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Determinants Influencing Awareness and Healthy Practices among a Sample of Insulin-dependent Diabetic Egyptian Patients: A Rural Community-based Study

Ammal M. Metwally[1], Hanaa Yousof[2], Monira M. Elkholy[2], Lobna A. Eletreby[1], Abeer A. Barakat[2], Soha M. Abd El Dayem[3], Mohamed Abdelrahman[1], Sherif M. Eldeeb[1]*

[1]Department of Community Medicine Research, National Research Centre, Dokki, Cairo, Egypt; [2]Department of Public Health and Community Medicine, Faculty of Medicine, Cairo University, Cairo, Egypt, [3]Department of Pediatric, National Research Centre of Cairo, Egypt

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***Correspondence:** Dr. Sherif M. Eldeeb, Department of Community Medicine Research, Medical Research Division, National Research Centre, P.O. 12622, Dokki, Cairo, Egypt. E-mail: sm.el-deeb@nrc.sci.eg
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Abstract

BACKGROUND: The prevalence of diabetes mellitus (DM) is predicted to increase over the coming years.

AIM: The objectives of the study were to measure the level of awareness and healthy practices related to five healthy domains and assess the effect of different demographic characteristics, glycated hemoglobin (HbA1c) level, and body mass index (BMI) on these levels among diabetic patients in a rural Egyptian village.

METHODS: A cross-sectional study was done on 300 selected insulin-dependent diabetic patients resident in an Egyptian village. Data were collected using a questionnaire covering five domains: General disease awareness and management compliance practice, check-up, foot care, diet, and physical activity. HbA1c and BMI were also measured as an impact of the management adherence.

RESULTS: The study found that more than three quarters of the participants (82.0%) were uncontrolled or poorly uncontrolled (HbA1c >8) diabetics and 76.0% were either obese or morbidly obese. Total awareness and practices percentage scores were low (42.4 ± 16.8% and 40.5 ± 12.3%, respectively). The linear regression model showed that high educational level had significantly positive effects on both the total awareness and practice scores as well as their domains. The study found that female participants and those having relatives with DM had significantly higher diet awareness and practice scores ($p < 0.05$). Younger age had significantly higher scores on foot care and diet awareness scores, physical activity, general disease awareness, and management compliance practices domains.

CONCLUSION: The studied awareness and practice domains were inadequate. Their improvement is cornerstones to impact glycemic control of diabetics and control their health risks, especially in rural communities.

Introduction

Diabetes has been identified thousands of years ago. In fact, ancient Egyptians were the first to mention and discuss the disease, as evidenced by the Egyptian physician “Hesy-Ra” 3000 BC [1].

According to the International Diabetes Federation, it is estimated that around 40 million adults aged from 18 to 99 years are diagnosed with the disease in the Middle East and North Africa region [2], with more prevalence in the Arabian region [3]. This number is expected to increase to reach 84 million by 2045 [2].

The prevalence of diabetes in Egypt is estimated to be 15.6% with around 8.5 million suffering from diabetes in 2017. Some recent reports also indicate that there is around an extra 4.5 million undiagnosed [2], [4].

Among the rural population, the prevalence of diabetes mellitus (DM) is on the rise as evidenced by the increase in the number of cases over the past two decades [5]. Moreover, out of the 80% of the cases living in low and middle-income countries, 50% live in rural areas [6]. In addition, studies have indicated that rural residents had low or inadequate knowledge regarding the disease [7], [8]. It was also noted that knowledge was lower among rural compared to urban population [9], [10]. This is of great impact on the outcome of this incurable disease, as previous research showed that individuals with knowledge about self-care of the disease have better control over it [11], [12]. Moreover, lifestyle modification also proved to counteract the barriers against regular physical activity, medication compliance, and following healthy nutrition [13].

In Egypt, studies have shown variation in diabetes knowledge among patients, yet the majority

of these studies were done in health care settings and not as community ones. Previous studies indicated that diabetic patients living in rural areas had inadequate awareness and practices [14], [15], [16]. Accordingly, as an integral part of interventions targeting improving diabetic patients' health status, it is necessary to provide actual levels of knowledge and healthy practices and factors determining them.

The present study aimed to measure the level of awareness and healthy practices related to five healthy domains of diabetic patients and assess their determinants in the form of different demographic characteristics, glycated hemoglobin (HbA1c) level, and body mass index (BMI) among rural diabetic patients resident in El Ibrahimia El Qeblia village, Damietta governorate, Egypt.

Methods

The study is a cross-sectional community-based one. It was approved by the ethical committee at the National Research Centre (NRC) and it was part of the project titled "Community outreach approach for having a model of a village controlled from diabetes with improved quality of life."

Study duration and site

The study was conducted over 1 year from January 2018 to January 2019. The study took place in El Ibrahimia El Qeblia, an Egyptian village situated in Damietta Governorate in North East Lower Egypt.

Sample size and technique

Using PASS v11 [17], a sample size of 283 from a population of 787 (number of diabetic patients at the village) produces a two-sided 95% confidence interval with a distance from the mean to the limits equals to 1.5 when the estimated standard deviation is 16 [18]. The sample was a simple random one.

Inclusion and exclusion criteria

Insulin-dependent patients with a history of DM aged 18 years and more for at least 1 year, as proven by interviewing the patients and by laboratory investigations, were included in the study. Patients recently diagnosed with diabetes (<1 year) or with any condition interfering with proper communication or recall or evident clinical complications as well as patients on any therapy not including insulin were excluded from the study.

Study tool and data collection

The questionnaire was developed (Appendix 1 is the used study questionnaire and Appendix 2 is the English version) and subjected to pilot testing first on a small sample of diabetic patients at the NRC, Egypt. Then, pilot testing continued through questioning several diabetic patients from the study village, El Ibrahimia El Qeblia. Data from these patients were not included in the analysis. Experts' opinions were also taken from Professors of Public Health (at NRC). Both pilot tests were performed aiming at testing feasibility of the study implementation through validation (by expert opinion) of the prepared questionnaire forms, exploration of the site of the study and the system of work, and assessing the time needed to complete the interview questionnaire. Based on both pilot tests, some modifications were applied to the questionnaire.

The structured interview questionnaire collected demographic, socioeconomic, and clinical data, including age, gender, education, marital status, family history of diabetes, duration of illness, and co-morbidities.

Five domains were used for assessing diabetic patients' awareness and practices. The first was general disease awareness and management compliance practices which included knowledge of symptoms of hyper and hypoglycemia, complications, hyper and hypoglycemic coma, and the normal level of blood glucose. The healthy practices for the first domain included compliance to medication for symptoms, complication management, and physician follow-up. The second domain was for routine check-ups, including knowledge and practices for routine follow-up investigations of blood glucose, eye care, lipid profile test, and kidney and cardiac investigations. The third one was home foot care, including knowledge of the importance of foot care and self-care for foot. The fourth was knowledge and practices about the recommended number of daily meals, consumption of nutrient-rich food (vegetables, fruits, dairy products) versus energy-dense food (sweet) besides knowledge and use of harmful fats. The fifth domain was physical activity, including knowledge of the importance of physical activity, quality, and quantity for the practice of physical activity.

HbA1c was also assessed in percentages. Standard HbA1c for diabetics is 7% [19]. Samples were collected in EDTA tubes. Laboratory work was done in the clinical pathology laboratory at NRC. Infection control measures were followed throughout the sampling and transport of tubes to the laboratory. 5 µ of whole EDTA blood was used to assay HbA1c that was measured by Labona Check A1C HbA1c Analyzer, Ceragem Medisys Inc. by boronate affinity methods.

BMI was calculated based on the equation which equals weight (in kilograms) divided by the square of the height (in meters). Weight was measured using the Seca scale.

Study outcomes

Primary outcomes included mean awareness and mean practice scores. Secondary outcomes included mean HbA1c levels and mean BMI.

Data analysis

After data cleaning, all completed questionnaires were statistically analyzed using the Statistical Package of the Social Software program (SPSS), version 20. The data were summarized using descriptive statistics where mean and standard deviation were used for quantitative variables. Number and percentage were used for qualitative values. Statistical differences between groups were tested using independent sample t-test and ANOVA (analysis of variance with Bonferroni pairwise comparison) where different letters in Rank indicate a significant difference between groups. The correlation was done between total awareness and healthy practice scores using the Pearson test. A linear regression model was done to assess the effect of different variables on the total awareness and healthy practice scores. $p < 0.05$ was considered statistically significant.

Scoring system

For awareness, the maximum score was 36; general disease awareness: 21, check-up: 5, foot care: 1, diet: 8, and physical activity: 1. Questions were given one point for right answer (No. 1, 2, 5.01, 5.02, 5.03, 5.04, 6.01, 6.02, 6.1, 7.01, 7.02, 7.03, 8.01, 8.02, 8.03, 8.04, 9.01, 9.02, 9.03, 9.04, 9.05, 10.01, 10.02, 10.03, 10.04, 10.05, 11, 12, 13, 14, 15.01, 15.02, 15.03, 15.04, 18, 21). As for healthy practice, the maximum score was 41; management compliance practices: 5, check-up: 5, foot care: 9, diet: 16, and physical activity: 6. Questions were either given one point for right answer (No. 2, 3, 7.1, 8.1, 9.1, 10.11, 10.12, 10.13, 10.14, 10.15, 11.2, 22.01, 22.02, 22.03, 22.04, 22.05, 23) or a scale from 0-2 (No. 11.11, 11.12, 11.13, 11.14, 12.1,, 13.1, 14.1, 16, 17, 18.1, 19, 20).

Total awareness and total practice percentage scores were then calculated by dividing each individual score by the maximum score for each. The same was done for each domain of awareness and practice to obtain a mean total percentage score.

As for HbA1c, it was divided into four major categories; controlled (≤7%), unsatisfactory (>7–8%), uncontrolled (>8–10%), and poorly uncontrolled (>10%). BMI was also classified into four categories: Normal (18.5–<25 kg/m^2), overweight (25–<30 kg/m^2), obese (30–<40 kg/m^2), and morbid obesity (≥40 kg/m^2).

Study duration

The study was conducted from January 2018 to January 2019 over a total period of 1 year.

Ethical aspects

Ethical Committee of the NRC revised the study protocol (registration approval number: 16466). Written informed consent was taken from all participants. Participants' data were maintained throughout the study and the information was kept confidential. The study was conducted according to the World Medical Association Declaration of Helsinki [20].

Results

Regarding the studied 300 insulin-dependent diabetics, more than half of them were middle-aged adults (57%) followed by old adults (30%) and least percentage was for young adults (13%). The mean ± SD age of the participants was 52.7 ± 11.2 years with an average DM duration of 10.6 ± 6.6 years, giving an estimated age at diagnosis of around 40 years. Around two-thirds of the participants were females (69%). Most of the participants were married (81%) with around three quarters having a relative with DM as shown in Table 1. Concerning the level of education, three quarters of the cases were either illiterate or have received basic education (74.6%). The most prevalent comorbidity was hypertension (55%) followed by other cardiac problems and chronic liver disease. In addition, 14% of the participants were smokers. Although around two-thirds of the participants reported that they are regularly receiving DM medications (66%), only 42% of the participants visited the physician for follow-up. The most prevalent cause for skipping a dose was financial. Table 1 also showed that upon measuring the participants' HbA1c, the mean was 10.1 ± 2.2%. Most participants had HbA1c above 10%. When measuring the participants' BMI, the mean was 33.3 ± 4.8 kg/m^2 with two-thirds (66%) found to be either obese or morbid obese (BMI of 30 kg/m^2 or more).

Table 2 shows the percentage scores for the total awareness and healthy practices and their determinants in general. The mean±SD total awareness percentage score was 42.4 ± 16.8 with only 37% of the participants having scores of 50% or higher. The mean±SD total healthy practices' percentage score was 40.5 ± 12.3 with only 28% of the participants having scores of 50% or more. The table also shows that although both males and females had nearly the same awareness scores, yet the practices were higher among females. Both awareness and practice scores were higher among patients having relatives with diabetes, younger age, higher educational levels, lower HbA1c, and normal BMI.

The mean percentages for both the total awareness and healthy practices were seen in Figure 1. The order of domains differs between the

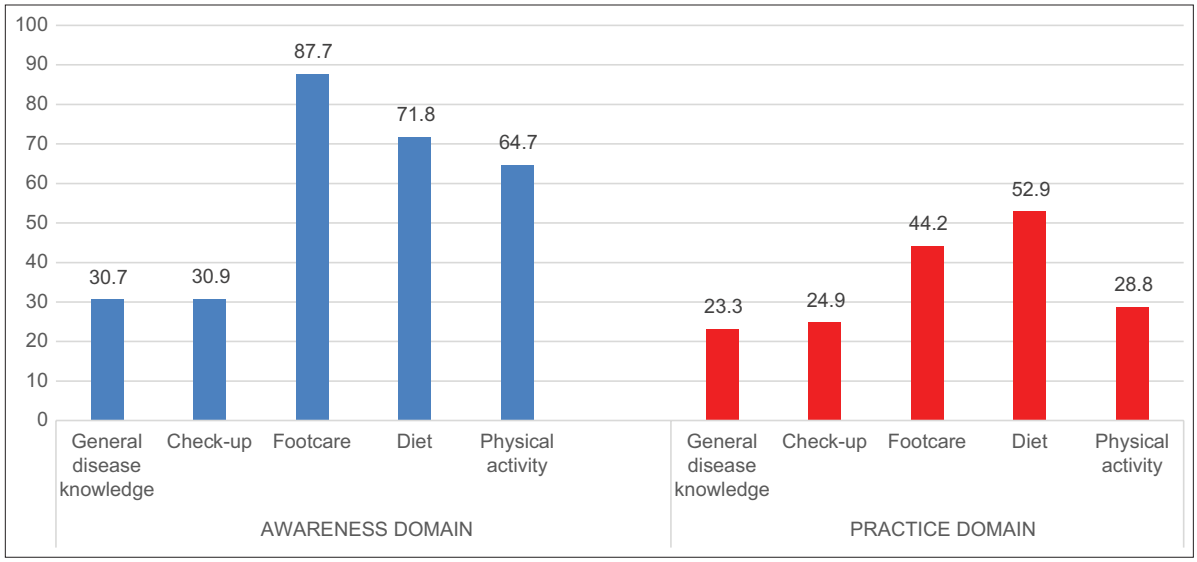

Figure 1: Mean percentage distribution of different awareness and practice domains

Table 1: Baseline sociodemographic and clinical characteristics of the studied participants

Variables	Number (out of 300)	Percentage
Age (years)*		
Young adults	38	12.7
Middle-aged adults	172	57.3
Old adults	90	30.0
Mean ± SD	52.7 ± 11.2	
Gender		
Male	93	31.0
Female	207	69.0
Marital status		
Married	243	81.0
Single	57	19.0
Education		
Illiterate	154	51.3
Basic	70	23.3
Secondary	54	18.1
University	22	7.3
Co-morbidities		
Chronic liver diseases	72	24.0
Chronic kidney diseases	25	8.3
Hypertension	166	55.3
Other heart morbidities	75	25.0
Autoimmune diseases	17	5.7
Having relatives with DM		
Yes	229	76.3
No	71	23.7
Regular medications		
Yes	199	66.3
No	101	33.7
Causes of missing dose (out of 101)		
Financial	62	61.4
Side effects	23	22.8
Forgot	11	10.9
Others	5	4.9
Physician follow-up		
Yes	127	42.3
No	173	57.7
Smoking		
Yes	53	14
No	247	86
Duration of DM (years)		
<10	143	47.7
≥10	157	52.3
Mean ± SD	10.6 ± 6.6	
HbA1c (%**)		
Controlled	22	7.3
Unsatisfactory	32	10.7
Uncontrolled	82	27.3
Poorly uncontrolled	164	54.7
Mean ± SD	10.1 ± 2.2	
BMI (kg/m^2)***		
Normal	16	5.3
Overweight	56	18.7
Obese	196	65.3
Morbid obese	32	10.7
Mean ± SD	33.3 ± 4.8	

*Young adults=18–39, middle-aged=40–59, old age=60 and more [46]. **Controlled=≤7, unsatisfactory=>7–8, uncontrolled= >8–10, poorly uncontrolled=>10. ***normal=18.5–<25 kg/m^2, overweight= 25–<30 kg/m^2, obese= 30–<35 kg/m^2, morbid obesity= ≥40 kg/m^2. DM: Diabetes mellitus, HbA1c: Glycated hemoglobin, BMI: Body mass index.

Table 2: Comparison of mean scores of awareness and practices based on sociodemographic and clinical characteristics

Studied parameters	Total awareness score		Total practice score	
	Mean±SD	Rank***	Mean±SD	Rank***
Total score	42.4 ± 16.8		40.5 ± 12.3	
Gender				
Male	42.0 ± 18.8	-	37.9 ± 13.9*	-
Female	42.6 ± 15.9		41.6 ± 11.3	
Having relative with DM				
Yes	42.9 ± 16.6	-	41.3 ± 11.9*	-
No	40.6 ± 17.6		37.7 ± 13.1	
Marital status				
Married	43.2 ± 17.0	-	40.8 ± 12.4	-
Single	39.1 ± 15.9		39.1 ± 11.9	
Smoking				
Yes	40.2 ± 17.9	-	37.3 ± 14.8	-
No	42.7 ± 16.6		41.0 ± 11.8	
Duration of DM (years)				
<10	43.8 ± 15.9	-	41.4 ± 13.1	-
≥10	41.1 ± 17.6		39.6 ± 11.5	
Age categories				
Young adults	49.2 ± 14.4*	A	43.7 ± 13.2*	A
Middle-aged	43.3 ± 16.3	A	41.4 ± 12.0	A
Old	37.8 ± 17.5	B	37.2 ± 11.9	B
Education				
Illiterate	37.8 ± 15.6**	A	37.6 ± 11.5**	A
Basic	39.8 ± 15.0	A	39.3 ± 10.9	A
Secondary	52.0 ± 15.5	B	46.6 ± 12.8	B
University	58.8 ± 14.4	B	49.1 ± 11.7	B
HbA1c (%)				
Controlled	55.6 ± 16.7**	A	55.2 ± 10.6**	A
Unsatisfactory	47.2 ± 16.6	AB	44.6 ± 11.0	B
Uncontrolled	41.8 ± 16.1	B	40.2 ± 10.1	BC
Poorly uncontrolled	40.0 ± 16.4	B	37.8 ± 12.2	C
BMI (kg/m^2)				
Normal	58.5 ± 15.0**	A	55.6 ± 10.4**	A
Overweight	48.4 ± 17.2	A	45.8 ± 12.6	B
Obese	40.2 ± 15.1	B	38.6 ± 10.5	C
Morbid obese	37.6 ± 19.9	B	35.1 ± 14.2	C

*Significant, **Highly significant. ***Different letters indicate significant difference between groups. DM: Diabetes mellitus, HbA1c: Glycated hemoglobin, BMI: Body mass index.

awareness and practices. Regarding awareness' domains, foot care was the highest (88%), followed by diet (72%), physical activity (65%), and finally, the domains for general disease awareness and check-ups (31% each), whereas for healthy practices, diet was the highest (53%), followed by foot care (44%), physical activity (29%), check-ups (25%), and finally, management compliance practices (23%). There was positive correlation between awareness and healthy practices ($r = 0.750$; $p < 0.001$).

The effect of different determinants on the level of awareness for each domain was shown in

Table 3. Concerning foot care domain, it was higher among younger age and individuals with HbA1c of 7% or less. The diet domain was higher among females, patients having relatives with DM, younger age, and higher educational levels. The physical activity domain score was higher among married participants, patients with DM duration <10 years, younger age, and higher educational level. The mean check-ups domain was higher among patients with higher educational levels. The final domain: General disease awareness was higher among married participants, younger age, and higher educational level. Lower glycated levels and normal BMI showed higher awareness scores for all the studied domains except (physical activity and foot care, respectively).

Table 3: Comparison of mean scores of awareness based on sociodemographic and clinical characteristics in each domain

Domains	General disease awareness	Check-ups	Foot care	Diet	Physical activity
Total score	30.7 ± 18.6	30.9 ± 28.9	87.6 ± 32.9	71.8 ± 19.2	64.7 ± 47.9
Gender					
Male	32.6 ± 19.5	29.9 ± 29.9	83.9 ± 37.0	66.0 ± 21.8	65.6 ± 47.8
Female	29.9 ± 18.2	31.4 ± 28.4	89.4 ± 31.0	74.4 ± 17.3*	64.3 ± 48.0
Having relative with DM					
Yes	30.6 ± 18.6	31.0 ± 29.0	89.0 ± 31.2	74.0 ± 18.4	67.2 ± 47.0
No	31.0 ± 18.6	30.7 ± 28.7	83.1 ± 37.7	64.8 ± 21.1*	56.3 ± 49.9
Marital status					
Married	31.8 ± 18.8	30.9 ± 28.4	87.7 ± 33.0	72.0 ± 18.9	67.9 ± 46.8
Single	26.0 ± 16.8*	31.2 ± 30.9	87.7 ± 33.1	71.1 ± 20.5	50.9 ± 50.4*
Smoking					
Yes	32.2 ± 17.8	30.5 ± 27.3	85.7 ± 35.4	64.0 ± 23.3	64.3 ± 48.5
No	30.8 ± 18.7	30.0 ± 29.1	88.0 ± 32.6	73.1 ± 18.1*	64.7 ± 47.9
Duration of DM (years)					
<10	32.2 ± 18.0	32.2 ± 26.4	88.1 ± 32.3	72.5 ± 19.4	72.0 ± 45.0
≥10	29.3 ± 19.1	29.8 ± 30.9	87.3 ± 33.4	71.2 ± 19.0	58.0 ± 49.5*
Age categories					
Young adults	39.2 ± 16.1	32.2 ± 26.8	97.4 ± 16.2	75.7 ± 19.9	78.9 ± 41.3
Middle-aged	31.2 ± 18.9	31.7 ± 28.3	90.7 ± 29.1	73.1 ± 18.4	69.2 ± 46.3
Old	26.1 ± 17.8*	28.4 ± 30.9	77.8 ± 41.8*	67.6 ± 19.7*	50.0 ± 50.3*
Education					
Illiterate	25.2 ± 16.4	27.7 ± 29.2	85.7 ± 35.1	69.2 ± 19.4	55.8 ± 49.8
Basic	27.6 ± 16.2	28.3 ± 28.2	85.7 ± 35.2	70.2 ± 20.1	65.7 ± 47.8
Secondary	42.3 ± 17.0	38.5 ± 27.7	92.6 ± 26.4	77.5 ± 16.5	77.8 ± 42.0
University	50.9 ± 18.3**	43.6 ± 25.9*	95.4 ± 21.3	80.7 ± 15.8*	90.9 ± 29.4*
HbA1c (%)					
Controlled	42.9 ± 21.4	50.0 ± 31.3	100.0 ± 0.0	83.0 ± 12.5	86.4 ± 35.1
Unsatisfactory	33.9 ± 19.2	38.8 ± 28.3	100.0 ± 0.0	77.7 ± 16.4	71.9 ± 45.7
Uncontrolled	31.3 ± 17.8	29.5 ± 29.2	85.4 ± 35.6	68.8 ± 17.3	63.4 ± 48.5
Poorly uncontrolled	28.1 ± 17.8*	27.6 ± 27.4*	84.8 ± 36.1*	70.7 ± 20.3*	61.0 ± 48.9
BMI (kg/m^2)					
Normal	47.0 ± 18.8	58.8 ± 30.5	100.0 ± 0.0	78.9 ± 12.7	93.8 ± 25.0
Overweight	37.3 ± 19.4	35.7 ± 29.7	92.9 ± 26.0	77.0 ± 20.9	69.6 ± 46.4
Obese	28.2 ± 16.6	29.0 ± 27.4	86.2 ± 34.6	69.8 ± 18.5	63.8 ± 48.2
Morbid obese	26.3 ± 22.1**	20.6 ± 26.6**	81.3 ± 39.7	71.1 ± 20.9*	46.9 ± 50.7*

*Significant, **Highly significant. DM: Diabetes mellitus, HbA1c: Glycated hemoglobin, BMI: Body mass index.

Table 4 shows the effect of same determinants on the healthy practices' domains. Diet domain was higher among females, patients having relatives with diabetes, non-smokers, and higher educational levels. Foot care domain was higher among patients with higher educational levels. The physical activity domain was higher among females, married patients, with disease duration of less than 10 years, and younger age. Mean percentage for the check-up domain was higher among patients with higher education levels. The management compliance practice domain was higher among married participants, younger age, and higher education. Lower glycated levels and normal BMI showed higher practices' scores for all the studied domains.

Table 4: Comparison of mean scores of practice based on sociodemographic and clinical characteristics in each domain

Domains	Management compliance practices	Check-ups	Foot care	Diet	Physical activity
Total score	23.3 ± 18.3	24.9 ± 24.3	44.2 ± 23.0	53.0 ± 14.5	28.8 ± 18.8
Gender					
Male	24.5 ± 19.4	23.0 ± 25.4	42.9 ± 24.8	48.6 ± 15.2	25.3 ± 16.2
Female	22.7 ± 17.7	25.8 ± 23.8	44.8 ± 22.3	54.9 ± 13.8*	30.4 ± 19.7*
Having relative with DM					
Yes	23.4 ± 18.3	25.4 ± 24.4	44.8 ± 22.1	54.6 ± 14.3	29.0 ± 18.8
No	22.8 ± 18.3	23.4 ± 24.1	42.4 ± 26.0	47.5 ± 13.9**	28.4 ± 19.0
Marital status					
Married	24.2 ± 18.7	24.4 ± 23.5	44.6 ± 22.6	52.9 ± 15.1	30.2 ± 18.3
Single	19.3 ± 15.6*	27.4 ± 27.4	42.7 ± 24.0	53.1 ± 11.6	22.8 ± 20.1*
Smoking					
Yes	24.4 ± 17.8	24.8 ± 24.1	41.8 ± 26.7	47.6 ± 16.8	26.2 ± 17.3
No	23.4 ± 18.4	25.0 ± 24.4	44.6 ± 22.4	53.8 ± 13.9*	29.3 ± 19.0
Duration of DM (years)					
<10	24.5 ± 17.7	26.0 ± 22.9	44.5 ± 23.6	52.9 ± 14.9	32.8 ± 19.3
≥10	22.2 ± 18.8	23.9 ± 25.6	43.9 ± 22.6	52.9 ± 14.1	25.3 ± 17.7*
Age categories					
Young adults	33.2 ± 16.9	24.7 ± 23.0	46.5 ± 22.5	54.6 ± 18.0	35.1 ± 18.1
Middle-aged	23.6 ± 18.3	26.7 ± 24.6	45.4 ± 21.6	53.6 ± 14.6	30.2 ± 18.3
Old	18.4 ± 17.0**	21.6 ± 24.2	41.0 ± 25.7	51.0 ± 12.5	23.5 ± 19.0*
Education					
Illiterate	17.9 ± 16.0	21.4 ± 23.9	39.7 ± 22.9	51.3 ± 14.3	27.8 ± 19.7
Basic	20.0 ± 15.2	23.7 ± 23.2	44.0 ± 23.8	51.3 ± 13.8	29.5 ± 17.8
Secondary	34.4 ± 16.7	33.0 ± 24.9	52.7 ± 22.0	57.5 ± 14.7	29.9 ± 17.2
University	43.6 ± 20.1**	33.6 ± 24.2*	56.1 ± 12.6**	58.5 ± 14.5*	31.1 ± 20.1
HbA1c (%)					
Controlled	34.5 ± 21.5	46.5 ± 30.5	64.6 ± 13.6	63.1 ± 14.7	44.7 ± 14.9
Unsatisfactory	26.3 ± 17.9	32.5 ± 21.4	47.2 ± 26.8	56.8 ± 11.6	33.3 ± 18.0
Uncontrolled	23.4 ± 17.2	23.9 ± 23.6	48.2 ± 19.5	51.5 ± 13.0	25.6 ± 17.6
Poorly uncontrolled	21.1 ± 17.9*	21.1 ± 22.6**	38.9 ± 23.0**	51.5 ± 15.1*	27.4 ± 19.0**
BMI (kg/m^2)					
Normal	38.8 ± 21.3	51.3 ± 30.1	65.3 ± 20.6	60.5 ± 13.8	45.8 ± 12.9
Overweight	29.6 ± 18.7	27.5 ± 21.8	52.2 ± 23.1	57.1 ± 16.0	34.8 ± 14.3
Obese	21.0 ± 16.7	23.3 ± 23.5	41.7 ± 22.0	51.6 ± 13.7	26.5 ± 18.3
Morbid obese	18.1 ± 19.3**	17.5 ± 22.6**	35.4 ± 21.4**	50.0 ± 4.8**	24.0 ± 18.9**

*Significant, **Highly significant. DM: Diabetes mellitus, HbA1c: Glycated hemoglobin, BMI: Body mass index.

Table 5 presents a linear regression model for predictors of the likelihood of awareness and practices which showed the variables that had a positive effect to be a high level of education (β = 14.053 and 9.382, respectively) and females for the practice (β = 4.115), whereas age (in years) had a negative effect on awareness (β = −0.207) (R square = 0.179 for awareness and 0.131 for practice).

Table 5: Linear regression model for the predictors of awareness and practice

Model	β	Std. Error	Sig.	95% CI	
				Lower bound	Upper bound
Knowledge*					
Constant	49.705	4.603	<0.001	40.646	58.764
Age (years)	−0.207	0.082	0.013	−0.369	−0.044
High educational level	14.053	2.112	<0.001	9.896	18.210
Practice**					
Constant	35.248	1.265	<0.001	32.758	37.737
High educational level	9.382	4.526	<0.001	6.379	12.385
Gender (female)	4.115	1.435	0.004	1.291	6.939

*R square = 0.179, **R square = 0.131.

Discussion

The current study is a community-based study for assessing awareness and healthy practices among 300 insulin-dependent diabetic patients and their determinants. The problem of DM was common among middle-aged adults (57.3%), females (69.0%), hypertensive ones (55.3%), and those having relatives with DM (76.3%). The mean ± SD diabetes awareness

and practices percentage score in the present study was 42.4 ± 16.8% and 40.5 ± 12.3%, respectively. Although this result agrees with the results of some studies [18], [21], yet other studies reported a higher percentage [22], [23]. On the other hand, our study participants had higher scores than that reported by Balla *et al*. [24]. The reason behind this variation could be attributed to the fact that these studies were done in clinical or hospital setting and not community-based. In addition, such variations could be attributed to the type of counseling received, high or low cost of medications, or compliance to treatment. Moreover, the present study showed that around one-third of the participants (33.7%) were not taking their medication on a regular basis and reported that the main reason for discontinuing treatment was the high cost of the medication (61%) and only 42% visited physician on a regular basis for follow-up which could result in skipping dose and might be a reason for lowering practices score. Another explanation behind the low scores of awareness and practices could be attributed to the sociodemographic characteristics of the study participants. Our study being implemented in a rural village reported that most participants (75%) were either illiterate or had only their basic education and at the same time showed that both awareness and practices tend to increase with an increase in the level of education. Furthermore, both tend also to increase among younger age which represents only 12.7% of our participants. Such findings agreed with other studies [22], [23], [25], [26]. Moreover, individuals living in rural areas tend to have lower awareness levels because these individuals might lack access to valid information, especially in Egypt [13], [16], and accordingly lower practices.

Another major factor behind the low practices score is the misconceptions and faulty information delivered to the patients where, in the present study, many participants reported that watching a TV channel commercially speaking about some sort of herbal medication is a credible source of information, believing that herbs can cure diabetes.

Furthermore, our study finding of the high level of HbA1c with more than three-quarters of the participants (82.0%) was uncontrolled or poorly uncontrolled (HbA1c> 8) reinforce the concept that the disease is poorly controlled especially taking into consideration the high prevalence of obesity among participants where over three-quarters of our participants (76.0%) were identified as being obese (BMI ≥30 kg/m^2) especially that the present study was done among a rural population whose main activity is agriculture. High prevalence of obesity was also noted in another study which indicated that 65% of participants were obese [21].

Another important finding of this study showed that although the awareness score was insignificantly higher among patients with family members diagnosed with diabetes than patients without diabetic family members, yet their practices varied significantly. Balla *et al*., Al-maskari *et al*., and Niroomand *et al.* had supported this finding in their studies [22], [24], [27]. The South African study also agreed with the present study in the fact that having a family member with the disease was associated with higher practice score [21]. Although this is a good indicator, it is important not to totally rely on, especially in places where there are some false beliefs or misconceptions regarding the disease.

The present study was not limited to only assessing the overall awareness and practices level of diabetics but digging deeply for assessing the proved to influence the prevalence of diabetes and its control being a core risk factor for many health-related diseases. This study revealed variation within both the awareness and practices. Even though the knowledge percentage scores for foot care domain was 88% and physical activity domain was 65% which agrees with a Saudi Arabian study which reported similar results for both domains [26], yet other domains; the general disease awareness and check-ups domains showed much lower results (31% each). Such discrepancies are important as participants seemed to have adequate diet knowledge (72%) compared to knowledge of disease symptoms, signs, and complications as well as knowledge of the important investigations to be done. Furthermore, the check-up domains for both awareness and practices were inadequate, meaning that the participants are not aware of the importance of follow-up for the incurable disease. This also could be one of the reasons behind patients' noncompliance, especially that more than half of participants had diabetes for more than 10 years with a mean of 11 years, indicating the need for successful programs assessing reasons behind the non-compliance like other chronic diseases [13], working on interventions for increasing compliance to treatment for chronic diseases is required [28]. In addition, the relatively low awareness and practice scores among participants along with average disease duration of around 10 years raise concerns of the requirement of proper, efficient and, effective intervention models targeting diabetics, especially in rural communities. It is expected that the participants did not receive sufficient counseling as evident by the below-average awareness and practice percentage scores. These findings highlight the importance of providing community-based interventions to improve access to information which in turn reflected on both health care practices and impacted the health of diabetics. Community-based activities can lead to enhancement of the overall awareness and healthy practices among diabetics, helping proper self-control of the disease and providing support to overcome patients' problems. In Egypt, the implementation of community-based interventions was responsive to community needs proved to positively impact different aspects of health care practices regarding infant [29], [30], [31], [32], child health and cognitive development [33], [34], [35], maternal and reproductive health [36], [37], environmental health [38], [39], and also for controlling

diseases such as HCV [40], [41], HBV [42], [43], and end-stage renal diseases [28]. All these studies provided examples of best practices about the impact of community-based interventions on improving KAPs and health status. These findings support the future need for similar activities to achieve impact on the detected very low KAP of diabetics detected in the current study and improve their health status.

Lack of regular physical activity is another important factor where even though 44% of our study participants practiced regular mild physical activity like climbing stairs, walking, and housework, yet the percentage practicing sports or moderate to vigorous activity was extremely low (<5%) and the overall mean physical activity score was 28.8%. This could be due to the nature of the area rather than any intervention. Low level of vigorous physical activity could be ought to the high proportion of females (around two thirds) in addition to age where the majority of participants were 30 years or more and one third 60 years or more. Low level of physical activity was also reported in the Egyptian STEPS survey, where over 79% of Egyptians were not involved in vigorous physical activity [4].

The current study revealed the difference between the scores of the diet and foot care awareness domains and their corresponding practices indicating that being knowledgeable does not guarantee sound practices, but there is always a need to motivate for sound practices supporting again the need for community-based interventions. The low level of foot care practice domain agrees with other recent studies [44].

In the present study, there was a positive correlation between level of the awareness and healthy practices ($r = 0.750$, $p < 0.001$) which agrees with other studies ($r = 0.314$, $p < 0.001$) [18], and ($r = 0.320$, $p < 0.001$) [22]. This also agrees with a survey done in Bangladesh among rural residents where poor or low level of knowledge was associated with poor practices and ultimately poor control and management of the disease [45], [46]. An important point to be considered is that even though there are certain predictors for the likelihood of change in both awareness and healthy practices, yet the overall effect of the model is not high. Both regression models showed that the total effect of these variables was around 18% for awareness and 13% for healthy practices, as evidenced by the R square value indicating the possibility of the presence of other factors that could also affect the control of DM.

Conclusion

The overall awareness and practice among the studied participants were inadequate. Both were high with younger age, increase level of education, lower HbA1c level, and normal BMI.

Whereas female patients, those with relatives with DM, and non-smokers had significantly higher scores concerning the awareness and practices related to the diet domain, female patients and participants with shorter duration of the disease (<10 years) had significantly higher practice scores related to physical activity domain.

Marriage affected awareness and practices related to the general disease, management compliance practices, and physical activity domains.

Cost-effective targeted approaches to improve diabetic patients' awareness and healthy practices domains are required to improve self-care and impact glycemic control of diabetics, especially in rural communities.

Strengths of the study

Most of the previous studies in Egypt were done in a health care setting. The current study provided evidence drawn from the assessment of diabetics at a rural community level.

The findings of the study are considered principle and cornerstone support allowing future cost-effective and targeted counseling and self-management. Moreover, this study believes that measurements and assessment of diabetics' awareness and practices of the five studied domains concerning general disease awareness and management compliance practices, check-ups, foot care, diet, and physical activity are prerequisites for achieving real change for self-management and counteracting against any barrier. Accordingly, the findings of the study are considered principle and cornerstone support allowing future cost-effective and targeted counseling and self-management.

Limitation of the study

This study was lacking determining the best channels of communication for applying the culturally sensitive educational tools required for diabetics' self-management. These tools can be used to improve the adoption of the safe recommended behaviors by different sectors of the community to achieve the reduction of diabetes prevalence.

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