Awareness and Knowledge of Diabetes among Al-Wazarat Family Medicine Health Center Attendants

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Abstract

Background: Diabetes mellitus is a major public health problem in Saudi Arabia.

Objective: This study aimed to evaluate the knowledge and perception of diabetes among attendees of a primary care centre in Riyadh capital of Saudi Arabia and to utilize the results of the study in setting future public diabetes health education programs.

Methods: A sample of 500 male and female aged 18 years was included for this cross-sectional survey. Data were collected from the waiting area at Al- Al-Wazarat Family medicine Health Center (FMHC) using self administered pretested Arabic questionnaire. The questionnaire contained 3 main sections. The first section focused on participants' socio-demographic characteristics. The second section contained 31 multiple choice questions (MCQs) on knowledge related to diabetes general knowledge, symptoms, risk factors, diagnosis, complications and management. Last question determined participants' sources of knowledge

about diabetes. A Score of one is given for each correct answer and zero for the wrong or did not know answers. The maximum score for the second and third section was 31 points.

Results: 467 participants completed their questionnaire. Knowledge of diabetes was suboptimal. The mean total Score was 18.6 (60%) and the maximum score was obtained in the knowledge regarding treatment and management section with a mean of 3.8 (77.6%). The lowest score was in the knowledge about the diagnosis of diabetes; the mean score was 0.55 (27.7%). Education level, media as a source of information and being diabetic were found to be positively associated with more knowledge.

Conclusion: This study showed that a significant number of Saudi population lack awareness and knowledge about DM. This finding supports the need for well-designed health education programs with focusing on public area of weakness and misconceptions, and encourages healthy life style for early prevention.

Keywords: Diabetes mellitus; knowledge; awareness; MCQs; Saudi Arabia

Running title: Awareness of Diabetes among Health Center Attendants

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Introduction

Diabetes mellitus (DM) continues to be a major threat to global public health.⁽¹⁾ Worldwide, the prevalence of diabetes for all age-groups was estimated to be 2.8% in 2000 and 4.4% in 2030. The number of people with diabetes in the world is expected to approximately double between 2000 and 2030 (form 171 million in 2000 to 366 million in 2030).⁽²⁾ The greatest relative increases will occur in the Middle Eastern Crescent, sub-Saharan Africa, and India ⁽²⁾. Saudi Arabia is one of the middle-east countries, between 1995 and 2000, the prevalence of DM in adults (30-70years) was 23.7 %.⁽³The global increase in diabetes is associated with many factors, including ageing population, unhealthy diets and sedentary life styles that heighten the individual's propensity towards obesity.

Morbidities of Diabetes, such as diabetic retinopathy, neuropathy and cardiovascular disease have placed a heavy financial burden on countries. In the United State, the total annual economic cost of diabetes in 2007 was estimated to be \$174 billion. Medical expenditures totaled \$116 billion and were comprised of \$27 billion for diabetes care, \$58 billion for chronic diabetes-related complications, and \$31 billion for excess general medical costs. Indirect costs resulting from increased absenteeism, reduced productivity, disease-related unemployment disability, and loss of productive capacity due to early mortality totaled \$58 billion.⁽⁴⁾ In Saudi Arabia, direct cost around 8.6 billons Saudi Riyals.⁽⁵⁾

There is growing evidence that prevention or delaying of diabetes is possible through many options which include, increasing physical activity, modest weight reduction, having a healthy or diabetic diet, and pharmacological intervention.⁽⁶⁻⁹⁾ So, increasing public awareness regarding modifiable diabetic risk factors and healthy life style is an important measure to stem the present epidemic of diabetes.

However, many programs of early detection and health education were conducted in Saudi Arabia. But, an effective community intervention program is a challenge which requires full assessment of public perception and knowledge about diabetes, addressing their misconception and specific need. ⁽¹⁰⁻¹¹⁾ These data will help the policy makers and health care providers to direct their resources in proper direction and audit their programs.

The main objective of this study was to evaluate public knowledge, awareness and perceptions about diabetes mellitus among Saudi population and to utilize the results of the study in setting future public diabetes health education programs.

Methods

This was a cross-sectional study conducted during November 2012 to February 2013 in Al-Wazarat Family medicine Health Center (FMHC) which was the main primary health care center for Riyadh Military Hospital (RMH), located in the middle of Riyadh city, the capital of Saudi Arabia. This center provides primary medical care to about 80% of Saudi military and civilians under the medical services department (MSD) of the Ministry of Defense and Aviation (MODA). The population was highly representative of the Saudi socio-demographic structure.

The calculated sample size was 400 participants using EpiInfo Program. To reach the sufficient sample size and accounting for a non response rate of about 20%, it was decided to take 500 participants ($500 \times 80 = 400$)

A questionnaire was designed to collect the information from participants. It was written in Arabic language and was divided into 3 main sections. The first section focused on participants' socio-demographic characteristics including 7 variables (age, gender, level of education, employment, type of job, income, and if candidate is diabetic or not). The second section consists of multiple choice questions (MCQs) single best answer focusing on different aspects of diabetes mellitus, namely, general knowledge about diabetes (6 questions), symptoms (2 questions), diagnosis (2 questions), and management (5 questions). For all MCQs last answer was "I do not know" to eliminate answering correctly by chance. Third section contains MCQs, more than one correct answer focusing on risk factors (7 variables) & Complications (9 variables). The last question determined participants' sources of knowledge about diabetes. A Score of one was given for each correct answer and zero for the wrong or did not know answers. The maximum score for the second and third section was 31 points.

The questionnaire was tested for its readability and understanding to the public before distribution. The sample was collected from Al-Wazarat FMHC waiting areas. Any person could be given the questionnaire to answer whether he/she is a patient or a companion of a patient. 50 questionnaires were distributed and collected each day for 10 days for a total of 500 participants. Two trained teams helped in collecting the data, two doctors in the male waiting area and two health educator nurses in the female waiting area. The questionnaire was self administered by the participants after explanation of the objective of the study and obtaining a verbal consent from them. All participants were asked to answer all questions. All incomplete questionnaires were omitted from the study. For illiterates the questions were read for them by one of the study team, in clear, consistent way and the answers were recorded according to the particular participants' answer.

All people above 18 years of age who attended Al-Wazarat FMHC for routine visits were included. Severely ill patients and those attending in medical emergency situations were excluded. Data was analyzed by SPSS, ANOVAs test was used to test significance with a P values <0.05 indicating statistical significance (95% confidence intervals).

Result

A total of 500 questionnaires were distributed, 467 were completed (respond rate, 93.4%). The characteristics of participants are shown in (Table 1).

Table 1. Demographic characteristics of the participants in Al-Wazarat FMHC,	2009
(n=467)	

	No.	%	Cumulative %
Age (years)			
18-29	196	42.0	42.0
30 - 49	213	45.6	87.6
50 and above	58	12.4	100.0
Gender			
Male	235	50.3	50.3
Female	232	49.7	100.0
Educational level	-		
Illiterates	34	7.3	7.3
< high school	120	25.7	33.0
High school	149	31.9	64.9
> High school	164	35.1	100.0
Occupation			
Students	45	9.6	9.6
Employee	238	51.0	60.6
Non-employee	184	39.4	100.0
Jobs in relations to health			
profession or study			
Related	50	10.7	10.7
Non-related	417	89.3	100
Monthly income			-
No answer	59	12.6	12.6
<6000 SR	194	41.5	54.2
6000 – 11999 SR	176	37.7	91.9
>12000 SR	38	8.1	100.0
Diabetic history			
Diabetic	95	20.3	20.3
Not diabetic	372	79.7	100

The distribution of total score obtained by the participants is shown in figure 1. The mean total Score was 18.6 (60%). Figure 2 described the score of different area in knowledge about diabetes the maximum score was obtained in the knowledge regarding management section with

a mean of 3.8 (77.6%) and the lowest score was in the knowledge about the diagnosis of diabetes; the mean score was 0.55 (27.7%).



Figure 1. The Total scores of participants' knowledge about Diabetes Mellitus (n=467).



Figure 2. The scores of participants' knowledge about different areas of Diabetes Mellitus (n=467).

Most of the participants were aware that DM can affect both children and adults and described the natural history of DM as chronic disease that can be controlled to prevent its complications (441 (94.4%) and 388 (83.1%) respectively). Only 116 (24.8%) defined DM correctly, where 300 (64.2%) defined diabetes as either high or low blood sugar from normal value (not shown in table). Few participants defined insulin as a hormone which decrease blood sugar level 140 (30%). About half of participants knew that DM has genetic and environmental causes, and the pathogenesis of DM is decrease insulin secretion or decrease body sensitivity to insulin 249 (53.3%), 239 (51.2%) respectively. There was no significant difference between diabetic and unaffected individuals in general knowledge about DM (p = 0.780) (table 2). There was a highly significant difference in the general knowledge of the participants about DM and their levels of education and income (p = 0.000) (Table 2).

Variables	Diabet Kr	Diabetes mellitus General Knowledge score		
	mean	Standard Deviation	P value	
Age (years)				
18 - 29	3.3265	1.18776	0.729	
30 - 49	3.4178	1.28455		
50 and above	3.3276	1.17560		
Gender				
Male	3.4255	1.24970	0.312	
Female	3.3103	1.20901		
Educational level				
Illiterates	2.5000	1.18705	0.000	
< high school	3.1667	1.23216		
High school	3.3356	1.24451		
> High school	3.7256	1.09839		
Occupation				
Student	3.0000	1.06600	0.003	
Employee	3.5504	1.29734		
Non-employee	3.2228	1.14009		
Jobs in relations to health				
profession or study	1	1		
Related	3.5400	1.45980	0.297	
Non-related	3.3477	1.19954		
Monthly income			•	
No answer	3.2034	1.11076	0.000	
<6000 SR	3.1289	1.22110		
6000 – 11999 SR	3.6080	1.20463		
>12000 SR	3.7368	1.30869		
Diabetic history		1	P	
Diabetic	3.3368	1.22570	0.780	
Not diabetic	3.3368	1.23222		

Table 2. Diabetes Mellitus general knowledge score in relation to participants' socio-
demographic data (n=467)

The most frequently identified risk factors were obesity 369 (79.0%), excessive carbohydrate and fat intake 357 (76.4%). About half of the participants' 235 (50.3%) believed that stress is a risk factor for DM (Table 3). Age, Income and education levels directly and significantly affected the knowledge about risk factors (Table 4).

	Answers		Total	
Variables	Correct Answer No. (%)	Wrong Answer No. (%)	No. (%)	
Obesity	369 (79.0)	98 (21.0)	467 (100)	
Excessive carbohydrate and fat intake	357 (76.4)	110 (23.6)	467 (100)	
Family History of DM	299 (64.0)	168 (36.0)	467 (100)	
Pregnancy	271 (58.0)	195 (41.8)	467 (100)	
Stress	235 (50.3)	232 (49.7)	467 (100)	
Age \geq 40 years old	209 (44.8)	258 (55.2)	467 (100)	
Low activity level	204 (43.7)	263 (56.3)	467 (100)	

Table 3. Participants' knowledge of risk factors and non-risk factors of DiabetesMellitus (n=467)

	Diabetes me	ellitus Knowled	dge of risk
Variables	factors score		
Vallables	mean	Standard Deviation	P value
Age (years)			
18 - 29	3.9796	1.36986	0.035
30 - 49	4.3380	1.36268	
50 and above	4.1724	1.59096	
Gender			
Male	4.1617	1.39574	0.934
Female	4.1724	1.41284	
Educational level			
Illiterates	4.2353	1.59656	0.007
< high school	4.2333	1.30115	
High school	3.8523	1.52624	
> High school	4.3902	1.27029	
Occupation			
Students	3.7333	1.42063	0.092
Employee	4.2185	1.40018	
Non-employee	4.2065	1.39114	
Jobs in relations to health			
profession or study			
Related	4.0600	1.53077	0.569
Non-related	4.1799	1.38806	
Monthly income			
No answer	4.0847	1.50044	0.037
<6000 SR	3.9794	1.46092	
6000 – 11999 SR	4.3977	1.25621	
>12000 SR	4.1842	1.48607	
Diabetic history			
Diabetic	4.3474	1.54209	0.161
Not diabetic	4.1210	1.36332	

Table 4. Participants ²	' knowledge score of	diabetes risk	factors in relation	to socio-
	demographic	data (n=467)		

Polyuria and polydipesia were the most frequently mentioned known symptoms of DM 399 (85.4%), while weight loss and polyphagia were least mentioned 136 (29.1%). Both education level (p = 0.012) and income status (p = 0.032) were positively correlated with the level of participants' knowledge about DM symptoms (Table 5).

Few participants managed to determine the diagnostic levels, Fasting and random blood sugar where identified by 104 (22.3%), 155 (33.2%) respectively. Those who were diabetic were significantly more aware about how to diagnose diabetes (p=0.000) (table 6).

Table 5. Participants' Knowledge score about the symptoms of Diabetes Mellitus	s in
relation to socio-demographic data (n=467)	

Variables	Knowledge score about symptoms of DM		
Variables	mean Standard P value		
Age (years)			
18 - 29	1.1122	0.56173	0.469
30 - 49	1.1831	0.62139	
50 and above	1.1207	0.67739	
Gender			
Male	1.1660	0.61508	0.464
Female	1.1250	0.59353	
Educational level			•
Illiterates	.8529	0.65747	0.012
< high school	1.1333	0.64734	
High school	1.1342	0.57725	
> High school	1.2256	0.56835	
Occupation			•
Students	1.0000	0.42640	0.028
Employee	1.2143	0.63002	
Non-employee	1.0924	0.59794	
Jobs in relations to health			•
profession or study			
Related	1.2000	0.57143	0.501
Non-related	1.1391	0.60830	
Monthly income			
No answer	1.0508	0.57005	0.032
<6000 SR	1.0619	0.59904	
6000 – 11999 SR	1.2670	0.61620	
>12000 SR	1.1579	0.54655	
Diabetic history			
Diabetic	1.2211	0.63880	0.173
Not diabetic	1.1263	0.59436	

Variables	Score of Knowledge regarding diagnosis of DM		
Variables	mean	Standard Deviation	P value
Age (years)			
18 - 29	0.4694	0.63576	0.028
30 - 49	0.6009	0.59511	
50 and above	0.6724	0.57393	
Gender			
Male	0.5447	0.61422	0.725
Female	0.5647	0.61380	
Educational level			
Illiterates	0.6176	0.60376	0.010
< high school	0.5083	0.57971	
High school	0.4497	0.60890	
> High school	0.6707	0.62768	
Occupation			
Students	0.4000	0.61791	0.203
Employee	0.5756	0.61671	
Non-employee	0.5652	0.60606	
Jobs in relations to health			
profession or study			
Related	0.6400	0.59796	0.298
Non-related	0.5444	0.61517	
Monthly income			
No answer	0.4746	0.56800	0.032
<6000 SR	0.4794	0.62095	
6000 – 11999 SR	0.6364	0.62668	
>12000 SR	0.6842	0.52532	
Diabetic history			
Diabetic	0.8211	0.56454	0.000
Not diabetic	0.4866	0.60753	

 Table 6. Participants Knowledge score of Diabetes Mellitus diagnosis in relation to demographic data (n=467)

Awareness of diabetes complications was suboptimal. Over all, Nephropathy was the most frequently mentioned complication. But, only half of the participants 234 (50.1%), followed by blindness 207 (44.3%), stroke 205 (43.9%), and neuropathy 200 (42.8). Gangrene was known to less than one third 147 (31.5%). Few participants (12.8%) have misbelieved that

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DM increased the risk for cancer (Table 7). The level of education and being a diabetic played an important role in identifying DM complications (P = 0.000) (Table 8).

	Ans	Total	
variables	Correct No. (%)	Wrong No. (%)	No. (%)
Does not increase cancer risk	407 (87.2)	60 (12.8)	467 (100)
Does not cause osteoporosis	244 (52.2)	223 (47.8)	467 (100)
Causes Nephropathy	234 (50.1)	233 (49.9)	467 (100)
Causes Blindness	207 (44.3)	260 (55.7)	467 (100)
Causes Stroke	205 (43.9)	262 (56.1)	467 (100)
Causes Neuropathy	200 (42.8)	267 (57.2)	467 (100)
Causes Sexual dysfunction	182 (39.0)	285 (61.0)	467 (100)
Causes Hypertension	179 (38.3)	288 (61.7)	467 (100)
Causes Gangrene	147 (31.5)	320 (68.5)	467 (100)

 Table 7. Participants' Knowledge about Diabetes Mellitus complications (n=467)

Variables	Score of Knowledge about complication of DM		
Variables	mean	Standard Deviation	P value
Age (years)			
18 – 29	4.9184	1.71374	0.729
30 - 49	5.7653	1.71324	
50 and above	6.4483	1.61324	
Gender			
Male	5.4000	1.62565	0.248
Female	5.5905	1.92286	
Educational level			
Illiterates	6.5882	1.43796	0.000
< high school	5.6667	1.77439	
High school	4.9463	1.73900	
> High school	5.6402	1.74049	
Occupation			
Students	4.4889	1.61839	0.000
Employee	5.5126	1.75199	
Non-employee	5.7174	1.77921	
Jobs in relations to health			
profession or study			
Related	5.3400	2.00621	0.516
Non-related	5.5132	1.75287	
Monthly income			
No answer	5.1356	1.60234	0.143
<6000 SR	5.4124	1.83942	
6000 – 11999 SR	5.6250	1.78125	
>12000 SR	5.8684	1.66313	
Diabetic history			
Diabetic	6.3895	1.73998	0.000
Not diabetic	5.2661	1.71928	

Table 8. Participants' knowledge score on Diabetes Mellitus complications in
relation to socio-demographic data (n=467)

In the section of management, the interventions were identified by participants in the following order: diet 432 (92.5%), regular exercise 414 (88.7%) and smoking cessation 385 (82.4%) (Table 9). Educational level and income had a statistically significant association with knowledge of management of DM (p=0.013, 0.005 respectively) (table 10). Table 11 shows

that total knowledge score has significant association with advanced age, level of education, income and being a diabetic (P = 0.000 for all).

	Answers		Total
Variables	Correct Answer No. (%)	Wrong Answer No. (%)	No. (%)
Diet	432 (92.5)	35 (7.5)	467 (100)
Regular exercise	414 (88.7)	53 (11.3)	467 (100)
Smoking	385 (82.4)	82 (17.6)	467 (100)
Option of treatment (insulin and oral hypoglycemia agent)	368 (78.8)	99 (21.2)	467 (100)
Presence of alternative treatment	213 (45.6)	254 (54.4)	467 (100)

 Table 9. Participants' Knowledge about management of Diabetes Mellitus (n=467)

Manialla	Score of knowledge about management of DM			
Variables	mean	Standard Deviation	P value	
Age (years)			·	
18-29	3.7653	1.03578	0.124	
30 - 49	3.9671	1.03880		
50 and above	3.9483	0.99864		
Gender				
Male	3.8043	1.03154	0.111	
Female	3.9569	1.03524		
Educational level		·	•	
Illiterates	3.8235	0.99911	0.013	
< high school	3.7583	1.20221		
High school	3.7584	1.05042		
> High school	4.0915	0.85669		
Occupation				
Students	3.4222	1.05505	0.007	
Employee	3.9202	1.00102		
Non-employee	3.9402	1.05152		
Jobs in relations to health				
profession or study			•	
Related	3.9000	0.90914	0.516	
Non-related	3.8777	1.05014		
Monthly income				
No answer	3.8644	1.18114	0.005	
<6000 SR	3.7062	1.04374		
6000 – 11999 SR	3.9943	0.99425		
>12000 SR	4.2632	0.75995		
Diabetic history		-		
Diabetic	4.0316	1.04630	0.110	
Not diabetic	3.8414	1.03006		

Table10. Participants' Knowledge score about management of Diabetes Mellitusin relation to demographic data (n=467)

	Total Knowledge score			
Variables	mean	Standard Deviation	P value	
Age (years)				
18-29	17.5714	4.12000	0.000	
30 - 49	19.2723	4.00719		
50 and above	19.6897	4.39380		
Gender				
Male	18.5021	4.02171	0.575	
Female	18.7198	4.36276		
Educational level				
Illiterates	18.6176	4.51942	0.000	
< high school	18.4667	4.13213		
High school	17.4765	4.33026		
> High school	19.7439	3.75740		
Occupation				
Students	16.0444	3.79566	0.000	
Employee	18.9916	4.20065		
Non-employee	18.7446	4.07377		
Jobs in relations to health				
Profession or study				
Related	18.6800	4.97110	0.901	
Non-related	18.6019	4.09500		
Monthly income				
No answer	17.8136	3.95437	0.000	
<6000 SR	17.7680	4.32762		
6000 – 11999 SR	19.5284	3.93944		
>12000 SR	19.8947	3.90280		
Diabetic history				
Diabetic	20.1474	4.30232	0.000	
Not diabetic	18.2177	4.07655		

Table 11. Total Knowledge Score about Diabetes Mellitus in relation to demographic data of the participants (n=467)

All the following independent variables including demographical characteristic of participants and their source of information were analyzed by regression model, the most significant association were with the following variables: education level, media as a source of information and being diabetic (table 12)

Table 12. Regression analysis showing predictors of total knowledge Score of the
participants about Diabetes Mellitus (n=467)

	Total Knowledge Score			
Variables	Standardized Coefficients (Beta)	P value		
Education	0.241	0.000		
Media	0.231	0.000		
Diabetic	0.211	0.000		
Age	0.184	0.000		
Physicians	0.132	0.002		
Newspaper and Magazine	0.119	0.009		
Med Lectures	0.101	0.018		
Friends and relatives	0.099	0.026		
a Dependent Variable: Total Knowledge Score				
Excluded Variables: Sex, health related job or study, income, medical books and internet				
Significance of the model =0.000				

It was found that the majority of participants' information was obtained from friends and

relatives, doctors and the media (71.9, 56.5, and 55.7% respectively) (figure 3).



Figure 3. Participants' source of information (n=467).

Discussion

In general, the result showed that the participants' knowledge about diabetes was suboptimal, where the total score was 60%. The best score was in the management section and the worst in diagnosis section. Our results are like other study reported elsewhere. In Singapore, Wee, et al (1999), conducted a public survey which showed that the total score was 66.1% ⁽¹²⁾

For general knowledge about DM, there was unclear definition of DM, where more than half thought that DM is a condition of high or low blood sugar. The inclusion of low blood sugar in the definition of DM can be due the misconception of side effect of diabetes medications. On the other hand, natural history of disease and the type of people who gets the disease was known by most of participant.

Obesity was the most recognized risk factor by the participants (79%) which was higher compared to other study. In a study by Aljoudi and Taha (2009), in primary care in eastern region of Saudi Arabia, 35.8% identify obesity as a risk factor and lower result (29.5%) in a another study by *Alshafaee (2007)*, about Knowledge and perceptions of diabetes in a semi-urban Omani population.⁽¹³⁻¹⁴⁾ It is widely acknowledged that excessive sugar intake is a risk factor for incident diabetes mellitus.⁽¹⁵⁻¹⁷⁾ Excessive carbohydrate intake was the second most common identified risk factor (76.4%), this result was comparable to other studies results. .⁽¹⁴⁾ *In Alshafaee* study, 60% of participants were aware about this risk factor. However, low level activity was the least identifiable RF (43.7%) which was slightly higher compared to (32.3%) in Aljoudi and Taha study. These differences in result might be due to difference in demographical data of studies population.

Limited information about diagnostic values was expected in unaffected individuals in comparison to diabetic, due to difficulty in memorizing them for unaffected individuals, unlike diabetics where it was expected to be reinforced in their clinical follow up. Although diabetic patients had batter knowledge, they had low mean score in the knowledge about DM diagnostic blood levels (0.8211 out of 2). This highlights the need for greater effort for diabetic education among diabetic patients for batter management outcome.

The highest score was in the knowledge about management of DM, diet and regular exercise commonly mentioned. On the other hand, low level of activity was the least risk factor to be mentioned which indicated that the participants considered exercise only as a treatment option and not as a preventive measure which might be due to the fact that preventive measures are underestimated in the our community. However, about half of participants 213 (45%) believed in traditional and herbal medicine for example honey and black seeds as treatment options. This is an important point to address regarding patient health believes in education programs and further evidence based study to prove or disprove their believes.

There was a low score in the knowledge of DM complications. This low level of knowledge about DM complications might play an important role in participant lack of awareness about the seriousness of DM which might compromise their attitude toward the preventive measures and/or adherence to treatment in diabetic patients.

Over all the most important factor that affected the level of knowledge was the level of education and this was in agreement with other studies. In Pakistan, Rafique and khuwaja conducted a survey to assess the public awareness about diabetes, hypertension and life style. They found a positive association between the level of knowledge and the level of education ⁽¹⁸⁾. The same association was also found in both previous studies conducted by *Alshafaee (2007)* and Aljoudi and Taha (2009) ⁽¹³⁻¹⁴⁾. In our study, other factors were noticed to have positive relationship with participants` knowledge like media and physicians as source of information, also being diabetic, and advance age. The finding of the media as first most important source for correct information to the participant should motivate the health authorities for proper utilization of this tool for further educational program parallel with other sources in common use like newspaper and magazine and medical lectures. Physicians were the second important source of

correct information. Physicians mainly in family medicine could play an important role in increasing public awareness about DM in their daily practice by opportunistic diabetic and cardiovascular disease risk assessment, not to mention the marketing of healthy life style. Although most sources of information were friends and relatives, they were the least important source for correct information about DM. This might have had a positive impact as good source of information after mass improvement in public awareness and knowledge.

Limitation of the study

The limitation of our study result is that the results cannot be generalized to all over Saudi Arabia, as our data was collected from one primary health care center and in the capital; Riyadh. So, further studies in other parts of the country including villages and semi-urban cities are needed.

Conclusion

In consideration to high prevalence of Diabetes mellitus in Saudi Arabia, this study showed that there was a significant number of Saudi population who lack awareness and knowledge about DM. This finding supports the need for well-designed health education programs focusing on public areas of weaknesses and misconceptions, and encouraging of healthy life style for early prevention. It also showed that health education should be done through Multidisciplinary approach where mass media and printed media are important sources of public information.

Recommendations

- 1- Utilizing the media in an organized educational program about DM.
- 2- Organizing education campaigns in public gathering area e.g.: shopping Malls.
- 3- Distributing booklet about DM in the waiting area and using education posters and banners.
- 4- Utilizing audiovisual facilities in the waiting area to improve the knowledge about DM risk factors and complications.
- 5- Organized workshops about DM for phycsians, addressing their role in increase public awareness about DM and its preventive measures.
- 6- Addressing this study to higher authorities, to help in national health planning, and for their support for current and suggestive projects.
- 7- Advertizing for Diabetic related events and activities in international diabetic day (14 November).
- 8- Public advertizing for health life style and encourage utilization of the public sidewalks.

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