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CLINICAL & BASIC RESEARCH

Self-Reported Knowledge of Diabetes among High School Students in Al-Amerat and Quriyat, Muscat Governate, Oman

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قياس المعرفة الذاتية حول مرض السكري بين طلبة المدارس الثانوية في العامرات وقريات،محافظة مسقط، عمان

بدرية المحروقية، رحمة الحضرمية، أمل العامرية، سيف التميمي، أسماء الشيذانية، هادية اللواتية، عايدة الإسماعيلية، خولة الهوتية، ثمرة آلغافرية

الملخص: **الهدف**: يعتبر مرض السكري النوع الثاني أحد أكبر المشاكل الصحية في العالم، وقد تزايد انتشاره بمعدل ينذر بالخطر بعد وصوله إلى مستويات وبائية على مستوى العالم. ومع تزايد الإصابات بهذا المرض، أصبحت الحاجة ملحة للتركيز على تنفيذ البرامج التثقيفية المعززة للوقاية الأولية والاكتشاف المبكر للمرض. وقد أجريت هذه الدراسة لتقدير مستوى المعرفة بمرض السكري النوع الثاني بين طلبة المدارس الثانوية ولاستكشاف العوامل المؤثرة في هذه المعرفة. **الطريقة**: أجريت دراسة مسحية شملت أربع مدارس ثانوية في ولايتين من ولايات محافظة مسقط، سلطنة عمان، وهما ولايتي العامرات وقريات. وقد أجريت الدراسة باستخدام استبانة مجربة سابقا باللغة الإنجليزية تغطي جميع جوانب مرض السكري النوع الثاني عن طريق المقابلة الشخصية. تم استخدام نظام التسجيل لتقييم معرفة الطلاب. **النتائج**: حصل 24% فقط من بين 541 طالب مسجلا في هذه الدراسة (45% ذكور و 55% إناث)، على معدل أكثر من 10 من أصل 20 درجة. وكانت أهم المجالات الرئيسية التي بينت افتقار الطلبة فيها من المعرفة هي التصورات الخاطئة عن وجبات الطعام لمرضى السكري (73%)، والاعتقاد بإمكانية الشفاء من مرض السكري (63%). **الخلاصة**: بينت الدراسة تدني المستوى المعرفي بمرض السكري النوع الثاني بشكل عام بين طلاب المدارس. أوصت الدراسة بضرورة تكثيف الجهود القائمة للصحة المدرسية لزيادة الوعي حول مرض السكري بين هذه الفئة العمرية.

مفتاح الكلمات: مرض السكري، عمان؛ المراهقة؛ تقرير ذاتي؛ المعرفة؛ المضاعفات؛ عوامل الخطر؛ المدارس.

abstract: ***Objectives:*** Type 2 diabetes mellitus (T2DM) is emerging as one of the world's greatest health problems, and its incidence and prevalence are increasing at an alarming rate and globally reaching epidemic proportions. With this increasing incidence, emphasis is now being placed on implementing primary prevention, early detection, and educational prevention programmes. This study was undertaken to estimate the level of knowledge of T2DM among high school students and to explore the factors influencing the knowledge of T2DM. ***Methods***: A cross-sectional study was conducted in four secondary schools in two *wilayats* (districts) of Muscat governate, Oman, namely Al-Amerat and Quriyat. The study was conducted using a validated English questionnaire covering all aspects of T2DM in one-to-one interviews. A scoring system was used to assess the students' knowledge. ***Results***: Of the 541 students enrolled in the study (45% male and 55% female), only 24% achieved a score of over 10 out of 20. The key areas of poor knowledge were wrong perceptions about diabetic meals (73%), and the possibility of a cure for diabetes (63%). ***Conclusion***: Overall poor knowledge levels about T2DM were found among school students. National efforts and school-health-based interventions are highly recommended to increase awareness about diabetes among this age group.

Keywords: Diabetes; Oman; Adolescence; Self Report; Knowledge; Complications; Risk Factors; Schools.

Advances in Knowledge

- *This study has shown that this Omani population of high school students had overall low knowledge levels about type 2 diabetes mellitus (T2DM), with less than a quarter of students achieving a 50% knowledge score.*
- *The students showed a good knowledge of T2DM symptoms and risk factors.*
- *The key areas of poor knowledge were wrong perceptions about diabetic meals and the possibility of a cure for diabetes.*

Application to Patient Care

- *This study will lead to an action plan and interventions to improve the knowledge of these students about diabetes.*

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- *These interventions should improve the quality of care of the students' diabetic relatives; motivate them to participate in the care of their relatives, such as giving insulin injections and performing blood sugar monitoring, and improve the lifestyle of the students which will help in preventing diabetes.*
- *Education of these students about diabetes and its complications will help in increasing the compliance of their relatives or even themselves as patients in future.*

Type 2 diabetes Mellitus (T2DM) is a disease that has taken on epidemic proportions worldwide, with the incidence estimated to reach 5.4% by the year 2025. The number of adults with diabetes in the world will rise from 135 million in 1995 to 300 million in the year 2025.[1] In Oman, the prevalence of diabetes is high and has increased over the past decade. In 2000, the age-adjusted prevalence of diabetes among Omanis aged 30–64 years reached 16.1% compared to 14.7% in 1991.[2] Primary prevention programmes need to be strengthened urgently in order to counteract major risk factors that promote the development of T2DM. One of the existing prevention programmes in Oman is the Ministry of Health's National Screening Program; this screens all people, aged forty and above for chronic non-communicable diseases. An increasing incidence of T2DM is being observed in the young.[1]

A review of recent literature generally showed suboptimal levels of diabetes awareness. For example, a study conducted between 1998–1999 on 13,293 Mexican students (11–24 years) to evaluate knowledge about T2DM risk and prevention revealed that only 1.6% of the students (95% confidence interval [CI] = 1.4–1.8) had high T2DM knowledge levels compared to 85.6% (95% CI = 84.9–86.1) with low levels.[3]

On the other hand, a study done in 2007 in southeast Michigan, USA, demonstrated significant basic knowledge of T2DM risk factors and complications among adolescents. However, despite the high level of knowledge, the study emphasised the importance of novel interventions because of the high prevalence of risk factors among this population, and the need to resolve the discordance between knowledge and behaviour.[4] A similar study, conducted in a semi-urban Omani population, demonstrated that there is lack of awareness of major risk factors for diabetes mellitus.[5]

T2DM affects the most productive midlife period and has also started to appear in younger age groups. It largely results from lifestyle and behavioural factors like obesity, physical inactivity and an unhealthy diet. Thus any attempt to reduce the incidence of T2DM should include young people as they are at an impressionable age and can be motivated to make appropriate healthy lifestyle modifications.[6] They can also, in turn, influence the community at large and determine the health of the next generation.

This study therefore aimed to estimate the level of awareness of T2DM and factors influencing this knowledge among a population of Omani school students. It is important to know more about awareness levels of T2DM, as knowledge is a critical component of behavioural change. Once awareness is created, people are more likely to participate in prevention and control activities.[1] This study fitted in well with the Omani Ministry of Health's (MOH) interest in developing a school health programme as part of the overall national primary healthcare programme.

Methods

This cross-sectional study was conducted in 4 secondary schools in two *wilayats* (districts) of Muscat governorate (Al-Amerat and Quriyat), Oman. The study was undertaken in one secondary school for girls and one for boys in each of the two *wilayats*. Prior ethical approval was obtained from the MOH's Directorate General of Health Services (DGHS), Muscat, in January 2011.

Students from grades 11 and 12, who were willing to participate, were included in the study. The majority of these students (75%) were between 17 and 18 years of age. This age group was selected for two reasons. First, these are the last two grades in school education in Oman. Therefore, assessing their knowledge about diabetes would evaluate the final results of the health educational programmes provided during their schooling. Second, this generation would soon be adults so assessing their awareness of diabetes could be important in order to prevent a further increase in the prevalence of

Table 1: Demographic data of the students

Characteristic		n (%)
Gender	Male	246 (45.5)
	Female	295 (54.5)
Age in years	<17	53 (10)
	17–18	407 (75)
	>18	40 (15)
Grade	11th grade	314 (58)
	12th grade	226 (42)
Family history of diabetes	Yes	333 (62)
	No	208 (38)
Educational level of father	Illiterate	123 (23)
	Can read & write	97 (18)
	Primary	72 (13)
	Preparatory	113 (21)
	Secondary	86 (16)
	Advanced	48 (9)
Educational level of mother	Illiterate	212 (39)
	Can read & write	111 (21)
	Primary (grades 1–6)	70 (13)
	Preparatory (grades 7–9)	76 (14)
	Secondary (grades 10–12)	52 (10)
	Advanced	20 (4)

diabetes. Out of 4,206 students, 541 were selected by cluster random sampling assuming a prevalence of low knowledge of 10% with an error of 2.5%, power of 80% and design effect of 2.0. The data were collected through one-to-one interviews in the period from 2nd April to 4th May 2011. The questionnaire used in this study was adapted from international questionnaires for similar purposes, used in both awareness and knowledge of diabetes surveys in Chennai, India, (the Chennai Urban Rural Epidemiology Study) and by the Australian International Diabetes Federation in 2010.[7,8] The questionnaire was modified by making the questions clearer and adding some questions relating to the source of information as a factor affecting the level of knowledge.

This questionnaire was divided into three sections: demographic information, diabetes information history and clinical knowledge of T2DM. The demographic information included age, gender, grade, father's and mother's education levels and personal and family history of T2DM. The second section contained questions about the sources and preferred sources of T2DM information (media, school, healthcare staff and the public). The last section was designed to assess the clinical knowledge of T2DM in term of trends of T2DM, definition, symptoms, investigation-risk factors, complications and all aspects of treatment (diet, exercise and drugs).

Every seventh student in the list was selected for interview to reduce bias. If the seventh student was absent or refused to participate, the eighth student was interviewed instead. Written consent was taken from the Ministry of Education and all heads of the schools participating in the study and from all participating students. The study avoided any physical or moral harm to the students regardless of their level of knowledge, and all data were treated confidentially.

One day's training was conducted by family physicians for the 4 data-collector nurses. The data collectors and family physicians were all Arabic speakers. The questionnaire was explained, discussed in Arabic and any doubt involving translation was clarified. Then role-plays were conducted by the trainees and further doubts were clarified.

A scoring system was created by giving one mark for each correct answer. The best answer was given one mark only. Questions which contained more than one correct answer were given one mark for each correct answer. The maximum total mark was 20. A pilot study was carried out with a total of 30 secondary school students (grades 11 and 12) in both *wilayats* by the study team in order to validate the questionnaire.

The data were analysed using the Statistical Package for the Social Sciences (SPSS) software, Version 16, (IBM Corp., Chicago, Illinois, USA). Chi-square tests were used to determine the significance of the results. Score results were divided into quartiles and the association between the score quartiles and other demographic factors were determined. Logistic regression analysis was performed to determine the association between

Table 2: Association between family history and parent's educational level and knowledge of diabetes by *P* value

Demographic factor	Definition	Symptoms	Random Blood Sugar	Management of T2DM by exercise	Possibility of cure	Prevention	T2DM Meal
Family History of DM	0.025	----------	----------	0.001	----------	----------	0.005
Father's Education	0.001	----------	0.008	----------	0.017	----------	--------
Mother's Education	0.001	0.015	----------	----------	0.023	0.013	--------

dependent and independent variables.

Results

A total of 541 students participated in the study: 295 (54.5%) from girls' secondary schools and 246 (45.5%) from boys' secondary schools. Table 1 shows the demographic characteristics of the participants. It can be observed that 75% of the students were between 17 and 18 years. The majority of the students (58%) were from grade 11 and 42% of the students were from grade 12. A positive family history of diabetes was reported by 62% of the students. Low levels of family education were noted as 41% of fathers and 60% of mothers were either illiterate or could only read and write.

Although 82% of the students admitted that they knew little about diabetes, 24% of them achieved a score of more than 10 out of 20. In general, 90% of the students reported that they had received information about diabetes. Mass media and the school were the commonest sources of information (48% each), followed by healthcare staff (41%) and then the public (25%). On further questioning the students about their preferred source of information, 61% of the students preferred healthcare staff, followed by the media (56%), school (30%) and the public (12%).

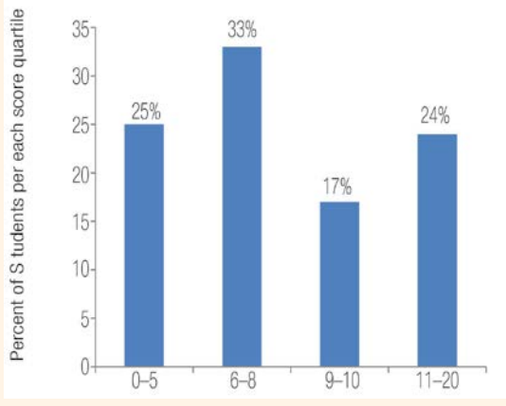

Figure 1: Score quartiles distribution among students

Awareness about the increase of T2DM cases in Oman was observed in 72% of the students. More than half of the students (52%) were able to define diabetes mellitus correctly. In terms of risk factors, 291 of the students (54%) knew at least two or three risk factors leading to diabetes (e.g. obesity, decreased physical activity, a family history of diabetes and mental stress). Frequent urination, hunger and thirst were reported by 82% of students as classic symptoms of diabetes. However, only 45% of the students were aware of normal fasting blood sugar levels and only 24% of them knew about normal random blood sugar levels.

In terms of diabetic complications, 351 of the students (65%) were aware that diabetes can cause complications. However, 47% of the students could not identify any of those complications. In general, knowledge about managing diabetes was high as 86% of the students knew that diabetics need a special diet, exercise and medications to manage their condition, and 322 (60%) of them reported that exercise can help to control blood sugar levels and that it can lower blood pressure and cholesterol levels. However, only 27% of the students knew that the diabetic meal plan must be individualised to meet the patient's needs. Weight reduction was recognised by 64% of the students as part of diabetes management. Encouragingly, 375 (70%) of the students agreed that diabetes is a disease which can be prevented. But unfortunately, most of the students (63%) believed that diabetes can be cured.

In general, female students and students in grade 11 scored highest with *P* values of 0.000 and 0.008, respectively. In addition, the percentage of female students with a family history of diabetes was higher than for males (*P* 0.04). The analysis showed that the subjects' family history and their parent's education did not contribute to score levels but did directly affect their knowledge in certain

Table 3: Association between score quartiles and other factors

Factors	*P* value
Gender	<0.001
Grade	0.008
Reported knowledge about diabetes	<0.001
Source of information - media	0.04
Source of information - school	<0.001

areas. Table 2 shows that students with a family history of diabetes were more knowledgeable about the definition of T2DM, the effect of exercise on diabetes management and the composition of a diabetic meal. On the other hand, having a father with higher education contributed to improving students' knowledge of normal random blood sugar, the awareness that there is no cure for diabetes, and also to their definition of diabetes. Students who had received information about T2DM from the media and their school achieved higher scores compared to other students who received information on diabetes from other sources (*P* values 0.04 and 0.00, respectively) [Table 3].

Discussion

Knowledge about a disease plays a vital role in its future development, early prevention and detection. Research has shown that community education about diabetes resulted in a significant increase in knowledge about the disease.[1]

This study was done to assess the level of diabetes knowledge in a population of Omani high school students. A family history of diabetes was reported by 62% of the students, which reflects the real T2DM situation in Oman since the last national health survey in 2000 showed that diabetes prevalence had reached 11.6%.[5,9] A similar percentage was found by Al Kawas *et al.* in the United Arab Emirates (UAE), a neighbouring Arabian Gulf country.[10]

The current study revealed relatively low educational levels among parents as almost 75% of fathers and 87% of mothers had below secondary level education. This can be attributed to many factors such as the presence of different races (such as people of East African or Pakistani origin), cultural factors and geographical reasons. For example, many people do not send their daughters to school because it is considered shameful for the family for girls to go outside the home. These findings are consistent with another study done in Oman in 2006, where educational levels in 63% of the urban and 78% of the rural populations in the study population were below secondary level.[11]

Many previous studies have confirmed the relation between personal education and the increase in knowledge of diabetes mellitus.[5,12–15] Since all the subjects in this study had the same level of education, the relationship between paternal educational levels and the knowledge of diabetes was tested as shown in Table 2. More students who gave a correct definition of T2DM, had parents with a higher level of education. Also, the father's education level had a direct impact on the knowledge of random blood sugar compared to the mother's education level which increased the knowledge of symptoms. Although parental education levels correlated with increased knowledge about the definition and symptoms of diabetes and random blood sugar, the relationship was not significant in regard to questions about prevention and cure of the disease.

In addition to parental education, a family history of diabetes has been found to influence the students' level of knowledge and perception of diabetes.[5,16] This relation was found to influence the level of knowledge in this study about the definition and management of diabetes by exercise and diet.

In general, female students in this study had higher scores (*P* 0.000) compared to males. This may be explained by the high number of females who had received information about diabetes compared to males (*P* 0.01). Furthermore, more female students reported having a family history of diabetes (65%) compared to males (57%). A similar effect of gender was observed in a study done in the UAE.[10]

In this study, 82% of the participants reported that they knew about the condition called diabetes. This is consistent with a study done in both urban and rural areas of Chennai, India.[7] However, the overall knowledge about diabetes was suboptimal, as only 24% of the students achieved scores of more than 10 out of 20. The study in 2008 by Al-Shafaee *et al.* among a semi-urban Omani population had similar findings.[5] Almost half of the students (52%) in the current study were able to define diabetes correctly. This is similar to the findings in the Al-Shafaee study. A total of 82% of the students

in this study recognised the symptoms of diabetes correctly. This can be attributed to a strong family history of the disease among these students.[12]

In term of risk factors, the results were promising since 99% of students in the current study could identify at least one risk factor of diabetes compared to findings of other studies.[1,5,7,17] The complications of diabetes were a major defect in the students' knowledge as shown in many studies.[1,5,7,12] This study's findings supported this since 47% of the students could not identify any of the complications of diabetes—although about 65% of the students were aware that diabetes can cause complications. This discrepancy between the knowledge about risk factors and complications could be due to the type of questions asked since the question about risk factors was multiple choice while the question about complications was open-ended.

The majority of the students (70%) in the current study agreed that diabetes was a disease which could be prevented. The high levels of knowledge about risk factors and the possibility of preventing diabetes should help to change the behaviour of these students in future and contribute to preventing diabetes. Unfortunately, most of the students (63%) believed that diabetes could be cured. This misconception was also found among a Saudi population studied by Mohieldein *et al*.[12] The perception of the possibility of a cure for diabetes will lead to poor diabetes control since the patients may decide to stop their medications whenever their diabetes is well-controlled leading to more complications.

The media and school were the main source of information on diabetes according to students (48% each) compared to the healthcare staff (41%). However, the preferred source of information was healthcare staff (61%). This corresponds to a study done in the USA where physicians were the preferred source of information for 60% of the study population.[18] Primary health care (PHC) is the first level of professional medical contact in the community and forms the cornerstone of the strategy to attain good levels of health.[12] Therefore, more efforts should be undertaken by healthcare staff in order to increase the awareness of this young generation about diabetes. Intervention could be done through a variety of programmes including theory-based methods like peer education, lectures and educational competitions, and practical methods like workshops, open days and physical education classes.

There are several limitations to this study which should be considered if this study were to be repeated elsewhere. Although this study population represented part of the Omani population, the results cannot be generalised due to the effect of different demographic factors on knowledge levels. The questionnaire was only verbally translated into Arabic which may have caused bias due to differences in the way the interviewers translated the questions during the interviews. The study only investigated knowledge of diabetes and did not cover the attitudes and behaviours of the participants that might reflect their awareness of diabetes prevention.

Conclusion

This study found that the knowledge of diabetes among this population of Omani high school students was suboptimal. Although they showed good knowledge about the symptoms and risk factors, their knowledge about diabetes complications was low. There was also the dangerous misconception among the students that diabetes could be cured. Therefore, it is highly recommended to strengthen health education on T2DM through the various school health programmes. Healthcare staff should also make more effort to increase the awareness among this young generation about diabetes in order to modify their attitudes and behaviour and thus help prevent diabetes. The interventions should start from the first grades of school in order to be most effective. This can be achieved by collaboration between the Ministry of Health and the Ministry of Education.

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