

## The impact of health education on the adjustment of glycated hemoglobin A1C level for women with type II diabetes mellitus in Riyadh city

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**Background:** diabetes is one of the leading chronic diseases in the whole world in general and in Saudi Arabia in particular, it shows a gradual increase in incidence especially that of Type II Diabetes, hence it is considered a pandemic disease. There isn't a registry of all patients, but the prevalence of diabetes in Saudi Arabia is alarming. Globally, Saudi Arabia has ranked 7th among the top 10 countries with higher prevalence of diabetes. Rapid economic development coupled with a large aging population has resulted in a dramatic boost in the prevalence of type II diabetes.

**Aim of the Study:** to evaluate the impact of health education programs on adjusting glycated hemoglobin A1C levels in Saudi women with type II diabetes mellitus in Riyadh city.

**Material & Methods :** Quasi experimental design was used for this study. The study was conducted in two outpatient clinics at Prince Sultan Military Medical City. A purposive and a simple random sample were used, the sample size was 66 newly diagnosed type II diabetic females, 33 subjects from each clinic. The subject of the study satisfied the following criteria; being a Saudi woman, newly diagnosed with type II diabetes mellitus. Data collection was done using a structured questionnaire sheet

**Results:** The study results showed that, the average glycated hemoglobin A1C levels decreased after the implementation of the health education program by about 2.15, there was a highly significant difference between the A1C levels before and after health program. After implementing the health education program, there was a decrease in the percentage of complications among the study group. There was a relation between the age, education, obesity, large families, and presence of diabetic complications

**Conclusions:** This study recommends the replication of the diabetes health education program among large numbers of patients to improve patient knowledge, attitudes, practices controlling HbA1C, effective intervention includes strategies for evolving meetings and phone contact conducted by nurses who provided instruction on foot care, diet, exercise, stress control and drug therapy. Such strategy would reduce the frequency of peripheral neuropathy, foot lesions, and failing kidney functions in patients.

**Keyword:** Type II diabetes mellitus, health education programs, glycated hemoglobin A1C.

Date of Submission: 18-09-2018

Date of acceptance: 03-10-2018

### I. Introduction

Diabetes mellitus is a chronic disease caused by inherited and/or acquired deficiency in production of insulin by the pancreas, or by the ineffectiveness of the insulin produced. Such a deficiency results in increased concentrations of glucose in the blood, which in turn damage many of the body's systems, in particular the blood vessels and nerves.<sup>1</sup>

The number of people with type 2 diabetes is growing rapidly worldwide. This rise is associated with economic development, ageing populations, increasing urbanization, dietary changes, reduced physical activity, and changes in other lifestyle patterns.<sup>2</sup> Diabetes has been called one of the greatest health crises of the 21st century, International Diabetes Federation recently estimates that 8.3% of adults – 382 million people – have diabetes, and the number of people with the disease is set to rise beyond 592 million in less than 25 years. Yet, with 175 million of cases currently undiagnosed, a vast amount of people with diabetes are progressing towards complications unawares. Moreover, with 80% of the total number affected living in low- and middle-income countries, where the epidemic is gathering pace at alarming rates, the IDF Diabetes Atlas' latest figures provide a worrying indication of the future impact of diabetes as a major threat to global development.<sup>3</sup>

Diabetes can be especially challenging for women given the unique and profound effects that it can have on women and their families. Given that the number of women at risk of developing diabetes is expected to continue rising, Intervening with women who have diagnosed diabetes and those who are at risk for the disease requires health care providers to take a multidisciplinary approach to address the multifaceted effects that diabetes can have on these women's lives. Heart disease is the number one killer of women and can contribute significantly to women with diabetes experiencing severe illness. With the increasing life span of women and the rapid increase in the prevalence of diabetes and CHD, such statistics are alarming, particularly because the number of women at risk for both diabetes and CHD is predicted to increase. The comorbidity of diabetes and CHD among women will place added demands on health care delivery system, communities, work sites, and other sectors of society.<sup>4</sup>

Globally, Saudi Arabia came in the 7th rank among the top 10 countries with higher prevalence of diabetes. Rapid economic development coupled with ageing populations has resulted in a dramatic increase in the prevalence of type 2 diabetes. Saudi Arabia one of the top countries affected by the prevalence of diabetes (23.9%).<sup>4,5</sup> National study estimated the overall prevalence of diabetes in Saudis aged 30-70 years at 23.7% (26.7% in women, and 21.5% in men).<sup>6,7,8</sup>

Type II diabetes is usually diagnosed based on screening. It is preceded by a state of prediabetes, which is defined by a single fasting plasma glucose of 5.6-6.9 mmol/L (100- 125 mg/dL) or an HbA1C of 39-48 mmol/mol (5.7% to 6.5%) in the absence of diabetes. Diabetes diagnosis is based on 2 confirmed values of: fasting plasma glucose >6.9 mmol/L (125 mg/dL); HbA1C of 48 mmol/mol (6.5%) or greater; or (less commonly) abnormal glucose tolerance test results, or a random plasma glucose of  $\geq 11.1$  mmol/L ( $\geq 200$  mg/dL) plus symptoms of hyperglycemia.<sup>9</sup> Type II diabetes often presents on a background of genetic predisposition and is characterized by insulin resistance and relative insulin deficiency. Insulin resistance is aggravated by ageing, physical inactivity, and overweight (BMI 25-29.9 kg/m<sup>2</sup>) or obesity (BMI >30 kg/m<sup>2</sup>).<sup>9</sup>

Diabetes diagnosed if the result of the Hemoglobin A1C ( HbA1C) test is 6.5% or higher . HbA1C test done every 6 month if diabetes is well controlled and the test done every 3 month if diabetes is not well controlled.<sup>10</sup> The initiation of insulin is an important stage in the management of type II diabetes. Many patients with diabetes are unable to achieve a goal A1C on oral therapies alone. Given the progressive nature of this disease, characterized by gradual impairment in  $\beta$ -cell function and loss of  $\beta$ -cell mass, Most patients with type II diabetes will eventually require insulin therapy to achieve a goal A1C of < 7% as defined by the American Diabetes Association (ADA) or  $\leq 6.5\%$  as defined by the American Association of Clinical Endocrinologists. Patient education is an important aspect of diabetes care. Greater disease knowledge among patients with diabetes has been associated with improved outcomes such as lower HbA1C and more stable metabolic control.<sup>11,12</sup>

Diabetes education, individualized self-management programs, and case management interventions have been conducted, such programs may not be feasible in locations with limited resources,<sup>13,14</sup> where both patients and providers need to rely on information sources that are more generic and affordable.<sup>15</sup> Appropriate glucose control can reduce the incidence of microvascular disease and risk for myocardial infarction and death.<sup>16,17</sup> even if the evidence is not totally clear for all age groups where some studies pointed out those individual goals for 10 metabolic control are needed, especially for elderly people.<sup>18</sup>

All types of diabetes require close collaboration between those affected and their healthcare providers in order to prevent a range of costly, dangerous complications, which can provoke damage to the eyes, kidneys, feet and heart, and, left untreated, result in early death. Ideally, people with diabetes are taught the importance of self-management through diabetes education. Diabetes self management education (DSME) is a critical element of care for all people with diabetes and those at risk for developing the disease to prevent or delay the complications of diabetes , lifestyle changes are essential for individuals with prediabetes as part of efforts to prevent the disease.<sup>19</sup>

Thus, Diabetes education has been recognized cornerstone of diabetes care, and education contributes to improved self-care and glycemic control in patients with diabetes .Increasingly, healthcare professionals are seeking certification as diabetes educators as recognition of specialization in diabetes management.<sup>20</sup> Numerous studies have demonstrated the central role of nurses in improving health behaviors and patient outcomes in diabetes.<sup>21,22</sup> Many of the positive outcomes seen in visits with nurses may be due to better communication between the nurse and patient. Finding ways to improve outcomes is critically important because most diabetes patients are not achieving optimal blood glucose control leading to poor health outcomes.<sup>23,24</sup> Optimal management of diabetes requires significant effort from both medical and nursing health professionals and the patient. The rapidly growing number of individuals with diabetes and the increased potential for poor outcomes demonstrates the importance for providing optimal diabetes care, understandable diabetes education, and the tools necessary for patient self management.<sup>25</sup> Identification of the patient beliefs about diabetes or "illness representations," understanding of risk for complications (health threats), and coping mechanisms and behaviors will allow medical providers to provide effective diabetic treatment.<sup>26,27,28</sup>

Maternity nurse play as diabetic educator who apply in depth knowledge and skill in the biological and social sciences, communication, counseling and pedagogy to enable patients to manage daily and future challenges. The increasing prevalence of diabetes and the growing focus on its prevention require strategies for providing people with knowledge, skills, as the primary aim of self management to increase self confidence in patient in order to facilitate change of un healthy behavior, these change include change current , good assessing , problem solving and good fallow up .

**Significance of the study:** Diabetes is recognized as a major risk factor for heart disease for women, but the impact of diabetes on women's health appears to be greater than on men's. In all populations, when a woman gets diabetes, her risk is greatly increased. They were also much more likely to have depression, particularly women with lower incomes, limitations on activities of daily living, which include things like bathing, dressing and preparing meals. So, we need to have greater awareness and support for the ways in which women experience a greater burden with diabetes.

Also, Diabetes mellitus imposes a large economic burden on the individual, national healthcare systems, and countries. People diagnosed with diabetes, on average, have medical healthcare expenditures that are ten times higher (\$3,686 vs. \$380) than what expenditures would be in the absence of diabetes. The estimated direct annual medical cost of diabetes care in Saudi Arabia is enormous; it constitutes an economic burden on the country , The total annual direct medical cost per group was found to be US\$1,384.19 for HbA1c. Also, there is indirect costs associated with diabetes, such as absenteeism, lost productivity from disease related absenteeism, unemployment from disease related disability, lost productivity due to early mortality by disease. The social cost of intangibles such as care provided by non-paid caregivers as well as healthcare system administrative costs, cost of medications, clinician training programs.<sup>29,30</sup> Further studies are needed to confirm the present findings and to improve our understanding of economic costs of diabetes and its related complications.

**Theoretical framework:** Teaching self-management concepts of diabetes are frequently compels challenges for both providers and patients. In diabetes, blood glucose can rise and fall outside the normal range quickly. Daily attention to all the factors involved is necessary to prevent negative metabolic effects, and long term complications. Therefore the issue of self-management, adherence to a prescribed regimen, and good control of diabetes is critical. Diabetes self-management is an important component of the Behavioral Theories: Many elements of the self-management approach incorporate concepts of behavioral theories. The focus on treating the patient as a partner or primarily responsible for his or her care incorporates elements of Motivational Interviewing (MI). MI is a newer approach that has been implemented in successful diabetes self-management. Motivational interviewing could be recognized as why people would want to change and what motivates them to change their behaviors. Motivational interviewing has just now been utilized as a counseling model for health promotion and disease management.<sup>31</sup> MI relies on patients being able to recognize their intrinsic values and goals to motivate behavior change. Consequently, a diabetic patient is motivated to attend class and learns, therefore, begins to exercise and ultimately improves A 1c levels.

**Aim of the study:** To evaluate the impact of health education program on adjustment glycated hemoglobin A1C level for Saudi women have type II diabetes mellitus in Riyadh city.

This aim will be achieved through the following objectives:

Assess level of knowledge regarding to diabetic management

Assess practice regarding to diabetic management

assess the change in their knowledge level and change in hemoglobin A1C after implementation of health education program (6 month) for both group

**Research hypothesis:**

1- Women with type II diabetes who participate in education program will have high level of knowledge to control HbA1C in relation to less complication than women who have not undergone this program.

2- Women with type II diabetes who not participate in education program will have low level of knowledge to control HbA1C.

**OPERATIONAL DEFINATIONS:**

Type 2 Diabetes Mellitus: "A group of metabolic diseases characterized by disordered glucose metabolism and inappropriate hyperglycemia due to defects in insulin secretion, insulin action, or both".

Glycated hemoglobin A1C test: is a common blood test used to diagnose type 1 and type 2 diabetes and then to gauge how the diabetes will be managed. It was tested first time when the program start and after six month according to American Diabetes Association. glycosylated hemoglobin was (HbA1c >8.0%) .

### **Methodology :**

Research design:

This is an interventional study using the quasi experimental design with pre- and post-comparison

Setting:

The study was conducted at Prince Sultan Military Medical City in Riyadh City, the capital of Saudi Arabia, considered as one of the most advanced center in the Middle East. Study was conducted at Chronic diseases clinic which providing continuous ,comprehensive ,integrated and evidence based care to diabetic hypertensive ,and asthmatic patients,there are 6 out patient clinic running by doctor and 4 clinic running bydiabetic educator nurse ,the researcher select.

### **Study population:**

The target population was all newly start insulin for type 2 diabetic females poorly controlled and their glycosylated hemoglobin was (HbA1c >8.0%) attending the center Estimated number of Diabetic women attaining diabetes educator clinic at Prince Sultan Military Medical City was estimated at about 200 women total number of diabetic women. A total of 66 patients were selected randomly: 33 patients were assigned to the intervention group and 33 patients were assigned to the control arm.

### **Sample size :**

A subject size calculation tool created by (Yamane, 1967)<sup>32</sup>. was used to determine the suggested number of participants , a number of (66) participant were recommended.The following criteria will compromise the subjects for this study:

### **Saudi women.**

newly start insulin type 2 diabetic females

### **Study design**

This is an interventional study using the quasi experimental design with pre- and post-comparison conducted from at august 2016 until end of January 2017at the Diabetes Center in Prince Sultan Military Medical City, a number of (66) participant were chosen using a random number table from a chart which included those subjects who have diabetes mellitus type II with newly start insulin therapy injection . The sample size was divided into two groups (33 intervention and 33 control )

### **Sampling technique:**

Chart were chose using a random number table and included those subjects who have diabetes mellitus type II with newly start insulin therapy injection . 2- The case and control subject was put in a tubal random number and than we draw the sample of desired size (66) , 33 subject from each clinic (case-control)in both ( alwazarat primary health center &almrooj health center ) in prince sultan military medical city.

### **Data collection tools:**

#### **B. Tool of Data collection**

Data collected through structured interviewing questionnaire which developed by researchers after extensive review ofthe current related literatures. It consist of four part :

**Part I :**Socio-demographic data such as age, education ,social status, Number of family members, obstetric history, information related to present health condition (blood pressure, Glycatedhemoglobin A1C test(HbA1c),level of cholesterol ,type of insulin, results of health examination and investigation test (Blood pressure Check, Eyesexamination, Flu Vaccine, Heart examination, Examined the protein in urine).

**Part II:** assessment for diabetic knowledge by using diabetes Knowledge Test which consists of 23 knowledge test items developed bythe Michigan Diabetes Research Training Center (MDRC).

**Part IV:** assessment for presence of complications of type 2 diabetes such as coronary artery disease is present if the patient reports having a myocardial infarction, symptoms of angina pectoris, or having been given the diagnosis by a physician.

### **Education program**

Patients in the intervention group were subjected to an education program which aims at achieving optimum glycemic control (HbA1c <6.0). The program was implemented for 6 months The intervention group received short one session morning or afternoon every week during first 2 months , after this they came every 2 week during third and fourth month and every 3 weeks in the fifth and sixth month. Educational program was delivered by researchers to the patients , The researchers had attended several conferences on diabetes and had Accredited certification from international organization. The goal was to enable a patient to change their behavior and eventually have glucose control to avoid diabetes complications

These educational interventions were prepared by the researchers based on review of pertinent literature. Diabetic education sessions were conducted with women to improve women's lifestyle in terms of diet, daily exercise for 30 minutes, insulin regimen, symptoms of hyperglycemia and hypoglycemia and its management when it occurs, adjusting the dose of insulin, management plan and measures for prevention of complications and frequent monitoring of blood glucose level using a glucometer and proper insulin injection.

### **The intervention**

All patients in the intervention group had a one-on-one initial education session every week for 2 months followed by one session every two weeks for the third and fourth month one session every 3 weeks for the fifth and sixth month. A one-hour initial education session was conducted by the researchers and a health educator in which patients were educated about the disease, types, risk factors, symptoms, seriousness, management, self-care, food items of low carbohydrate and high fiber content, exercise. Patients received posters, leaflets and pamphlets to remind them of the education session with focus on insulin injection, nutrition and practice exercises. Also, all patients received free a guide line instruction booklet used by Prince Sultan Medical City, the booklet included direction for using blood glucose monitoring device (contour meter) with strips and were shown how to self-monitor blood glucose levels daily and track readings during the whole study period. In addition, patients were instructed to conduct intensified 7-points glucose measurements (pre-prandial and 2-hour postprandial at each of the 3 meals and at bedtime) monthly in the day prior to the follow up visit. They were provided with a printed schedule to record 7 readings. Patients on insulin were taught how to self-inject.

Pre-test blood analysis and post-test was done for intervention and control groups. HbA1C Blood samples withdrawn twice before and after the interventions according to doctor order and transferred to laboratory immediately to test the glycosylated hemoglobin (HbA1c) by Tosoh Automated Glycohemoglobin Analyzer device. The laboratory results, were not disclosed to the researchers.

In each follow up visit, patients spent 30 minutes face-to-face education with the researchers during which problem-solving skills related to hyperglycemia and hypoglycemia were explored. The endocrinologist continued or modified pharmacologic treatment based on the intensified 7 points glucose readings. Patients in the control group were continued with their routine follow-up at 6-month intervals.

### **Monitoring and evaluation of the intervention**

The intervention was monitored and evaluated using a combination of questionnaire interview (post-test), and laboratory investigations. To evaluate patients' response to the educational intervention was tailored to encourage improvement in diet, exercise behaviors and enhancing women's adherence to medications and continue tracking of glucose readings as instructed. A pre- and post-questionnaire was developed by the researchers for the evaluation of the impact of the intervention. Medical assessment at the initial and last visits was considered for evaluation of the outcome of the intervention and included measurement of blood pressure, weight and height. Blood sample was obtained to test for HbA1c.

Statistical analysis :

All statistical analysis performed using SPSS statistical package, version 17. Descriptive statistics were used to describe socio-demographic characteristics of the sampled women. Percentages and frequencies were used for the categorical variables, while means and standard deviations were calculated for the continuous variables. The characteristics of the whole sample and of the knowledge groups were presented. The chi-square test was employed for categorical variables and analysis. The t-statistic and t-paired test have been employed to determine the difference of mean of continuous variables (e.g. height, weight, A1C.....etc.). Significance was set at  $P < 0.05$

### **Scoring system:**

Scoring system used to determine the knowledge level, answers of question related to knowledge score evaluated by the researcher and allotted score according to the correctness of the answer. The score is 0 for the wrong knowledge and 1 for the right and complete knowledge. The overall knowledge score have been summed up for each case and calculated in a percentage to the total corrected knowledge. Accordingly, knowledge levels identified in three categories namely; Good, Fair and Poor knowledge level.

- *Good knowledge: score summation ranges between 66.7 and 100%.*
- *Fair knowledge: score summation ranges between 33.4 and 66.6%*
- *Poor knowledge: score summation ranges between 0 and 33.3%*

For scoring and evaluating complications among study sample, scoring system of 0 and 1 have been used; for no and yes answers respectively. Each complication is ascertained by 2 or more questions. sum of the those question ranging from 0 to 6.

**Validity:**

The items content validity index (I-CVI) for the 23 items of knowledge questionnaire was 0.9130, could be considered as a valid tool to measure the knowledge for the studied sample. The item content validity index (I-CVI) for the 6 complication indices questionnaire was 0.9667. For each individual expert, their proportion of relevant varied between 83.33% and 100%, with an average of 96.67%. Accordingly, and based on the rating of 5 different experts the questionnaire could be considered as a valid tool to measure the complication indices for the studied sample.

**Reliability:**

The reliability coefficient of the 23 items of knowledge questionnaire is Cronbach's alpha for all questions was 0.83131; hence the questionnaire are likely to all be measuring the same construct. The reliability coefficient of the 6 complication was 0.75617; hence the questionnaire are likely to all be measuring the same construct.

**Administrative approval:**

Before conducting the study, an official letter was sent from King Saud University, College of Nursing to Prince Sultan Military Medical City research center, the study was approved by research center committee (No: 845).

**Ethical considerations:**

Diabetic patient attending the diabetic educator clinic were told of purpose of the study and were asked to sign approval consent from if they agreed to participate. They were informed the participation was voluntary and they can withdraw from this study at any time. The consent was taken and there confidentially was ensured.

**II. Results**

**Table (1). Comparison between Socio-demographic characteristics of control and intervention groups among type II diabetic women. (n = 66).**

ITEM	Sampled women				Statistical Test
	Control (n =33)		Study Cases (n =33)		
	No.	%	No.	%	
<b>Age</b>					$\chi^2 = 0.40530^*$ P 0.5244
<b>Mean</b>	36.1515		35.8485		
<b>Standard deviation</b>	4.8997		4.6846		
<b>Education Level</b>					$\chi^2 = 0.86389^*$ P 0.3526
Illiterate	6	18.18	6	18.18	
Elementary	4	12.12	4	12.12	
Junior high school	6	18.18	4	12.12	
High school	7	21.21	11	33.33	
University degree	10	30.30	8	24.24	
<b>Employment</b>					$\chi^2 = 1.4505$ P = 0.2284
Employee	5	15.15	9	27.27	
House-wife	28	84.85	24	72.73	
<b>Family Size</b>					$\chi^2 = 1.2923$ P = 0.5241
<b>Mean</b>	7.9394		7.0606		

Standard deviation	2.8056	2.6450
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\* Yates chi square has been applied when one or more cells contained frequency less than 5.

Socio-demographic characteristics of type II diabetic women is summarized and represented in table (1), to compare between control group and study cases. The age of control group varied between 22 and 40 years old with an average of 36.152 years and standard deviation of 4.8997. On the other hand, the age of the study cases varied between 24 and 40 years old, with an average of 35.849 years and standard deviation of 4.6846. Chi-square ( $\chi^2$ ) statistical analysis indicated non-significant difference between the two groups ( $p = 0.5244$ ).

Most of the sampled women within the two groups are un-employee. The percentage of un-employee women within the control group was 84.9% and it was 72.7% among study cases. Chi-square statistics results showed non-significant difference between the two groups (i.e. P-value was 0.2284). Concerning family size the control group varied between 5 and 15 persons, with an average of 7.93 and standard deviation of 2.8056.

**Table (2). Comparison between current health status of control and study cases among sampled type II diabetic women before implementation health education.(n = 66)**

ITEM	Sampled women				Statistical Test
	Control (n =33)		Study Cases (n =33)		
	No.	%	No.	%	
<b>Blood pressure</b>					
Normal(130/85 mm Hg)	11	33.33	24	72.73	$\chi^2 = 9.9966^*$ P= 0.0016
High normal(139-130/89- 95)	7	21.21	6	18.18	
Minor High=( 159-40/99-90 mm Hg)	14	42.42	3	9.09	
Medium High(179-160/119-110mm Hg)	1	3.03	0	0	
<b>HBA1C</b>					
6 – 8	10	30.30	10	30.30	$t\text{-test} = 0.3732$ D.f. 64 P= 0.3551
9 – 10	13	39.39	16	48.48	
> 10	10	30.30	7	21.21	
Mean	9.6061		9.4545		
Standard deviation	1.6382		1.6600		
<b>Insulin type</b>					
Clear	25	75.76	25	75.76	$\chi^2 = 0.0$ P=1.000
Cloudy	8	24.24	8	24.24	
<b>Insulin doses</b>					
One	9	27.27	7	21.21	$\chi^2 = 0.5738$ P=0.7506
Two	8	24.24	7	21.21	

Four	16	48.48	19	57.58
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\* Yates chi square has been applied when one or more cells contained frequency less than 5.

Table (2) summarized the comparison between the two sampled groups of diabetic women regarding their insulin medication and current health status.

Concerning blood pressure, the percentage of women who have normal blood pressure among study cases was outnumbering that among control group, 72.73% and 33.33%, respectively. Statistical test indicated a highly significant difference between the two groups, where P-value was 0.0016.

Regarding glycated hemoglobin test measures, the average measures for the two groups are alike. For the two groups, it varied between 7 and 13, with very comparable average; 9.606 and 9.454 for control and study cases group, respectively. Test for difference of mean showed non-significant differences, where P-value was 0.3551. For tabulated data, chi-square statistic also indicated non-significant difference, with P-value of 0.6571.

Insulin medication type was similar among the two groups, where 75.76% have clear insulin and 24.24% have cloudy insulin. In accordance, number of insulin doses per day was alike among the two groups. Chi-square statistics results showed non-significant differences, P-value was 0.7506.

**Table (3): Comparison between knowledge score percent among sampled type II diabetic women before implementation health education program.(n = 66)**

ITEM	Sampled women				Statistical Test
	Control (n =33)		Study Cases (n =33)		
	No.	%	No.	%	
<b>Knowledge Score Percent (% of correct answers out of 23)</b>					
Poor (≤ 33.3%)	7	21.21	17	51.52	$\chi^2 = 6.548$ P 0.0105
Moderate (33.4% – 66.6%)	26	78.79	16	48.48	
Good (> 66.6%)	-	-	-	-	
Minimum	4.35		17.39		<i>t-test</i> =2.2479 P= 0.01402
Maximum	56.52		56.52		
Mean	38.8669		32.8063		
Standard deviation	12.0028		9.7881		

Table (3) showed statistical comparison of knowledge score level about diabetes and diabetes self-management practices between control group and study cases group, before implementation health education program. Control group knowledge Score Percent varied between 4.35% and 56.52% with an average of 38.8669 and standard deviation of 12.0028. On the other hand, study cases group knowledge score percent varied between 17.39% and 56.52% with an average of 32.8062 and standard deviation of 9.7881.

**Table (4). Comparison between hemoglobin A1c measures among sampled type II diabetic women before implementation health education.(n = 66)**

ITEM	Sampled women				Statistical Test
	Control (n =33)		Study Cases (n =33)		
	No.	%	No.	%	
<b>HBA1C</b>					
6 – 8	10	30.30	10	30.30	$\chi^2 = 0.8398$ P 0.6571
9 – 10	13	39.39	16	48.48	
> 10	10	30.30	7	21.21	



Minimum	7	7	<i>t-test</i> =0.3732 P= 0.3551
Maximum	13	13	
Mean	9.6061	9.4545	
Standard deviation	1.6382	1.6600	

Table (4) showed statistical comparison of glycated hemoglobin A1C measures between control group and study cases group, before implement health education program. Control group glycated hemoglobin A1C measures varied between 7% and 13% with an average of 9.6061% and standard deviation of 1.6382. On the other hand, study cases group glycated hemoglobin A1C measures varied between 7% and 13% with an average of 9.4545% and standard deviation of 1.6600. The average glycated hemoglobin A1C measures for the two groups were comparable. *T*-test statistical analysis showed that there was non-significant difference between the two groups, where *t*-statistics was 0.3732 with P-value of 0.3551 which is greater than 0.05. To examine if there is a difference between control group and study cases group glycated hemoglobin A1C measures, chi-square test have been applied. From tabulated data, it was obvious that distribution of individuals for the two groups were resemble among different A1C measures ranges. Chi-square statistics showed non-significant differences between the two groups, where P-value was 0.6571.

**Table (5). Comparison between knowledge score percent among study cases before and after 6 month implement health education program.(n=33)**

ITEM	Sampled women				Statistical Test
	Pre		Post		
	No.	%	No.	%	
<b>Knowledge Score Percent (% of correct answers out of 23)</b>					$\chi^2 = 4.56275^*$ P 0.03267
Poor ( $\leq 33.3\%$ )	17	51.52	10	30.30	
Moderate (33.4% – 66.6%)	16	48.48	18	54.55	
Good ( $> 66.6\%$ )	0	0	5	15.15	
Minimum	17.39		17.39		<i>t-test</i> =3.6075 P= 0.0003
Maximum	56.52		95.65		
Mean	32.8063		47.0356		
Standard deviation	9.7881		20.4352		

\* Yates chi square has been applied when one or more cells contained frequency less than 5.

Table (5) showed that Before the program, knowledge Score percent varied between 17.39% and 56.52% with an average of 32.8063 and standard deviation of 9.7881. After health education program, study cases group knowledge score percent varied between 17.39% and 95.65% with an average of 47.0356 and standard deviation of 20.4352. The average knowledge score percent of study cases group increased by about 43.37%. *T*-pair test statistical analysis showed that there is highly significant difference between before and after education program, where *t*-statistics was 3.6075 with P-value of 0.0003 which is less than 0.01.

**Table (6). Comparison between hemoglobin A1c measures among study cases before and after 6 month implementation health education.(n=33)**

ITEM	Sampled women				Statistical Test
	Pre		Post		
	No.	%	No.	%	
<b>HBA1C</b>					$\chi^2 = 35.3023^*$ D.f 1 P $2.82 \times 10^{-9}$
6 – 8	10	30.30	33	100	

9 – 10	16	48.48			Highly-significant Difference
> 10	7	21.21			
Minimum	7		6		<i>t-test</i> =3.6075 D.f. 64 P= 0.0003 Highly-significant Difference
Maximum	13		8		
Mean	9.4545		7.3030		
Standard deviation	1.6600		0.5855		

\* Yates chi square has been applied when one or more cells contained frequency less than 5.

Statistical comparison of glycated hemoglobin A1C measures of study cases group before and after implement health education program summarized in table (6). Before health education program, glycated hemoglobin A1C measures varied between 7% and 13% with an average of 9.4545% and standard deviation of 1.6600. After health education program, glycated hemoglobin A1C measures varied between 6% and 8% with an average of 7.3030% and standard deviation of 0.5855. The average glycated hemoglobin A1C measure decreased after implement of health education program by about 2.1515. This decline represented about 22.76 % of the average measure before health education program. *T*-test statistical analysis showed that there was highly significant difference between the A1C measures before and after health program, where *t*-statistics was 3.6075 with P-value was 0.0003.

Table (7). Comparison between complication indices among study cases before and after 6 month implementation health education.

ITEM	Sampled women				$\chi^2$ & P-value
	Pre		Post		
	No.	%	No.	%	
<b>CORONARY ARTERY DISEASE</b>					6.1306* 0.0133
No	22	66.67	31	93.94	
Yes	11	33.33	2	6.06	
<b>PERIPHERAL VASCULAR DISEASE</b>					0* 1
No	32	96.97	32	96.97	
Yes	1	3.03	1	3.03	
<b>CARDIO VASCULAR DISEASES</b>					1.0607* 0.3031
No	26	78.79	30	90.91	
Yes	7	21.21	3	9.09	
<b>MORBIDITY NERVOUS SYSTEM</b>					3.1059* 0.0780
No	22	66.67	29	87.88	
Yes	11	33.33	4	12.12	
<b>FOOT PROBLEMS</b>					0.9167 0.3384
No	25	75.76	29	87.88	

Yes	8	24.24	4	12.12	
<b>EYE PROBLEMS</b>					<b>0.5475</b>
No	14	42.42	17	51.52	
Yes	19	57.58	16	48.48	<b>0.4593</b>

**\* Yates chi square has been applied when one or more cells contained frequency less than 5.**

Complication indices of study cases group before and after implement health education demonstrated in table (7). Coronary artery disease (CAD) index have been decreased from 33.33% to 6.06% before and after health education program, respectively. Statistically, there was highly significant difference, P-value was 0.0133. Regarding peripheral vascular diseases index (PVD), the percentage of individuals with PVD among study cases group did not change yet, 3.03%. Accordingly, there was no significant difference between before and after health education program. Concerning cardiovascular diseases index (CVD), the percentage of individual showed positive CVD slightly decreased among study cases group after health education program, from 21.21% to 9.09%. The difference was non-significant, P-value was 0.3031. Regarding morbidity of nervous system complications, the percentage of these complications among study cases group slightly decreased from 33.33% to 12.12% after health education program. Despite this decrease, there was no significant difference, P-value was 0.0780. Also for foot problem indices, there was a slight decrease in percentage after health education program, from 24.24% to 12.12%. The decrease was non-significant with P-value of 0.3384. For eye problem index, there was a slight decrease after health education program from 57.58% to 48.48%. Despite the slight decrease in percentage, there was no statistically significant difference, where P-value was 0.4593.

### III. Discussion

Saudi Arabia has one of the highest percentages of diabetes in the world, with an estimated number according to the statistics mentioned in the Saudi Health Information Survey Handbook 2013, there are about 1,851,080.00 in 2030.<sup>33</sup>The diabetes educator nurse is the logical facilitator of change. Access to diabetes education is critically important; incorporating diabetes educators into more and varied practice setting will serve to improve clinical and quality of life outcome of intervention and Diabetes Nurse Educator in insulin dose adjustment and change practices and life style in type II diabetic patients.<sup>34</sup> According to analysis of data in the present study , most of the women were of average age of 35.84-36.2, high school education, are house wives and live with their extended family. Those factors have on impact on patient to adopt health promoting behaviors with diabetic care. On the other hand, participants in this study had complications before implementation of health education program such as high cholesterol level ,high blood pressure. And of obstetric history of average 5.9-7.4 (this group are considered high risk group pregnancy). More than three quarter from each group (control-cases) their maximum body mass index (BMI) was 40.6, these patient need a set of health education measures or individual teaching and home care to improve their quality of life.<sup>34</sup> Moreover, fifty percent of the participants didn't undergo any recent HbA1C exam, regular blood pressure checkup, eye exam, heart condition checkup or urine test nor regular medical checkups. Minority of the subjects had normal blood pressure, 33.3% from control group, and 72% from cases. Also, HbA1C level among subjects was high. So, they must know that it is important as the higher the HbA1C the greater the risk of developing diabetesrelated complications.<sup>36,37</sup>

Result of the present study reflect existing level of knowledge regarding to diabetic management (nutrition, physical activity, blood glucose monitoring, insulin adjustment, hypoglycemia, hyperglycemia) that Before implement health education program, the control and study group had the same percentagepercentage of correct answers, After implement health educational program for 6 month , the study cases group achieved a higher percentage of correct answers, 47.04%, than the control group, 33.47%. The difference was statistically highly significant. the knowledge of the intervention group significantly increased after the education. This due to, Education can enhance the knowledge for diabetic patient , this Results are comparable with other studies.<sup>38-39-40-41</sup> which showed that diabetic education is required for all diabetic patients .The first step in controlling diabetes is education that can be impact in improving patients self care and reduction the HbA1C level and reduce complications . One of the reasons of why patients do not take action to control diabetes is because of lack of awareness, findings of the present study reflect that the health education intervention was successful in achieving significant changes in the knowledgeabout diabetes.

Health education is not an addition to treatment, but it is one of the treatment tools that has a great effect on enhancing the diabetic patients own abilities to carry out self-care through providing adequate

knowledge changing their attitude, and empowering them with skills that are essential for better control of the disease.<sup>42,43</sup> Regarding to change in hemoglobin A1C (HbA1C) after implementation health education (6 month) for both groups. The comparison of glycated hemoglobin A1C measures between control group and study cases group, before implement health education program. Control group glycated hemoglobin A1C measures varied between 7% and 13% with an average of 9.6061%. On the other hand, study cases group glycated hemoglobin A1C measures varied between 7% and 13% with an average of 9.4545% The average glycated hemoglobin A1C measures for the two groups were comparable. there was non-significant difference between the two groups, glycated hemoglobin A1C measures between control group and study cases group, after implement health education program ,Control group glycated hemoglobin A1C measures varied between 7% and 13% with an average of 9.2727% , On the other hand, study cases group glycated hemoglobin A1C measures varied between 6% and 8% with an average of 7.3030%. showed that there was highly significant difference between the two groups, After implement health education program the A1C measures For control and study cases groups varied; increased decreased or did not changes. The change For control group, in 51.51% of individuals the A1C measures decreased, in 39.39% the A1C measures increased, while in 9.09% the A1C measures didn't change.

Among study group, A1C measures decreased in considerable percentage of women; 90.91%. A1C measures didn't change in 9.09% of the study group. Accordingly, the general improvement in A1C measures among study cases is 6.4 times that improvement among control group. While in control group, HbA1c levels before and after 6 month , significant differences were not observed ,these results are consistent with other studies<sup>44-45-46-47-48</sup> . Reduction in hemoglobin A1c in the intervention group was comparable with other studies<sup>49</sup>Reductions in hemoglobin A1c, was mainly as a result of behavior 79 change in the intervention group and the average of blood glucose levels in patients during past 6 weeks had been shown that hemoglobin A1c was closer to normal and in the long-term risk of complications was reduced. Also, patient education is an important aspect of diabetes care. Greater disease knowledge among patients with diabetes has been associated with improved outcomes such as lower HbA1C and more stable metabolic control as mentioned by Wang C,et al., and Qteishat RR. &GhananimAR.Balagopal P, et al and Thirunavukkarasustated that diabetes education, individualized selfmanagement programs, and case management interventions have been conducted, such programs may not be feasible in locations with limited resources where both patients and providers need to rely on information sources that are more generic and affordable.<sup>50</sup>

Appropriate glucose control can reduce the incidence of microvascular disease and risk for myocardial infarction and death , even if the evidence is not totally clear for all age groups where some studies<sup>53,54</sup> pointed out that individual goals for metabolic control are needed and glycemic control often requires lifestyle adjustments such as smoking cessation, weight loss, dietary changes, increasing physical activity, self-monitoring of blood glucose, and adherence to medication recommendations .

Patients with type 2 diabetes the risk of diabetic complications were strongly associated with previous hyperglycemia. Any reduction in HbA1c is likely to reduce the risk of complications, with the lowest risk being in those with HbA1c values in the normal range (60% of people with type 2diabetes will develop some form of retinopathy). Retinopathy is the leading cause of blindness among adults aged 20 to 74 years. The first step toward preventing or delaying the onset of diabetic retinopathy is to achieve and maintain tight glycemic control and blood pressure.

Health education is the first tool to help in reduce the occurrence of the complications or prevent them . All patients should be followed at least annually. This may identify treatable retinopathy before any vision loss is apparent to the patient. Patients should be promptly referred to a retinal specialist if there is evidence that early retinopathy is progressing or if advanced retinopathy exists. In some cases, patients, in consultation with their eye care professionals, may consider reducing the frequency of this examination to every 2 to 3 years, or increasing the frequency if retinopathy is progressing .

#### **IV. Conclusion**

the findings of this study showed that educational program can promote effectively on increases knowledge , reduction on HbA1C, reduce the complication for type 2 DM patients. Considering that education is a major component of health care, more attention is needed in the design and planning of cooperative education in the country, and interactive behavior change for health and health issues are suggested.

Recommendations:

- Educational programs should target the community with the help religious leaders, it should involve all aspects of diabetes management through a variety of channels “radio, television’ newspapers ,intern and formal group talks “such information gathered should be delivered in local languages .
- In order to improvement and maintain continuity of health educational programs or activities, Collaborate with other professionals to extend the outreach of Diabetes self-management education.
- all health education programs must start in the high risk families to help the diabetic women’s and her family have better insight on their responsibility to embrace healthy behaviors in order to achieve long term control of

diabetes and its complication both in hospital & primary health care . • Government should take positive steps to improve the standard of the government hospital and primary health care center along with introducing general awareness among the public through different programs and social media .

• Globally, Saudi Arabia came in the 7th rank among the top 10 countries with higher prevalence of diabetes, so, nursing curriculum must put more consideration on diabetes management.

• Therefore, we highly recommend that a replication of this study with implementation education programs for large group of patients and in another city or continent.

**Conflict of Interest:** No conflict of interest has been declared by the authors

**Funding Statement:** Self

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“The impact of health education on the adjustment of glycated hemoglobin A1C level for women with type II diabetes mellitus in Riyadh city” *IOSR Journal of Nursing and Health Science (IOSR-JNHS)* , vol. 7, no.5 , 2018, pp. 13-26.