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Research Article

THE IMPACT OF USING BLOOD SUGAR HOME MONITORING DEVICE TO CONTROL BLOOD SUGAR LEVEL IN DIABETIC PATIENTS

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ABSTRACT
Diabetes is a major chronic health problem in the developing countries and especially in our area of the world. Patients are advised to monitor their blood sugar level by using home devices. The objective behind the study was to find out the percentage of people using blood sugar monitoring devices and if these devices help them control their disease. To find also how many patients know the normal level of blood sugar in the body and how many times they visit the doctor for regular checkup. A cross sectional study was done in primary care clinic patients in King Khalid University Hospital (KKUH) in Riyadh. We formed questionnaire and distributed 330 samples through face-to-face interview. Data analyzed by SPSS software. The total number of the sample is 330. About 64.1 % of patients use blood sugar monitoring device at their home and 35.9% don't. No significant difference between using the device or who don't and the mean HBA1c. Patients treated with diet only have better knowledge about the normal blood sugar level, there was no significant difference compared to gender, age, education and mean HBA1c. The attitude of patients about the usefulness of the home monitoring devices showed no significant difference. The majority of patients never visit the diabetic health educator and the dietician, while most of them visit the ophthalmologist annually. It can be concluded that although many patients in King Khalid university hospital use blood Sugar monitoring devices at their home, it seems there is no effect in control, and there was poor knowledge about the normal range of blood sugar level. The majority of them never visit the diabetic educator and dietician.

Keywords: *HBA1c, Home Blood Glucose (Sugar) Monitoring, Diabetes, Blood Sugar Control, Saudi Arabia*

INTRODUCTION
Diabetes is a disease that can affect patients' life weather direct or indirect way. Careless patients will develop many complication and even lead to their death, so they have to monitor their blood glucose level and keep it in the normal range.

The prevalence of DM in Saudi Arabia is increasing by time and about 20-30% of the population is suffering from this disease (WHO; Mohammad and Ismail, 2012). We came fourth in place after Kuwait, Lebanon and Qatar, respectively.

For type I diabetes in the Middle Eastern/North African region, Saudi Arabia has the largest number of cases (65,000) of T1DM in children aged 0–14 years (Mohammad and Ismail, 2012). So finding optimal care for this huge percentage is needed to avoid DM complications. Intensive blood sugar control was shown to decrease the progression of diabetes complications (Azab, 2001; IBM Corp, 2012; Baltaci *et al.*, 2012). However, this control needs frequent monitoring by both the patient him/herself at home and the treating doctors.

Home monitoring The term "diabetes mellitus" describes a metabolic disorder of multiple etiologies characterized by chronic hyperglycemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action, or both (Taylor and Campbell, 2007).

The effects of diabetes mellitus include long–term damage (WHO). In 2011, 9.1% of the populations from the Middle Eastern/North African region have type II diabetes (32.8 million) and this is projected to reach 60 million in 2030. In 2012, Saudi Arabia came fourth in place after Kuwait, Lebanon and Qatar, respectively. For type I diabetes in the Middle Eastern/North African region, Saudi Arabia has the largest number of cases (65,000) of T1DM in children aged 0–14 years (Mohammad and Ismail, 2012).

In the past five years, it has been quit few researches done in the Middle East about the impact of using blood sugar home monitoring devices to control blood sugar level. According to researches, 49% of diabetes mellitus patients attending Primary Health Care Centers in Riyadh are poorly controlled. Public education and awareness programs should be encouraged. Such programs must include the importance of appropriate life style changes and of self-monitoring of blood sugar at home (Azab, 2001).

Diabetic patients are encouraged to check their blood sugar levels and we hypothesize that all diabetic patients who use blood sugar home monitoring devices have better control of their normal blood sugar level than those who don't use them.

Objective

To Find Out

- If blood sugar home monitoring devices help patients control their disease.
- If patients know the normal range of blood sugar in the body.
- The level of awareness among patients about blood sugar monitoring devices.
- If patients regularly visit their doctor for checkup.

MATERIALS AND METHODS

Methodology

Patients with Diabetes mellitus following up in primary care unit at King Khalid University Hospital Riyadh, Kingdom of Saudi Arabia were enrolled in this study. The study was quantitative, observational, cross sectional study, from October 2012 to April 2013. The subjects are diabetic male and female patients from all groups. The data was collected through structured face-to-face interview with the participant. Person accompanying the participants asked for answering the question instead of elderly and children who could not understand the questions. In case there is no one to help these participants with the questions they will be excluded from the study. The subjects were chosen according to convenient sample.

The sample size was calculated according to the following formula: $n = Z2\alpha P (1-P)/d2$ to be 320.

The questionnaire includes four main sections. First, Socio-demographic data of patients including file number (mandatory to be filled), name, age, gender, education level (illiterate, elementary & intermediate, Secondary and higher education), marital state, occupational, place of work, hospital that he/she follow up in.

Second, diabetic data includes type of management, awareness about the normal level of blood glucose, using home monitoring device, how to use it and patients feedback about the usefulness of the home monitoring device. Third, general data about following up for vision problems and nutrition, also, ask if they want to receive SMS for general health education and awareness. Finally, the researchers extracted from patients' files in king Khalid University hospital in Riyadh the height, weight, body mass index, last three results of fasting glucose level, postprandial glucose level and HBA1C level.

The data form tested in a pilot study on a 30 purposive participants. The time, locality, and logistic tested in this pilot study. The necessary modifications done on the interview form. The completed interview form from the main study entered into PC computer and analyzed using SPSS software (IBM Corp, 2012). The necessary statistical tests such as T-test, Chi Square conducted on the data as necessary.

The ethical point of view was put in consideration and the investigators at the beginning of each interview took the informed consent. They explained the purpose of the study and the right of the participants to withdraw at any time without any obligation towards the study team. No rewards were given to the participants. The participants were assured that full privacy of their medical information records will take place and it will be accessed to this research only.

RESULTS AND DISCUSSION

Results

A 320 patient were included in the study. The control of blood sugar was measured by measuring the HbA1c level with each parameter. 46% (n=148) of our sample are having poor control on their disease

with HbA1c more than eight percent. And only 29% (n=92) are having good control with HbA1c level of less than seven percent. The remaining 25% (n=80) of the sample are having borderline control with HbA1c level between 7-8%. See figure 1. Table 1, shows sociodemographic data with the corresponding mean HBA1c level. The mean HBA1c wasn't significantly different in any of the parameters except for the type of treatment that the patients were on and the residency. Patients who are on diet and oral hypoglycemic drugs are having much better control on their blood sugar level than patients who are in insulin. The mean HbA1c levels are 8.08%, 8.03%, And 8.83% respectively with P-value of 0.002. Also, patients who live in Riyadh have better mean HBA1c level of 8.25% compared with 8.93% for patients who live outside Riyadh (p=0.005). None of the gender, age, education level, marital status, or BMI showed any statistical significance on the control of blood sugar in our study. Patients were asked about the normal blood sugar level to test their knowledge. Those who answered correctly and who don't know about the normal blood sugar level are having lower HbA1c level than patients who gave wrong answers (8.13%, 7.98% and 8.57% respectively, P-value=0.04). In addition, they were asked about; their personal point of view about helpfulness of the device in controlling their disease, frequency of using the device, visiting diabetic health educator, dietician and having eye examination. However, none of these shown any significant effects on their blood sugar control (See table 2). Table 3, shows the type of management and using the device with corresponding mean HbA1c level. There is no significant difference in the mean HbA1c level with in each category among patients who use the device and who don't p-value>0.05.

Table 1: Sociodemographic data (N=320)

		N	MeanHBA1c	P-value
Gender	Male	174	8.1773	0.18
	Female	146	8.4637	
Age	< 25 y	12	8.6989	
	25 - 45 y	68	8.3725	.42
	46 - 60 y	140	8.4254	
	> 60	100	8.0540	
Education	Illiterate	82	8.4224	
	Elementary & Intermediate	87	8.5726	.27
	Secondary	71	8.0359	
	University	80	8.1443	
Marital Status	Married	274	8.3362	.52
	Single/ Divorced or Widow	46	8.1395	
Residency	Riyadh	259	8.162	.005
	Outside Riyadh	61	8.9277	
BMI	Normal (18.5-25)	62	8.0022	
	Overweight (>25 - 30)	124	8.3729	.38
	Obese (>30)	134	8.3893	
Type of treatment	Diet	27	8.0815	
	Oral hypoglycemic drugs	183	8.0299	.002
	Insulin	110	8.8261	

Table 2: Patient knowledge, attitude, using of home monitoring device and frequency of health physician visits versus mean HBA1c

		N	MeanHBA1c	P-value
Knowledge about the normal blood sugar level	Correct answer	62	8.1253	
	Wrong answer	161	8.5735	.04
	Don't know	97	7.9841	
Patient point of view about helpfulness of the device in controlling their disease	Always	117	8.3338	
	Sometimes	57	8.3274	.94
	Never	32	8.4604	
Frequency of using the device	Always	77	8.1918	
	Sometimes	99	8.4861	.53
	Never or don't have	144	8.2476	
Do you visit the diabetes health educator?	Always	49	8.4418	
	Sometimes	67	8.2977	.87
	Never	204	8.2792	
Do you visit a dietician?	Always	71	8.6897	
	Sometimes	64	8.2455	.16
	Never	185	8.1831	
Do you examine your vision at least once per year?	Always	124	8.3555	
	Sometimes	106	8.3212	.89
	Never	90	8.2269	

Table 3: Using home devise and type of treatment

Type of treatment		Diet		Oral hypoglycemic drugs		Insulin		Total	
		N	mean HBA1c	N	mean HBA1c	N	mean HBA1c	N (%)	mean HBA1c
Do you use this device?	YES	3	7.27	105	8.0872	68	8.8226	176 (55%)	8.3574
	No	24	8.18	78	7.9528	42	8.8317	144(45%)	8.2476
	p-value	.48		.64		.98		.61	

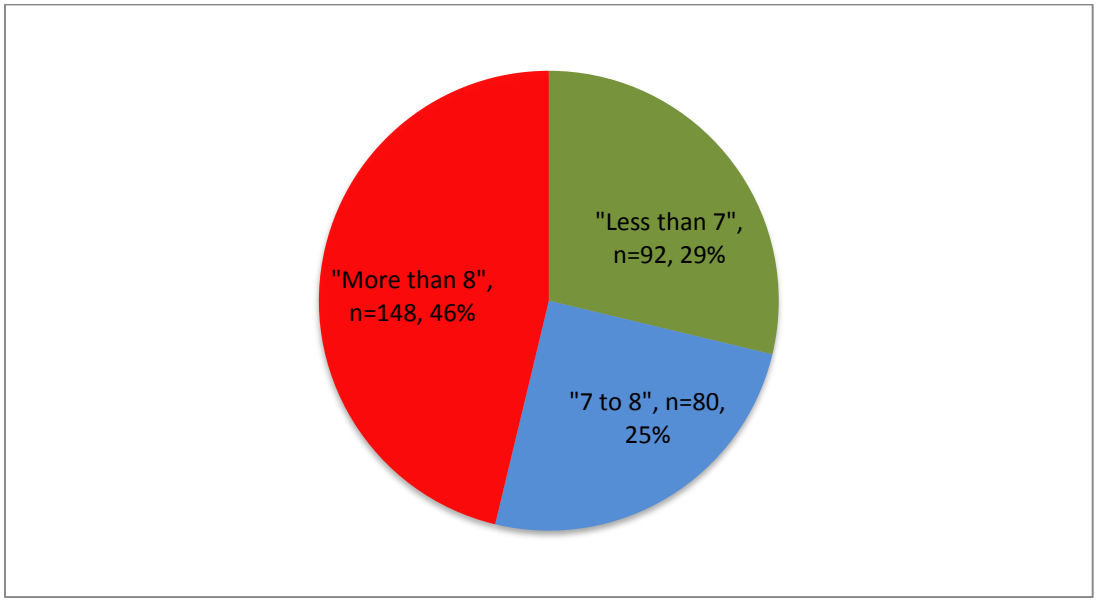

Figure 1: The control of HBa1c level among participants

Discussion

The purpose of the study was to investigate whether patients of diabetes use the blood monitoring devices for their disease and if it's controlling their blood sugar level. The findings suggest that 55% of the diabetic patients using the self-monitoring device and 45% don't. The study showed there was no difference between patients who are using the home monitoring devices or not compared to mean HBA1c. This supports and adds to the findings of a study done in turkey in 2012, which showed that regular users of the blood glucose monitor device was not superior to irregular or never use (Baltaci *et al.*, 2012). Our finding didn't match with previous studies done in Florida in 2007 (Taylor, 2007) and in Japan 2012 (Harashima *et al.*, 2015), which clearly indicate a significant improve of the blood levels to the normal ranges. The increase of awareness in our community about diabetes may contribute to our result, which means that patients are having a better lifestyle since it's an epidemic disease in gulf countries, even though most of our sample doesn't know the normal range of blood sugar in the body. We compared the knowledge about the normal blood sugar level with different variables and we saw that patients with diet management only have better knowledge than patients treated with oral hypoglycemic agent or insulin. This may be due to patients treated with diet are younger in age, which make them more aware about the disease. Also, this lack of knowledge can be correlated to the number of visits to diabetes health educator and we found that 63.6% of our total sample never visits the diabetes health educator, and about 56.9% never visits the dietician. The visits to the ophthalmologist are higher among patients; where about 38.4% of them visit annually. This may be due to the obvious complication to sight, where patients are afraid and seek for help immediately. Patients Opinion about the usefulness of the blood sugar monitoring device is controversial. Education, age group and type of management didn't show any significant difference. This might be due to the wrong use of the device which shows wrong results, or as we said duo to the increase of awareness in our community which make patients live healthier life and don't care about checking the blood sugar regularly.

Conclusion

In the present study it was found that 64.1% have the blood sugar home monitoring device. Although most of them have the home device, there was no significant difference between who uses the device and who doesn't compared to the mean HBA1c.

There was poor knowledge about the normal blood sugar level in body, only patients treated with diet have better knowledge. The attitude towards the usefulness of the blood sugar home monitoring device is controversial among patients. The majority of patients enrolled in this study never visit the diabetic health educator or the dietician.

Recommendation

Further studies are needed to investigate why the using of home monitoring devices is not effective in controlling the normal levels and find which factor is responsible for that. Increase the awareness about the normal level of blood sugar is extremely important among patients. Activate the rule of doctor and the other primary health care team to increase the awareness about the importance of visiting the doctor regularly.

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