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Assessment of knowledge and attitude of type 1 diabetes mellitus among primary and intermediate school staff in Al Ahsa, Saudi Arabia

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ABSTRACT

Background: Diabetes mellitus type 1 (T1D) is a metabolic disease. Those diagnosed with T1D, need special care, especially children, to prevent complication and provide proper care to T1D children, school staff they should have a high level of awareness and knowledge to deal with diabetic children because they are responsible for them in school. Evaluating awareness of T1D and the level of knowledge of school staff will help to increase awareness of dealing with diabetic children. To determine school staff's diabetes training needs and their ability to provide suitable care to their diabetic students, This study is aimed to assess the knowledge, attitudes, and management practices related to T1D in children among intermediate and primary school staff in Al Ahsa. *Methods:* A cross-sectional study was conducted among primary and intermediate school personnel in Al Ahsa, Saudi Arabia from October to November 2020. The data were collected by using an online questionnaire and a self-administered questionnaire for type 1 Diabetes mellitus used. Scientific Package of the Social Sciences version 22 (SPSS) was used to enter and analyze the data. *Results:* The sample size was 398; the general awareness level regarding T1D is good in (53.8%) participants. Only (25.6%) had a good level of awareness about complications associated with the disease while awareness of management practice regarding T1DM was good among (44.7%). *Conclusion:* In this study, the general knowledge about type 1 diabetes mellites present among the primary and intermediate schools staffs in Al Ahsa however, they had limited awareness regarding diabetes complications and management. Therefore, the study recommended the need for a training program to be created to increase the awareness of school staff about diabetes and how to manage or deal with students who have diabetes, especially in emergency cases.

Keywords: Diabetes mellitus, School staff, Alahsa, Saudi Arabia

1. INTRODUCTION

Diabetes mellitus type 1 (T1D) is a metabolic disease. T1D is caused by a defect in B-cell function, which are cells found in the pancreas and responsible for making insulin. This damage is triggered by the immune system which leads to insulin deficiency, thus increasing the level of glucose (IDF, 2020). T1D is one of the most prevalent chronic diseases in children. In 2019, the prevalence of T1D globally in the under 15 age group is 600,900 cases and the annual increase is 98,200 cases per year (Silverstein et al., 2005). There is a significant increase in the incidence of T1D especially among those who are under the age of 15 years; the increase is estimated to be around 3% (Patterson et al., 2019; Diamond, 2006).

Saudi Arabia is one of the countries in the world with the highest number of new cases of T1D as reported by the international diabetes federation in 2019. Approximately, 2500 children aged 0-14 are diagnosed with T1D yearly (Silverstein et al., 2005; Alzahrani et al., 2020). From 1990 to 2007, the incidence rate of childhood type 1 diabetes in eastern Saudi increased, and the percentages are higher in females at 7 and 11 years of age and in males at 8 and 12 years of age (Abduljabbar et al., 2010). Diabetes can lead to serious complications in any organ system in the body. One of the major acute issues of T1D is Diabetes ketoacidosis which leads to a total deficit of insulin, hyperglycemia, and metabolic acidosis (Silverstein et al., 2005; Bouya et al. 2020). Missing insulin injections seem to be the most common cause of Diabetes ketoacidosis in a diagnosed patient. Therefore, this complication can be prevented or reduced by proper care (Diabetes Group, 1994).

Children who are diagnosed with T1D need special care; they must regularly monitor blood glucose, follow a meal plan, and take Insulin which is usually administered in multiple daily injections. Children spend a long time in schools, so these students with diabetes need knowledgeable staff to help them in monitoring their diabetes when they are in school. So, teachers and school personal must be aware of diabetes and its complications and they also must be trained in managing and treating emergencies of diabetes because a decrease in the knowledge among them can lead to major consequences (American Association, 2003).

In the literature, Faisal (2003) found that Bahrain's school teachers lack diabetic knowledge. Moreover, Aycan et al. (2012) highlights that 47.6% of participants had a moderate level of knowledge about diabetes, and 32.4% had a lower level of knowledge, indicating that school teachers had limited knowledge about diabetes. Also, several studies are evaluating the awareness of T1D among school teachers in different parts of Saudi Arabia. According to Abdel (2009), just 18.6% of teachers had a good total score of diabetes management practices for their diabetic students in Makkah. Almehmad et al. (2018) found that the level of awareness about diabetes among school teachers was moderate. Furthermore, Duraywish & Nail (2017) indicate that teachers have adequate general knowledge of the symptoms of diabetes, but they were deficient in complications and management of the disease.

School staffs are responsible for school children, so they should have sufficient knowledge and a good level of understanding about diabetes to work with children with diabetes. This study may, therefore, contribute to increased awareness of the role of training to deal with diabetic children, especially in emergencies. To date, no other studies are investigating the awareness of school personnel about T1D in children in Al Ahsa province. Thus, this study aimed to assess the knowledge and awareness about T1D in children, its complications, and management practices among intermediate and primary school staff including administrators and educators, in Al Ahsa, Saudi Arabia.

2. MATERIALS AND METHODS

This cross-sectional study was conducted from October 2020 to November 2020 among intermediate and primary school staff, educators, and teachers in Al Ahsa, Saudi Arabia. The data was collected through a pre-tested self-administered online questionnaire. A total of 398 teachers and administrators who agreed to participate in the research and fulfilled the criteria were included.

The questionnaire addressed three main domains including demographic data, knowledge about T1D, and knowledge about complications and management practices. The demographic data domain collects information regarding age, gender, nationality, qualification, information about the workplace, and whether the participant is diabetic or has a diabetic relative. The second domain includes 12 questions assessing the participant information and facts about T1D. The third domain consists of 10 questions that test the knowledge regarding T1D complications and how to approach such cases. The consent was taken from the participants before fulfilling the questionnaire. Before the consent, the purpose of the study was explained, and anonymity was assured. The ethical approval of the study was obtained from King Fahad Medical City, Riyadh, Saudi Arabia.

Descriptive analysis based on frequency and percent distribution was done for all variables including teacher's bio-demographic data, general awareness items, knowledge regarding diabetes complications, and source of their information. A participant with a score of less than 60% of the maximum score was considered to have poor awareness while good awareness was

considered if he had a score of 60% of the maximum or more. All statistical analysis was done using two-tailed tests. A p-value of less than 0.05 was statistically significant. For awareness items, each correct answer was given a one-point score and the total sum of the discrete scores of the different items was calculated. Cross tabulation was used to assess the distribution of teachers' awareness according to their personal characteristics and source of information. Relations were tested using the Pearson chi-square test. After data were extracted, it was revised, coded, and fed to statistical software IBM SPSS version 22(SPSS, Inc. Chicago, IL).

3. RESULTS

The study included 398 participants, from Al Ahsa region, whose ages ranged from 20 to 59 years old with a mean age of 38.6 ± 12.7 years old. Half of the participants were females (52%) and (97.7%) were Saudi. Regarding their job, the majority of the sampled were class teachers (83.9%), (13.1%) were at administrative positions and the others are student guides (3%). As for qualification, (96.7%) had a diploma or bachelor's degree. Only (11.3%) of the participants were diabetic. However, (75.9%) had a family member with diabetes while (53%) ever had a child with diabetes in their classroom (Table *1*).

Table 1 Bio-demographic data of primary and intermediate school staff in Al Ahsa, Saudi Arabia

Bio-demographic data		*No*	*%*
Age in years	*< 25 Yrs.*	*7*	*1.8%*
	26-35	*32*	*8.0%*
	36-45	*199*	*50.0%*
	> 45 Yrs.	*160*	*40.2%*
Gender	*Male*	*191*	*48.0%*
	Female	*207*	*52.0%*
Nationality	*Saudi*	*389*	*97.7%*
	Non-Saudi	*9*	*2.3%*
Job	*Teacher*	*334*	*83.9%*
	Student guide	*12*	*3.0%*
	Administration	*52*	*13.1%*
Qualification	*Diplome/ bachelor*	*385*	*96.7%*
	Master/ PhD	*13*	*3.3%*
School type	*Governmental*	*384*	*96.5%*
	Private	*14*	*3.5%*
School grade	*Primary*	*200*	*50.3%*
	Intermediate	*198*	*49.7%*
what subject are you teaching	*English*	*38*	*9.5%*
	Science	*50*	*12.6%*
	Others	*310*	*77.9%*
Teaching experience years	*< 5 Yrs.*	*27*	*6.8%*
	5-10	*64*	*16.1%*
	> 10 Yrs.	*307*	*77.1%*

Have DM	*Yes*	*45*	*11.3%*
	No	*353*	*88.7%*
Family history of DM	*Yes*	*302*	*75.9%*
	No	*96*	*24.1%*
Ever have diabetic child in your class	*Yes*	*211*	*53.0%*
	No	*187*	*47.0%*

General knowledge regarding diabetes is illustrated in Table 2. About (63%) of the participants had heard of DM1. As for symptoms of type I DM, the most reported was frequent urination (83.9%) followed by increased thirst (58.3%), tiredness (48%), blurred vision (35.2%), and unexplained weight loss (31.9%). The majority of participants were aware of the correct way to measure blood glucose level (87.4%), however, only (27.4%) correctly answered that the normal range of fasting blood sugar levels should be less than 100 mg/l. Insulin causes blood sugar to be decreased was reported by 69.6% of the participants and 92.5% know that insulin is given as an injection. More than half of participants (61.6%) agreed that diabetic children can take part in physical education classes and 86.7% believed that diabetic children should take some precautions before physical activities classes. Also, only 1.3% of the participants thought that a special meal doesn't need to be provided for a diabetic child staying for school while 93.5% believed that a diabetic child must have a mid-morning snack.

Table 2 General knowledge regarding type 1 diabetes among primary and intermediate school staff in Al Ahsa, Saudi Arabia

Knowledge regarding diabetes		*No*	*%*
Received training or information about type 1 diabetes	*Yes*	*252*	*63.3%*
	No	*146*	*36.7%*
Symptoms of DM	*Don't know*	*45*	*11.3%*
	Frequent urination	*334*	*83.9%*
	Blurred vision	*140*	*35.2%*
	Increased thirst	*232*	*58.3%*
	Un-explained weight loss	*127*	*31.9%*
	Tiredness	*191*	*48.0%*
	Loss of consciousness	*96*	*24.1%*
	Weight gain	*38*	*9.5%*
The most common way of measure blood sugar level	*Don't know*	*16*	*4.0%*
	Blood test	*348*	*87.4%*
	Urine test	*32*	*8.0%*
	Saliva test	*2*	*.5%*
Normal range of fasting blood sugar levels	*Don't know*	*108*	*27.1%*
	<100 mg/dl	*109*	*27.4%*
	100-135 mg/dl	*174*	*43.7%*
	>135 mg/dl.	*7*	*1.8%*
Insulin causes the blood glucose (sugar) level to	*Don't know*	*64*	*16.1%*
	Decrease BG level	*277*	*69.6%*
	Increase BG level	*45*	*11.3%*
	No effect	*12*	*3.0%*
Insulin can be given by	*Don't know*	*12*	*3.0%*

	Injection	*368*	*92.5%*
	Tablets	*18*	*4.5%*
Diabetic child can take part in physical education class	*Don't know*	*40*	*10.1%*
	Yes	*245*	*61.6%*
	No	*113*	*28.4%*
Diabetic children take any precautions before physical activities class	*Don't know*	*28*	*7.0%*
	Yes	*345*	*86.7%*
	No	*25*	*6.3%*
It is necessary for a special meal to be provided for a diabetic child staying for school	*Don't know*	*3*	*.8%*
	Yes	*390*	*98.0%*
	No	*5*	*1.3%*
It is necessary for a diabetic child to have a mid-morning snack	*Don't know*	*15*	*3.8%*
	Yes	*372*	*93.5%*
	No	*11*	*2.8%*

Table 3 Knowledge regarding complications and management of type 1 diabetes among primary and intermediate school staff in Al Ahsa, Saudi Arabia

knowledge about complication and management practices		*No*	*%*
Can you measure blood sugar level	*Yes*	*224*	*56.3%*
	No	*174*	*43.7%*
Would you be willing to learn how to measure blood sugar level	*Yes*	*163*	*93.7%*
	No	*11*	*6.3%*
If a diabetic child develops thirst, vomiting, and stomach pain is his blood sugar level likely to be low or high	*Don't know*	*152*	*38.2%*
	Increased blood glucose level	*169*	*42.5%*
	Decreased blood glucose level	*77*	*19.3%*
This situation can be coped with in school	*Don't know*	*90*	*22.6%*
	Yes	*204*	*51.3%*
	No	*104*	*26.1%*
if diabetic child develops dizziness, sweating, and confusion is his blood sugar level likely to be low or high	*Don't know*	*85*	*21.4%*
	Increased blood glucose level	*85*	*21.4%*
	Decreased blood glucose level	*228*	*57.3%*
This situation can be coped with in school	*Don't know*	*77*	*19.3%*
	Yes	*250*	*62.8%*
	No	*71*	*17.8%*
When a child with type 1 diabetes experiences a low blood glucose (sugar) level, should they have access to:	*Sugar*	*369*	*92.7%*
	Insulin	*11*	*2.8%*
	Nothing	*18*	*4.5%*

In case of coma, small amount of jam or honey can be put into the mouth of the diabetic student?	*Don't know*	*19*	*4.8%*
	Yes	*253*	*63.6%*
	No	*126*	*31.7%*
Child with type 1 diabetes can be allowed to eat in the classroom during lessons?	*Don't know*	*28*	*7.0%*
	Yes	*357*	*89.7%*
	No	*13*	*3.3%*
It is useful to receive more information and taking training programs on supporting children with type 1 diabetes in schools	*Don't know*	*40*	*10.1%*
	Yes	*343*	*86.2%*
	No	*15*	*3.8%*

Table *3* shows the knowledge regarding complications and management of type 1. A total of 56.3% of the study participants reported that they know how to measure blood glucose level regardless of 93.7% were interested to learn the method from experts. About 42.5% of the participants think that thirst, vomiting, and stomach pain indicate a high blood sugar level in a diabetic child. But, only 26.1% answered that this situation can be coped within the school. On the other hand, 57.3% of the participants identified low blood sugar levels to be associated with dizziness, sweating, and confusion and 62.8% think that it can be managed in the school. Also, 92.7% of the participants selected giving sugar to a diabetic child with low blood glucose and 63.6% know that it is possible to put a small amount of jam or honey into the mouth of the diabetic student. Eating during the classroom for a diabetic child was considered allowed by 89.7% of the participants and 86.2% agreed that it is useful to receive more information and taking training programs on supporting children with type 1 diabetes in schools. In total, (53.8%) participants had good general awareness level regarding T1DM, (25.6%) had good awareness level regarding T1DM complications and management practice with good overall awareness level regarding T1DM in total among (44.7%) (Figure *1*).

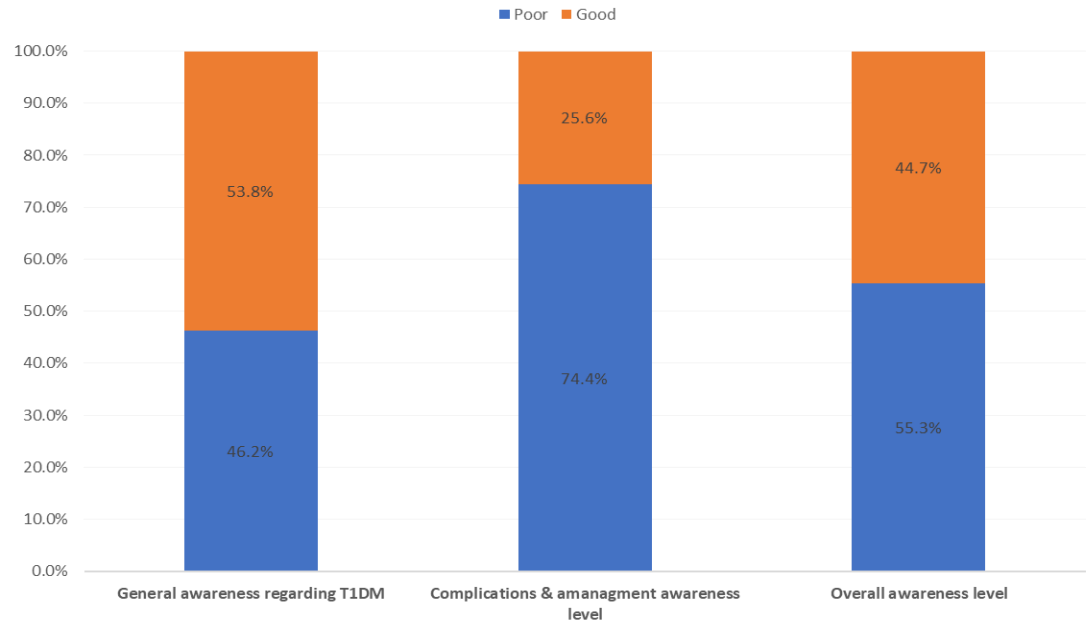

Figure 1 Participants awareness level regarding T1DM among primary and intermediate school staff in Al Ahsa, Saudi Arabia

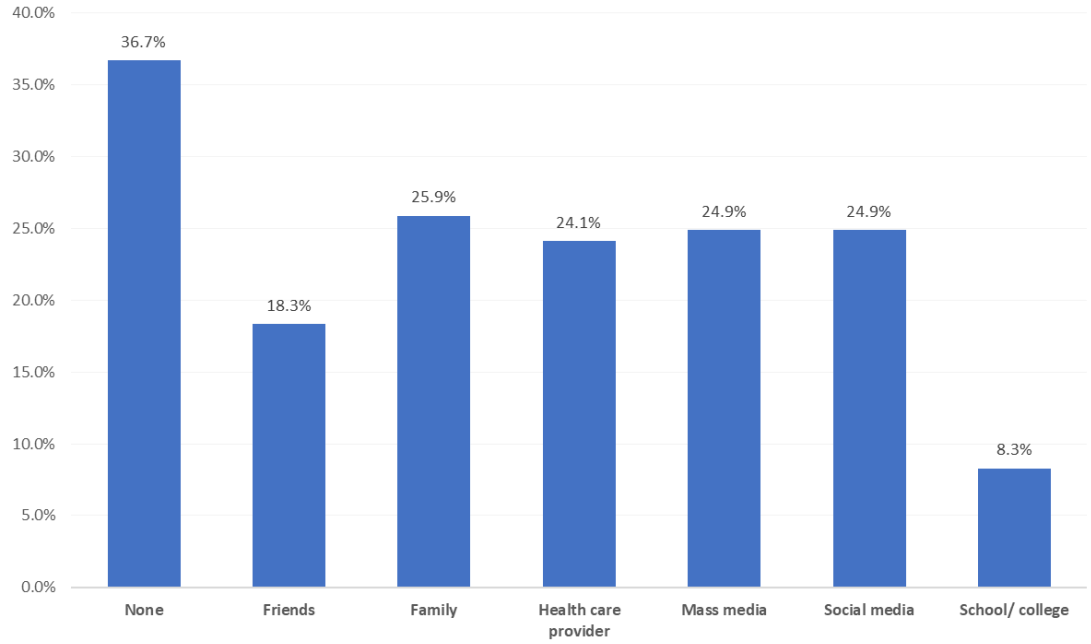

Figure 2 Source of participants' information regarding T1DM among primary and intermediate school staff in Al Ahsa, Saudi Arabia

Considering Source of participants' information regarding T1DM (Figure 2), the family was the most reported source (25.9%) followed by social media (24.9%), mass media (24.9%), and health care provider (24.1%) while 36.7% of the participants had no specific reported source. Table 4 demonstrates the distribution of participants' awareness regarding T1DM by their bio-demographic data. Good awareness was detected among 49.4% of participants aged more than 45 years compared to none of those who were below the age of 25 years with statistical significance (P=.049). Also, 49.8% of female participants had good awareness in comparison to 39.3% of males (P=.035). Good awareness was detected among 68% of teachers who teach science compared to 41.9% of other subject teachers (P=.002). As for teaching experience, 48.5% of teachers with experience exceeded 20 years compared to 25.9% of those with experience less than 5 years (P=.015). Also, 60% of diabetic teachers had a good awareness level in comparison to 42.8% of those without (P=.029).

Table 4 Distribution participants' awareness regarding T1DM by their bio-demographic data

Factors		*Overall awareness level*				*P-value*
		Poor		*Good*		
		No	*%*	*No*	*%*	
Age in years	*< 25 Yrs.*	*7*	*100.0%*	*0*	*0.0%*	*.049**
	26-35	*20*	*62.5%*	*12*	*37.5%*	
	36-45	*112*	*56.3%*	*87*	*43.7%*	
	> 45 Yrs.	*81*	*50.6%*	*79*	*49.4%*	
Gender	*Male*	*116*	*60.7%*	*75*	*39.3%*	*.035**
	Female	*104*	*50.2%*	*103*	*49.8%*	
Job	*Teacher*	*172*	*51.5%*	*162*	*48.5%*	*.001**
	Student guide	*7*	*58.3%*	*5*	*41.7%*	
	Administration	*41*	*78.8%*	*11*	*21.2%*	
Qualification	*Diplome/ bachelor*	*213*	*55.3%*	*172*	*44.7%*	*.916*

	Master/ PhD	*7*	*53.8%*	*6*	*46.2%*	
School type	*Governmental*	*209*	*54.4%*	*175*	*45.6%*	*.074*
	Private	*11*	*78.6%*	*3*	*21.4%*	
School grade	*Primary*	*114*	*57.0%*	*86*	*43.0%*	*.487*
	Intermediate	*106*	*53.5%*	*92*	*46.5%*	
what subject are you teaching	*English*	*24*	*63.2%*	*14*	*36.8%*	
	Science	*16*	*32.0%*	*34*	*68.0%*	*.002**
	Others	*180*	*58.1%*	*130*	*41.9%*	
Teaching experience years	*< 5 Yrs.*	*20*	*74.1%*	*7*	*25.9%*	
	5-10	*42*	*65.6%*	*22*	*34.4%*	*.015**
	> 10 Yrs.	*158*	*51.5%*	*149*	*48.5%*	
Have DM	*Yes*	*18*	*40.0%*	*27*	*60.0%*	*.029**
	No	*202*	*57.2%*	*151*	*42.8%*	
Family history of DM	*Yes*	*166*	*55.0%*	*136*	*45.0%*	*.826*
	No	*54*	*56.3%*	*42*	*43.8%*	
Ever have diabetic child in your class	*Yes*	*112*	*53.1%*	*99*	*46.9%*	*.349*
	No	*108*	*57.8%*	*79*	*42.2%*	

P: Pearson X^2 test

** P < 0.05 (significant)*

4. DISCUSSION

The current study aimed to assess primary and intermediate schools' staff's knowledge and attitude towards T1D diabetes mellitus. Also, to assess staff's management practices related to T1D in children among intermediate and primary school in Al Ahsa and to determine their diabetes training needs and their ability to provide suitable care to their diabetic students. Type 1 diabetes is one of the most common chronic health problems among children (Atkinson et al., 2014). The highest prevalence rates of diabetes are recorded in North Africa and the Middle East (Lam & Le Roith, 2012). In Saudi Arabia, diabetes is a challenging problem with a high burden (Tabish, 2007). In the last few years, there is a rising in diabetes prevalence in Saudi Arabia (Alotaibi et al., 2017). About 26% of the Saudi population are under the age of 14 years (Saudi Statistics, 2020). Nearly 35,000 children and adolescents in Saudi Arabia had T1DM, which putting Saudi Arabia at the 8th rank regarding numbers of TIDM patients and 4th country in the world as for of the incidence rate (33.5 per 100,000 individuals) of T1DM (Robert et al., 2018; Sheikh et al., 2020).

The results indicate that teacher's awareness regarding T1D symptoms varied according to symptom nature as frequent urination with increased thirst were the most identified. Unexplained weight loss and loss of consciousness were knowledgeable for only one-third of the teachers. This is a very important item as teachers observe for their students most daytime, making them vulnerable to identify diabetic child early through symptoms. In this study, teachers also reported high awareness regarding methods to diagnose T1D and for normal range of blood glucose level. Regarding insulin-related data, teachers had excellent knowledge regarding its role and method of injection. Considering the needs of a diabetic child, teachers knew that students should have snacks between meals, and they should follow certain precautions before exercises. In total, more than half of the teachers were knowledgeable regarding the general overview of T1D. Also Duraywish et al., (2017) found that more than 75% of the participants had adequate general knowledge about diabetes. On other hand, Faisal (2003) concluded that the school's teachers in Bahrain are deficient in diabetic knowledge. The mean knowledge score was 5.34. Of the total group of 1054 teachers which disagree with this study and the reason behind this difference is the time when we compare these days with 2003 so many things is different because in these days people can be improved their awareness by social media, for example, the Ministry of Health had

especial accounts in social media and they always send information about many chronic diseases one of them is T1D. As well as increasing numbers of volunteer campaigns in everywhere in malls, schools and so on, which may play role in increase improving awareness?

Regarding complications and management practice of T1D in the current study, nearly half of the teacher reported that they can measure blood glucose level, but the majority intended to learn how to measure. The alarming findings were for the teacher's awareness regarding signs of increased or decreased blood glucose level for a diabetic child (only half of the teachers correctly named the effect). Also, half of the teachers reported that hyperglycemia status can be managed in the school which is incorrect and may push a child to have DKA. On the other hand, awareness regarding dealing with dropped blood glucose levels was high (through oral sugar, jam, or honey). This indicated that the overall awareness of the sampled teachers regarding diabetes complications and management was poor (1 out of 4 were knowledgeable). These findings are similar to which be found in a study conducted in Riyadh's Schools. Abdel (2009) found that knowledge about T1D in Riyadh's schools seem to be also inadequate as only 18.6% of the sample got a good level of total diabetes management. Also, awareness about complications of T1D similarly found to be low in Bahrain and Turkey (Faisal, 2003; Aycan et al., 2012).

The overall awareness level reported revealed that less than half of the teachers had a good awareness level regarding T1D. This can be explained by that the most reported sources of information among the study teachers were family, friends, social media, and mass media. Health care providers as a source of information were reported by only one-fourth of the teachers. The population should know from where they take information because these days there are a lot of misunderstandings and wrong believes, so they should consider the health care provider as the main source of information as well as MOH especial accounts in social media.

This study reported that awareness level was higher among male teachers, aged 45 years or more, science teachers, teachers with high experience, and those who had DM. In Bahrain, Faisal (2003) found that the school's teachers had poor knowledge of diabetes. The mean knowledge score was 5.34. Married teachers, primary school teachers, and female teachers had better knowledge than other teachers. Science teachers had better diabetic knowledge (89.6%) than Arts teachers (83.6%). In addition, Almehmad et al., (2018) assessed the awareness of school teachers about diabetes mellitus and found that nearly 36% of the teachers had a high awareness level. Also, the age of teachers significantly (P-value=0.009) affected the level of awareness, where teachers with older age (≥50 years) had the highest awareness among other participants, but others with age 40-49 years were the leading group to have both moderate 30 (58.8%) and low awareness 20 (39.2%). Also, the exact of males 23 (33.8) had a high level of awareness than females 3(12.6%). In Tabuk, Hassan et al., (2017) found that overall; the teachers` knowledge of type 1 DM was insufficient in more than half of them (59.3%) and good in 40.7% which matches the current study findings. Also, a Good level of knowledge was detected among 46% of male teachers in comparison to 35.2% of female teachers.

According to the American Diabetes Association (2003), hypoglycemia is the most common immediate health problem for students with diabetes. Severe hypoglycemia, which is rare, may lead to unconsciousness and convulsions and can be life-threatening if not treated promptly. On other hand, hyperglycemia if untreated over a period of days, can cause a serious condition called diabetic ketoacidosis (DKA), which is characterized by nausea, vomiting, and a high level of ketones in the blood and urine. For students using insulin infusion pumps, lack of insulin supply may lead to DKA more rapidly. DKA can be life-threatening and thus requires immediate medical attention.

5. CONCLUSIONS

The current study shows that primary and intermediate school staffs in the Al-Ahsa region have a general knowledge about type 1 diabetes mellites; however, they have limited awareness regarding diabetes complications and management. More than half of these personnel had met a diabetic child in their classroom. Furthermore, the majority of the staff is willing to attend training programs and receive more information about supporting diabetic students. Therefore, our study suggests that training programs must be created to inform teachers about diabetes and its management, as well as their role in schools in managing diabetic children.

Abbreviations

T1D: Type 1 diabetes mellitus; DKA: Diabetic Ketoacidosis

Ethical Consideration

The ethical approval of the study was obtained from King Fahad Medical City, Riyadh, Saudi Arabia. (Ethical approval code: 20-646E)

Authors Contribution

All authors shared in writing the proposal, data collection, data entry and analysis with review of the manuscript.

Competing interests

The authors declare that they have no competing interest

Funding

No external funding was received.

Conflict of interest

Authors declare that there are no conflicts of interest.

Informed consent

Written informed consent was obtained from all individual participants included in this study.

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Data and materials availability

All data associated with this study are present in the paper.

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