

# Knowledge of diabetes among patients in the United Arab Emirates and trends since 2001: a study using the Michigan Diabetes Knowledge Test

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## معلومات المرضى عن السكري في الإمارات العربية المتحدة منذ عام 2001: دراسة باستخدام اختبار ميتشيجان للمعلومات المتعلقة بالسكري

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الخلاصة: إن المعرفة بمرض السكري لدى المرضى في الإمارات العربية المتحدة عامل أساسي للرعاية الذاتية. لقد قيمنا مستوى المعرفة عند مرضى السكري في دراسة مقارنة مع دراسات سابقة في نفس المدينة. أجرينا دراسة مقطعية مستخدمين استبيان يجري بواسطة مقابلات في عيادتين في منطقة العين، الإمارات العربية المتحدة. استخدمت النسخة المترجمة لاختبار ميتشيجان لتقييم مدى المعرفة لمرض السكري. من أصل 165 مشارك مصاب بالسكري كان عدد النساء 130 (78.8%). إن متوسط الدرجات المحرزة للمعرفة كان منخفضاً إلى 55% (6.6 من 12 وهي أعلى درجة ممكنة احرازها، الانحراف المعياري 1.8). وهذا المستوى مشابه للمستويات التي وجدت في دراسات سابقة 55.5% في عام 2001 و 68.2% في عام 2006. إن المفاهيم الخاطئة حول النظام الغذائي وفحص الدم لمرض السكري تعتبر شائعة. وقد ظل مستوى المعرفة بمرض السكري متدنياً منذ عام 2001. إن هذه النتائج تبعث على القلق بالنظر إلى حجم الاستشارات الكبيرة التي وظفت في مجال مرض السكري والتثقيف الصحي في المنطقة.

ABSTRACT Knowledge of diabetes among patients with the disease in the United Arab Emirates is essential for effective self-management. We assessed the level of diabetes-related knowledge among patients and compared it with that found in previous studies in the same city. A cross-sectional study, using an interviewer-administered questionnaire, was conducted at two clinics in Al Ain, United Arab Emirates. The Michigan Diabetes Knowledge Test, translated into Arabic, was used to assess knowledge of diabetes. Of 165 participants with diabetes, 130 (78.8%) were women. The mean knowledge score was low at 55% (6.6 out of a maximum possible score of 12, standard deviation 1.8). This is comparable to levels found in previous studies: 55.5% in 2001 and 68.2% in 2006. Misconceptions about the diabetic diet and blood testing were common. The level of diabetes-related knowledge has remained low since 2001. These results are of concern in view of the substantial investments made in diabetes care and health education in the region.

## Connaissance du diabète parmi les patients aux Émirats arabes unis depuis 2001 : étude menée à l'aide du test d'évaluation des connaissances sur le diabète du Michigan

RÉSUMÉ La connaissance du diabète parmi les patients atteints de la maladie aux Émirats arabes unis est essentielle pour une auto-prise en charge efficace. Nous avons évalué le niveau de connaissance sur le diabète parmi les patients et l'avons comparé avec celui trouvé dans les études précédentes menées dans la même ville. Une étude transversale, reposant sur un questionnaire administré par un enquêteur, a été conduite dans deux cliniques à Al Ain, aux Émirats arabes unis. Le test d'évaluation des connaissances sur le diabète du Michigan, traduit en arabe, a été utilisé pour évaluer la connaissance du diabète. Sur 165 participants diabétiques, 130 (78,8 %) étaient des femmes. Le score de connaissance moyen était bas (55 %, soit 6,6 sur un score maximum possible de 12, avec un écart-type de 1,8). Ceci est comparable aux taux trouvés dans les études précédentes : 55,5 % en 2001, et 68,2 % en 2006. Des idées reçues sur le régime alimentaire pour diabétiques et les analyses de sang étaient courantes. Le niveau de connaissance sur le diabète reste bas depuis 2001. Ces résultats sont préoccupants compte tenu de l'investissement non négligeable réalisé dans le domaine des soins apportés aux patients diabétiques et de l'éducation sur le diabète dans la région.

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## Introduction

Knowledge about diabetes among patients is considered critical for good self-management (1). While diabetes-related knowledge is generally associated with better glycaemic control (2), this is not always the case (3). Still, patients who have knowledge of diabetes are likely to have fewer misconceptions and a better understanding of the health consequences of the disease (4).

In the Eastern Mediterranean Region, the burden of diabetes continues to increase (5). Researchers have stressed the urgent need for education on diabetes and nutrition (6). In one study, over one-quarter of the patients with diabetes could not recognize or respond to the symptoms of hypoglycaemia, even though many of them were taking insulin (7). In a group of Arab women with gestational diabetes, knowledge was not better than in a control group of non-diabetic women (6). Importantly, in Arab patients with diabetes, disease-related knowledge was found to be correlated with better adherence to medication (8).

The United Arab Emirates (UAE) is experiencing a transition, in which rapid socioeconomic development has led to an epidemic of obesity and diabetes. Studies of diabetes prevalence place the UAE among the regions with the highest burden of disease, with an estimated 29.0% of adults aged 30–64 years having diagnosed or undiagnosed diabetes (9). Additionally, high burdens of pre-diabetes (22.7%) and obesity (37.3%) were found in a community survey in the city of Al Ain, which continue to fuel the diabetes epidemic (10). This is of concern, since only 41% of Emirati patients at a dedicated diabetes centre in Al Ain achieved their glycaemic control goals (11). Cross-sectional studies of diabetes knowledge among patients were conducted by the United Arab Emirates University in 2001 and 2006 (3, 12). These now provide an opportunity to assess the impact of intensive

investments in health systems on diabetes knowledge among the diabetic patients in the city of Al Ain, the fourth-largest metropolitan area in the UAE. The objective of this study, therefore, was to assess the changes in diabetes-related knowledge among patients with diabetes in Al Ain, in comparison with the previous studies.

## Methods

A cross-sectional study was conducted using an interviewer-administered pre-validated questionnaire to assess knowledge of diabetes among adult Emirati Arab patients with type 2 diabetes mellitus. The study was conducted from February to June 2014 at two clinics affiliated with a tertiary care hospital in Al Ain city. Both clinics have diabetes nurse educators and dietitians, and treat patients with diabetes using a chronic disease care model and an electronic health record system. Written informed consent was obtained from study participants after the intent and process of the research had been explained. A trained medical research assistant carried out the interviews using paper forms for data collection.

### Eligibility criteria and methods of participant selection

The eligibility criteria were: age more than 18 years, Emirati Arab ethnicity (stipulated by the funding agency), and a diagnosis of type 2 diabetes mellitus. Patients with diabetes mellitus type 1 were excluded, as were those with any apparent mental, visual or hearing impairment. Participants were selected using non-random sampling in the waiting areas of the clinics. After obtaining approval from the clinic nurse in charge, the research assistant approached potential participants in the clinic waiting areas. Those who gave consent were interviewed in a private area.

### Data collection instrument

We used the Michigan Diabetes Knowledge Test (MDKT) (13), with adaptations as described below. The MDKT is a validated instrument with fairly good reliability ( $\alpha = 0.71$ ) (13), and has been widely used in different settings to assess knowledge of diabetes among patients (8, 14–16). The online questionnaire in English (17) has 14 items that assess knowledge of diabetes and nine items that evaluate understanding of insulin use. Each item is structured as a question with a single correct answer, and three or four answer options are given. The questionnaire items deal with diet, blood glucose control and complications of diabetes.

We adapted the MDKT as follows. A bilingual researcher (HM) translated the items into Arabic in several iterations, checking for consistency and idiomatic expression of the original meaning. Some of the answer options were modified to be more locally relevant. In item 2, “Swiss cheese” was changed to “haloumi cheese” (a local variety), and “peanut butter” to “*harees*” (a traditional Arabic dish made from whole wheat and chicken or meat). Similarly, in item 3, “corn” was changed to “boiled rice”. In item 5, “day” was replaced by “one month”, and “6–10 weeks” was changed to “3 months”. In item 6, “both equally good” was replaced by “how I feel”. The original question in item 8 was in a negative format (“should not be used”); this was changed to a positive form (“should be used”), and the following answer options were given: three pieces of candy, eating carrots, one cup of diet soda, and eating popcorn. Finally, for item 11, “massage with alcohol” (rarely used in the region) was changed to “apply moisturizing cream daily”. An earlier study (12) in this region reported making similar changes with regard to local foods. The changes did not alter the correct answers. Item 4 was omitted, as the use of the phrase “free food” is uncommon in our region and the question was difficult to interpret after translation.

Similarly, item 9 on the effect of exercise on blood glucose was felt to be unclear for local use and was removed. The nine items related to insulin use were not incorporated in our study, since most potential participants were not being treated with insulin.

### Other variables

We collected self-reported demographic data on participants, including age, sex, educational attainment, and years since diagnosis of diabetes. For some patients, an attendant, usually a family member or a domestic aide, assisted in answering these questions. We reduced bias in our data by using the same interviewer and questionnaire throughout the study.

A minimum sample size of 150 subjects was needed to differentiate between scores of 0.50 and 0.65 with a power of 95% and alpha level of 0.05. SPSS software version 21 was used to

analyse the data and conduct bivariate correlations, analysis of variance tests (two-sided testing with significance level preset at 0.05) and multiple linear regression. Quantitative data (continuous variables) were not grouped prior to statistical analysis. Missing values were not imputed. At the end of data collection, age and year of diagnosis were missing for 10% and 32% of patients, respectively. However, almost all the MDKT questionnaire items had complete data. No adjustments were made to the analysis, as the sampling strategy yielded fairly representative data.

## Results

Table 1 presents the demographic characteristics of the 165 participants. Most of the participants were older patients, women, or persons with newly diagnosed diabetes; this is consistent with patient patterns generally observed

in clinics in this region. The level of diabetes knowledge was low, as indicated by the mean number of correct answers to the 12 questions: 6.6 (55% correct responses), standard deviation (SD) 1.8. Using an arbitrary cut-off point of 6 correct answers as a minimum satisfactory level, 41 participants (24.8%) were below this level.

### Responses to specific questions

Figure 1 shows the answers to some of the questions. Reassuringly, most participants were aware that the diabetic diet is a healthy diet, and knew about diabetes complications. However, 92 (55%) thought that *harees* was higher in carbohydrates than baked potatoes, and 80 (49%) were under the impression that boiled rice had more fat than low-fat milk. Misconceptions about haemoglobin A1c and urine glucose tests were also not uncommon. Perhaps of greater concern are the incorrect

**Table 1** Characteristics of the 165 study participants

Characteristic	Number of participants (%)	Mean test score <sup>a</sup> (SD)	Significance <sup>b</sup> (P value)
<b>Age (years)</b>			0.004
≤ 30	5 (3.0)	6.0 (2.0)	
31–40	16 (9.7)	6.9 (1.5)	
41–50	52 (31.5)	7.3 (1.5)	
51–60	58 (35.2)	6.1 (1.9)	
≥ 61	18 (10.9)	5.9 (2.0)	
<b>Sex</b>			0.602
Male	20 (12.1)	6.8 (1.4)	
Female	130 (78.8)	6.6 (1.9)	
<b>Educational attainment</b>			0.039
No schooling	38 (23.0)	5.9 (1.8)	
Primary school	11 (6.7)	7.2 (1.7)	
Junior school	3 (1.8)	5.7 (1.5)	
Senior school	75 (45.5)	6.8 (1.8)	
College graduate	23 (13.9)	7.0 (1.6)	
<b>Number of years since diagnosis of diabetes</b>			0.896
≤ 5	73 (44.2)	6.9 (1.8)	
6–10	37 (22.4)	6.9 (1.8)	
≥ 11	3 (1.8)	7.3 (0.6)	

<sup>a</sup> Out of 12 questions.

<sup>b</sup> One-way analysis of variance of test scores.

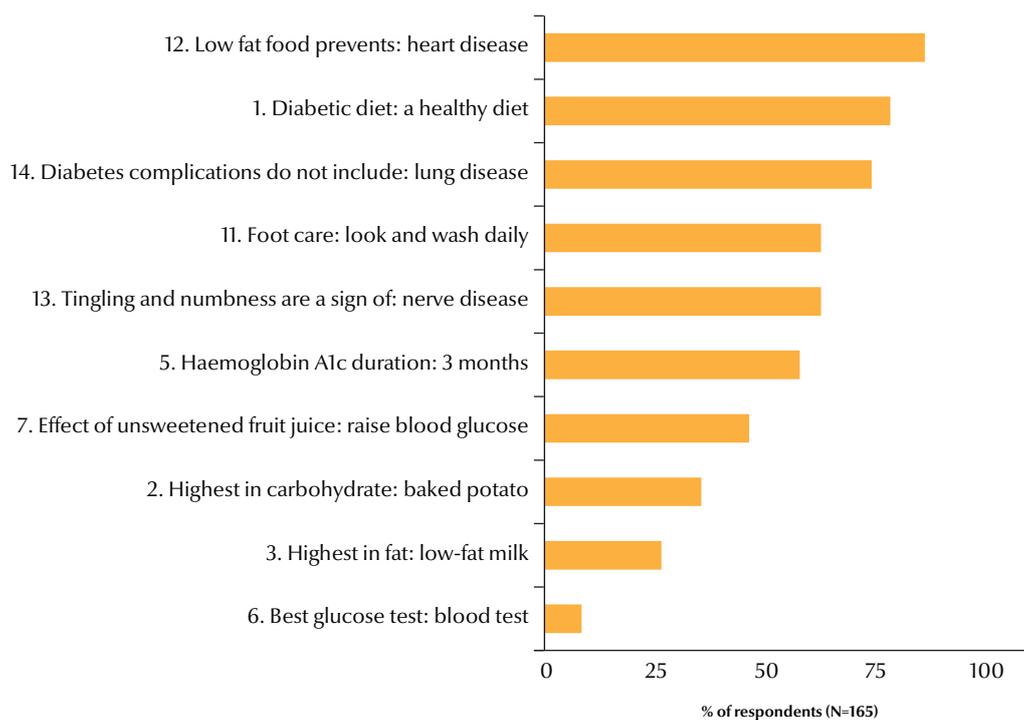


Figure 1 Percentage of participants responding correctly to selected questions

answers for treating hypoglycaemic episodes (not shown in Figure 1): only 105 (64%) thought that sweets should be used, while the rest chose inappropriate options such as popcorn or diet soda. Furthermore, 61 (37%) gave medically inappropriate responses to the question about foot care, indicating a lack of awareness and patient education.

### Diabetes knowledge and age

The correlation analysis showed that diabetes knowledge tended to decrease slightly with age ( $R = -0.196, P = 0.017$ ). Unexpectedly, the knowledge score did not increase with the number of years since diagnosis ( $R = 0.026, P = 0.79$ ). As might be expected, participants' age was correlated with years since diagnosis ( $R = 0.52, P < 0.0001$ ).

### Diabetes knowledge and educational attainment

Diabetes knowledge scores were higher among participants with more years of education, although the difference was small. The scores ranged from a mean of 5.8 among participants with

no schooling to 7.0 among those with college education ( $P = 0.039$ ; one-way analysis of variance (ANOVA)). Interestingly, the diabetes knowledge score was similar among male and female participants ( $P = 0.602$ ). On multiple linear regression, none of the covariables (age, sex, years since diagnosis and educational attainment) were statistically significant predictors of the overall score ( $R^2 = 0.011$ ).

### Trend analysis

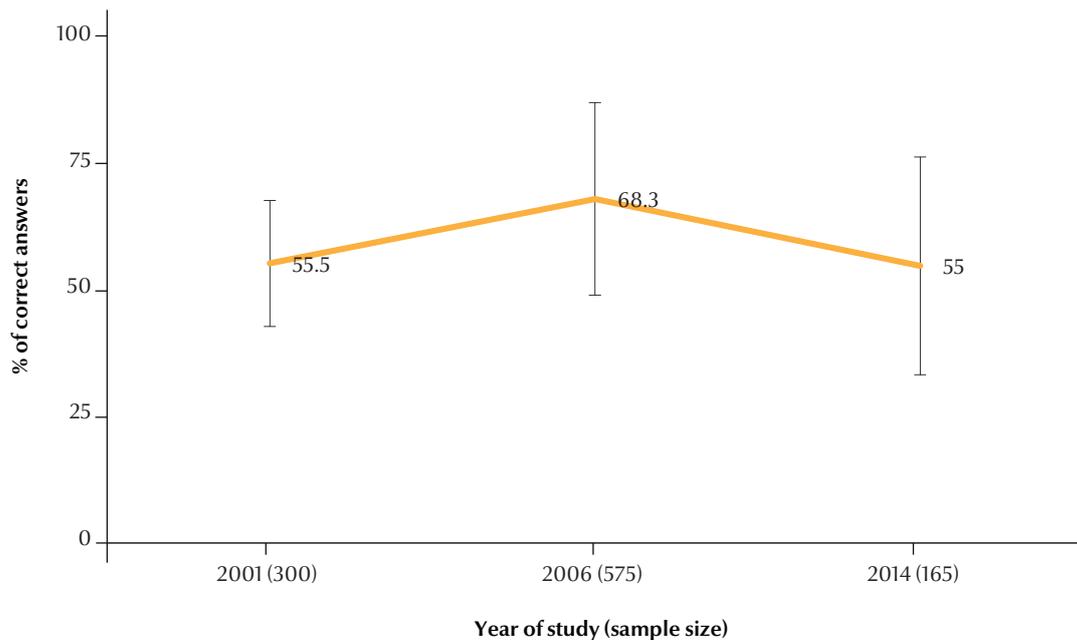
Comparison of the results of the present study with the baseline data from the earlier studies revealed no improvement in diabetes knowledge scores in patients in Al Ain (Figure 2).

## Discussion

Two previous studies using the MDKT questionnaire in clinic settings in Al Ain city, in 2001 and 2006, observed low levels of knowledge about diabetes among patients. Our study's finding that the level of diabetes knowledge in

patients has remained low and relatively unchanged over 14 years is disconcerting, especially in view of major investments in health care in general and diabetes care in particular.

There may be several possible explanations for these results. The rapidly rising prevalence of diabetes may have outstripped the ability of the health system to provide adequate health education. A shortage of health care professionals, especially diabetes educators, may be a contributing factor. Diabetes knowledge appears to depend partly on the availability of structured education programmes at health facilities, and not on other system factors, such as the speciality of the caring physician (18). Health systems development may not yet be fully adapted to the chronic care model. Care processes for effective management of chronic disease are often difficult to implement, leading to episode-based care delivery (19). Additionally, health education is a challenge in multicultural societies and among groups with low literacy rates. Yet it is



**Figure 2** Trend in mean diabetes knowledge scores among patients in Al Ain city, United Arab Emirates

worth noting that the clinics we surveyed had diabetes educators, dieticians and educational materials, including locally developed patient handouts in Arabic. The impact of these interventions on patient knowledge remains unclear.

Comparing our mean score of 55% correct responses with the results of other researchers who used the MDKT provides an interesting perspective. A study in Nigeria (14) reported a mean score of 44%, while a survey in the United States of America (2) observed a mean score of 60%. Another study in the USA (20) involving older patients found “poor” performance, with a score of 64.9%. This last study reported cognitive function and depression as independent predictors of knowledge score.

The questions in the MDKT instrument used in our study dealt with a fairly basic understanding of the diabetic diet. For example, glucose levels are routinely measured using blood samples. Yet, when asked about the best method of assessing glucose levels, only 8.5% correctly chose blood samples, while 4.2% chose urine testing and, remarkably, 144

of 165 participants (87.3%) indicated that glucose levels are best ascertained by “how I feel”. This apparently widespread misunderstanding leads patients to skip blood testing, while sustaining asymptomatic hyperglycaemia for extended periods. Diabetes educators in the region may need to emphasize the “silent killer” role of diabetes, as well as the need for blood testing to assess glycaemic control.

Misconceptions about diet are also common. In our study, baked potatoes were not thought to be the highest in carbohydrates, and low-fat milk was thought to be lower in fat than honey. Notably, unsweetened fruit juice was believed by the majority of participants either to lower the blood glucose or to have no effect – a fallacy that may stem from general recommendations to eat more fruit or the notion that unsweetened fruit juices have a low carbohydrate load. These misconceptions may lead to persistent dietary patterns that jeopardize diabetes management, despite optimal drug treatment. On the other hand, knowledge of diabetes complications appeared satisfactory in

our study participants, as found elsewhere (3).

We observed weak associations with age (peaking at 41–50 years) and education as predictors of knowledge; this, however, did not hold on multivariate adjustment. In a recent study in the region, patients’ self-perceived knowledge of diabetes declined with increasing age, supporting our findings (21). Al-Maskari and colleagues (3) reported several significant associations, possibly as a result of their larger sample size, but with small differences. For instance, counselling by diabetes educators had minimal effect on patients’ knowledge and attitudes, and no effect on diet and self-care.

There seems to be a tentative link between knowledge and outcomes: one study found that, for each increase in the number of questions answered correctly on the MDKT, haemoglobin A1c decreased by 0.239 (2). While intensive, structured diabetes self-management education programmes increase knowledge and appear to improve glycaemic control, the effect is attenuated if the baseline knowledge is already high (22).

Thus, it may be preferable for diabetes education to be focused on patients with low baseline knowledge.

Some authors have speculated that knowledge alone is not sufficient to translate into the motivation needed for improved self-care (23). Diabetes education efforts should incorporate behavioural strategies to motivate and enable patients to care for themselves effectively. Even knowledge of diabetes goals, the “know your numbers” approach, by itself does not lead to better risk factor control (24). Thus, there appears to be a knowledge–practice gap among patients with diabetes, which means that improving knowledge does not lead to improved metabolic indicators (25).

Lack of knowledge may not be the limiting factor in these patients. Issues such as lack of motivation, absence of social support, competing demands, and paucity of culturally appropriate exercise settings for women may play a greater role (10). Social factors, such as cultural practices and even economic limitations, affect patients with diabetes (26). Indeed, health promotion for

a healthy lifestyle needs to start at an early age in view of the high prevalence of obesity and metabolic syndrome among adolescents in this region (27).

Caution is needed in drawing inferences from our study findings, because of the limited sample size, the restriction of participants to Emirati Arabs only, and the lack of patient-oriented outcomes. Nevertheless, our use of a validated instrument allows comparisons with other locales as well as over time in the region. Taking into account that our study was conducted at urban university-affiliated clinics with tertiary care support, the low levels of knowledge are of concern and suggest that conditions in rural settings may be even worse.

## Conclusion

Knowledge of diabetes among patients attending clinics in Al Ain city has remained low since 2001. With the marked rise in diabetes prevalence in the UAE and neighbouring countries, this is a cause for concern as it could

represent a considerable burden for regional health systems. Additional efforts are needed to improve diabetes education and long-term care.

## Ethical approval

Research ethics approval was obtained prior to commencement of the study from Al Ain Medical District Human Research Ethics committee, protocol number 09/38; CRD# 47/11. Additionally, institutional approval was obtained from Tawam Hospital, Al Ain, to conduct research at its affiliated clinics.

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