),the majority of them were males (61.67%) .

Conclusion: This review highlights the need for increased knowledge and awareness of DM among the Saudi students. Raising adolescents' awareness about the primary prevention strategies for T2DM should be a public health priority in Saudi Arabia. The HBM could inform further research on diabetes prevention among Saudi adolescents. 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: Diabetes mellitus, knowledge, awareness, secondary, school, students, Saudi Arabia

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Eur. Chem. Bull. 2022, 11 (Regular Issue), 206-218

206

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Introduction:

International Diabetes Federation stated that people with diabetes is expected to increase from 171 million in 2000 to 578 million in 2030 globally. In July 2020, the number of people with diabetes is calculated to be almost 463 million worldwide. [1]

Saudi Arabia is considered to be one of the highest countries in the Middle East for the incidence of diabetes mellitus. Data are lacking regarding knowledge and awareness about Diabetes mellitus among secondary school students in Saudi Arabia [2]

The youth are the future of a country and are considered dynamic human capital that plays a vital role in nation-building. If students adopt sedentary lifestyles and are inclined to fast food and irregular eating habits, then there is a lot of probability of suffering from being overweight, obese, and, consequently, type 2 diabetes mellitus (T2DM) at a young age[3]

Low knowledge about diabetes coupled with high disease prevalence is common in low-resource countries. It is essential to evaluate and update the 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 [4] 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.[5]

It is essential to evaluate and update the knowledge, education and awareness of the diabetes among secondary school students [6]

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[7]. 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 [8,9]. 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 [10]. 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.[11]

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.[12]

The study aimed to assess the level of knowledge and awareness of diabetes mellitus among secondary school students at the Makkah in Saudi Arabia . The main objective of this study was to assess the level of knowledge and awareness among diabetic secondary school students at Makkah which might require additional educational efforts in secondary school students. This 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

The most of systematic review has shown that there is generally low knowledge and awareness among diabetic secondary school students, about the risk factors and its complications among the Saudi population and secondary school students in particular . Most diabetes mellitus patients had low to moderate knowledge scores in Riyadh,

Eur. Chem. Bull. 2022, 11 (Regular Issue), 206-218

207

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.[13]

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.[14]

Midhet et al[15] 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: a maternal history of diabetes, education level, lack of exercise and dietary habits were significant risk factors. The adjusted odds ratios for these risk factors were: regular eating of Kabsa OR = 5.5 (95% CI 2.3 to 13.5), eating vegetables OR = 0.4 (95% Cl 0.2 to 0.7), eating dates OR = 1.8 (95% Cl 1.0 to 3.3) and sedentary lifestyle OR = 2.5 (95% Cl 1.2 to 5.0) [15]

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]

In Bahraini study, it was reported an average knowledge of secondary students[18] similar results were reported by other secondary studies [19]. In a study from Turkey about knowledge and attitude of secondary students and teachers toward DM complications, it was found that the secondary students and teachers had adequate knowledge of diabetes mellitus complications [20].

Two studies carried out in the United Kingdom by Christie et al[21] and Deeb,[22] reported better education among diabetic patients improves their ability to control the disease, resulting in better patient outcomes and reduced complications. Therefore, increasing knowledge and awareness of diabetes mellitus in the population will contribute to better community health outcomes. Increased knowledge about diabetes mellitus is needed for patients to optimize their lifestyles and improve their medication habits to get the optimum benefits and delay the onset of long-term complications. Education is also essential to help diabetes mellitus patients' families cope with the necessary lifestyle modifications and provide psychological and dietary support. Therefore, improving knowledge

and awareness about diabetes mellitus among secondary school students is imperative, given the prevalence of the disease in Saudi Arabia. Public health centers are considered the best place to provide health education interventions for citizens and student both with and without diabetes mellitus.

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. [23]

According to results of study in the Kuwait, the results showed that the students had an average level of knowledge of diabetes although there were areas of shortage. Students performed best in the general knowledge section and worst in symptoms and complications of diabetes section. In this study show students scored on average more than 63.2% in each section of the questionnaire. This average was lower than expected, since students at this level are expected to have more information about diabetes.The results showed that students had good general knowledge of the disease. 89.3% knew that there are different types of diabetes affecting different ages. This could be explained by the high percentage of diabetes in Kuwait.[24]

Murad et al [15] 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 [25] found 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. Among diabetic secondary school students

2.1.Rationale:

There may be a gap between knowledge of diabetes and perceptions of diabetes among secondary school students and young adults in Saudi Arabia. Diabetes mellitus is a life-long disorder 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. Prevention and health promotion is one of the cornerstones in our practice, thus investing in knowledge, attitudes, and practices toward management of Type 2 DM.

2.2 Aim of the study:
The study aimed to assess the level of knowledge and awareness of DM among secondary school students at the Makkah in Saudi Arabia 2021

2.3 Objectives:
To assess the level of knowledge and awareness among diabetic secondary school students at Makkah

3. Methodology:
3.1 Study design:
This study is descriptive type of cross-sectional study was conducted among 300 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 Makkah 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.[26][19] 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 Makkah Mokarramah. During the April to June, 2021 the period of study in 2021

3.4.1 Selection criteria:
3.4.1 Inclusion criteria
- Secondary school students at Makkah.
- All nationalities

3.4.2 Exclusion criteria :
No specific exclusion criteria.

3.5 Sample 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 (600) 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 600. 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; (600).

3.7 Data collection tool
The self-administered questionnaire is designed based on previous studies and frameworks to assess the level of knowledge and awareness of DM 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 6 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 April to June, 2020 the period of study in 2020.
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

Eur. Chem. Bull. 2022, 11 (Regular Issue), 206-218

209

knowledge and awareness 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 knowledge and awareness 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 knowledge and awareness 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.
- Knowledge, and awareness 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 ($\chi2$) 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.

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:
Knowledge and awareness among diabetic secondary school students . The researcher expects from the study, low level of Knowledge and awareness among diabetic secondary school students

7. Budget: Self-funded
Results
Table 1 Distribution of demographic data(age, gender, Level of education, economic level, Sources of information) in our study(n=600)

	N	%
Age		
12-14.	120	20.00
14-16	130	21.67
More than 16	350	58.33
Range	12.5-18	
Mean±SD	14.849±2.035	
Gender		
Female	230	38.33
Male	370	61.67
Level of education		
Intermediate	250	41.67
Secondary	350	58.33
Economic level		
Low	170	28.33

Medium	225	37.50
High	205	34.17
Sources of information about DM		
Booklets and brochures	22	3.67
Mass media	55	9.17
Own personal experience	121	20.17
Educational films	45	7.50
Medical education in health centers and hospitals	357	59.50

Table 1 shows that most of the participants (58.33%) were in the age group more than 16 years follow by the (21.67%)were in the age 14-16 years and the data ranged from(12.5-18) by mean ±SD(14.849±2.035),the majority of them were males (61.67%) while female(38.33%),also regarding level of education the majority of participant are secondary level were(58.33%) while intermediate were(41.67%).

Regarding the economic level the majority of participant medium economic level were(37.50%). While sources of information most of participants from Medical education in health centers and hospitals were (59.50%) while Own personal experience were (20.17%)

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

Knowledge			Score	
	N	%	Range	Mean±SD
Weak	144	24.0	3-12.	8.497±2.037
Average	359	59.8		
High	97	16.2		
Total	600	100.0		

Table 2 and figure(1) Regarding knowledge of the participant toward diabetes mellitus study results show the majority of participant had average information were(59.8%) while weak knowledge

were(24.0%) the data ranged from(3-12) by mean ±SD(8.497±2.037).

Figure (1) Distribution of the knowledge among diabetic secondary school students
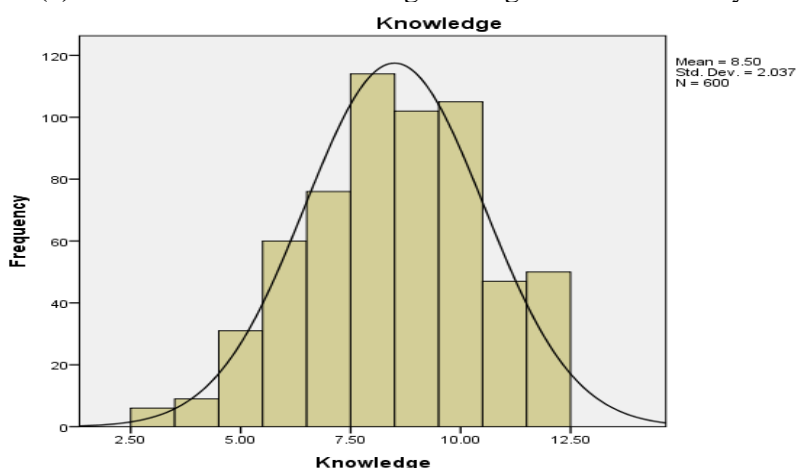
Table(3) and figure(2) Distribution of the awareness among diabetic secondary school students

Awareness			Score	
	N	%	Range	Mean±SD
Weak	164	27.3	11-31.	21.045±3.454
Average	428	71.3		
High	8	1.3		
Total	600	100.0		

Eur. Chem. Bull. 2022, 11 (Regular Issue), 206-218

211

Table 3 and figure(2) Regarding awareness of the participant toward diabetes mellitus study results show the majority of participant had average information were(71.3%) while weak awareness were(27.3%) the data ranged from(11-31) by mean ±SD(21.045±3.454).

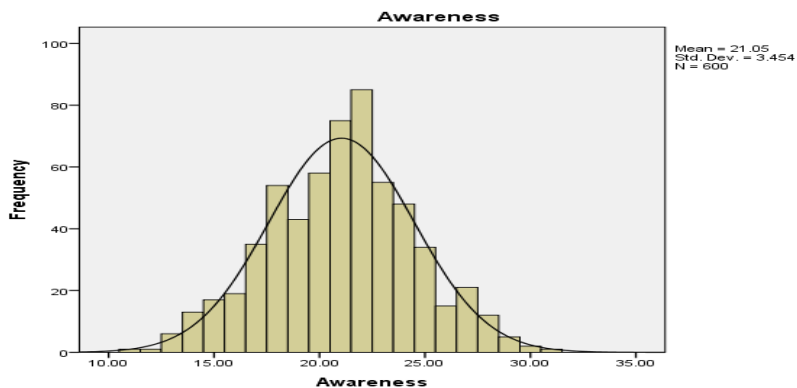**Figure (2)** Distribution of the awareness among diabetic secondary school students

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

Correlations		
	Knowledge	
	r	P-value
Awareness	0.670	<0.001*

Table show that is a significant positive correlation between Knowledge and Awareness were r= 0.670) and p-value =0.001

Figure (3): Correlation between Knowledge and Awareness
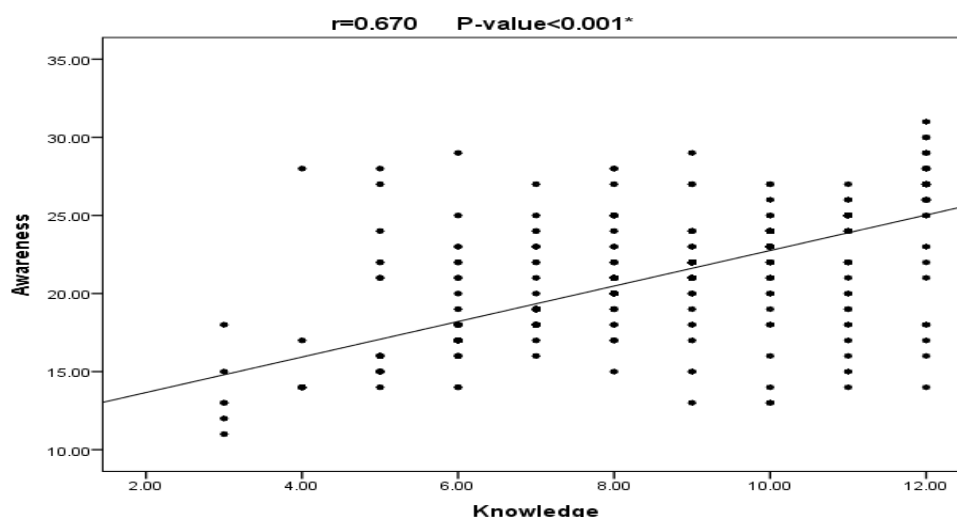
Table(5) and figure(4) Distribution of the knowledge among diabetic secondary school students and the demographic data(age, gender, Level of education, economic level)

Demographic data		N	Knowledge			T or F	ANOVA or T-test	
			Mean	±	SD		Test value	P-value
Age	<14	120	6.453	±	1.801	F	181.167	<0.001*
	14-16	130	7.795	±	1.246			
	>16	350	9.489	±	1.648			
Gender	Female	230	9.895	±	1.767	T	15.681	<0.001*
	Male	370	7.633	±	1.685			
Level of education	Intermediate	250	7.108	±	1.691	T	-17.257	<0.001*

Eur. Chem. Bull. 2022, 11 (Regular Issue), 206-218

212

	Secondary	350	9.489	±	1.648			
Economic level	Low	170	6.812	±	1.764	F	195.670	<0.001*
	Medium	225	8.351	±	1.322			
	High	205	10.054	±	1.693			

Table (5) and figure(4)show that is a significant relation between knowledge and demographic data regarding age (increase in >16 follow by age 14-16) where F=181.167 and P-value=<0.001 by mean+ SD (9.489±1.648, 7.795 ±1.246).

Regarding gender In our study the majority of our participants were noticed in female more than male with Mean± SD (9.895 ±1.767) with a significant relation between knowledge and gender were T=- 15.681 and P-value=0.001. Regarding Level of education show that a significant relation between knowledge and Level of education (increase in secondary) were T=-17.257 and P-value=0.001 by mean+ SD (9.489±1.648). Also regarding the economic level show that a significant relation between knowledge and economic level (increase in the high income participants) were F=0.179 and P-value=0.001 by mean+ SD (10.054±1.693).

Figure(4) Distribution of the knowledge among diabetic secondary school students and the demographic data(age, gender, Level of education, economic level)
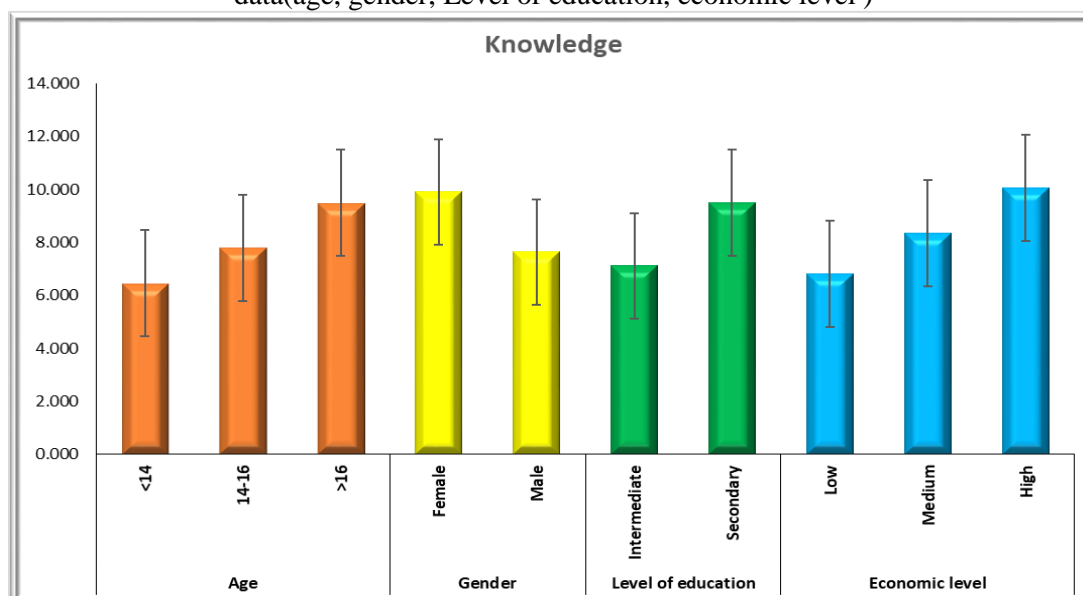
Table(6) and figure(5) Distribution of the awareness among diabetic secondary school students and the demographic data(age, gender, Level of education, economic level)

| Demographic data		N	Awareness			T or F	ANOVA or T-test	
			Mean	±	SD		Test value	P-value
Age	<14	120	17.813	±	2.974	F	136.927	<0.001*
	14-16	130	20.098	±	2.122			
	>16	350	22.557	±	3.042			
Gender	Female	230	23.048	±	3.280	T	12.530	<0.001*
	Male	370	19.809	±	2.944			
Level of education	Intermediate	250	18.928	±	2.830	T	-14.826	<0.001*
	Secondary	350	22.557	±	3.042			
Economic level	Low	170	18.347	±	3.118	F	143.000	<0.001*
	Medium	225	20.996	±	2.158			
	High	205	23.337	±	3.243			

Table (6) and figure(5)show that is a significant relation between awareness and demographic data regarding age (increase in >16 follow by age 14-16) where F=136.927 and P-value=<0.001 by mean+ SD (22.557±3.042, 20.098±2.122).

Regarding gender In our study the majority of our participants were noticed in female more than male with Mean± SD (23.048±3.280) with a significant relation between awareness and gender were T=12.530 and P-value=0.001. Regarding Level of

Eur. Chem. Bull. 2022, 11 (Regular Issue), 206-218

213

education show that a significant relation between awareness and Level of education (increase in secondary) were T=-14.826 and P-value=0.001 by mean+ SD (22.557±3.042). Also regarding the economic level show that a significant relation between awareness and economic level (increase in the high income participants) were F=143.000 and P-value=0.001 by mean+ SD (23.337±3.243).

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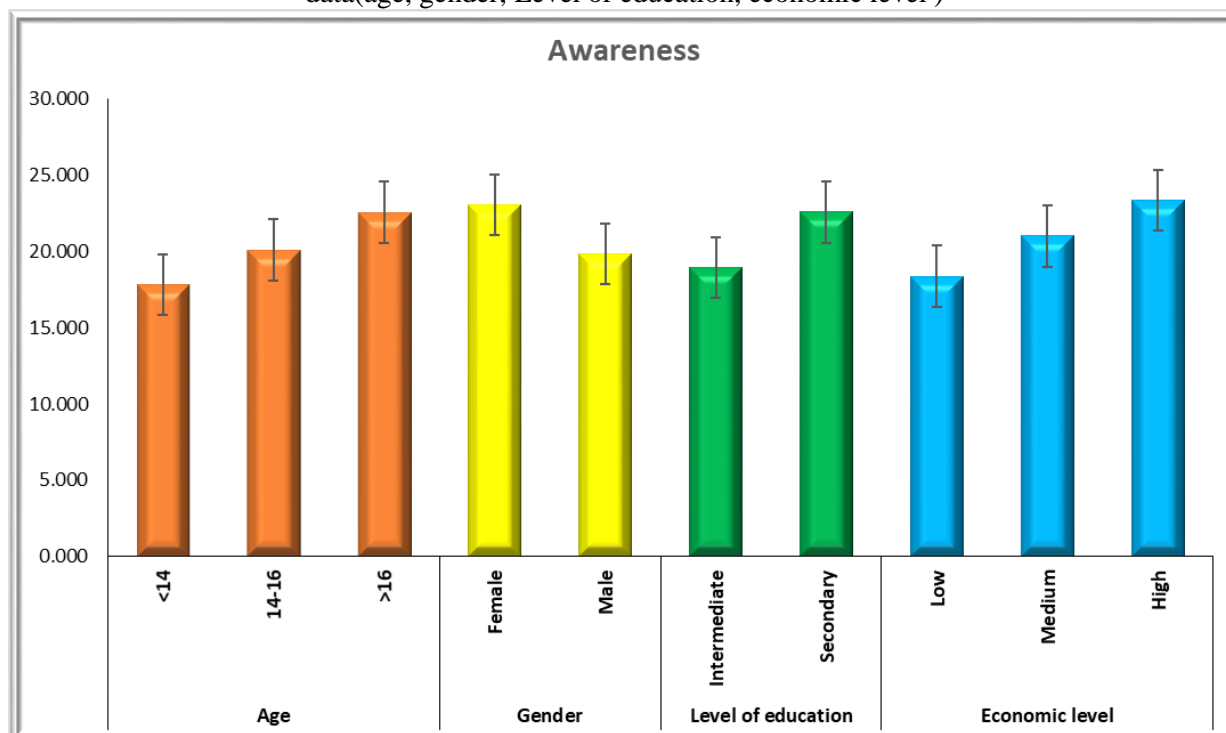
Discussion

There may be a gap between knowledge of diabetes and awareness of diabetes all participants in our study were the students of secondary school, the study aimed to assess the level of knowledge and awareness of diabetes mellitus among secondary school students at the Makkah in Saudi Arabia 2021, objectives of the study to assess the level of knowledge and awareness among diabetic secondary school students.

This is the first study to assess the level of knowledge and awareness among diabetic secondary school students in Makah. In the present study, the male students were more participants (61.67%) than female students (38.33%) and the large majority of participants were in the age range more than 16 years old representing (58.33%) of all participants, in our result show most of the participants (58.33%) were in the age group more than 16 years follow by the (21.67%)were in the age 14-16 years and the data ranged from(12.5-18) by mean ±SD(14.849±2.035),the majority of them were males (61.67%) while female(38.33%),also regarding level of education the majority of participant are secondary level were(58.33%) while intermediate were(41.67%). The economic

level the majority of participant medium economic level were(37.50%). While sources of information most of participants from Medical education in health centers and hospitals were (59.50%) while Own personal experience were (20.17%) . The highest percent of students secondary education (58.33%), while the least percent (41.67%) had Intermediate education degree(See Table 1). In a Jordanian study[27] there was dominancy in male and young age participants. A study from Turkey showed that 50% of participant students were males [20] . A study from Ghana [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[18]

Overall the results showed that more than half (59.8) our students had an average level of knowledge of diabetes although there were areas of shortage. knowledge of the participant toward diabetes mellitus study results show the majority of participant had average information were(59.8%) while weak knowledge were(24.0%) the data

ranged from(3-12) by mean ±SD(8.497±2.037).(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 [29]. Al-Aboudi et al.[30] 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. [31], 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 (71.3) 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(71.3%) while weak awareness were(27.3%) the data ranged from(11-31) by mean ±SD(21.045±3.454).(Table 3)

In light of this result, it is interesting to know that a similar study was done in Singapore [32] 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 [33]

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 is a significant positive correlation between Knowledge and Awareness were (r= 0.670) and p-value =0.001.(Table 4), similar a Chinese study reported inadequate knowledge of diabetes and its related factors among college students.[34] in our study about less than half of the respondents have an high

knowledge about the DM (16.2%). also our participants require a lot of awareness of this aspect as we observed that a small percentage (1.3%) 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.[35] In a recent survey, Alqahtani et al (2020) in Riyadh, KSA, revealed better knowledge scores among the adult population regarding DM.[36] Alenazi et al (2020) mentioned relatively better (62.6%) knowledge scores in young school children regarding diabetes mellitus.[37]

In relation to variables associated with knowledge significant relation between knowledge and demographic data regarding age (increase in >16) where F=181.167 and P-value=<0.001 by mean+ SD (9.489±1.648). also a significant relation between knowledge and gender were T=-15.681 and P-value=0.001. but level of education show that a significant relation between knowledge and level of education (increase in secondary) were T=-17.257 and P-value=0.001 by mean+ SD (9.489±1.648). and the economic level show that a significant relation between knowledge and economic level (increase in the high income participants) were F=0.179 and P-value=0.001 by mean+ SD (10.054±1.693). (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[38]. In relation to variables associated with awareness, is a significant relation between awareness and demographic data regarding age (increase in >16) where F=136.927 and P-value=<0.001. Also gender In our study were noticed in female more than male with a significant relation between awareness and gender were T=12.530 and P-value=0.001. but level of education show that a significant relation between awareness and level of education were T=-14.826 and P-value=0.001, the economic level show that a significant relation between awareness and economic level were F=143.000 and P-value=0.001 (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

Eur. Chem. Bull. 2022, 11 (Regular Issue), 206-218

215

demographic variables (including diabetes mellitus status) with awareness scores [30]; 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 [40]. 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 concluded 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. However, a significant association was found between the knowledge and awareness level of the high school students about the age, gender, and level of education of the students. Health authorities and school authorities in the region should offer special efforts to improve the level of knowledge and awareness through regular health education campaigns about diabetes mellitus, particularly for school students, school teachers, and parents of the school students. Simultaneously, incorporation of health education messages about major chronic diseases into textbooks and school curriculum will provide opportunities for increasing awareness of school students regarding diabetes mellitus

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216

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217

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Eur. Chem. Bull. 2022, 11 (Regular Issue), 206-218

218