

# Role of Health Education in Improving Knowledge, Attitudes and Practices & its Control among Diabetic Patients Attending Omdurman Military Hospital, Sudan (2012-2014)

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## **Abstract**

**Study background :** Diabetes is undoubtedly one of the most challenging health problems in the 21st century. It is rapidly getting worse; leaving the biggest impact on adults of working age in developing countries. Hence, Education of patients with diabetes is considered a fundamental aspect of diabetes care (IDF, 2012).

**Objective :** The study aimed to assess the effects of health education on knowledge, attitudes and practices in diabetic individuals.

**Materials and Methods :** This interventional study was carried out on 384 randomly selected diabetic patients attending diabetes clinic in OMH , from January 2012 to January 2014. Data were collected using structured questionnaire.

**Results :** A significant education in weight was found after intervention, the mean weight and standard deviation before intervention was (73.1 kg  $\pm$ 13.6) had decreased to(73.0 kg  $\pm$ 14.2) after educational intervention program. Significant decrease in glycosylated hemoglobin was reported, the mean glycosylated hemoglobin was (8.3 $\pm$ 2.3) have decreased significantly to (8.2 $\pm$ 1.9) after educational intervention. BMI was significantly associated with duration of diagnosis. A significant difference between patient 's age and BMI before and after intervention. Association was found between level of education and practice of sport.

**Conclusion:** Health education was an effective tool that implicated change in diabetic patient 's knowledge, attitudes and practices towards diabetes and its impact in control of diabetes.

**Recommendations:** Diabetic care clinics should include integrated health education to patients regarding main knowledge, attitudes and practices and regular follow-up and investigations.

**Keywords:** Diabetes mellitus,

## دور التنقيف الصحي في تحسين المعرفة والسلوكيات والممارسات و تأثيره في مرضى داء السكري وسط المترددين على مستشفى أم درمان العسكري، ولاية الخرطوم ، السودان (2012-2014)

### ملخص الدراسة

**خلفية الدراسة:** يعتبر داء السكري من المشاكل الصحية الأكثر تحدياً في القرن الحادي والعشرين . ويتفاقم الأمر ويزداد سوءاً بصورة متسارعة وذلك بتركه أكبر الأثر على البالغين في سن العمل في البلدان النامية. وبالتالي، تأتي أهمية التدخل التوعوي لمرض السكري في تحسين الرعاية الذاتية لداء السكري من أجل منع هذه المضاعفات. (التحالف العالمي لمرضى السكري، 2012).

**الهدف:** هدفت هذه الدراسة إلى تقييم دور التنقيف الصحي وتأثيره في تحسين المعرفة والسلوكيات والممارسات لدى مرضى داء السكري وسط المترددين على مستشفى أم درمان العسكري.

**الطرق:** أجريت هذه الدراسة على 384 من مرضى السكري تم اختيارها عشوائياً من الحاضرين لعيادة السكري في مستشفى أم درمان العسكري ، خلال الفترة من يناير 2012 وحتى يناير 2014 . تم استخدام الاستبيان ( القبلي والبعدي) لجمع بيانات الدراسة.

**النتائج:** تم الحصول على أهمية احصائية معنوية في تقليل الوزن، كان متوسط الوزن والانحراف المعياري 73.1 كجم  $\pm$  13.6 وقد انخفض إلى 73.0 كجم  $\pm$  14.2 بعد التدخل ببرنامج التنقيف الصحي، كما وجد انخفاض ملحوظ في مؤشر كتلة الجسم بعد التدخل. وجد حدوث انخفاض كبير في الهيموغلوبين الجليكوزيلات بعد التدخل من 8.3  $\pm$  2.3 إلى 8.2  $\pm$  1.9. كان هناك ارتباط بين مؤشر كتلة الجسم والفترة التشخيصية لداء السكري . هناك اختلافات كبيرة بين عمر المرضى ومؤشر كتلة الجسم قبل التدخل وبعد التدخل. كان هناك ارتباط ذو أهمية احصائية معنوية بين المستوى التعليمي وممارسة المرضى للرياضة بانتظام.

**الخلاصة:** التنقيف الصحي أداة فعالة ينتج عنها تغيير في المعارف والمواقف والممارسات لمرضى السكري تجاه داء السكري مع تأثيره في ضبط السكري.

**التوصيات:** العيادة المتكاملة لمرضى السكري يجب أن تشمل توعية صحية فعالة عن المعرفة والاتجاهات والسلوك فيما يخص بدء السكري، بالإضافة للمتابعة المنتظمة لتوفير كل الفحوصات الروتينية.

## CHAPTER ONE

### INTRODUCTION, PROBLEM STATEMENT AND RATIONALE

#### 1. INTRODUCTION

Diabetes mellitus is a combination of heterogeneous disorders commonly presenting with episodes of hyperglycaemia and glucose intolerance, as a result of lack of insulin, defective insulin action, or both (Sicree et al., 2006). Such complications arise due to derangements in the regulatory systems for storage and mobilization of metabolic fuels, including the catabolism and anabolism of carbohydrates, lipids and proteins emanating from defective insulin secretion, insulin action, or both (Votey and Peters, 2007).

The newest global estimation of the prevalence of diabetes in 2030 is already 552 million; in 2011 the number of diabetic individuals was 366 million, most of them living in low- and middle-income countries (Whiting et al., 2011).

Early identification of those at risk of developing type 2 diabetes is essential for prevention of diabetes and its complications. Fasting plasma glucose (FPG) and the 2-hour oral glucose tolerance test (OGTT) are recommended for early detection of type 2 diabetes (American Diabetes Association, 2010).

1.1.2 CLASSIFICATION there are two types of diabetes; type1 and type2 and each has its different complications (ADA, 2014)..(---)

#### 1.1.3 DIAGNOSTIC CRITERIA

For decades, the diagnosis of diabetes has been based on glucose criteria, either the fasting plasma glucose (FPG) or the 75-g oral glucose tolerance test (ADA, 2010). In 1997, the first Expert Committee on the Diagnosis and Classification of Diabetes Mellitus revised the diagnostic criteria (ADA, 2010). The new diagnostic criteria for diabetes mellitus consist of positive findings from at least two of the following on different days (ADA, 2010):

- Glycated hemoglobin (A1C)  $\geq 6.5\%$ . The test should be performed in a laboratory using a method that is certified by the National Glycohemoglobin Standardization Program (NGSP) and standardized or traceable to the Diabetes Control and Complications Trial reference assay (DCCT).
- Fasting plasma glucose (FPG)  $\geq 7.0$  mmol/l (126 mg/dl). Fasting is defined as no caloric intake for at least 8 hours.
- 2-hour plasma glucose  $\geq 11.1$  mmol/l (200 mg/dl) during an oral glucose tolerance test (OGTT). The test should be performed as described by the World Health Organization, using a glucose load containing the equivalent of 75 g anhydrous glucose dissolved in water.
- In a patient with classic symptoms of hyperglycemia or hyperglycemic crisis, a random plasma glucose  $\geq 11.1$  mmol/l (200 mg/dl).

#### 1.1.4. SYMPTOMATOLOGY

The classical symptoms of diabetes mellitus consists of: polyuria (frequent urination), polydipsia (increased thirst) and polyphagia (increased hunger), (Duganis et al., 2009) but type 2 diabetes mellitus is largely

asymptomatic (Ogunbanjo, 2006). Most patients believe that they are cured after the initial symptoms disappear with treatment.

They tend not to observe healthy lifestyle habits and do not take their treatment regularly. They usually seek medical attention only when complications are present (Joshi et al., 2009).

### **1.1.5 COMPLICATIONS**

#### **1.1.5.1 ACUTE COMPLICATIONS OF TYPE 2 DIABETES MELLITUS**

Acute complications occur suddenly and may be the first manifestation of type 2 diabetes mellitus in a person who does not know that he is diabetic. The acute complications of type 2 diabetes mellitus may also happen when insulin therapy is suddenly withdrawn, or when infection, surgery or other stressful events occur. Common acute complications of type 2 diabetes mellitus are diabetic ketoacidosis (more common in type 1 diabetes mellitus), hyperglycaemic hyperosmolar status, hypoglycaemia and diabetic coma (Tabora, 2011).

#### **1.1.5.2. LONG TERM COMPLICATIONS OF TYPE 2 DIABETES MELLITUS**

The long-term complications of type 2 diabetes mellitus occur within 10 to 15 years from the onset of diabetes (Tabora, 2011). The two major complications of the chronic effect of hyperglycaemia on the small blood vessels and on the arteries are microvascular and macrovascular disease respectively (Rackel, 2009; Wikipedia, 2011).

##### **1. Microvascular disease**

The damage to small blood vessels leads to microangiopathy, which can cause one or more of the following (Wikipedia, 2011):

- Diabetic cardiomyopathy, causing damage to the heart and leading to diastolic dysfunction and eventually heart failure.
- Diabetic nephropathy, causing damage to the kidney which can lead to chronic renal failure, eventually requiring dialysis.
- Diabetic neuropathy, causing abnormal and decreased sensation, usually in a 'glove and stocking' distribution starting with the feet but potentially in other nerves, later often fingers and hands. When combined with damaged blood vessels this can lead to diabetic septic foot. Other forms of diabetic neuropathy may present as mononeuritis or autonomic neuropathy. Diabetic amyotrophy is muscle weakness due to neuropathy.
- Diabetic retinopathy, causing growth of friable and poor-quality new blood vessels in the retina as well as macular edema, which can lead to severe vision loss or blindness.

##### **2. Macrovascular disease**

Macrovascular disease leads to cardiovascular disease (Wikipedia, 2011):

- Coronary artery disease, leading to angina or myocardial infarction.
- Diabetic myonecrosis ('muscle wasting')
- Peripheral vascular disease, which contributes to intermittent claudication as well as diabetic foot.
- Stroke, mainly the ischemic type.

### **Comprehensive Diabetes Evaluation**

A complete medical evaluation should be performed to classify the diabetes, detect the presence of diabetes complications, review previous treatment and risk factor control in patients with established diabetes, assist in formulating a management plan, and provide a basis for continuing care. Laboratory tests appropriate to the evaluation of each patient's medical condition should be completed. A focus on the components of

comprehensive care will enable the health care team to optimally manage the patient with diabetes. The Components of the comprehensive diabetes evaluation includes medical history, diabetes education history, diabetes related-complications history and physical examinations (ADA, 2014).

### **Diabetes Self-Management Education and Support**

In accordance with the national standards for diabetes self-management education (DSME) and support (DSMS), all people with diabetes should participate in DSME to facilitate the knowledge, skills, and ability necessary for diabetes self-care and in DSMS to assist with implementing and sustaining skills and behaviors needed for ongoing self-management, both at diagnosis and as needed thereafter (ADA, 2014).

DSME is associated with increased primary and preventive service use (Robbins et al., 2008) and lower acute, inpatient hospital service use (Steinsbekk et al., 2012). Patients who participate in DSME are more likely to follow best practice treatment recommendations, particularly among the Medicare population, and have lower Medicare and insurance claim costs (Duncan et al., 2011).

#### **1.1.6. PROBLEM STATEMENT:**

In Sudan the government spending on health services constitutes a negligible portion of the national budget; most of this is dedicated to tackling communicable diseases. Communicable diseases are given a low priority, the human and economic costs of diabetes continue to grow unchecked and people with diabetes receive attention in general primary care clinics, where even the minimum requirements of diabetes care are not available (Ahmed, 2006).

#### **1.1.7. STUDY RATIONALE:**

Diabetes mellitus is a disorder which is resulted due to the abnormal metabolism of carbohydrates (Kumar et al., 2007) as a result of excessive consumption of the sweet tasted substances and there is one person in the world dying of diabetes every ten seconds. Hence, a two cases of diabetes in the world being identified every ten seconds!! ([www.idf.org/home/index.cfm](http://www.idf.org/home/index.cfm)).

Diabetes mellitus is a chronic multi system disease related to the abnormal insulin production, impaired utilization of insulin or both (Lewis et al., 2007).

Diabetes is the fourth leading cause of death by disease (3.8 million / year), at least 50% of all people with diabetes are unaware of their condition.

In some countries, it may reach up to 80% (WHO diabetes unit and the international diabetes federation) (IDF and WHO, 2007).

Diabetes, the most common non- communicable disease in Sudan, is having an increasing impact on rates of morbidity and mortality in Sudan. The spread of sedentary lifestyles and adoption of western dietary habits – high in refined carbohydrates and fat are driving an increase in the number of people with obesity-related type 2 diabetes (Mohammed, 2006). Since, no cure of diabetes in sight, the control of the disease is the most efficient intervention which can be adapted.

### **3. STUDY OBJECTIVES**

#### **3.1. GENERAL OBJECTIVE**

To assess the role of health education in improving knowledge, attitudes, practices and its impact in diabetic patients Attending OMH , Sudan (2012-2014)

### 3.1.2. SPECIFIC OBJECTIVES

To assess the effect of health education in knowledge, attitude and practices of diabetic patients.

To assess different factors influencing diabetic educational programm.

To assess the impact of health education in control of diabetes and lifestyle modifications.

### 3.1.3. STUDY HYPOTHESES:

Health education has impact on improving health of diabetic patients through raising awareness for control of diabetes.

## IJSER

CHAPTER THREE  
MATERIAL AND METHODS

#### 4.1. Study design:

This is an interventional educational; pre- and post study carried out at Omdurman Military Hospital (OMH), Diabetes Clinic during the period from January 2012 to April 2014.

#### 4.1. Study population:

Diabetic patient 's type 1 and type2 both sex attending to OMH with diabetes.

#### 4.2. Inclusion criteria:

All newly diagnosed adult patients (within 2years) attending to OMH with diabetes. Adult 's patients from 60 years and above, residence in the town and coming for follow up or first visit.

4.3. Exclusion criteria: Young age less than 20 year, elderly above 60 years , having chronic irreversible health problems including renal failure or CHF or hepatic cell failure, old cases of diabetes more than 2years and any patients coming with diabetes complications in the first visit.

#### 4.4. Sample size and sampling techniques:

For the present interventional study, simple random sample was taken according to the following formula:

$$n = \frac{z^2 * p * q}{(d)^2} \quad (\text{Olayinka et al., 2013})$$

n = sample size; Z = 1.96; P =50%; q = 1-p; d = 0.05

$$n = (1.96)^2 \times 0.5 \times 0.5 / (0.05)^2 = 384$$

The sample size calculated was 384 patients attending to the hospital including all patients with inclusion criteria during the period of the study were recruited.

#### 4.5. Phases of the study:

The study was undertaken in many phases each phase with specific task such as staff orientation, training package, selection of patients, intervention program, evaluation and the other requirements, consents and confidentiality were obtained and assured.

#### 4.7. Data collection tools:

Data was collected by structured questionnaire pre- and post that was designed to include the personal data and time of onset and duration of diabetes, knowledge and attitude towards different aspects of diabetes. We used closed ended questions to ask about knowledge regarding; symptoms, complications, treatment and prevention of complications. Scoring of the knowledge questions was classified as "know" given 2 scores, "partially know" given 1 score and "don't know" given 1.

- Attitude of patients towards diet regimen, exercise and the value of follow-up were assessed by using open ended questions. The answer of each question was classified according to the following; positive attitude=3, Negative attitude =2 and don't respond=1.

- practice of patients towards food intake, sport, follow planned diet and monitor body weight. The answer of each question was classified according to the following; practice=3 partially practice =2, don't practice =1.

#### 4.8. Follow up Tools:

A printed follow up sheet was used. One copy was given to the patient and the other was kept with the group counseling. It includes;

- Structure questionnaire.
- Blood sample for RBS Hb A1C.
- BM1 (Measurement for height and weight to calculate).

#### 4.5.3.2. Laboratory investigations: to summarized

A sample of venous blood was withdrawn from antecubital vein using 3cc intermedica syringes and stored in tubes containing Ethylene Diamine Tetra Acetic acid (EDTA) for measuring the HbA1C and heparin for random blood sugar. The blood samples were coded and sent to the laboratory for the estimation of the blood glucose and HbA1C (ADA, 2014). More than 96% (369) of the respondents completed all implemented sessions while the rest of participants 15 (4%) attended only from 4-5 sessions during the interventional period. A curriculum was designed with following objectives:

- To acquaint the participation on how to understand health behaviors that cause and prevent disease for promotion of the health of individual, family group and community in order to minimize the behaviors that cause disease so as to reduce behavioral changes for better healthy life.
- To acquaint the participation on how to conduct communication methods and media to enhance the awareness of patients on diabetes.

#### 4.9. Data Collection Methods

##### 4.9.1. Investigations:

Consent was obtained from the patient after explaining the purpose of the study and reassuring him about the strict confidentiality of any obtained information, and that the study results would be used only for the purpose of research. Then the pre-test was filled by the researcher.

#### 4.10. Health education sessions:

##### 4.10.1. The first visit:

Patients were subjected to the first session of health education message after taking blood samples from them. A spoken message was delivered by the researcher in the form of group discussion. It included general knowledge about diabetes symptoms with stress on symptoms of hypoglycemic coma and how to deal with it. Also the importance of adherence to treatment was emphasized. Then the patient was given the printed pictured health education papers and asked to attend any of the next educational sessions at Thursday of each week to be informed about the results of their laboratory tests. However, weight and height of patients were taken.

##### 4.10.2. The next visits:

Patients who attended the 2nd sessions were informed about the results of laboratory tests and the time of the next visit. Laboratory results and time of next visit are also recorded in their follow up sheet. In the 2nd education session patients were reminded rapidly by the 1st session contents then they are given information about exercise program, diet plan and value of measuring blood glucose as well as a demonstration on how to measure it. Complications of diabetes took a large sector of this session particularly diabetic foot. The message was provided by the group counseling and took about an hour.

The key messages for Diabetes type 2 were delivered regarding knowledge, attitudes and practices of patients were as follows; **4.6. Data processing and analysis:**

Data was coded, entered and analyzed by the SPSS program version 19.0, using Mc-Nemar chi square test for analyzing paired quantitative data. However,, descriptive statistics was used (mean and frequency distribution). Some associations and difference between pre and post, result was tested for significant to predict the effect of different socio-demographic characteristics (Age, gender, marital status, education and occupation) on acquiring adequate knowledge, attitudes and practices and HbA1c and BMI and different associations were tested.

#### **4.12. Ethical considerations:**

- Ethical clearance was obtained from the University of Gezeira.
- Formal letters were given to OMH informing the purpose of the study.
- Consent was obtained from OMH .
- Confidentiality of the respondents was secured.
- Every participant had a right to participate or not participate in the study.
- No interference with treatment.
- Free investigations were done to all participants.



### Results and Discussion

This study was an effort to assess the role of diabetes education program on diabetic patients in OMH. It measured the effect of diabetes education program on patients anthropometric measurements, lab test, knowledge, attitudes and practice and pre- and post interventions.

Health education is a process that bridges the gap between health information and health practice. An important step in planning health education intervention is to identify predisposing factors like; knowledge, attitude, practice and different socio-demographic characters of patients (Nutbeam, 2000).

**Table 5.3.1. BMI (height and weight) at pre and post educational intervention program of diabetic patients attending OMH2012-2014**

Measurements	N	Before intervention Mean± SD	After intervention Mean± SD	P-value
Weight	384	73.1±13.6	73.0±14.2	<b>0.000***</b>
Body Mass Index	384	27.3±5.0	27±5.3	<b>0.000***</b>

\*\*\*P-value considered significant at 0.05 levels

By using paired t-test to compare the weight changes before and after intervention, a significant decrease (p =0.000) in weight was shown in table (5.3.1). The mean weight before intervention was 73.1±13.6 had decreased to 73.0±14.2 after intervention (-0.1). Accordingly, BMI was also decreased significantly (p=0.000) after educational intervention, where the mean BMI becomes 27.0±5.3 after educational intervention from 27.3±5.0 before intervention (- 0.3).

#### 5.9. Association between Diabetes duration of diagnosis and BMI among diabetic patients attending OMH, 2012-2014

Variable	Description	When were you diagnosed with diabetes?			Total	p-value	
		< 6 months	6 months-1 year	1- 2 years	< 6 months		
Underweight	N	0	2	1	3	<b>0.024***</b>	
	%	.0%	66.7%	33.3%	<b>100.0%</b>		
	Normal	N	6	40	58		<b>104</b>
		%	5.8%	38.5%	55.8%		<b>100.0%</b>

BMI	Overweight	N	16	94	95	<b>205</b>
		%	7.8%	45.9%	46.3%	<b>100.0%</b>
	Obese	N	8	16	48	<b>72</b>
		%	11.1%	22.2%	66.7%	<b>100.0%</b>
<b>Total</b>		<b>N</b>	<b>30</b>	<b>152</b>	<b>202</b>	<b>384</b>
		<b>%</b>	<b>7.8%</b>	<b>39.6%</b>	<b>52.6%</b>	<b>100.0%</b>

\*\*\*P-value considered significant at 0.05 levels

Table 5.9 shows that there was association between BMI and diabetes duration of diagnosis (p=0.024). Overweight (46.3%) and obese (66.7%) was more likely greater in those whose duration of diagnosis was old (1-2) years compared to those whose duration of diagnosis were less than 6 months.

**Table 5.10. Association between BMI and type of treatment used among diabetic patients attending OMH , 2012-2014**

Variable		Description	What type of treatment were you used?			Total	P-value
			Diet with insulin injection	Diet with oral hypoglycemic	Other		
BMI	Underweight	N	0	2	0	<b>2</b>	0.02***
		%	.0%	100.0%	.0%	<b>100.0%</b>	
	Normal	N	39	78	0	<b>117</b>	
		%	33.3%	66.7%	.0%	<b>100.0%</b>	
	Overweight	N	32	124	12	<b>168</b>	
		%	19.0%	73.8%	7.1%	<b>100.0%</b>	
	Obese	N	14	79	4	<b>97</b>	
		%	14.4%	81.4%	4.1%	<b>100.0%</b>	
<b>Total</b>		<b>N</b>	<b>85</b>	<b>283</b>	<b>16</b>	<b>384</b>	
		<b>%</b>	<b>22.1%</b>	<b>73.7%</b>	<b>4.2%</b>	<b>100.0%</b>	

\*\*\*P-value considered significant at 0.05 levels

Table 5.10 shows there was association between BMI and types of treatment used (p=0.02). Those who used diet with oral hypoglycemic were more likely overweight (73.8%) and obese (81.4%). Patients who used diet with insulin injection significantly resulted in good effect of lowering the proportion of obese and overweight patients, 14.4% and 19% compared to diet with oral hypoglycemic, 81.4% and 73.8% respectively.

**Table 5.11. Distribution of Patients' Knowledge about diabetes before and after health education intervention in OMH , 2012-2014**

Do you know the suitable diet for diabetic patients?	Before Intervention	After Intervention	Significance test	
	Frequency (%)	Frequency (%)	$\chi^2$	P-value
Know	26 (6.8%)	338 (88%)	65.882	.000***
Partially know	169 (44.0%)	43 (11.2%)		
Don't know	189 (49.2%)	3(.8%)		
<b>Total</b>	<b>384 (100.0%)</b>	<b>384 (100.0%)</b>		
<b>Do you know the symptoms of hyperglycemia</b>			43.611	.000***
Know	29 (7.6%)	344(89.6%)		
Partially know	143 (37.2%)	38 (9.9%)		
Don't know	212 (55.2%)	2 (.5%)		
<b>Total</b>	<b>384 (100.0%)</b>	<b>384 (100.0%)</b>		
<b>Do you know the symptoms of hypertension?</b>			50.395	.000***
Know	22(5.7%)	349 (90.9%)		
Partially know	148 (38.5%)	33 (8.6%)		
Don't know	214 (55.7%)	2 (.5%)		
<b>Total</b>	<b>384 (100.0%)</b>	<b>384 (100.0%)</b>		

\*\*\*P-value considered significant at 0.05 levels

Table 5.11. Shows a statistically significant difference between pre and post test results (( $p < 0.05$ ) in all items of knowledge between those who know, partially know and don't know after the implementation of health education program. The improvement was marked regarding knowledge of suitable diet for diabetic patients, symptoms of hyperglycemia and symptoms of hypertension

**Table 5.14. Association between patients' practices and appropriate nutrition habits after health education intervention by education level in OMH , 2012-2014**

		The food often intake is:			Total	$\chi^2$	P-value
		Suitable	Moderate	Not suitable			
Illiterate	N	77	26	4	107		

<b>Education level</b>		%	24.8%	40.0%	44.4%	27.9%	25.024	.005***
	Basic	N	51	16	0	67		
		%	16.5%	24.6%	.0%	17.4%		
	Intermediate	N	37	2	0	39		
		%	11.9%	3.1%	.0%	10.2%		
	Secondary	N	84	15	4	103		
		%	27.1%	23.1%	44.4%	26.8%		
	Graduate	N	61	5	1	67		
		%	19.7%	7.7%	11.1%	17.4%		
	Post-graduate	N	0	1	0	1		
		%	.0%	1.5%	.0%	.3%		
	<b>Total</b>		<b>N</b>	<b>310</b>	<b>65</b>	<b>9</b>		
		<b>%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>		

\*\*\*P-value considered significant at 0.05 levels

Illiterates and secondary education patients were significantly more practiced “not suitable food often intake” (44.4%) compared to graduated (11.1%) and post graduated patients (0.0%), (P=.005) table 5.14.

The body weight was measured before and after educational intervention program for study sample as well as body mass Index was assessed. There was mean change in weight and BMI before and after educational intervention .The results related to weight showed a significant decrease ( $p < 0.05$  level) in weight as the average weight before intervention was 73.1 and 73.0 after intervention with average decrease 0.1 kg. In regard to BMI which is one of the standards of determining obesity, results showed a significant decrease in BMI ( $p = 0.000$ ) where the average BMI before intervention was 27.0 and 27.3 after intervention with average decrease 0.3. Thus , the past results indicate that the body weight and BMI drop significantly .This drop can be due to the role of educational intervention program in increasing their awareness on the need to maintain their normal weight and avoid obesity and guiding them to practice a continuous physical activity and planned diet. The results of this research were consistence with the results of earlier studies on the effect of diabetes education on weight loss which affects positively on body mass index. Davis and others found a greater weight loss (-2.98kg) in intervention group compared with (-1.85 kg) in follow up study from the beginning of group structured diabetes educational program (**Davies et al., 2008**).

The study also revealed the results concerning glycosylated haemoglobin where a significant

effect in decreasing the HbA1c ( $P < 0.05$  level) as the mean average before intervention was 8.3% and 8.2% after intervention with average decrease 0.1%. This change after receiving the educational program can be due to following the instruction related to dietary management and physical activity which lower the fasting blood sugar and therefore lowering the glycosylated haemoglobin. Glycosylated haemoglobin plays an important role to see the discipline of blood sugar because the blood sugar changes from day to day, even from hour to hour and this investigation indicates the level of blood sugar during the preceding period of 2-3 months (**Hamdan, 2007**).

The study showed that more than two third of the participants follow planned diet regularly with significance difference ( $p=0.042$ ), where more than (67.0%) for males compared to (61.3%) for females. The less percentage of females to followed planned diet, may be returned to majority of females were housewives working at home and their main task is working in the kitchen and preparing food. Whereas males were working outside and eat most of their meals at their workplaces (**Al-Sabbah et al, 2000**).

There were significant difference found between males and females regarding practicing sport (85.6% of males practiced regularly (3 times a week) compared with 59.7% of females) ( $p = 0.000$ ). Similar finding obtained by **Hu et al, 2005** showed that a moderate or high level of physical activity (less than 2 times a week) has been shown to reduce the risk of total and cardiovascular mortality among patients with type 2 diabetes, independent of BMI, blood pressure, total cholesterol and smoking status.

The current study proved that there was association between nutrition status and diabetes duration of diagnosis ( $p=0.024$ ). However, Overweight (46.3%) and obese (66.7%) was more likely greater in those whose duration of diagnosis was old (1-2) years compared to those whose duration of diagnosis were newly more than six months and less than one year). This relation may be attributed to regular follow-up or diet and exercise. This finding is agree with Davison *et al.*, **2014** in Brazil the finding that patients who reported adherence to the diet had lower BMI, HbA1c, triglycerides, LDL-cholesterol, non HDL-cholesterol and diastolic blood pressure and had more HbA1c at goal, performed more frequently self-monitoring of blood glucose ( $p < 0.001$ ), and reported less difficulties to follow specific schedules of diet plans ( $p < 0.001$ ). Less patients who reported to be adherent were obese or overweight ( $p = 0.005$ ) (**Mackner et al., 2001**).

The study showed that there was association between nutrition status and types of treatment used ( $p=0.02$ ). However, those who used diet with oral hypoglycemic were more likely overweight (73.8%) and obese (81.4%). The finding of the study conform (**Luis et al., 2013**).

A statistically significant difference between pre and post test results ( $p < 0.05$ ) in all items of knowledge between those who know, partially know and don't know after the implementation of health education program. The improvement was marked regarding knowledge of suitable diet for diabetic patients, symptoms of hyperglycemia and symptoms of hypertension. However, the majority of the studied patients had adequate knowledge levels of correct knowledge (ranging from 88.0% to 90.9%) regarding different aspects of diabetes such as; suitable diet for diabetic patients, symptoms of hyperglycemia and symptoms of hypertension. These results proved a significant improvement in the patients' information about the disease as a result of the educational program role. At the post-program phase, there were statistically significant improvements in the patient's knowledge in all areas ( $p < 0.05$ ). This ranged from 6.8% for suitable diet for diabetic patient, to 88.0% after intervention, and 7.6% for symptoms of hyperglycemia before intervention to 89.6% after intervention, and knowledge of symptoms of hypertension from 5.7% to 90.9% after intervention ( $p < 0.05$ ). The findings consistent with a study conducted in Khartoum state which found that test before and after intervention was found to be statistically significant ( $p < 0.05$ ) for diabetic patients. They gained more knowledge after the implementation of the program; particularly in the areas of the nature and signs and symptoms of the disease, signs and symptoms of hypo & hyperglycemia (Fathia *et al.*, 2014).

The study showed the changes in the attitude of the studied group, where a highly significant increase in the percentages of their positive attitude regarding different aspects of diabetes after the application of the health education messages is noticed concerning their opinions about if diabetic patients need require special diet, if oral and dental care is important for diabetic patients and if sport is important for diabetic patients.

Respondents positive attitudes was significantly increased regarding diabetic patients require special diet before and after intervention, importance of periodic foot care, importance of oral and dental care for diabetic patients and for the importance of sport for diabetic patients. Corresponding finding shown that a practical method for improving dental hygienists' comprehensive service to patients with diabetes is to offer more continuing education on diabetes and oral health to supplement their knowledge, skills, and confidence to educate this growing population (Hon *et al.*, 2009).

Good practice habits with strong statistically significant ( $p = 0.000$ ) were observed regarding food intake, practice sport, followed of planned diet, periodically monitor body weight and regularly checking blood sugar after application of health education program. The practice of diabetic patients was increased in terms of food intake, practice sport, follow plan diet and periodically

monitor body weight after health education intervention ( $p < 0.05$ ). However, the improvement in knowledge scores was associated with better practice (Ali, 2010). The study correspond to other study obtained by Wang *et al.*, 2013 stated that after education, patients' nutrition knowledge, awareness and practice accuracy improved significantly ( $P < 0.05$ ). The rates of patients with recommended daily intake of vegetables, grains and dairy were boosted ( $P < 0.05$ ). Various nutrient intakes increased ( $P < 0.05$ )

### 5.1. Limitations of the study: to be summarized/deleted

- Time factor: The assessment of effect of the Health education program is limited to one follow up (3 months).
- Selection bias: bias in a sense is a systematic deviation from the truth, which has potential impact on the quality of the data. Only one health facility was selected in the study area.
- The study did not use control group. The investigator had no control over the events that took place between pre-test and post-test.
- The study confined just to patients at the hospital.
- Lipid profile was not done.
- This study enrolled only 384 patients (small sample) from Khartoum State only and hence findings of the study cannot be generalized to the diabetic population of Sudan. Additionally, recruiting larger sample from inpatient and outpatient clinics will enhance the generalizability of the findings of future studies.
- The study exposed to the opinions of participants regarding oral and dental and foot care importance for diabetic patients only and not to integrated care of oral, dental of foot care.

### CONCLUSION

1. Implementation of health education intervention was proved as an effective tool that implicated a significant change in patients' knowledge, attitude and practice towards different aspects of diabetes. This is shown by the fact that most of the variables in post test are with significant value.
2. There was highly statistically significant positive change in lifestyle of patients with diabetes regarding knowledge, attitudes and practice and improving weight reduction, BMI and Blood Glucose control (Glycosylated Hb) and Random Blood Sugar (HA1c) after health education intervention.
3. Body Mass Index was significantly associated with diabetes duration of diagnosis, types of treatment used. This relation may be attributed to regular follow-up or diet exercise.

4. The diet with insulin injection significantly had good effect in lowering the proportion of obese and overweight patients compared to diet with oral hypoglycemic, respectively.

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