بسم الله الرحمن الرحيم

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Effect of Training Program Regarding Self-monitoring of Blood Glucose and Urine Glucose on the Management of diabetes mellitus among Diabetic Patients attending Kassala Diabetic Centre

A thesis Submitted in Fulfillment of the Requirement for PhD In Medical Surgical Nursing

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بسم الله الرحمن الرحيم

قال تعالى:

﴿ويسألونك عن الروح قل الروح من امر ربى وما أوتيتكم من العلم إلا قليلا﴾

صدق الله العظيم

الآية (85) من سورة الإسراء

Dedication

This thesis is dedicated to mymother, who taught me that even the largest task can be accomplished if it is done one step at a time. It is also dedicated to myfather, who taught me that the best kind of knowledge to have is that which is learned for its own sake.

To my brothers and sisters, who always support, encourage and drive me to be better inmy life.

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Abstract

This study is a quasi-interventional, hospital based study, conducted in Sudan, Kassala locality at the diabetic center in Kassala teaching hospital during the period from November 2013 to June 2017 to assess the impact of training program regarding self-monitoring of blood and urine glucose on the management of diabetes mellitus among diabetic patients attending Kassala Diabetic Centre. Covering sample include all diabetic patients attending the diabetic center or admitted at Kassala teaching hospital excluding those below 15 years and those with advanced diabetic complications.

One hundred nine and diabetic patients participated in the study. The data was collected in two phases before implementation (pre-test data), and after implementation (post-test) of the educational program. The questionnaire was filled by the researcher then each patient was observed and checked by simplified checklist regarding blood glucose test and urine glucose test, the data was analyzed by (SPSS) software program.

The study showed that the knowledge of the participants was poor in almost all tested aspects before the educational program after the educational program there was allot of improvement as evidenced by: improvement in knowledge about the definition of diabetes from 44% to 68.8% (***P*** value =0.01), about symptoms and signs from 75.2% to 89% (***P*** value =0.01).

Regarding glucometer 50.5% did not know it and 31.2% knew it but they did not know how to use it in contrast to post intervention as all of participants recognized the device and knew how to use it (p-value 0.000). Also regarding the normal range of blood glucose the knowledge of the participants improved from 36.7% to 83.5% (***P***value=0.05).

Concerning the skills of the participants there was significant improvement as evidenced by: the improvement of the performance of the blood glucose (2.858 to 1.49), urine glucose test (from 2.867 to 1.44). Moreover the study revealed youngest participants (15 to 25 years) and educated showed good knowledge.

The illiterate showed poor performance in doing the tests in contrast to students and employees, but all participants showed ability to interpret the result after educational program.

In conclusion this study proves the efficacy of the educational program among the diabetics in improving their knowledge and performance which has been reflected on the degree of diabetic control as evidenced by gradual decrease in blood glucose level and there for better quality of life and less complications.

Finally, we recommend conducting such educational programs in all diabetic centers to improve the quality of life of diabetics and reduce the cost of diabetes mellitus care.

ملخص البحث

أجريت هذه الدراسة شبه التجريبية بالسودان بولايه كسلا محلية كسلا بغرض تطبيق برنامج تعليمى لمرضي السكري عن الفحص الذاتى لسكر الدم وسكر البول في الفترة من نوفمبر 2013 وحتي يونيو 2017 وذلك للتاكد من مدي فعالية هذا البرنامج في تغيير معرفه وسلوك المرضي لضبط سكرالدم والبول.

تم جمع المعلومات عن طريق استبيان قياسي مغلق الاسئلة وقائمة تحقق عن كيفية الفحص الذاتى لسكر الدم وسكرالبول لتقييم مهاراتهم وقدراتهم. شملت الدراسة عدد (109) مريض سكري حيث جمعت المعلومات في مرحلتين المرحله الاولي تم جمع المعلومات من المرضي بواسطة الاستبيان المعد لذلك بواسطة المعاينه الشخصية لكل مريض ثم ملاحظتهم بواسطة قائمه في مده أربعة شهور.

في المرحله الثانيه تم تطبيق البرنامج في مده ثمانيه اشهر حيث تم تقسيمهم الي مجموعات صغيره بواقع درسين في الاسبوع لكل مجموعه ثم تم جمع البيانات وتحليلها باستخدام برنامج التحليل الحزمي للبيانات الحيوية بالحاسوب.

اوضحت الدراسة ان معرفة المرضى كانت ضعيفة فى كل النواحى المعرفية قبل تطبيق البرنامج التعليمى لكن بعد تطبيقه اظهرت الدراسة تحسن واضح فى المعرفة حيث اوجدت ان هناك ضعف فى معرفة المرضى حول تعريف مرض السكرى قبل تطبيق البرنامج (44%) وتحسنت الى (68.8%) بعد البرنامج بدلالة احصائية (***P*** value =0.01)، كذلك معرفتهم باعراض وعلامات مرض السكرى كانت ضعيفة قبل البرنامج (75.2%) واصبحت (89%) بعد تطبيق البرنامج(***P*** value =0.01).

اوضحت الدراسة ايضا فيما يخص جهاز قياس سكر الدم (الجلوكوميتر) ان (50.5%) من المرضى لايعرفونه؛ وان (31.2%) منهم يعرفون الجهاز ولكن لايعرفون كيفية استخدامه قبل البرنامج التدريبى وتحسنت معرفتهم حتى اصبح كل المرضى يعرفون الجهاز وطريقة استخدامه بعد تنفيذ البرنامج التدريبى(p-value 0.000)، وكذلك هناك ازدياد فى معرفتهم بالمعدل الطبيعى لسكر الدم بعد تطبيق البرنامج التدريبى الى (83.5%) بدلا عن (36.7%) قبل التدريب مع وجود علاقة ذات دلالة احصائية قوية (***P*** value=0.05).

فيما يخصمهارات المرضىاوجدت الدراسة تحسن واضح حيث انه مهارة فحص سكر الدم تحسنت من (2.858 الى 1.49) ومهارات فحص البول تحسنت من (2.867 الى 1.44).ايضا اثبتت الدراسة ان المعرفة الجيدة توجد بين المرضى صغار السن الذين تتراوح اعمارهم بين 15-25 سنة والمتعلمين. الغير

متعلمين لديهم مستوى ضعيف فى مهارة فحص الدم على غير الطلاب والموظفين، لكن كل المرضى استطاعوا تفسير نتيجة الفحص بعد تطبيق البرنامج.

وتوصلت الدراسة الي ان البرنامج التدريبى ذو فعالية عالية لمرضى السكرى فى تحسين معرفتهم ومهاراتهم التى انعكست على مستوى ضبط سكر الدم حيث نقصت معدلات سكر الدم تدريجيا بالتالى تحسين جودة حياة المرضى وتقليل حدوث المضاعفات.

واوصت الدراسة بضرورة تطبيق مثل هذه البرامج فى كل مراكز السكرى لتحسين حياة المرضي المصابين بالداء السكري ومتابعتهم وذلك لزيادة الوعي الصحي تجاه المرضي وتقليل تكاليف المرض.

List of abbreviations

Abbreviations	Meaning
A1C	Glycosylated hemoglobin, formerly known as HbA1C
ACE	Angiotensin converting enzyme
ACTH	Adenocorticotropic hormone
BMI	Body mass index
CVA	Cerebrovascular accident
DKA	Diabetic keto-acidosis
DM	Diabetes mellitus
DSME	Diabetic self-management education
EASD	European Association for the Study of Diabetes
ECG	Electrocardia gram
ESC	European Society of Cardiology
ESRD	End-stage renal disease
FDA	Food and drug administration
GDM	Gestational diabetes mellitus
HHNS	Hyperosmolar hyperglycemic non-ketosis state
HHS	Hyperosmolar hyperglycemic state
HLA	Human leukocyte antigen
HPLC	High-performance liquid chromatography
IDDM	Insulin-dependent diabetes mellitus
IV	Intravenous
LDL	low density lipoprotein
MI	Myocardium Infraction
NIDDM	Non-insulin-dependent diabetes mellitus
NPH	Neutral Protamine Hagedorn
NSAID	Non-steroidal anti-inflammatory drugs
OADs	Oral agent drugs
OGTT	Oral glucose tolerance test
OHAs	Oral hypoglycemic agents

SMBG	Self-management of blood glucose
T2D	Type 2 diabetes
UKPDS	United Kingdom Prospective Diabetes Study
WHO	World Health Organization

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1. Introduction

1.ئ0. Background:

Diabetes mellitus is a chronic systemic disease characterized by hyperglycemia and disorder of carbohydrates, fat and protein metabolism. It is caused by disturbance in production, action, or metabolic rate of utilization of insulin hormone, which is secreted by beta cell in the island of Lngerhans in pancreas[(1), (2)]

Diabetes is an important health problem for the aging population; at least 20% of patients over the age of 65 years have diabetes that is because of beta cell function declines with age. The number of older persons with diabetes can be expected to grow rapidly over the coming decades [(3)]Hyperglycemia is among the top five determinants of worldwide mortality [(4)] The chronic hyperglycemia of diabetes is associated with long-term damage, dysfunction, and failure of various organs, specially the eyes, kidneys, nerves, heart, and blood vessels[(2), (4)]

According to World Health Organization, 2016, there is 442 million adults have diabetes, 1.5 million deaths are directly attributed to diabetes each year, and 1 in 3 adult aged over 18 years is overweight and 1 in 10 is obese [(5)]

Currently, it is estimated that more than 23 million people in the United States have diabetes, although almost one third of these cases is undiagnosed. In 2000, the worldwide estimate of the prevalence of diabetes was 171 million people, and by 2030, this is expected to increase to more than 360 million[1]. Diabetes is especially prevalent in the elderly. People 65 years and older account for almost 40% of people with diabetes [(1)]

Diabetes mellitus is a major health problem in Africa and worldwide, it’s estimated that around 20 million Africans are now living with diabetes. The worldwide prevalence of diabetes is increasing rapidly, with the majority and far more rapidly in patients having type II diabetes[(4), (12)]

In type II diabetes over 90 % of patient with diabetes, occurs in age over 35 years, 80 % -90 % of patient are over-weight and now being seen in children.[9]

Approximately three-quarters of all newly diagnosed cases of type I diabetes occur in individuals younger than 18 years of age[(10)] Care of this group requires integration of diabetes management with the complicated physical and emotional growth needs of children, adolescents, and their families. Diabetes care for children of this age group should be provided by a team that can deal with these special medical, educational, nutritional, and behavioral issues. At the time of initial diagnosis, it is extremely important to establish the goals of care and to begin diabetes self-management education. A firm educational base should be provided so that the individual and family can become increasingly independent in the self-management of diabetes. Glycemic goals may need to be modified to take into account, the fact that most children younger than 6 or 7 years of age have a form of "hypoglycemic unawareness," in that they lack the cognitive capacity to recognize and respond to hypoglycemic symptoms and may be at greater risk for the sequelae of hypoglycemia [(10)]

The crude prevalence was 3.4% (men, 3.5%; women, 3.4%) for diabetes and 2.9% (men, 2.2%; women, 3.3%) for impaired glucose tolerance. The highest crude prevalence was in the northern parts of Sudan (5.5%) and the lowest in the western desert-like parts (0.9%) [(4,6)]

There is no data found the prevalence in all of Sudan, but there was regional data; as the over-all prevalence of diabetes in the northern part of Sudan (River Nile State) estimated as 19.1% in adult, in 2016, and the prevalence in rural population was 11.2% in 2013[(65),] and in Khartoum- Jabir Abu Izz (4%) of children were labeled as having type II diabetes in 2013[(104)]

People of South Asian or Afro-Caribbean origin are at higher risk of developing diabetes[(4, 6)] Morbidity and mortality of diabetes is more among South East Asian

continent than the rest of the world.[67] They are also more likely to have type II diabetes presenting at a young age and usually have poorer risk factor control[(4) ,(6)]

Diabetes is the commonest cause of hospital admission and morbidity due to a non-communicable disease (7 and 10% respectively). The problems of diabetes care in Sudan include the lack of efficient diabetes care centers, lack of specially trained personnel, the high cost of anti-diabetic treatments, poor compliance with therapy or diet, ignorance and wrong beliefs, food and dietary factors and gender-related problems. The goal of efficient diabetes care can be achieved through implementing a national diabetes program. This program should be responsible for personnel training, establishing model care centers, patients' education, availability and affordability of insulin, clinical scientific research and primary prevention.[(7)]

Established patient self-management tools, such as self-monitoring of blood glucose (SMBG), are now being used in tandem with information technology and telecommunications to provide a more integrated management of the disease.[11]

This technology is available in the market and has been shown to help patients improve glucose excursions, reduce glucose variability, decrease time spent in hypoglycemia and hyperglycemia and improve A1C levels [(12)]

1.1. Rationale

The incidence of diabetes mellitus is increasing.[46] According to World Health organization, 2016, there is 442 million adults have diabetes, 1.5 million deaths are directly attributed to diabetes each year.[5] The number of people with diabetes is expected to rise to more than 360 million by 2030,[1] and increase to 592 million by 2035[43]

Worldwide in 2012 and 2013 diabetes resulted in 1.5 to 5.1 million deaths per year, making it the 8th leading cause of death.[43, 44] Globally, in 2013, an estimated that, people with type 2 diabetes making up to about 90% of the cases[43]

In 2000, the worldwide estimate of the prevalence of diabetes was 171 million people [1]

Currently, it is estimated that more than 23 million people in the United States have diabetes, although almost one third of these cases are undiagnosed. Diabetes is especially prevalent in the elderly. People of 65 years and older account for almost 40% of people with diabetes [1]

DM characterized by hyperglycemia as a result of the defects in insulin secretion, insulin action, or both. The chronic hyperglycemia of diabetes is associated with long-term damage, dysfunction, and failure of various organs, especially the eyes, kidneys, nerves, heart, and blood vessel. [46] Untreated, DM can cause DKA and non-ketotic hyperosmolar coma[26, 28]

The burden of diabetes, both in terms of prevalence and number of adults affected, has increased faster in low-income and middle-income countries than in high-income countries[37]

There is no data found the prevalence of diabetes in Sudan but the over-all prevalence of diabetes in the northern part of Sudan (River Nile State) estimated

as 19.1% in adult, in 2016, while the prevalence in rural population in Sudan was 11.2% in 2013[65]

Type II diabetes is a very expensive disease: about 10–15% of the total health care costs in developed countries are spent on treating type II diabetes and its complications [10] the economic costs of diabetes globally were estimated in 2013 about $548 billion [44] and in the United States in 2012 $245 billion [45]

Successful diabetes care depends on the daily commitment of the person with diabetes mellitus to self-management through the balance of lifestyle and medication. Diabetes care should be organized around a multi- and interdisciplinary diabetes healthcare team that can establish and sustain a communication network between the person with diabetes and the necessary health care and community systems. Both the organization and delivery of diabetes care should be comprehensive, according to evidence-based clinical practice guidelines, equitable in access and continuous throughout a person's life time. Where possible, diabetes programs and services should be culturally appropriate, community based and respectful of age, gender and socioeconomic conditions.[41]

Diabetes education is effective in enhancing knowledge, skills and behavioral change. It has been shown to improve self-care and clinical outcomes [42]

The increase of incidence of diabetes in Sudan among children and adult, especially in illiterate whose most of them were house wife, increase of diabetes complication and the rate of amputation, increase the diabetic centers in Sudan and there is no proper training program for the patient, so, educational program about self-monitoring of blood glucose and urine glucose for diabetic patients is essential and can enhance diabetes control, decrease the incidence of complications and promote better quality of life.

1.2. Objectives of the Study

The general objectives:

To determine the impact of self-monitoring (blood and urine glucose) training program on the management of diabetes mellitus and degree of control among diabetic patients attending Kassala Diabetic Center.

The Specific objectives:

1. To assess the knowledge and practice of diabetic patients attending Kassala Diabetic Center regarding self-monitoring of their diabetes mellitus
2. To educate diabetic patients attending Kassala Diabetic Center to self-monitor their disease.
3. To evaluate the effect of an educational program about self-monitoring of blood and urine glucose on diabetic patients knowledge and practice among diabetic patients attending Kassala Diabetic Center.

- **Literature review**

Literature review

Education for diabetic patient:

Diabetes is a chronic illness that requires continuing medical care and patient self-management education to prevent acute complications and reduce the risk of long-term complications[(2)] The goal of patient education is to support the patient's autonomous decision making[(2)]Diabetes self-management education (DSME) is recognized as acrucial component in diabetes care[(10)]

In the past, management of diabetes has been viewed primarily as the responsibility of providers, but recently, the people with diabetes are responsible for most day to day decisions related to the management of their disease. So, the patient and family should be included in the diabetes education because they are an essential component of diabetes treatment.[(1)] The skill set required for diabetes is a complex one requiring problem-solving skills and the use of multiple technologies for blood glucose testing and medication administration.

The potential benefits of an effective patient educational program for people with diabetes include:

- Improving knowledge, health beliefs, and lifestyle changes.
- Improving patient outcomes, e.g. weight, hemoglobin A1C, lipid levels, smoking, and psychosocial changes such as quality of life and levels of depression.
- Improving levels of physical activity.
- Reducing the need for, and potentially better targeting of, medication and other items such as blood testing strips [(97)]

Type 2 diabetes (T2D) is a chronic preventable disease, so it is necessary for the patient with T2D to be able to prevent this disease to has knowledge about its natural history with a preclinical phase, modifiable risk factors, effective and

simple screening tool to identify high-risk subjects and effective intervention that is affordable and acceptable and evidence based.[10] It is well known that obesity, unbalanced diet and physical inactivity are the major risk factors for T2D for susceptible patient. The self-management tasks required to successfully control diabetes include self-monitoring blood glucose levels, daily medications (insulin and/or oral agents), nutrition- eating regularly and controlling weight, regular physical exercise, recognizing early symptoms of hypo- or hyperglycemia and responding appropriately[2]

Self-management support programs:

It is refer to systematic provision of education and supportive interventions by health care staff to increase patients' skills and confidence in managing their health problems, including regular assessment of progress and problems, goal setting, and problem-solving support. It is expected to reduce costly health crises and improve health outcomes for chronically ill patients with conditions such as asthma, cardiovascular disease, depression, diabetes, heart failure, and migraine headaches[1].The diabetes education should be focus on patient empowerment. Patient education should address behavior change, increasing self-efficacy, health beliefs, and knowledge which can lead to better disease control, reduced utilization of health care services and ultimately reduced costs[25],[1]

The certain physical or emotional factors may be impairing the patient's ability to perform self-care skills such as decreased visual acuity which may impair the patient's ability to administer insulin accurately, measure the blood glucose level, or inspect the skin and feet. Also decreased joint mobility or preexisting disability may impair the patient's ability to inspect the bottom of the feet. In addition, denial of the diagnosis or depression may impair the patient's ability to carry out multiple daily self-care measures.

The patients interaction with health care providers to obtain ongoing care depend on age, socioeconomic level, existing complications, type of diabetes [(1)]

Pathophysiology of diabetes mellitus (DM):

Insulin is a storage hormone, secreted by beta cells in the islets of Lngerhans in the pancreas. It affects the carbohydrates, fat and protein metabolism. It mediates the hormonal balance between insulin and glucagon secretion to decrease the serum blood glucose level, facilitate storage of excess glucose in liver, muscle, and lipid tissue, and encourage synthesis of muscle proteins.

When a person eats a meal, insulin secretion increases and moves glucose from the blood into muscle, liver, and fat cells. In those cells, insulin transports and metabolizes glucose for energy, stimulates storage of glucose in the liver and muscle (in the form of glycogen), signals the liver to stop the release of glucose, enhances storage of dietary fat in adipose tissue, accelerates transport of amino acids (derived from dietary protein) into cells. Insulin also inhibits the breakdown of stored glucose, protein, and fat.

During fasting periods (between meals and overnight), the pancreas continuously releases a small amount of insulin (basal insulin); another pancreatic hormone called glucagon (secreted by the alpha cells of the islets of Lngerhans) is released when blood glucose levels decrease and stimulates the liver to release stored glucose. The insulin and the glucagon together maintain a constant level of glucose in the blood by stimulating the release of glucose from the liver.

Initially, the liver produces glucose through the breakdown of glycogen (glycogenolysis). After 8 to 12 hours without food, the liver forms glucose from the breakdown of non-carbohydrate substances, including amino acids (gluconeogenesis).When insulin secretion is compromised, and the body can no longer use glucose from carbohydrates, it then converts some of the protein and fat to glucose (gluconeogenesis). A decline in insulin and the concomitant

increased metabolic needs call for the release of fatty acids from fat storage depots (adipose tissues) and amino acids from muscles. Consequently, both fatty acids and amino acids are transported to the liver to be used for energy[14]

If the amount of insulin available is insufficient, or cells respond poorly to the effects of insulin (insulin insensitivity or insulin resistance), or if the insulin itself is defective, then glucose will not be absorbed properly by the body cells that require it, and it will not be stored appropriately in the liver and muscles. The net effect is persistently high levels of blood glucose, poor protein synthesis and other metabolic derangements such as acidosis[16]

When the glucose concentrate in the blood remains high over time, the kidneys will reach a threshold of reabsorption(180mg/dl) (9.9 mmol/L) and glucose will be excreted in the urine (glycosuria).[1],[15] This increases the osmotic pressure of the urine and inhibits reabsorption of water by the kidney, resulting in increased urine production (polyuria) and increased fluid loss. Lost blood volume will be replaced automatically from water held in body cells and other body compartments, causing dehydration and increased thirst (polydipsia)[16]

Signs and symptoms of DM:

The classic symptoms of untreated diabetes are weight loss in spite of polyphagia, polyuria (frequent urination) and polydipsia (increased thirst) which occur as a result of the excess loss of fluid associated with osmotic diuresis secondary to high blood glucose concentration, polyphagia (increased hunger) that results from the catabolic state induced by insulin deficiency and the breakdown of proteins and fats[10],[26]Symptoms may develop rapidly (weeks or months) in type I diabetes, while they usually develop much more slowly and may be subtle or absent in type II diabetes[27]

Several other symptoms and signs can mark the onset of diabetes include Fatigue, irritability, poorly healing skin wound, visual changes (if glucose levels are very

high), skin infections, sepsis and pruritus,[10] **t**ingling or numbness in hands or feet, dry skin, skin lesions. The onset of type1 diabetes may also be associated with sudden weight loss or nausea, vomiting, or abdominal pains, if DKA has developed[1]

Causes and risk factors of DM:

Diabetes mellitus remains of unknown cause, but it ultimately caused by beta cell failure and/or peripheral insulin resistance[14]

Diabetes mellitus is affected by many risk factors which include, age 45 years and more, family history of diabetes, history of gestational diabetes or delivery of babies over9 lb, obesity (i.e., 20% over desired body weight or BMI 27 kg/m, race or ethnicity, sedentary lifestyle, A 'westernized' dietary pattern with low fiber, high saturated and trans fats, refined carbohydrates, sweetened beverages, hypertension (140/90 mm Hg), previously identified impaired fasting glucose or impaired glucose tolerance, (high density lipoprotein) HDL cholesterol level 35 mg/dL (0.90 mmol/L) and/or triglyceride level 250 mg/dL (2.8 mmol/L)[1],[10]

Classification of DM:

Diabetes mellitus is classified into four broad categories: type I, type II, gestational diabetes, and diabetes mellitus associated with other conditions or syndromes [1]

Type I **Diabetes:**

Type I diabetes is a chronic condition result from decreased or no production of insulin due to destruction of the pancreatic beta cells.[5],[98]This form of diabetes previously classified as juvenile diabetes, juvenile-onset diabetes, and insulin - dependent diabetes mellitus (IDDM). The cause is unknown [1],[28]It affects approximately 5% to 10% of people with the disease and usually occurs before 30 years of age. Etiology includes genetic, immunologic, and environmental factors[1]

TypeI diabetes is an autoimmune disease in nature. An autoimmune process resulting in destruction of self-tissue such as the beta cells of the pancreas. Due to abnormalities of the human leukocyte antigen (HLA) system environmental antigen (such as a virus) can invade the beta cells of the pancreas and destroy them.[14]Thus type1 diabetes is partly inherited HLA genotypes, known to influence the risk of diabetes. In genetically susceptible people, the onset of diabetes can be triggered by one or more environmental factors, such as diet or a viral infection[14]

Type I diabetes can affect children or adults, but was traditionally termed "juvenile diabetes" because the majority of these diabetes cases were in children. Diabetic ketoacidosis is a common acute complication of type I diabetes resulting from breakdown of fat due to little or no endogenous insulin. If the concentration of glucose in the blood exceeds the renal threshold for glucose glycosuria occurs. Type I diabetes is treated with insulin to preserve life[1]

Type II **Diabetes:**

Type II diabetes mellitus also called non-insulin-dependent diabetes mellitus (NIDDM) or maturity onset diabetes; occur due to insulin resistance, a condition in which cells fail to respond to insulin properly[28] As the disease progresses a lack of insulin may also develop,[1],[29] In lack of insulin, increased basal hepatic glucose and decreased insulin-stimulated glucose uptake in the muscles in spite of gastrointestinal absorption of glucose, that increase blood glucose. This form was previously referred to as non-insulin-dependent diabetes mellitus (NIDDM) or "adult-onset diabetes"[1],[28].Type II diabetes is most common type, affect 90% to 95% of people with the disease and occur over 30 years of age.

Type II diabetes is due primarily to lifestyle factors and genetics[1],[30]A number of lifestyle factors are known to be important to the development of type II diabetes, including obesity (defined by a body mass index of greater than thirty) primarily

intra-abdominal obesity, lack of physical activity, poor diet, stress[1],[31],[99]Obesity associated with 80% of cases[1]

Type II diabetes also occurs in children because of the growing epidemic of obesity. Because type II diabetes is associated with a slow, progressive glucose intolerance, its onset may go undetected for many years. Thus Approximately 75% of patients with type II diabetes are detected incidentally[1]There is high incidence in developed or developing countries where it is associated with increased caloric intake and decreased caloric expenditure (obesity). A very low incidence and prevalence of the disease in underdeveloped countries and it occurs primarily in the elderly[14]

Exercise and dietary management are used for obese people with type 2 diabetes to improve glucose metabolism and enhances loss of body fat. Exercise coupled with weight loss improves insulin sensitivity and may decrease the need for insulin or oral ant diabetic agent[1] Type II diabetes need insulin therapy on a long-term basis to control glucose levels if meal planning and oral agents are ineffective, or temporarily during illness, infection, pregnancy, surgery, or some other stressful event[1]

Gestational Diabetes:

Gestational diabetes mellitus (GDM) is a risk factor for developing type II diabetes later in life.[94]It is occurs when pregnant women without a previous history of diabetes develop a high blood glucose level.[1], [28]Hyperglycemia develops during pregnancy because of the secretion of placental hormones, which causes insulin resistance (which inhibit the action of insulin).

Gestational diabetes usually occurs in the second or third trimester in 14% of pregnant women and occurs commonly at high risk women for diabetes before pregnancy. Gestational diabetes is fully treatable, but requires careful medical supervision throughout the pregnancy. Management may include dietary changes,

blood glucose monitoring, and in some cases insulin may be required. Screening for diabetes periodically and counseling to maintain ideal body weight and exercise regularly reduce the risk for type2 diabetes for Women with GDM.[1]

GDM may be transient, untreated gestational diabetes can affect the health of the fetus or mother. Risks to the baby include macrosomia (high birth weight), and increases the risk for hypertensive disorders during pregnancy for the mother.

Other forms of diabetes:

Other forms of hyperglycemia may be caused by rare syndromes and also associated with stress, steroid use, and ingestion of some drugs that are toxic to beta cells. It accounts for less than 1% of the total number of people with diabetes[14]

Latent autoimmune diabetes of adults (LADA) is a condition in which type 1 DM develops in adults. Adults with LADA are frequently initially misdiagnosed as having type II DM, based on age rather than etiology.

Some cases of diabetes are caused by the body's tissue receptors not responding to insulin (even when insulin levels are normal, which is what separates it from type II diabetes); this form is very uncommon. Genetic mutations (autosomal or mitochondrial) can lead to defects in beta cell function. Abnormal insulin action may also have been genetically determined in some cases. Any disease that causes extensive damage to the pancreas may lead to diabetes (for example, chronic pancreatitis and cystic fibrosis). Diseases associated with excessive secretion of antagonistic hormones can cause diabetes (which is typically resolved once the hormone excess is removed). Many drugs impair insulin secretion and some toxins damage pancreatic beta cells [32] Also infection such as cytomegalovirus infection and coxsackievirus B [48] Urine glucose tests should not be used to diagnose diabetes; if glycosuria is detected, the blood glucose should be tested [32]

Diagnosis of DM:

An abnormally high blood glucose level is the basic criterion for the diagnosis of diabetes[(1)]

There are standard values of a variety of tests that lead to a diagnosis of diabetes whatever the type of diabetes mellitus and include:

- Fasting plasma glucose ≥ 126 mg/dl (7.0 mmol/L). Fasting is defined as no caloric intake for at least 8 hours.[(1)]
- Symptoms of hyperglycemia and random plasma glucose level ≥ 200 mg/dl (11.1 mmol/L).
- 2 hr on the oral glucose tolerance test of more than 140 mg/dl (7.7 mmol/L) at 75 g. of glucose in 250–350 ml of water [(1)],[(14)],[(4)]
- Glycated Hemoglobin (HgbA1C, or A1C) at range less than 7% [(1)]
- In the absence of unequivocal hyperglycemia with acute metabolic decompensation, these criteria should be confirmed by repeat testing on a different day. [1]According to the current definition, two fasting glucose measurements above 126 mg/dl (7.0 mmol/l) is considered diagnostic for diabetes mellitus[(32)]

According to the World Health Organization people with fasting glucose levels from 6.1 to 6.9 mmol/l (110 to 125 mg/dl) are considered to have glucose intolerance. People with plasma glucose at or above7.8 mmol/L (140 mg/dL), but not over 11.1 mmol/L (200 mg/dL), two hours after a 75 g oral glucose load are considered to have impaired glucose tolerance. Of these two prediabetic states, the latter in particular is a major risk factor for progression to full-blown diabetes mellitus, as well as an increase the risk of cardiovascular disease[(32)] The American Diabetes Association since 2003 uses a slightly different range for impaired

fasting glucose of 5.6 to 6.9 mmol/l (100 to 125 mg/dl)[100] HbA1c is a useful measure of blood glucose control[32]

Elevated blood glucose levels appear to be age related and occur in the fifth decade of life and increase in frequency with advancing age. Approximately 10% to 30% of elderly people have age related hyperglycemia, not counting those with overt diabetes. The cause is not known but may be related to physical inactivity, altered insulin secretion, and increase in fat tissue, which increases insulin resistance[1]

Management of DM:

Diabetes mellitus is a chronic disease, for which there is no known cure except in very specific situations[49]**.**The therapeutic goal for diabetes management is to achieve normal blood glucose levels (euglycemia) without hypoglycemia and HbA1C level not more than 6.5% [50], while maintaining a high quality of life.

Intensive glucose control dramatically reduced the development and progression of complications such as retinopathy, nephropathy, and neuropathy[1]

Attention is also paid to other health problems that may accelerate the deleterious effects of diabetes. These include smoking, elevated cholesterol levels, obesity, high blood pressure, and lack of regular exercise[51]Specialized footwear is widely used to reduce the risk of ulceration, or re-ulceration, in at-risk diabetic feet. Evidence for the efficacy of this remains equivocal, however, [48] people with diabetes can benefit from education about the disease and treatment, good nutrition to achieve a normal body weight, and sensible exercise, with the goal of keeping both short-term and long-term blood glucose levels within acceptable bounds. In addition, given the associated higher risks of cardiovascular disease, lifestyle modifications are recommended to control blood pressure[49]

Diabetes management has five components: nutritional therapy, exercise, pharmacologic therapy, education, and monitoring[1]

Nutritional therapy:

The most important objectives in the nutritional management of diabetes are control of total caloric intake to attain or maintain a reasonable body weight, control of blood glucose levels, and normalization of lipids and blood pressure to prevent heart disease.

Achieving the nutritional goals is not always easy because medical nutrition therapy (nutritional management) of diabetes is complex. An experience dietitian usually is needed to design and teach the nutritional therapeutic plan. The Nurses and all other members of the health care team must be knowledgeable about nutritional therapy and other supportive measures.

The meal plan must consider the patient's food preferences, lifestyle, usual eating times, and ethnic and cultural background.

For patients who require insulin, they need to maintain consistency as possible in the amount of calories and carbohydrates ingested at each meal and approximate time intervals between meals with the addition of snacks if necessary, that helps prevent hypoglycemic reactions and maintain overall blood glucose control. If the patient can master the insulin-to-carbohydrate calculations, lifestyle can be more flexible and diabetes control more predictable.

According to recommendation of American Dietetic Association, for all levels of caloric intake, 50% to 60% of calories should be derived from carbohydrates, 20% to 30% from fat, and the remaining 10% to 20% from protein.

Carbohydrates consist of sugars (e.g., sucrose) and starches (e.g., rice, pasta, bread). Low glycemic index diets may reduce postprandial glucose levels. Therefore, the nutrition guidelines recommend that all carbohydrates should be eaten in moderation per meal (e.g., 45 to 60 g). According to fat, the recommendations regarding fat content of the diabetic diet reducing the amount of saturated fats to 10% of total calories and limiting the total intake of dietary

cholesterol to less than 300 mg/day. Regarding protein, the meal plan may include the use of some non-animal sources of protein (e.g., legumes, whole grains), to help reduce saturated fat and cholesterol intake. Also fiber is needed, increased fiber in the diet may improve blood glucose levels, decrease the need for exogenous insulin, and lower total cholesterol and low-density lipoprotein levels in the blood, specially soluble fiber in foods such as legumes, oats, and some fruits. Soluble fiber slows stomach emptying and the movement of food through the upper digestive tract. The potential glucose-lowering effect of fiber may be caused by the slower rate of glucose absorption from foods that contain soluble fiber [(1),(2)]

People with diabetes should avoid Alcohol consumption because it absorbed before other nutrients and does not require insulin for absorption, large amounts can be converted to fats, increasing the risk for DKA. Also it can lead to hypoglycemia due to decrease in the normal physiologic reactions in the body that produce glucose (gluconeogenesis) especially for patients who take insulin or insulin secretagogues when consumed in an empty stomach [(1)]

The diabetic patient can use artificial sweeteners in food products with moderate amount to avoid potential adverse effects. It have two main types; nutritive and nonnutritive. Nonnutritive sweeteners have a minimal or no calories. They have been approved by the U.S. Food and Drug Administration (FDA) as safe for people with diabetes because they produce minimal or no elevation in blood glucose levels, include they sacchari, and aspartame (NutraSweet).The nutritive sweeteners contain calories, include fructose (fruit sugar), sorbitol, and xylitol, all of which provide calories in amounts similar to those in sucrose. They cause less elevation in blood sugar levels than sucrose does and are often used in “sugar-free” foods[(1)]

Exercise:

Exercise is extremely important in diabetes management. Its effects are lowering blood glucose through increasing the uptake of glucose by body muscles, improving insulin utilization, improving the circulation and muscle tone, altering blood lipid concentrations, increasing levels of high density lipoproteins and decreasing total cholesterol and triglyceride levels and aiding in losing weight, through resistance (strength) training, such as weight lifting, can increase lean muscle mass, thereby increasing the resting metabolic rate. Improved glycemic control, decreases the risk for chronic vascular disease, and an improve quality of life.

Advantages of exercise in diabetic patient include a decrease in hyperglycemia, a general sense of well-being, and better use of ingested calories, resulting in weight reduction.

The safe and beneficial form of exercise for many patients is walking that requires no special equipment (except for proper shoes) and can be performed anywhere. According to exercise recommendation, the diabetic patient should exercise at the same time (preferably when blood glucose levels are at their peak) and in the same amount each day, regular daily exercise, rather than sporadic exercise and must be altered as necessary for patients with diabetic complications such as retinopathy, autonomic neuropathy, sensorimotor neuropathy, and cardiovascular disease[(1)]Exercise precautions for diabetic patient include, use of proper footwear, avoid exercise in extreme heat or cold and during periods of poor metabolic control and inspect feet daily after exercise. Patients who take insulin should eat a 15-g carbohydrate snack (a fruit exchange) or a snack of complex carbohydrates with a protein before engaging in moderate exercise to prevent unexpected hypoglycemia. Also need to eat a snack at the end of the exercise session to avoid post exercise hypoglycemia which occurs many hours after exercise and at

bedtime and monitor the blood glucose level more frequently. The amount of food needed varies from person to person and should be determined by blood glucose monitoring.

Patients who are capable, knowledgeable, and responsible can learn to adjust their own insulin doses by working closely with a diabetes educator [(1),(2)]

Injectable management of diabetes:

Insulin Therapy:

Insulin is secreted by the beta cells of the islets of Langerhans and works to lower the blood glucose level after meals by facilitating the uptake and utilization of glucose by muscle, fat, and liver cells[(1)]

Type of insulin:

The laboratory production of human insulin in the early 1980s has gradually resulted in the replacement of animal insulin as a viable therapeutic choice for patients with diabetes. Human insulin and newer insulin analogues produced by recombinant DNA technology are becoming the main insulin used in the current treatment of diabetes in most countries. Insulin for clinical use can be characterized according to their pharmacokinetic profiles. They are available in rapid-acting which used for rapid reduction of glucose level, to treat postprandial hyperglycemia, and/or to prevent nocturnal hypoglycemia, other type is short-acting (regular insulin), is a clear solution, may be taken alone or in combination with longer acting insulin. The only insulin approved for IV, intermediate-acting, also called lente insulin or NPH insulin (neutral protamine Hagedorn), it is white and cloudy, usually taken after food, and long-acting preparations. Table shows the onset, peak, and duration of action after subcutaneous injections of the insulin used commonly in therapy. The different time-action profiles make it feasible to pursue the goal of simulating physiologic insulin secretion, however, this goal

remains difficult to achieve with the current formulations. Insulin replacement should be thought of in terms of mealtime (bolus) and basal insulin.

The mealtime insulin is the rapid-acting analogues or short-acting regular human insulin. This insulin has been used to attempt to simulate the high levels of insulin seen in individuals without diabetes after ingestion of a meal. The basal insulin is the intermediate- and long-acting human insulin and analogue. They simulate the basal level of insulin occurring between meals, through the night, and with fasting. Insulin is commercially available in concentrations of 100 or 500 units/mL designated U-100 or U-500. The U-500 concentration, which is available only in short-acting formulations, is used only in rare cases of insulin resistance when the patient requires extremely large doses of insulin [(1), (52), (53), (54)]

The following table lists the types of injectable insulin with details about onset (the length of time before insulin reaches the bloodstream and begins to lower blood sugar), peak (the time period when the insulin is the most effective in lowering blood sugar) and duration (how long insulin continues to lower blood sugar). The final column provides some insight into the "coverage" provided by the different insulin types in relation to mealtime [(111)]

Type of Insulin & Brand Names	Onset	Peak	Duration	Role in Blood Sugar Management
Rapid-Acting				
Humalog or lispro	15-30 min.	30-90 min	3-5 hours	Rapid-acting insulin covers insulin needs for meals eaten at the same time as the injection. This type of insulin is often used with longer-acting insulin.
Novolog or aspart	10-20 min.	40-50 min.	3-5 hours	
Apidra or glulisine	20-30 min.	30-90 min.	1-2½ hours	
Short-Acting				
Regular (R) humulin or novolin	30 min. -1 hour	2-5 hours	5-8 hours	Short-acting insulin covers insulin needs for meals

Velosulin (for use in the insulin pump)	30 min.-1 hour	2-3 hours	2-3 hours	eaten within 30-60 minutes
Intermediate-Acting				
NPH (N)	1-2 hours	4-12 hours	18-24 hours	Intermediate-acting insulin covers insulin needs for about half the day or overnight. This type of insulin is often combined with rapid- or short-acting insulin.
Long-Acting				
Long-acting insulin covers insulin needs for about one full day. This type of insulin is often combined, when needed, with rapid- or short-acting insulin.	Lantus (insulin glargine)	1-1½ hour	No peak time; insulin is delivered at a steady level	20-24 hours
	Levemir (insulin detemir)	1-2 hours	6-8 hours	Up to 24 hours
Pre-Mixed*				
Humulin 70/30	30 min.	2-4 hours	14-24 hours	These products are generally taken two or three times a day before mealtime.
Novolin 70/30	30 min.	2-12 hours	Up to 24 hours	
Novolog 70/30	10-20 min.	1-4 hours	Up to 24 hours	
Humulin 50/50	30 min.	2-5 hours	18-24 hours	
Humalog mix 75/25	15 min.	30 min.-2½ hours	16-20 hours	
*Premixed insulin are a combination of specific proportions of intermediate-acting and short-acting insulin in one bottle or insulin pen (the numbers following the brand name indicate the percentage of each type of insulin).				

In type I diabetes, the body loses the ability to produce insulin there for exogenous insulin must be administered for life. Insulin injections are administered two or more times daily in many cases to control the blood glucose level and must be given at same time each day to prevent overlap of action.

Types of insulin according to time course of action:

Insulin Regimens: Insulin regimens vary from one to four injections per day. Usually there is a combination of short-acting insulin and longer-acting insulin. There are no set guidelines as to which insulin regimen should be used for which patient. The appropriate insulin regimen for patient depends on the patient lifestyle, age, motivation, general health, self-management skills and goal of treatment.

Approaches to insulin therapy:

a. Conventional Regimen: is to simplify the insulin regimen as much as possible, with the aim of avoiding the acute complications of diabetes. The patient should not vary meal patterns and activity levels.

b. Intensive Regimen: is refer to use a more complex insulin regimen to achieve as much control over blood glucose levels as is safe and practical. It allows the patient more flexibility to change the insulin doses from day to day in accordance with changes in eating and activity patterns, stress and illness, and as needed for variations in the prevailing glucose level. This type of regimen uses self-monitoring of blood glucose, the patient can learn to use SMBG results and carbohydrate counting to vary the insulin doses. In spite of flexibility of the regimen; it require strong level of commitment, intensive education, and close follow-up by the health care team[(1)]

Insulin is used in people with type I diabetes to mimic normal basal insulin secretion (insulin replacement) and some cases with type 2 diabetes may need (basal) insulin support, and the need for insulin replacement arises over time.

Insulin Indications in Type 2 Diabetes:

Failing to obtain good metabolic control with submaximal doses of oral agent drugs (OADs), Excessive weight loss, severe hypoglycemia symptoms, acute MI, acute diseases with fever, systemic diseases, hyperosmolar hyperglycemic state

(HHS) and ketotic state, major surgical operation, pregnancy and lactation, kidney or liver failure, severe allergy or side-effects to any OADs. Potentially anyone with type 2 diabetes stands to benefit from insulin treatment[58]

Strong indications for insulin therapy include:

Recurrent fungal infections (especially genital thrush) or bacterial infections (especially urinary tract infections), pregnancy or planning pregnancy, oral hypoglycemic treatments not tolerated/contraindicated and weight loss without dieting in some one of low or normal weight.

Possible indications for insulin therapy include:

Unsatisfactory glycemic control; even with the maximum tolerated dose of oral hypoglycemic agents (OHAs), (HbA1c higher than 59m mol/mol (7.5 percent), self-blood glucose monitoring results higher than 7m mols before meals or 9m mols two hours after meals, personal preference, painful neuropathy, foot ulceration and infection [58]

Methods of Insulin Delivery:

a. Traditional subcutaneous injections.

Insulin syringes with 8mm needle and vials are still available if a person prefers these.

Sequence of injection:

Inject into the subcutaneous tissue at a 90˚ angle, Push the needle in all the way, needles come in 4mm, 5mm, 6mm and 8mm lengths. Shorter needles reduce the fear of injections and suit most people regard less of age or weight. A few people prefer longer needles, but they may need to raise a skin fold to avoid injecting into a muscle; 12mm and 12.7mm needles are available but they are no longer indicated in routine clinical use. [59] After the injection, leave the needle in the skin for 5-10 Seconds to avoid leakage. With large doses, it may need to be left in for longer. Occasionally there may be bleeding after the needle is withdrawn.

Reassure the person, and advise them to apply gentle pressure for a couple of minutes to minimize bruising. They should not rub the area, as deep massage for several minutes may increase the rate of insulin absorption[(55), (56), (57). (60)]

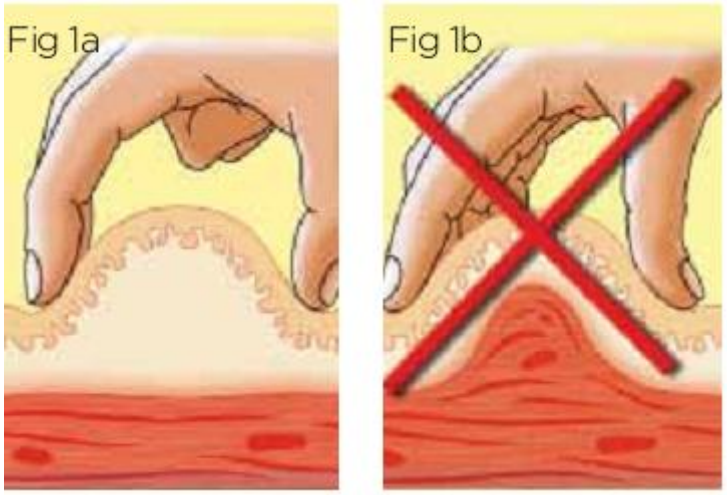


Fig 1a. **Lift the skin between thumb and two fingers with one hand, pulling the skin and fat away from the underlying muscle.** Fig 1b. **Incorrect technique**

A lifted skin fold should be used with a needle length less than 8mm in patients who are very thin and in children [(61)]

Rotation of injection site is important to prevent lipohypertrophy or lipoatrophy. Rotation within one area is recommended as opposed to rotating to different areas within the body [(55), (56), (57)]

b. Insulin pens: is a prefilled insulin syringe which is a pen-like holder, loaded 150- to 300-unit of insulin. It is convenient for patient administering insulin before meal if eating out or traveling. Also it is useful for patients with impaired manual dexterity, vision, or cognitive function, which makes the use of traditional syringes difficult [(1),(2)]

When injecting using a pen device, the needle should be kept in the skin (with a lifted skin fold, if necessary) for at least 10 seconds after delivering the drug. This helps to ensure complete expulsion of the injectable therapy through the needle and avoid dribble through equalization of pressure inside the pen and is it in subcutaneous tissue [61]

Sequence for injecting:

The optimal sequence for injection technique should be: Make a lifted skin fold if necessary, Insert the needle into the skin at a 90° angle; Administer insulin, Leave the needle in the skin for at least 10 seconds after the insulin has been injected, withdraw the needle from the skin, Release the lifted skin fold if used, dispose of the used needle safely, following local sharps disposal guidelines [61]

There are two main types of injection pen devices on the market

- Some 'pens' come pre-loaded with insulin and are disposable.
- Others use cartridges of insulin that are inserted into a re-usable device.

Pre-loaded injection devices can be easier to use, but are more expensive[61], [62]

c. Jet injectors: are devices delivering insulin through the skin and not using needle. These devices are more expensive and require training and supervision.

d. Continuous subcutaneous Insulin infusion: (insulin pump): it is devices that produce continuous subcutaneous insulin infusion that closely mimic the function of the normal pancreas.

The patients using insulin pumps must have extensive education in the use of the pump and in self-management of blood glucose and insulin doses and taught to administer insulin by manual injection to minimize this risk [1],[2]

The chief benefit of insulin pump therapy is customized, flexible basal and bolus dosing to meet patients' individual insulin requirements while reducing the risk of severe hypoglycemia [60] Insulin delivery via pump is more consistent and precise

than delivery by syringe or injection pen. With a pump, basal insulin can be adjusted in increments as small as 0.25-unit, depending on the model of pump [63]

The disadvantages for patient using insulin pumps include risk of DKA due to unexpected disruptions in the flow of insulin from the pump that may occur if the tubing or needle becomes occluded, if the supply of insulin runs out, or if the battery is depleted, that is because of only rapid-acting insulin is used in the pump. This is in addition to hypoglycemia, and infection at needle insertion sites.[1],[2]

Patients starting insulin pump therapy must be motivated to improve their glucose control and willing to work with their health care team to pursue mutually agreed objectives of therapy. Frequent (up to 6-8 times daily) self-monitoring of blood glucose (SMBG) is the foundation of intensive diabetes management.

Diabetic ketoacidosis (DKA) is rare among pump users who perform SMBG adequately, but can develop quickly because of the short half-life of rapid-acting insulin analogues (lispro, aspart, glulisine) commonly used in pumps [63]

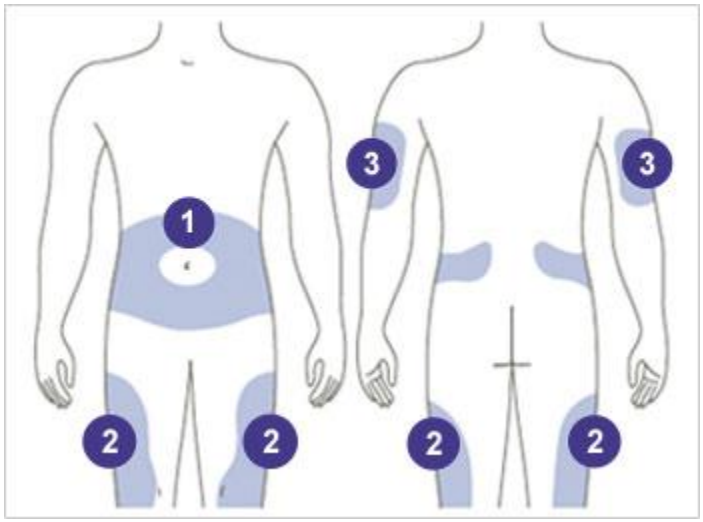
Insulin injection sites:

There are a number of alternatives to inject insulin and include:

- Abdomen, which is a fastest absorption, usually plenty of subcutaneous fat, making it easy to do a pinch up. A good option for fast-acting insulin.
- Thighs, is slower absorption. Best with intermediate acting insulin, or the evening dose of a twice-daily insulin regimen. Very little subcutaneous fat laterally, so use a pinch up and/or short needles.
- Arms, is medium to fast absorption. Make sure there is sufficient fat, and use short needles. A circle with a 5.08-cm (2 in.) radius around the navel should be avoided. Injection into areas with little subcutaneous fat may result in intramuscular administration, which is painful and may result in faster insulin absorption.

- Buttocks, is a slowest absorption. Use for intermediate or long-acting insulin. Plenty of subcutaneous fat, so no 'pinch up' is needed.[33]

The complications of insulin therapy include local allergic reactions, systemic allergic reactions, insulin lip dystrophy, resistance to injected insulin, morning hyperglycemia[(1), (56)]



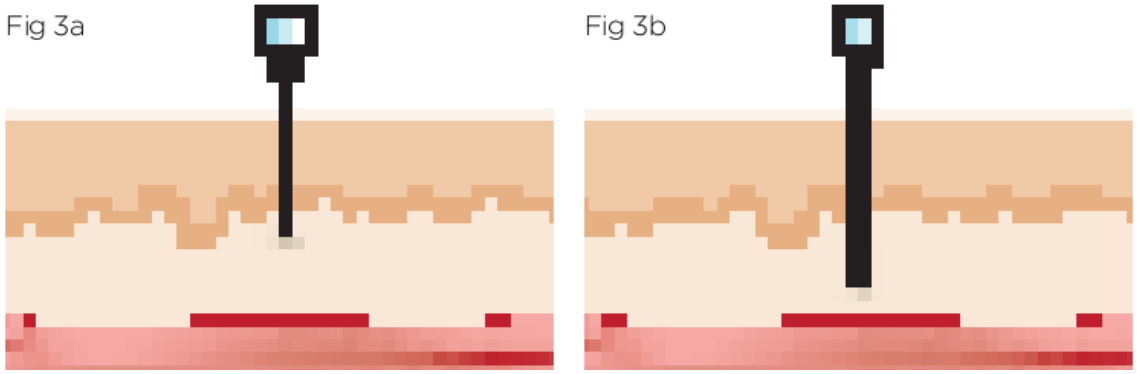
Picture 2: The insulin injection sites

Complications of poor technique:

Poor technique, includes using the incorrect needle length, can lead to insulin not being absorbed in a predictable manner. This may cause immediate problems such as hypoglycemia (a sudden drop in blood sugar because of accelerated insulin absorption if the insulin is injected into muscle) and/or hyperglycemia (a rise in blood sugar because of slow insulin absorption or insulin running out too quickly).[(86)] many studies demonstrated that it does not matter if insulin is injected into fat just under the dermis or just above the muscle, as long as it is injected into fat.

In patients with very little fat, short needles may be useful or the area with very little fat or subcutaneous tissue should be avoided and a more suitable injection site found (Figs 3a and 3b).

Fig 3. **Insulin must be injected into fat. This can be just below the dermis (3a) or just above the muscle (3b)**



Lipohypertrophy:

A common problem resulting from poor injection technique is the development of lipohypertrophy (commonly referred to as lipos).

This is the accumulation of fat under the skin, partly caused by injecting too frequently in the same area.

Lipohypertrophy can be unsightly and painful; in some people the lesions can be hard or scar like.

To detect lipohypertrophy, injecting sites should be both inspected and palpated, as some lesions can be more easily felt than seen.

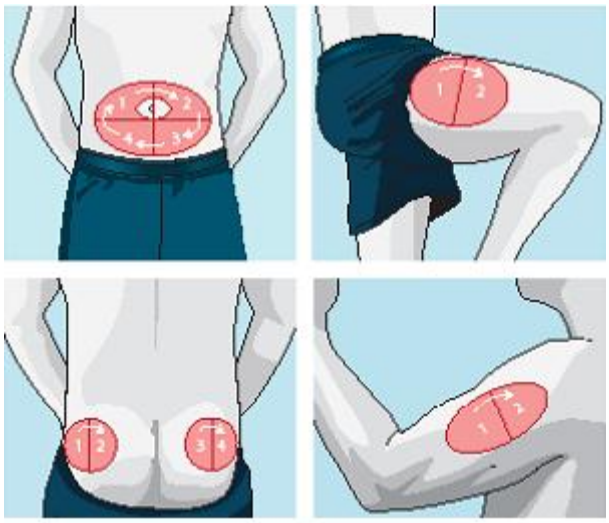
Healthy skin can be pinched tightly together, while areas of lipohypertrophy cannot.

In some cases, lipoatrophy can develop, which is the wasting of subcutaneous tissue. It is less common now due to the purification of human and analogue insulin but is once again being seen occasionally in clinical practice because impure insulin is being used in some developing countries.

Injection site rotation

The site should be changed at each injection (rotated) to reduce the risk of lipohypertrophy.

A simple way to reduce this risk is to systematically rotate the site where the insulin is injected [(1)] There are four main injection sites – abdomen, thigh, arm and buttocks (Fig 4).Each of these has different characteristics, and the rate at which human insulin is absorbed differs for each one (however, there does not appear to be any difference with analogue insulin). One scheme with proven effectiveness involves dividing the injection site into quadrants (or halves when using the thighs, buttocks or arms),[(87)] One quadrant should be used per week and moving always in the same direction, either clockwise or anti-clockwise, keeping the injections at least 2cm apart (picture 4).



Picture (4): Rotation of the injection site

Reusing needles:

Reuse can lead to bruising and bleeding as a result of the needle being blunted by overuse. Infection is possible if needles are reused or an injection is given through clothing. It is recommended needles are used only once, and injections should not be given through clothing [(87)]

Oral anti diabetic medication:

When lifestyle changes like healthy eating, weight loss, and exercise are not enough to normalize blood sugars, there is always a need for medication.

1- **Secretagonous**: Are drugs that induce the pancreas to increase its production of insulin. Three classes of secretagogues are currently in use. These include Sulfonylureas, meglitinides, and D-phenylalanine derivatives.

- **Sulfonylureas:** were the first and only oral anti diabetic drugs for type 2 diabetics for many years. The only first-generation sulfonylurea still on the market is Diabetes. Second-generation drugs are more potent so can be given at lower dosages. They also have fewer side effects than the first-generation drugs, although hypoglycemia is still a possibility when meals are omitted or delayed or exercise is prolonged. They may also cause weight gain, water retention, and sometimes flushing with alcohol, although this is less common than with Diabinese. The weight gain is an especially vexing problem, as increased weight increases insulin resistance. Water retention can also increase blood pressure, which is often a part of the diabetic picture. Sulfonylureas should only be prescribed for type 2 clients who are able to increase their beta cell production of insulin. Because type2 diabetes is a progressive disease, eventually the beta cells will have no more to give, and different drugs, including insulin, may be added or substituted to bring blood glucose into normal range. Sulfonylureas are also mild sulfa drugs that may not be appropriate for anyone with an allergy to sulfa. First generation was chlorpropamide - Diabinese and Second generation glipizide (Glucotrol*and GlucatrolXL), glyburide (DiaBeta*,GlynasePresTab and Micronase) and glimepiride (Amaryl)[(2),(14)]

Glibenclamide (daonil):

Daonil also known as glyburide or diabeta, 5mg, contains glibenclamide an oral anti-hyperglycemic drug used to control the blood glucose in mild to moderate

type 2 diabetes mellitus. It lowers high blood glucose by acting directly on the beta cell to increase their sensitivity to glucose and to stimulate the cell to produce and release more insulin. Insulin is normally produced in response to food and increased blood glucose levels and it controls postprandial (after eating) blood glucose levels (glycaemic control). In diabetes, resistance to insulin results in loss of glycaemic control. Daonil thelps the body to produce sufficient insulin to maintain normal blood glucose levels after a meal as well as between meals and is effective for up to 24 hours.

It in conjunction with diet control and exercise can be used alone as mono therapy or in combine with insulin or other anti-diabetic medicines like metformin when a single drug does not provide adequate glycemic control. It swallowed just before meal, if there was missing dose; should be taken as soon as remembered, unless it is time of the next dose and not double a dose.

The most commonly reported side effects of Daonil tablets include: gastrointestinal complaints like nausea, diarrhoea, constipation and stomach or abdominal pain; allergic skin reactions like, redness (erythema), itching (pruritus), hives (urticaria); dizziness, drowsiness, headache, visual disturbances, confusion, malaise and tremor, which are usually transient and may be signs of hypoglycaemia which is a more serious side effect. Because the Daonil continue to work between meals to reduce blood sugar levels and therefore if glucose levels fall too low, by missing a meal or waiting too long between eating, severe hypoglycaemia can be the result.

Daonil should not be used for type one diabetes mellitus, unstable diabetes, DKA, pregnant or mother on breast feeding, severe kidney or liver disease and diabetic with adrenal or pituitary insufficiency, as this may increase risk of hypoglycaemia. There some drugs that affect Daonil and cause hypoglycaemia or hyperglycemia. Hypoglaemia occur by increasing its glucose-lowering effect: the

non-steroidal anti-inflammatory drugs (NSAID) like aspirin, beta-blockers like propranolol for high blood pressure, cimetidine for peptic ulcers, and the anticoagulant warfarin. Hyperglycemoa occur due to reducing its glucose-lowering effect: corticosteroids, bronchodilators like salbutamol, diuretics, and oral contraceptive [69],[70]

Meglitinides: The only drug approved by the food and drug administration (FDA) to date in this class is repaglinide (Prandin). Its mechanism of action is similar to sulfonylureas; however, it acts much more rapidly. Therefore, it is taken right before a meal and increases insulin production dependent on blood glucose from this meal. This increases the flexibility of meal planning and decreases incidence of hypoglycemia because it is not taken unless a meal is to be eaten within 30 minutes. It can be taken alone or combined with metformin, alpha-glucosidase inhibitors, or thiazolidinediones [2]

- **Phenylalanine Derivatives**: The only FDA-approved drug in this class is nateglinide (Starlix). This drug acts similarly to Prandin in that it stimulates a rapid release of insulin from the beta cells thus controlling blood sugars after meals. It is taken right before a meal, so the side effect of hypoglycemia is rare. Because it is metabolized and partially excreted by the liver, its duration of action can be prolonged in people with significant liver disease, resulting in an increased risk of hypoglycemia. This drug can be taken alone or in combination with metformin to enhance insulin sensitivity[2]

2. Biguanides: Drugs in this class act primarily to decrease the liver's inappropriate release of glycogen into the blood, thus increasing blood sugar. It also improves cellular insulin sensitivity. Both problem sare in type II diabetes. Metformin (Glucophage) was the first non-sulfonylurea to be added to the arsenal of oral agents for type II diabetes. Side effects include diarrhea, bloating, and nausea, all of which decrease over time and are minimized by taking the lowest

dose and titrating upward until glycemic control is achieved. The most problematic adverse effect is lactic acidosis, which is rare, but can be fatal. Clients with liver or renal disease should not take this drug. When taken alone, Glucophage does not contribute to weight gain or cause hypoglycemia. It may even lower (LDL) cholesterol (bad cholesterol) and triglyceride levels, which are both problems in type 2 diabetes. This drug can be used as a first-line agent to improve glycemic control, or it can be combined with sulfonylureas, meglitinides (Prandin), alpha- glucosidase inhibitors (Precose and Glyset), thiazolidinediones (Actos and Avandia), and insulin. Three combination pills are currently available: Glucovance (metformin and glyburide), Metaglip (metformin and glipizide), and Avandamet (metformin and rosiglitazone) [(2)]

3. Thiazolidinediones: This group of drugs, better known as "glitazones," includes pioglitazone (Actos) and rosiglitazone (Avandia). They act by decreasing cellular resistance to insulin, thus improving control of blood sugars. The obese population of type II diabetics may improve glycemic control by adding one of these drugs to lifestyle changes of weight loss, healthy diet, and increased physical activity. It can also be taken with sulfonylureas, meglitinides (Prandin), metformin (Glucophage or as Avandamet), alpha-glucosidase inhibitors (Precose or Glyset), or insulin. The FDA recommends liver function tests be done before and during treatment with this class of drugs because the first one, troglitazon (Rezulin), was withdrawn from the market in 2000 due to reports of rare incidents of liver failure and related deaths. The two newer drugs, Actos and Avandia, are much less toxic to the liver, but patient selection must be appropriate. If a patient's liver enzymes increase, the drug is usually discontinued for this individual. Glitazone drugs can also cause fluid retention and rapid weight gain independent of fluid retention. Clients at risk for congestive heart failure should probably not take this drug. All clients taking these drugs need to be monitored for cardiac function and weight

gain, ruling out fluid retention as the cause. A new combination drug called Avandadryl is on the market. This drug combines Avandia and glimeperide, a sulfonyl-urea (trade name Amaryl). It has the same precautions concerning liver function that all glitazones have and should be administered with the first good meal of the day to minimize hypoglycemia from Amaryl[(2)]

4. Alpha-Glucosidase Inhibitors:

The two drugs in this class, acarbose (Precose; called Glucobay in Europe and Prandase in Canada) and miglitol (Glyset), work in the small intestine to delay the digestion of carbohydrates (starches and sucrose) and decrease the peak postprandial (after meal) glucose levels allowing insulin production to better match glucose absorption. They can be taken alone or in combination with sulfonylureas, repaglinide (Prandin), metformin (Glucophage), thiazolidinediones (Actos or Avandia), or insulin. When taken alone, these drugs do not cause hypoglycemia, but when taken with other agents that do cause low blood sugar, only glucose (as in glucose tablets or gel) or fructose from fruit juice will treat the hypoglycemia. The most common side effects are gas, diarrhea, and cramps. These diminish with time and are minimized by starting at the lowest dose and gradually increasing it if needed to control blood sugars. Because of these side effects, this drug may not be appropriate for anyone with irritable bowel syndrome[(2)]

Complications of DM:

Acute complication:

1. Hyperglycemia:

The glucose levels depend on the timing of food intake from fasting and pre-prandial levels to 1–2 hours postprandial levels.

Hyperglycemia result when there is too much glucose and not enough or biological non-active insulin present. The lack of available insulin either because of a lack of insulin- making capability or resistance to insulin use.

Causes of hyperglycemia:

- Forgotten of an insulin injection or the oral hypoglycemic (secretagogue) agent or purposefully omitted.
- Deviation from the diet by ingesting large quantities of carbohydrate (such as sweet desserts or starches) especially when this extra intake is not compensated by exercise or medication.
- Infection and fever also increase blood glucose levels by activating the adrenal medulla and cortex, which produce epinephrine and cortisol, respectively and healing process will be slowed with higher blood glucose levels. Epinephrine increasing the rate of glycogenolysis and lipolysis, and hence the discharge of glucose and free fatty acids from the liver, and the adenocorticotropic hormone (ACTH) causes a release of glucocorticoids from the adrenal cortex, promoting gluconeogenesis.
- Stress (physical or psychological) due to release of epinephrine.
- Treatment with certain drugs such as steroids, surgery, myocardial infarction (MI), and stroke (cerebrovascular accident, or CVA) may also result in a hyperglycemic state[(14)]

Symptoms of hyperglycemia:

Most people with diabetes have no symptoms until blood sugar approaches 250 mg/dl. This is an important point to make with clients who do not routinely monitor their glucose levels. The most common symptoms include frequent urination of very dilute urine, thirst from the loss of body fluids in the urine, and hunger for simple sugars. Other symptoms may include the following: headache, sleepiness, difficulty concentrating, visual disturbances from the glucose

concentration in the eye fluids, dry or flushed skin from dehydration and general malaise. These symptoms may be so common that older clients may think they are a normal part of aging. When illness, even the common cold, or other stressors increase blood sugars to 400 mg/dl and higher, ketoacidosis can occur. When the body does not have enough insulin to move glucose into cells for energy, the cells turn to fat to provide needed fuel. The metabolism of fat produces fatty acids and ketones that accumulate in the blood and affect the brain, producing the symptoms listed above and represent an emergency situation. The kidneys try to eliminate ketones and glucose, giving rise to ketonuria and glycosuria. Testing urine for ketones is a confirmation that ketoacidosis is occurring[(2)] This is common in type1 diabetes and in newly diagnose patient in type I or type II, but not common when the diabetes is well controlled[(14)] Other symptoms of this very dangerous condition include the following: shortness of breath, fruity smelling breath (more like the acetone of nail polish remover), nausea and vomiting. If ketoacidosis persists the client will lapse into a coma. The blood sugar level that produces a coma is very individualized and can be anywhere from 600 mg/dl to 1,500 mg/dl or higher[(2),(20),(4)] This condition occurs mostly with type I diabetes and is caused by omitting an insulin dose, eating excessive amounts of carbohydrates, illness, and some medications. However, these same conditions, if severe enough, can overwhelm the ability of the pancreas of a type II diabetic to respond to oral agents by increasing production of insulin. When this happens, the type II diabetic can become ketotic. On the other hand, when ketones are not present in the unconscious type II diabetic, the resulting condition is called hyperosmolar nonketotic. This may happen in an older client who lapses into a coma from the severe dehydration caused by hyperglycemia[(2)]

Treatment of DKA:

The treatment of **DKA** involves major steps: restoration of normal carbohydrate, fat, and protein metabolism, restoration of fluid balance, prompt recognition and treatment of circulatory complications, and treatment of an underlying cause as infection.

In the acute state of diabetic ketoacidosis, fluids and insulin must be administered to restore the body's fluid balance and the normal metabolism of carbohydrate, fat, and protein. Regular insulin is the insulin of choice because, intravenously, it has an immediate action and a short duration. The intravenous (IV) profile of regular and the newer analog rapid-acting insulin is the same, but regular insulin is much less costly than the analogs. There are many IV insulin therapy protocols to start insulin infusion, but b better way is to base on body weightat 0.1 unit·kg ·hr. Half that dose (0.05 unit·kg ·hr) is a safe starting dose regardless of body weight and negates the problem of insulin resistance or sensitivity. Then IV insulin dose can be titrated by the blood glucose value measured hourly to maintain the blood glucose level that recommended at below 110 mg/dl. IV insulin therapy is usually carried out in intensive care units or on hospital floors if the patient is stable, nurses are trained to handle IV insulin therapy and if the floor is equipped for cardiac monitoring. IV fluids will often bring down the blood glucose level by several hundred milligrams per deciliter and reestablish renal blood flow. Maintenance and depletion amounts of fluid will be calculate, an initial bolus of 10–20 cc of normal saline per kg of body weight is usually given over the first hour, and then the flow rate calculated for the next 23 hours for maintenance and for correction of the calculated deficiency. Normal saline is the fluid of choice. Too slow a correction leaves the patient in acidosis longer and may be detrimental to renal, hepatic, and cardiac function and too rapid a drop in blood glucose levels may precipitate cerebral edema.

Sodium and potassium will be calculated and replacement according to lab value. The formula for correction of sodium is: add 1.6 mEq/L to the lab sodium value for every 100 mg/dl (5.56 mmol/L). Potassium should be added to the IV fluids as soon as renal blood flow and urinary output have been established by maintenance of 1 mEq.kg .day to the level of 5 mEq/L. Electrolytes should initially be monitored at least every 2 hr by laboratory value and the patient's electrocardiogram (ECG). Also give bicarbonate to correct acidosis. Given as part of the IV fluids over 24–48 hr. There is no maintenance dose of bicarbonate and correction doses should be given to correct to bicarbonate level of 12 mEq/L of the bicarbonate space unless severe hyperkalemia or cardiac arrest, it may be given by bolus.

Monitoring is essential part of DKA management. The nurse should monitor the laboratory of basic metabolic profile containing sodium, potassium, and bicarbonate levels and a serum creatinine level to monitor the state of hydration, ECG if the nurse trained in reading it for T wave abnormalities for least every 2 hrs two times, then every 4 hrs four times, and then every 8 hrs until values are in the normal range. There can never be too much monitoring. There is often too little [(14)]

Hypoglycemia:

Is a medical emergency that involves an abnormally diminished content of glucose in the blood to less than 50 to 60 mg/dL. [(1),(21).] The most common forms of hypoglycemia occur as a complication of treatment of diabetes mellitus as too much insulin or oral hypoglycemic agent, or too little food, or excessive physical activity.It often occurs before meals, especially if meals are delayed or snacks are omitted[(1)] It can produce a variety of symptoms and effects but the principal problems arise from an inadequate supply of glucose to the brain, resulting in impairment of function (neuroglycopenia). Effects can range from mild dysphoria

to more serious issues such as seizures, unconsciousness, and (rarely) permanent brain damage or death[1],[22],[23] Hypoglycemia is treated by restoring the blood glucose level to normal by the ingestion or administration of dextrose or carbohydrate foods. It is often self-diagnosed and self-medicated orally by the ingestion of balanced meals. Immediate treatment recommended for hypoglycemia is 15 g of a fast acting concentrated source of carbohydrate; given orally, such as three or four commercially prepared glucose tablets, 4 to 6 oz of fruit juice, and 2 to 3 teaspoons of sugar or honey. In more severe circumstances, it is treated by injection or infusion of glucagon. The level of blood glucose low enough to define hypoglycemia may be different for different people, in different circumstances, and for different purposes, and occasionally has been a matter of controversy. It can sometimes be difficult to determine whether a person's symptoms are due to hypoglycemia. Most have the following symptoms, tremors, shakiness, or jerky movements, sweating, pale moist skin, dizziness, feeling faint, headache, excessive hunger, especially for carbohydrates, sudden atypical change in behavior, mood swings, or erratic behavior , tingling or numbness around the mouth or tongue, difficulty paying attention, confusion, visual disturbances, difficulty reading, dilated pupils, increased heart and respiratory rates seizures and coma. The need to treat a low blood sugar is fairly immediate to prevent brain cell damage[2] Affected patients must perform SMBG on a frequent regular basis, especially before driving or engaging in other potentially dangerous activities[1]

The following table shows the hyperglycemia versus hypoglycemia regarding the symptoms and signs

Similar	
Hyperglycemia	**Hypoglycemia**
Irritability	Irritability
Headache	Headache
Hunger	Hunger
Nausea	Nausea
Vomiting	Vomiting
Coma	Coma
Convulsion	Convulsion
Different	
Soft pupils	Dilated or constricted pupils
Dry skin Cold	clammy sweat
Double vision	Blurred vision
Anxious	Confusion and Drowsiness

Hyperglycemic Hyperosmolar Nonketotic Syndrome (HHNS):

(HHNS) occurs primarily in type II diabetes, when blood glucose levels are high as a result of stress or illness. Because the person with type II diabetes has some insulin production, cells do not starve and DKA usually does not occur. It occurs more often in the elderly more than 60 years. As the blood glucose raises (hyperglycemic), polyuria causes profound dehydration, producing the hyperosmolar (concentrated) state. Blood glucose may rise as high as 1500 mg/dl. Because ketoacidosis is not present, the patient may not feel as physically ill as the patient with DKA and may delay seeking treatment. Symptoms of HHNK

develop slowly and include extreme thirst, lethargy, and mental confusion. Shock, coma, and death occur if HHNK is left untreated. The mortality rate for HHNK is about 15 percent. Treatment consists of replacement of fluids and electrolytes, especially potassium, administration of insulin and glucose monitoring. Less insulin is required with HHNS than with diabetic ketoacidosis because the patient is not ketotic, but fluid requirements are higher because of the extreme hyperosmolality. Because the patient usually are older and may have renal insufficiency and/or congestive heart failure, fluid administration must be done carefully to prevent fluid overload. The help of the nephrology service or the cardiology service may be needed. The cause of HHNK syndrome should be identified and treated. It can be prevented with careful monitoring of glucose levels at home. Patients should be instructed to drink plenty of fluids if blood glucose levels are beginning to rise, especially in times of stress and illness. They should also know when to call their physician with high blood glucose results [8], [14]

Lactic acidosis:

Lactic acidosis is a condition of increased levels of lactic acid in the blood; it is a high incidence of death. The major concern is not the increased lactic acid but the grave underlying problems producing the abnormality. Lactic acidosis occurs in advanced stages of diabetes, especially in individuals who have uremia, arteriosclerotic heart disease, pneumonia, acute pancreatitis, chronic alcoholism, and bacterial infection. Treatment of lactic acidosis consists of administration of insulin, fluids, and electrolyte replacement as needed. Intravenous administration of solutions containing lactate must be avoided [14]

Chronic complication of DM:

Over time, chronic hyperglycemia causes a variety of serious complications in persons with diabetes. These involve the circulatory system, eyes, kidneys, and

nerves. Most of the complications involve either the large blood vessels in the body (macrovascular complications) or the tiny blood vessels, such as those in the eyes or kidneys (Microvascular complications). The United Kingdom Prospective Diabetes Study (UKPDS), completed in 1998, showed that individuals with type II diabetes who maintain an HbA1c below 7 percent can significantly reduce complications [8]

Macro-vascular complication:

It is occur in the medium to large blood vessels when blood vessel walls become thicken, sclerosed, and occluded by plaque that adheres to the vessel walls[1],[8] Commonly include coronary artery disease, cerebrovascular disease, and peripheral vascular disease. Coronary artery disease may account for 50% to 60% of all deaths among patients with diabetes. The typical ischemic symptoms may be absent in patients with diabetes. Therefore, the patient may not experience the early warning signs of decreased coronary blood flow and may have "silent" MIs, which may be discovered only as changes on the electrocardiogram (ECG) that secondary to autonomic neuropathy[1]Patient with type 2 diabetes mellitus who have multiple cardiac risk factors are more likely to suffer from macro-vascular complications and therefore should be targeted to undergo intensive education regarding lifestyle modification[71] People with diabetes have twice risk of developing cerebrovascular disease, and an increased risk of death from CVA. Atherosclerotic changes in the large blood vessels of the lower extremities are of increased incidence (two to three times higher than in non-diabetic people). In severe case increased incidence of gangrene and subsequent amputation. Neuropathy and impairments in wound healing also play a role in diabetic foot disease.[1]Blood glucose and blood pressure control is vital to help prevent these deadly complications. Patients should also avoid smoking, and maintain normal

weight. Aspirin therapy to reduce platelet aggregation is recommended for patients older than 21 years of age with diabetes[71]

Micro-vascular complication:

1. Diabetic retinopathy:

Blindness is one of the most feared complications of diabetes, but also one of the most preventable. Diabetes is the commonest cause of blindness in people aged 20 and 74 years. Twenty years after the onset of diabetes almost all patients with Type I diabetes [1] and over 60% of patients with Type II diabetes will have some degree of retinopathy [64], and even at the time of diagnosis of Type II diabetes, approximately one-quarter of patients already have established background retinopathy[64]People with diabetes experience higher rates of cataracts and glaucoma. The rupture of small aneurysms in the retinal vessels is the major cause of blindness in diabetic patient.[8] diabetic retinopathy is caused by changes in the small blood vessels in the retina, the area of the eye that receives images and sends information about the images to the brain. Retinopathy is a painless process. Blurry vision may occur in some patients as manifestation. It can be diagnose by ophthalmoscope or fluoresce in angiography [1]

As treatment is now available to prevent blindness in the majority of cases, it is essential to identify patients with retinopathy before their vision is affected. Vision-threatening retinopathy is usually due mainly to neovascularization in Type 1 diabetes and maculopathy in Type II diabetes [24] .The first focus of management is on primary and secondary prevention. So the maintenance of blood glucose to a normal or near-normal level in type 1diabetes through intensive insulin therapy and patient education decreased the risk for development of retinopathy by 76% when compared with conventional therapy in patients without preexisting retinopathy. Also, control of hypertension, and cessation of smoking

are other strategies that may slow the progression of diabetic retinopathy. [1],[8] The laser treatment (argon laser photocoagulation) for advanced cases of diabetic retinopathy is main treatment which destroys leaking blood vessels and areas of neovascularization. For patients who are at increased risk for hemorrhage, panretinal photocoagulation may significantly reduce the rate of progression to blindness. Photocoagulation treatments are usually performed on an outpatient basis, and most patients can return to their usual activities by the next day. Limitations may be placed on activities involving weight bearing or bearing down. A few patients may experience slight visual loss, loss of peripheral vision, or impairments in adaptation to the dark. However, the risk of slight visual changes from the laser treatment itself is much less than the potential for loss of vision from progression of retinopathy.A vasectomy is a surgical procedure that use to remove vitreous humor filled with blood or fibrous tissue and performed for patients who already have visual loss [1]

1. Diabetic Neuropathies:

Diabetic neuropathy refers to a group of diseases that affect all types of nerves, including peripheral (sensorimotor), autonomic, and spinal nerves.The prevalence increases with the age of the patient and the duration of the disease and may be as high as 50% in patients who have had diabetes for 25 years[1]

- **Peripheral Neuropathy** is most commonly affects the distal portions of the nerves[1]The commonest form is a peripheral sensorimotor neuropathy that affects the feet first[4] The development and progression of neuropathy are associated with poorly controlled hyperglycaemia, uncontrolled hypertension and dyslipidaemia. There is no specific therapy that effectively alters the natural history of neuropathy. Polyneuropathy is a classic diabetic complication developing mainly in those with poor diabetic control, progressing (albeit at very variable rates) as

the duration of diabetes lengthens, but not always, associated with other long-term diabetic complications. In contrast, mononeuropathies and acute painful neuropathies had acute onset and completely recover in six to 18 months. These reversible neuropathies, which may be the reason for initial presentation of diabetes, can occur after any duration of diabetes, are commoner in Type II diabetic men, and also are not necessarily associated with other diabetic complications. Pressure neuropathies are commoner in those with diabetes and include carpal tunnel syndrome (median nerve), ulnar neuropathy, and rarely foot drop (lateral popliteal nerve).[4] Patient presented with pain or altered sensation in the feet. In contrast some patients experience a feeling of complete numbness; this is a hazard to the patient who is at risk of injury, ulceration and ensuing infection.

Neuropathy can affect both type I and type II patients. In patients with type I diabetes it is seen after many years of diabetes but in type II patients it may be present at the time of diagnosis. It is revealed by impairment of pressure perception tested with a 10 g monofilament, reduced vibration perception tested using a 128 Hz tuning fork and absent ankle reflexes and nerve conduction studies.

Autonomic Neuropathies:

Diffuse damage to both parasympathetic and sympathetic nerves. It is common in diabetic patients with diffuse peripheral neuropathy. Fortunately the disabling symptoms which result are not common, and even when they do occur some of them, especially diarrhea, vomiting, and postural hypotension, are intermittent. Impaired sweating in the feet, which is a feature of autonomic dysfunction results in the dryness of skin that may predispose to foot ulceration[4]Sexual dysfunction also effect of autonomic nephropathy. It is more common in men than the women. Reduced vaginal lubrication lead to vaginal infection, urinary tract infections and vaginitis may affect female sexual function. Impotence (inability of the penis to

become rigid and sustain an erection adequate for penetration) and retrograde ejaculation (seminal fluid is propelled backward through the posterior urethra and into the urinary bladder) occur in men with autonomic neuropathy[1]

Nephropathy:

It is a common complication of diabetes. The development of proteinuria in any diabetic patient is ominous [24] Many patients with type II diabetes have had diabetes for many years before the diabetes is diagnosed and treated. Therefore, they may have evidence of nephropathy at the time of diagnosis. If blood glucose levels are elevated consistently for a significant period of time, the kidney's filtration mechanism is stressed, allowing blood proteins to leak into the urine. As a result, the pressure in the blood vessels of the kidney increases, and this elevated pressure serve as the stimulus for the development of nephropathy[1] Nephropathyis associated with a risk of severe retinopathy and neuropathy, and above all carries a major increased risk in mortality from coronary artery disease, as well as progression to renal failure in some patients. Yet developments in this field to improve the prognosis have been substantial. Most of the signs and symptoms of renal dysfunction in patients with diabetes are similar to those without diabetes[1] Furthermore, at the earliest sign of proteinuria, administration of medication and very tight blood pressure control ameliorate the course of the disease and substantially delay the development of renal failure.[24] Angiotensin converting enzyme (ACE) inhibitor prescribed for lowering blood pressure and reduces micro-albumin urea, and alternatively, angiotensin receptor blocking agents may be prescribed. Also the management of nephropathy include prevention or vigorous treatment of urinary tract infections, avoidance of nephrotoxic substances (eg, antibiotics, other selected medications), Adjustment of medications as renal function changes, and low-sodium and protein diet.

As renal failure progresses, frequent hypoglycemic episodes may as a result of decreases breakdown of both exogenous and endogenous insulin[(1)]

And for those who are less fortunate, transplantation and dialysis restore a good quality of life to the majority. Proteinuria occurs in both Type I and Type II diabetes[(24)]

In the United States, people with diabetes account for almost 50% of new cases of end-stage renal disease (ESRD) each year, and about 25% of those require dialysis or transplantation. About 20% to 30% of people with type I or type II diabetes develops nephropathy, but fewer of those with type II diabetes progress to ESRD.

Both patients with type I and type II diabetes frequently show initial signs of renal disease after 10 years after the diagnosis of diabetes. The results showed that intensive treatment of type 1 diabetes with a goal of achieving a hemoglobin A1C level as close to the non-diabetic range reduced the occurrence of early signs of nephropathy, and also controlled blood glucose levels in patients with type II

	Normal (I)	Incipient (II)	Persistent (III)	Clinical (IV)	End stage (V)
Albuminuria (mg/24h)	20	20-300 (microalbuminuria)	more than 300 up to 15g/day	More than 300 (up to 15g/day)	More than 300 (can fall)
Glomerular filtration rate (ml/min)	High/normal hypertension	Normal/high	Normal or decreased	Decreased	Greatly decreased
Serum creatinine (mol/l)	Normal 60-100	Normal 60-120	High normal 80-120	High 120-400	Very high more than 400
Blood pressure(mm/hg)	normal	Slightly increased	Increased	Increased	Increased
Clinical signs	None	None	Anaemia + or _oedema,increased blood pressure, may be none	Anaemia + or -oedema, increased blood pressure,may be none	Anaemia oedema,increased blood pressure,uraemic symptoms

Diabetes reduced the incidence of overt nephropathy [1]

Stages of nephropathy the natural course of diabetic nephropathy is the progression through five stages from normal renal function to end stage renal failure as shown in the table: [64]

Stages of progression of diabetic nephropathy

Management of nephropathy:

The management of nephropathy include achieving and maintaining near-normal blood glucose levels, control of hypertension, prevention or vigorous treatment of urinary tract infections, avoidance of nephrotoxic substances (eg, antibiotics, other selected medications), Adjustment of medications as renal function changes, and low-sodium and protein diet

4. **Foot complication:**

Foot complications are common and serious that threats the life of patients with diabetes. Tight diabetic control is the cornerstone in preventing food complication. Effective management of the diabetic foot starts with preventative strategies. Prevention of diabetic foot ulceration should be the Primary goal for all involved in diabetic foot care. Frykberg (2006) suggests this is best accomplished by a number of strategies: A multidisciplinary team (MDT) approach to the management of diabetes and foot health; The team might include dialectologists, GPs, nurses, podiatrists, dietitians and orthotists, dependent on local policy; Patient and family education; Regular podiatry treatment, including debridement of callus and management of Pathological toenails; Healthcare provider education to ensure appropriate screening and recognition of risk factors for ulceration.[85]

The main types of foot lesion include ischemic foot (arterial insufficiency), neuropathic foot (peripheral neuropathy) or both (neuro-schemic), which can readily lead to ulceration which may be associated with deep infection and put the patient at risk of osteomyelitis and systemic sepsis.

Ischemia affect major vessel due to atherosclerosis. The limb circulation is affected: posterior tibial and dorsalis pedis pulsation are weak or absence. Regarding neuropathy, loss of pain, temperature and vibration sense due to sensory defect, and loss of sweet which lead to dry foot and cracks in autonomic neuropathy all that lead to foot infection [(94)]

While mild infections are relatively easily treated, moderate infections may be limb threatening, and severe infections may be life threatening. The lower extremity amputations in people with diabetes represent 50% and 75% of all cases. Local care pathways for managing foot complications should be well understood to ensure prompt action and reduce the need for amputation. The involved three factors; are vascular disease, peripheral neuropathy and raised risk of infection. Foot complication is the most preventable complication, but requires coordinated teamwork to care for patient[(1)]

Prevention of DM:

Diabetes is a life-long disease, it has far-reaching and devastating physical, social, and economic consequences[(1)] If blood sugar stays high for a long time, people may have a higher chance of heart attacks, strokes, amputations, blindness, nerve damage, and kidney damage. Keeping your blood sugar at a good level may lower your chance of these problems[(18),(94)]

Primary prevention is one of prevention strategies of diabetes, it can be achieved by building the knowledge and ability of the health care providers to teach and treat the patient. Prevention can be done for modifiable (environmental factor) risk factors but the most important risk factor for developing diabetes have no control over (genetics and ethnicity)[(94)]

Primary prevention and early detection are essential to reduce the personal and community burden associated with the metabolic syndrome and Type II diabetes and its complications [(32), (95), (96)]

Behavior change and effective self-care behavior are effective method of prevention which can be achieved by providing knowledge and skill training that helps individuals identify barriers and facilitates problem-solving and coping skills to prevent diabetes [73]

There is no known preventive measure for type I diabetes[28] Type II diabetes can often be prevented by a person being a normal body weight, physical exercise, and following a healthy diet [28] Dietary changes known to be effective in helping to prevent diabetes include a diet rich in whole grains and fiber, and choosing fats, such as polyunsaturated fats found in nuts, vegetable oils, and fish[74] Limiting sugary beverages and eating less red meat and other sources of saturated fat can also help in the prevention of diabetes[74] Active smoking is also associated with an increased risk of diabetes; cigarette smoking and alcohol consumption may also have important roles, either indirectly through their effects on obesity [75], [76], [77] or directly through physiological factors related to insulin secretion or insulin resistance[78], [79], [80] Independent of body size, people who smoke have a higher transient increase in blood glucose concentration after an oral glucose challenge [76], [77], [94] than non-smokers and higher insulin resistance [82] ,suggesting a potential to increase the risk of diabetes[83] so smoking cessation can be an important preventive measure as well.Nicotine replacement therapy using proprietary sublingual preparations, chewing gum, self-adhesive patches, or alternatively amfebutamone tablets can help, especially if used in conjunction with the counseling which is provided by smoking clinics[65] The World Health Organization (WHO) continues to advocate routine oral glucose tolerance test (OGTT) screening in at-risk individuals to identify people at risk of complications early, in order for early treatment to be instituted[32]

Monitoring glucose levels and ketones:

Blood glucose monitoring is a cornerstone of diabetes management, and self-monitoring of blood glucose levels has dramatically altered diabetes care [(1)] Self blood glucose monitoring is an important context of self-care in the management of diabetes mellitus [(67)] Self-monitoring of blood glucose is well established and a highly valuable and beneficial approach for the daily management and achievement of long-term glycemic control in type 2 diabetes mellitus (T2DM) [(19)]

Self-Monitoring of Blood Glucose:

Since its development, Self blood glucose monitoring has developed into a sophisticated monitoring system. A variety of glucose-monitoring devices are now available that give a digital readout of the blood glucose concentration and approved for patients' use in the home and some test strips calibrate blood glucose readings to plasma values[(3)] SMBG role in management of diabetes is increasing[(19)]Using frequent SMBG and learning how to respond to the results enable diabetic patient to adjust their treatment regimen to obtain optimal blood glucose control. Also allows for detection and prevention of hypoglycemia and hyperglycemia and plays a crucial role in normalizing blood glucose levels, which may reduce the risk of long-term diabetic complications. SMBG represent a cornerstone of insulin therapy [(1)] Structured and personalized self-monitoring of blood glucose (SMBG) is a systematic approach to glucose monitoring that reveals significant patterns of glycemia occurring throughout the day [(19)]

Because the insulin dose required by the individual patient is determined by the level of glucose in the blood thus the accurate monitoring of blood glucose levels is essential[(1)]

Regular self-monitoring and treatment of blood glucose helps to prevent all further micro-vascular and macro-vascular complications. Serial monitoring helps

to adjust anti diabetic medications and warn patients as well as physicians when blood glucose gone extremely high or low [67]

Intensive glycemic control is a cost effective way of reducing the complications associated with type II diabetes [68]

According to Recommendations from the International Central-Eastern European Expert Group (a growing body of evidence suggesting that structured SMBG is beneficial for all type II diabetes patients, regardless of therapy). The group considered SMBG to be an essential tool that should be accessible to all patients with diabetes, including those with non–insulin-treated type II diabetes [93]

Methods for SMBG:

The test is done by obtaining a drop of blood from the fingertip, applying the blood to a special reagent strip, and allowing the blood to stay on the strip for the amount of time usually 5 to 30 seconds. The meter gives a digital readout of the blood glucose value. This test can be done at home. The devices continue to be improved, and the time required for the test to be completed is now as short as 5 seconds. In addition, the size of the blood samples required has decreased, and many meters use a direct activation system. Some of the newest meters allow blood sampling both from the finger and from the forearm, thereby reducing the overuse and callousing of the fingers[1], [3], [18]

The diabetic patients who use SMBG devices for blood glucose monitoring should remember that laboratory methods measure plasma glucose of which the result values are 10% to 15% higher than whole blood glucose values. There are some available meters to check both blood glucose and blood ketone levels by those who are particularly susceptible to DKA [1]

Steps of self-monitoring of blood glucose

Factors affecting SMBG performance:

Methods for SMBG must match the skill level of patients. The factors which affect performing of SMBG include visual acuity, fine motor coordination, cognitive ability, comfort with technology and willingness to use it, and cost.

There are some meters have audio components which can be used by patients with visual impairments to assist in performing the test and obtaining the result. The hazard of SMBG is obtaining and report erroneous blood glucose values as a result of using incorrect techniques. Some common sources of error include improper application of blood (e.g. drop too small), damage to the reagent strips caused by heat or humidity, use of outdated strips, and improper meter cleaning and maintenance. Thus the need for nurses is an important to provide initial

teaching about SMBG techniques and evaluation. The accuracy of the meter and strips can be assessed with control solutions specific to that meter whenever a new vial of strips is used and whenever the validity of the reading is in doubt. The diabetic patients who use SMBG conduct a comparison of their meter result with a simultaneous laboratory-measured blood glucose level usually every 6 to 12 months [(1)]

Candidates for Self-Monitoring of Blood Glucose:

SMBG is a useful tool for managing self-care for both type1 and type II diabetes, especially for those who use insulin.

SMBG is recommended for patients using insulin in the following conditions:

- Diabetic patient on intensive insulin therapy regimen (ie, two to four injections per day or use of an insulin pump), Diabetes management during pregnancy
- Unstable diabetes (severe swings from very high to very low blood glucose levels within a 24-hour day)
- A tendency to develop severe ketosis or hypoglycemia
- Hypoglycemia without warning symptoms

For patients not taking insulin, SMBG is helpful for the following conditions:

- Effectiveness of exercise, diet, oral anti-diabetic agents. Also used during periods of suspected hyperglycemia (eg, illness) or hypoglycemia (eg, unusual increased activity levels) and when the medication or dosage of medication is modified[(18)]

Frequency of Self-Monitoring of Blood Glucose:

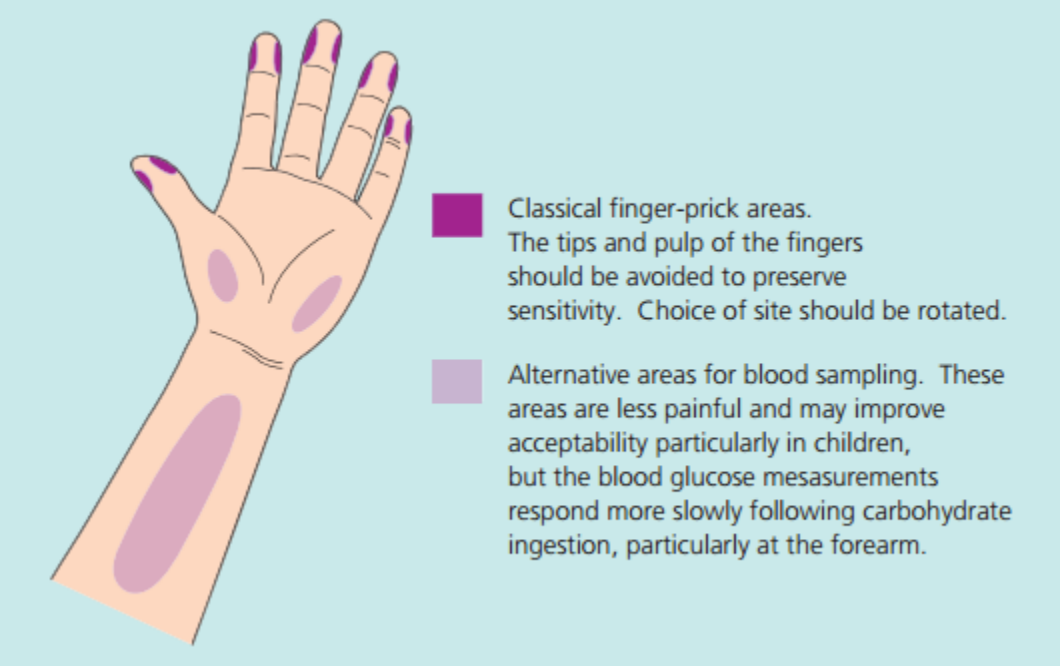
- For patients who require insulin, SMBG is recommended two to four times daily, usually before meals to determine each dose and at bedtime. Those not receiving insulin monitor at least two or three times per week. For all patients, testing is recommended whenever hypoglycemia or hyperglycemia is suspected, with changes in medications, activity, or diet, and with stress or illness.[(18)]

Responding to Self-Monitoring of Blood Glucose Results:

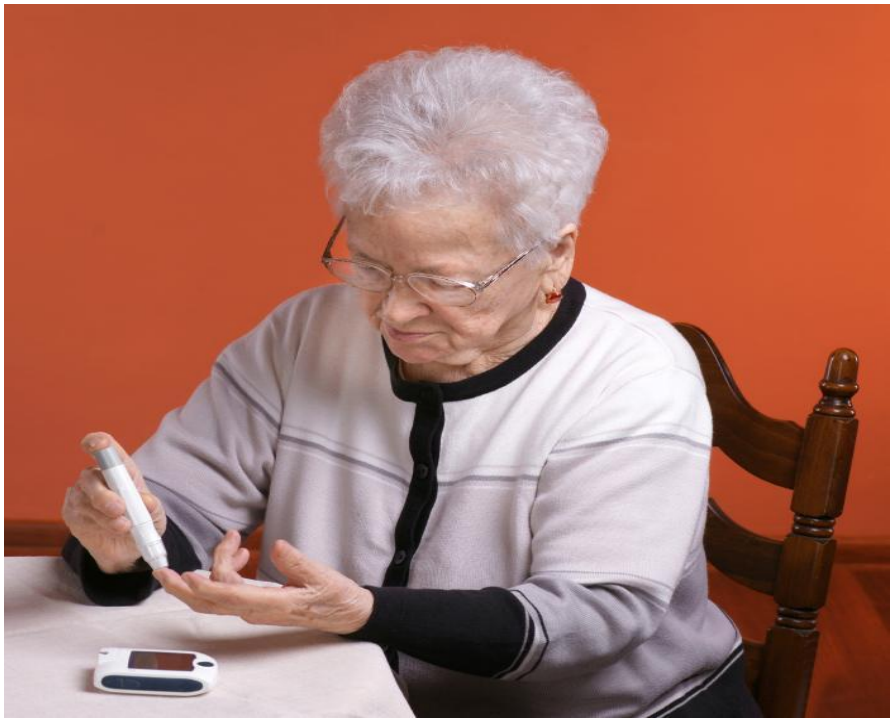
To effectively respond to SMBG result, the patient asked to keep a record or logbook of blood glucose levels to detect patterns. Testing is done at the peak action time of the medication to evaluate the need for dosage adjustments. The patient must receive instruction about using the results and positive reinforcement to alter the treatment regimen and to avoid discontinuation of SMBG.

This test is done one or more times a day. It can be done first thing in the morning before you eat (fasting) or at other times of the day, like 2 hours after a meal. This test tells what your blood sugar level is at that moment.

The fasting target is usually 80 to 120 and after a meal is usually less than 180.[(1),(18)] SMBG increases patient's awareness of hypoglycemia and therefore provides a potential strategy to trigger self-regulatory prevention of significant hypoglycemic episodes.[(19)]



Picture (5): The suitable sites on the hand for blood sample



Picture (6): Practical tips for blood glucose monitoring [92]

Picture (7): Blood for glucose monitoring [92]

According to the Task Force on Diabetes and Cardiovascular Diseases of the European Society of Cardiology (ESC) and of the European Association for the

Study of Diabetes (EASD)," SMBG is acknowledged as a major part of comprehensive management to reduce cardiovascular risk in diabetes patients.

Despite growing evidence supporting the beneficial potential of SMBG in diabetes management, some authors presented divergent observations. In addition, SMBG is reported to be accompanied by an increase in challenges for the patients[19]

Testing for Glycated Hemoglobin:

Glycated hemoglobin also known as (glycosylated hemoglobin or HgbA1C, or A1C). It is a blood test that reflects average blood glucose levels over a period of approximately 2 to 3 months[1]

In normoglycemic subjects, a carbohydrate moiety is attached to a small proportion of hemoglobin A, thus creating what is called *glycosylated* or *glycated* hemoglobin. The glycosylated hemoglobin can be separated into three distinct fractions, which are designated A1a, A1b, and A1c. Because of electrophoretic behavior of these minor hemoglobins, they are referred to as fast hemoglobin. The A1c fraction is the most reactive site of the *N* -valine terminal of the B-chain, which accounts for 60% of the bound glucose.

In conditions of sustained hyperglycemia, the proportion of hemoglobin that is glycosylated increases substantially. This glycosylation is the result of posttranslational modification of hemoglobin A molecules; the binding of glucose is a non-enzymatic process that occurs continuously during the life of the red blood cell. Thus, the amount of glycosylated hemoglobin reflects the glycemic control of a patient during the 6- to 8-week period before the blood sample was obtained, given the average life span of a red blood cell of 120 days. The amount of glycosylated hemoglobin correlates well with fasting and postprandial blood glucose levels[1], [88]

When the amount of glucose in the blood remains above normal, the more glucose binds to hemoglobin and glycated hemoglobin level becomes elevated. If near-

normal blood glucose levels are maintained, with only occasional increases, the overall value will not be greatly elevated. However, if the blood glucose values are consistently high, then the test result is also elevated. If the patient reports mostly normal SMBG results but the glycated hemoglobin is high, there may be errors in the methods used for glucose monitoring, errors in recording results, or frequent elevations in glucose levels at times during the day when the patient is not usually monitoring blood sugar levels. Normal values typically range from 4% to 6% and indicate consistently near-normal blood glucose concentrations. The target range for people with diabetes is less than 7% [(1)]

Currently, the glycosylated hemoglobin can be measured by ion-exchange high-performance liquid chromatography (HPLC), affinity chromatography, and immunologic methods [(1), (88)]

Testing for Ketones:

Ketones or ketone bodies are byproducts of fat breakdown, and they accumulate in the blood and urine. Ketones in the urine signal that there is a deficiency of insulin and control of type I diabetes are deteriorating. The risk of DKA is high. When there is almost no effective insulin available, the body starts to break down stored fat for energy. Urine testing is the most common method used for self-testing of ketone bodies by patients. A meter that enables testing of blood for ketones is available. Most commonly, the patient uses a urine dipstick (Ketostix or Chemstrip uK) to detect ketonuria .The reagent pad on the strip turns purple when ketones are present. (One of the ketone bodies is called acetone, and this term is frequently used interchangeably with the term ketones). Other strips are available for measuring both urine glucose and ketones. Large amounts of ketones may depress the color response of the glucose test area. Urine ketone testing should be performed whenever patients with type1 diabetes have glycosuria or persistently

elevated blood glucose levels more than 240 mg/dL and during illness, in pregnancy with preexisting diabetes, and in gestational diabetes [1]

Chapter Three

- **Material &Methodology**

3. Methodology

3.1. Design:

This study is - Quasi experimental, hospital based study; conducted to evaluate the impact of training program about self-monitoring of blood and urine glucose for diabetic patients.

3.2. Study area:

The study was conducted at Kassala town (Sudan) which is 620 km southern east of Khartoum and 580 km south of Port Sudan. The capital of Kassala State is Kassala town which is located on the eastern border of Sudan and the total area of the state is about 42282 Km^2. The total population of Kassala 'locality' is estimated at about 2,133,663 most of them farmers. Kassala University was established in the early 1993 and stand as a leading institution in the eastern part of Sudan.

3.3. Setting:

This study was conducted at Kassala teaching hospital. This hospital was established in 1905.The hospital provides most types of medical services (medicine, surgery, pediatric and intensive care unit), laboratory and radiology services. The Hospital encompasses about 208 beds. Beside these there are tuberculosis and HIV centers. In the hospital there is a big theater complex in which most type of general operations can be done (caesarean, GIT surgery and orthopedic surgery …etc). There are two diabetic outpatient clinics which were established in 2010, one for adult and other for children, and they are composed of three rooms each; laboratory, doctor and nursing follow-up rooms in which they provide care, follow up and education. In this clinic the nurses rotate the duty

among them. The pediatric clinic is led by specialist and work on weekly basis (every Thursday). Number of patients attending this clinic ranges from 25 to 35 per week. The adult clinic works on daily basis and patients number ranges from 5 to 15.

3.4 Study population:

This study includes diabetic patients admitted at Kassala teaching hospital or those who visited the outpatient diabetic clinics for adult during the time of the study.

Inclusion criteria:

- Both sexes
- Age: more than 20.
- Agreement to participate

Exclusion criteria:

- Patients participated in pilot study
- Patients with advanced diabetic complications
- Age less than 20 years.

3.5. Sampling and sample size:

All patients who attended the diabetic center at the time of the study and fulfilled the inclusion criteria were included

3.6. Data collection tools:

The following two tools were used to collect data during this study:

- Structured questionnaire for patients.
- Observational Checklist for patients.

Both tools were designed and developed by the researcher.

3.6.1. Structured questionnaire for patients:

This tool contains four sections:

Section one*:*

Concerned with demographic data, it includes eight structured questions related to patient age, sex, educational level, occupation, and marital status, type of diabetes, duration of illness and duration of treatment.

Section two*:*

Include questions regarding patient's knowledge about diabetes mellitus such as definition, clinical manifestations, and sources of information about diabetes.

Section three*:*

Includes structured questions designed to obtain information about patients knowledge regarding self-monitoring of blood glucose as follow: glucometer and its benefits, self-monitoring of blood glucose, regularity of blood glucose, time for self-monitoring, condition for self-monitoring, interpretation and uses of result, response to hypo and hyperglycemia.

Section four:

Includes structured questions designed to obtain information about patients' knowledge regarding self-monitoring of urine glucose; include: knowledge about using urine strips and sources of information about it, self-monitoring of urine glucose, time for self-monitoring, interpretation and response to result.

3.6.2. Observational checklist:

An observational checklist was developed by the researcher guided by reviewing text books and other literature [47],[48],[49]

Scale system:

The scale system had been described according to the respondents' skills and rated for good performance, satisfactory performance and poor performance.

The observational checklist includes:

Step	Good	Satisfactory	Poor
Degree	3	2	1

- Blood glucose test checklist, composed of 15 steps
- Urine glucose test checklist, composed of 13steps

In blood glucose test checklist:

- More than 30 degrees were considered as good performance.
- 15 to30 degrees were considered as satisfactory performance.
- And less than 15 degrees were taken as poor performance.

In urine test checklist:

- More than 26 degrees were considered as good performance.
- 13 to 26 degrees were considered as satisfactory performance.
- And less than 13 degrees were considered as poor performance.

Scale system of knowledge:

- More than (75%) is good knowledge.
- (50%-75%) is fair knowledge.
- And below (50%) is poor knowledge.

3.7. Operational Design:

- Operational design includes pilot study and data collection technique.

3.7.1. Validity and reliability:

- The tools have been examined, revised and modified to meet the needs of achieving the aims of the study.
- A pilot study was carried before embarking on the actual study (data collection) to test applicability of the tools of data collection and to estimate the time required for filling the required forms. It was carried out on twenty diabetic patients to evaluate the content of tools in order to determine whether or not the items were understood by the patients.

The results of pilot were as follows:

- Some items were modified; rephrased
- Based on pilot results the modification, furthermore the researcher refined each tools, and item and ensured that each tool achieved the aims of the study.
- The participants of the pilot study (20 patients) were excluded from the study population

3.8. Data collection technique:

The data was collected in two phases before implementation of educational program (pretest data), in which interview and questionnaire filled by the researcher after explanation verbally the purposes of the study and a written consent was taken and then each patient was observed by simplified checklist to perform the skills. After the implementation of this program in the outpatient diabetic clinic, eight months later the same tools used in pretest was used to collect post-test data from patients.

- **Experimental design model:**

Content	Pre test	Training session	Post test
Knowledge map	O1	X1	O2
Practice map	O1	X1	O2

Note:

- (1) X = the experimental treatments
- (2) O1 = the pre-test
- (3) O2 = the post-test

Operational procedure

Test	**Time**	**Period**	**Task**
Pre test	4 month	4 weeks	Questionnaire :- filled by the researcher (5-10) minutes
		12 weeks	Observational skills :-each patient was observed alone (10) minutes
Teaching of patients in large 4 groups (25-30) for lectures, and each group divided to small group (5-7) to group discussion and practice	8 month	8 weeks	Diabetes in general
		12 weeks	Blood glucose test
		12 weeks	Urine glucose test
After program	4 months	4weeks	Questionnaire :-filled by the researcher (5-10) minutes
		12 weeks	Observational skills :- each patients was observed alone by the researcher (10) minutes

3.9 Ethical considerations:

- The study was approved by ethical committee of the college and hospital.
- Before conducting the study permission was taken from hospital general manager.
- The purpose of the study was explained to each one of the responders and the researcher assured them that the data collected through the questionnaire will remains confidential and it will not be allowed for any person to identify. Responders were informed that they could refuse to participate in the study and withdraw from it at any time.
- Clarification of the aims of the study to each of the patients had been explained verbally, to be familiar with the importance of their participations, and then written consent has been taken in additional, assuring them that, obtained information will be only used for the research purposes and the patients have choice to participate or stop at any time he\she wish.

3.10. Health Education Program:

An intense educational program has been designed by the researcher based on actual assessment of diabetic adult's needs to improve self-care practice regarding monitoring of blood and urine glucose in the light of the available researches and literature. The intervention has been developed in a simple Arabic language to cover the relevant theoretical and practical aspects of self-monitoring of blood and urine glucose of diabetic adults. Different teaching methods as lecture, discussion, demonstration, and re-demonstration, have been used .The intervention has been implemented to diabetic patients in large and small groups divided into four main large groups each group contains (25-28) patients and every large groups divided to four small group each group includes (6-7) patients. The program has been

implemented in two sessions per week for eight months. Each session about one hour and at the end of each session, each patient has been assessed for his/her understanding of the instructions. The impact of the program was be determined by the improvement of the knowledge and practice of diabetic patients about self-monitoring of blood and urine glucose, also they will be more compliant to diabetes, to decrease the occurrence of diabetes complications.

Models:

Real objects (glucometer devices, blood and urine strips, urine container, lancet, cotton, alcohol, diabetic note book, pen), simulated left arm model, has been used. The researcher used different media as colored pictures showing sites of taking sample, video for demonstration and did actual glucose test for blood and urine and gave them hand out and booklets.

3.11. Data analysis:

After the data was collected, it was coded and transferred into a specially designed formats so as to be suitable for computer feeding by using the software program SPSS version 16, following data entry, checking and verification process were carried out to avoid any errors during data entry. Frequency analysis, cross tabulation, and manual revision were all used to detect any errors.

The following statistical measures were used

1. Descriptive measures includes: count, percentage, mean, and standard deviation.
2. Statistical test includes: Chi square test, T test was used for quantitative variables for research questions.
3. Correlation between the variable of the study.

The level of significance selected for this study was **P- value** equal to or less than **0.05.**

Chapter Four

- Results

4. Results

4.1: Demographic characteristic of the studied group.

A total of 109 diabetic patients were included in the study, (61) (56%) were female, (48) (44%) male, and (4) (3.7%) type1 diabetes, (105) (96.3%) type2 diabetes.

4.1.1: Age:

Table (1): Distribution of the studied group according to their age

N = 109

Item / **Age in years**	**Frequency**	**Present %**
15 - 25	4	3.7
26 - 40	31	28.4
41 - 65	62	56.9
More than 65	12	11.0
Total	**109**	**100**

This table shows that, age of the studied group ranged between (20-70) years, more than half of them (56.9%) ranged between (51-65) years.

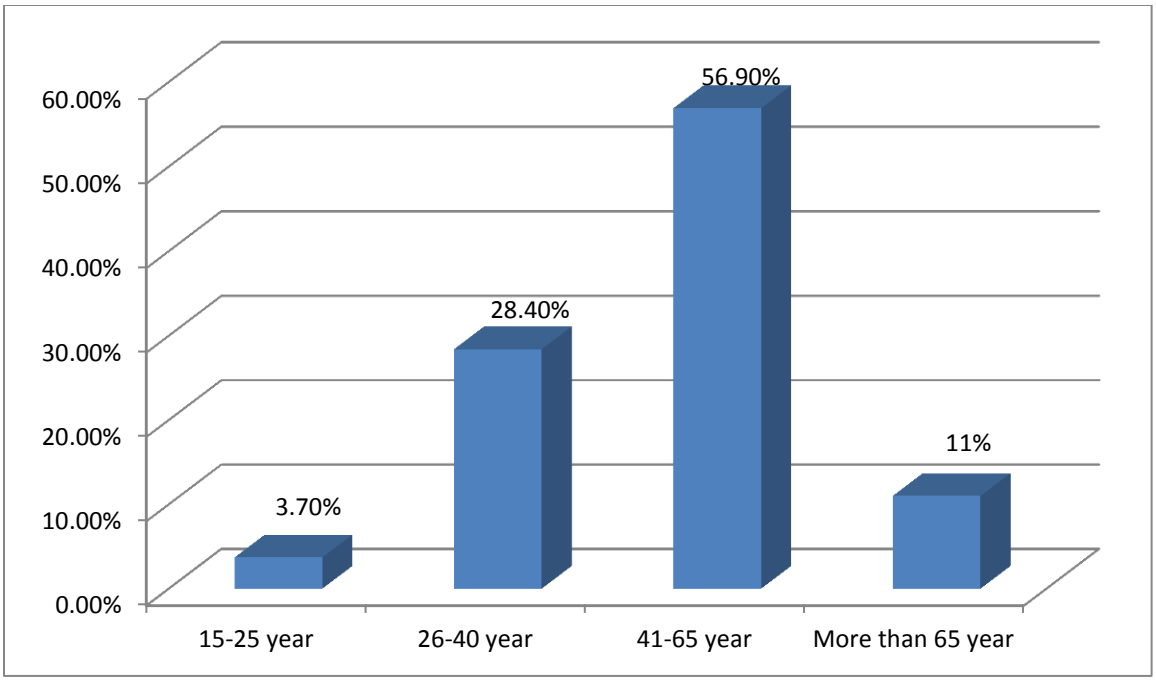


Figure (1): Distribution of age of the studied group

N = 109

4.1.2: Level of education:

Table (2): Distribution of the studied group according to their level of education

N = 109

Item Level of education	Frequency	Present %
Illiterate	46	42.2
Primary education	34	31.2
Secondary education	19	17.4
Graduate	8	7.3
Post graduate	2	1.8
Total	**109**	**100**

This table shows that, more than two fifth of the studied group (46) (42.2%) were illiterate and the graduated participants were only (10) (9.1%).

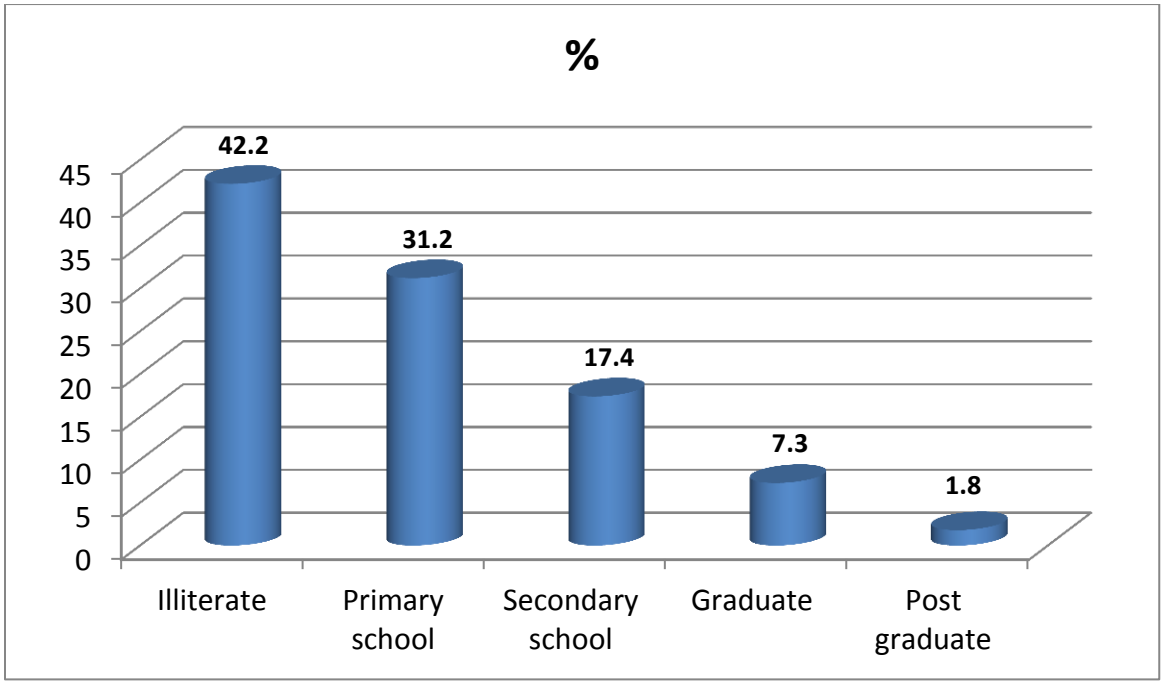


Figure (2): Distribution of the studied group according to their level of education

N = 109

4.1.3: Occupation:

Table (3): Distribution of the studied group according to their occupation

N = 109

Item Occupation	Frequency	Present %
Free worker	18	16.5
Employee	25	22.9
House wife	37	33.9
Student	3	2.8
Worker	7	6.4
Retired	19	17.4
Total	**109**	**100**

This table shows that more than one third (37) (33.9%) of the participants were house wife, followed by employee (32) (29.3 and only (3) (2.8%) were student.

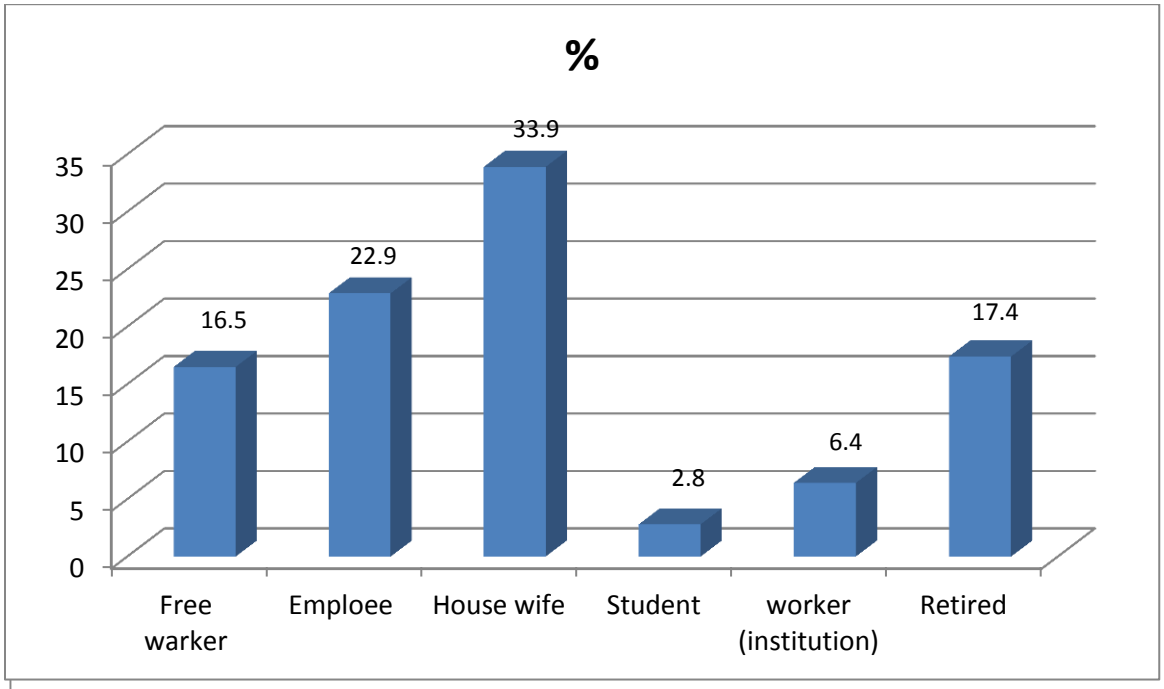


Figure (3): Distribution of the studied population according to their occupation.

N = 109

4.1.4: Duration of the disease:

Table (4): Distribution of the studied group according to the duration of their disease

Item Duration of the disease	Frequency	Present %
Less than one year	4	3.6%
1-5 years	39	35.8%
6-10 years	33	30.3%
More than 10 years	33	30.3%
Total	**109**	**100**

N = 109

This table shows that more than one third of the participants (39) (35.8%) had duration of their disease between (1-5) years, and only (4) (3.6%) were recently diagnosed.

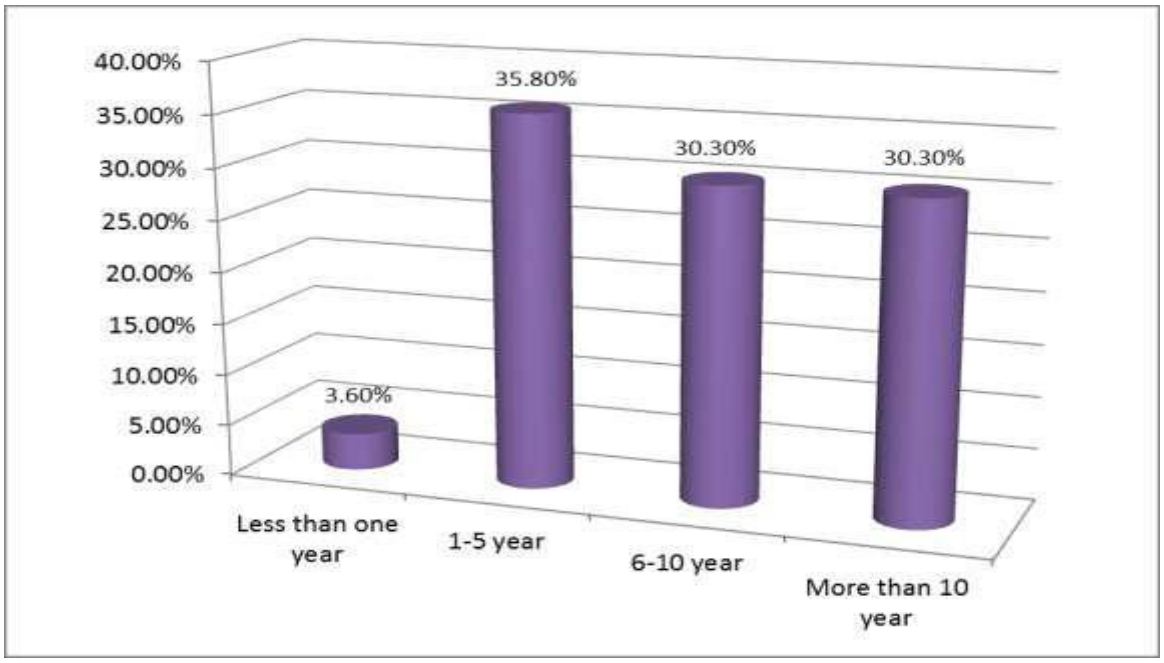


Figure (4): Distribution of the studied group according to the duration of their disease

N=109

4.1.5: Duration of treatment:

Table (5): Distribution of the studied group according to the duration of treatment of their disease

Item Duration of treatment (year)	Frequency	Present %
Less than one	6	5.5
1- < 6	43	39.4
6-10	31	28.4
More than 10	29	26.6
Total	**109**	**100**

N = 109

This table shows that all participants are on regular treatment. More than one third of them (39) (35.8%) were on regular treatment for (1- < 6) year, and only (6) (5.5%) less than one year

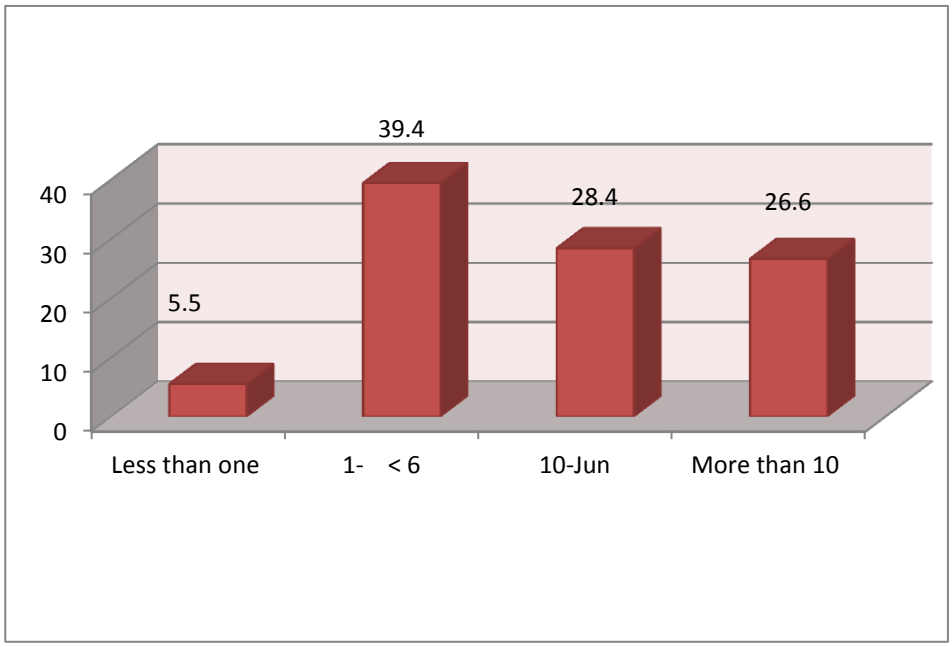


Figure (5): Distribution of the studied group according to the duration of treatment of their disease N=109

4.1.6: type of diabetes mellitus:

Table (6): Distribution of the study group according to the type diabetes mellitus

N = 109

Item Type of diabetes	Frequency	Present %
Type 1	4	3.7%
Type 2	105	96.3%
Total	**109**	**100**

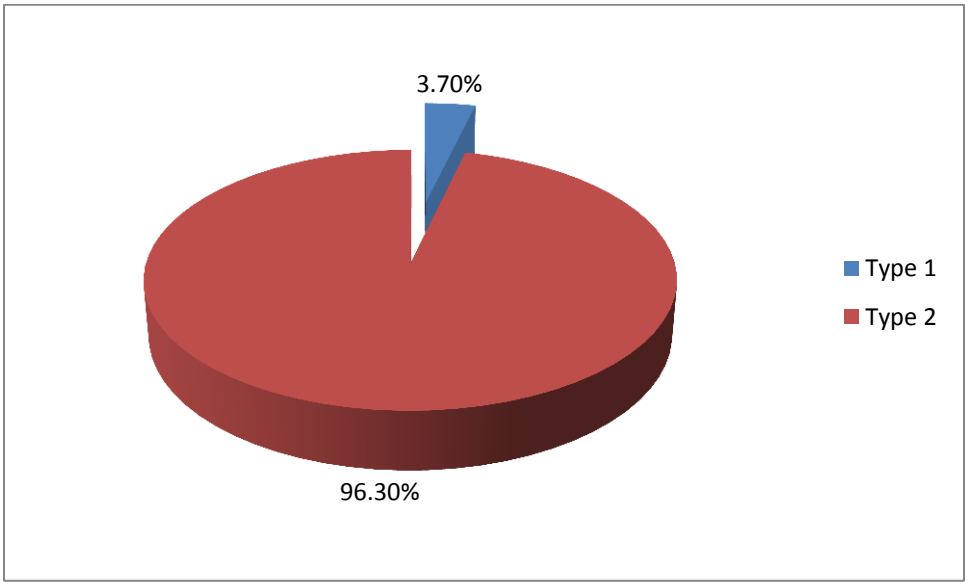


Figure (6): Distribution of the study group according to the type diabetes mellitus

N = 109

Table (7): Distribution of the study group according to the type treatment

N = 109

Item Type of treatment	Frequency	Present %
Insulin	27	24.8%
Oral anti-diabetic	81	74.3%
Diet and exercise only	1	0.9%
Total	**109**	**100**

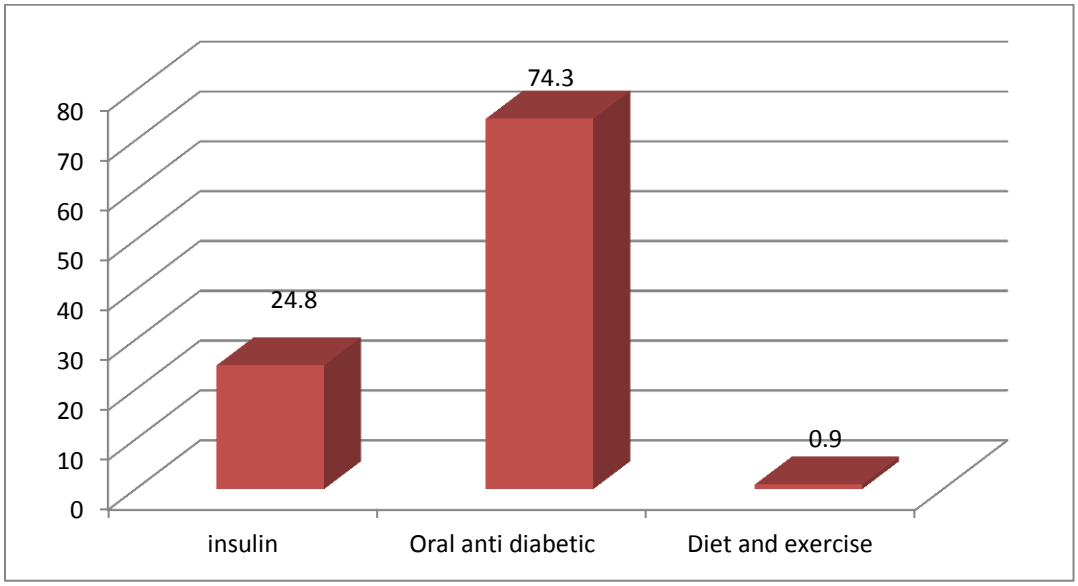


Figure (7): Distribution of the study group according to the type treatment

N = 109

4.2: Comparisons between knowledge and attitude of the studied group regarding self-monitoring of glucose:

Table (8): Distribution of studied group according to their knowledge about the glucometer before and after intervention

N = 109

Item	Before intervention		After intervention		*P* value
knowledge about the glucometer	**Frequency**	**Percentage %**	**Frequency**	**Percentage %**	
know the glucometer and how to use	20	18.3	109	100	0.000
know the glucometer but not knowing how to use	34	31.2	-	-	
Know nothing about the glucometer and how to use	55	50.5	-	-	
Total	109	100	109	100	

This table shows that only (18.3%) of the participants know the glucometer device and used it before intervention, compared to half of the participants (50.5%) who had no idea about it, but after intervention all of participant know the glucometer device and how to use. (P=0.000).

Table (9): Distribution of studied group according to source of their information they have about self-monitoring of blood and urine glucose
N = 109

Item	Doctor or nurse	Other Patient	Relative or friend	Mass media	Have no information
Blood	7 (6.4%)	4 (3.7%)	11(10.1%)	1(0.9%)	86 (78.9%)
Urine	10 (9.2%)	2 (1.8%)	8 (7.3%)	3 (2.8%)	86(78.9%)

Table (9) shows that, most of the participants (86) (78.9%) had no idea about self-monitoring of glucose in blood and urine in contrast to minorities who got their information from different sources

Table (10): Distribution of the studied group according to the daily urine test for glucose

N = 109

Item	Before intervention		After intervention		P value
	Check	Never check	Check	Never check	
	Frequency	Frequency	Frequency	Frequency	
Urine	14 (12.8%)	95 (87.2%)	109 (100%)	-	0.000

This table shows that the majority of the studied group (87.2%) never tested their urine for glucose before intervention, after intervention all of them test it daily.

Table (11): Distribution of the study's group according to daily testing of blood for glucose before intervention

N = 109

Item	Check		Never check	
	Frequency	**Percentage %**	**Frequency**	**Percentage %**
Blood	28	25.7	81	74.3

This table shows that the majority of the studied group never tested their blood for glucose before intervention.

Table (12): Distribution of the study's group every other day testing of blood for glucose after intervention

N = 109

Item	Check		Never check	
	Frequency	Percentage %	Frequency	Percentage %
Blood	109	100	0	0

This table shows that the all of the studied group tested their blood for glucose after intervention day after day.

Table (13): Distribution of the studied group according to their understanding of how frequent they need to check their blood glucose level

N = 109

Item	Before intervention	After intervention
Frequency of blood glucose test	**Frequency**	**Frequency**
Regular	19 (17.4%)	109 (100%)
Sometimes	53 (48.6%)	-
On need	37 (33.9%)	-
Total	**109 (100%)**	**109 (100%)**

Table (13) shows that, a minority of the study group (17.4%) understood the need of regular follow up of blood glucose, about half (48.6) of them thought that it is needed sometimes and one third (33.9) only when needed. After intervention all of them understood the need for regular blood glucose test.

4.3: Differences between studied group knowledge regarding diabetes mellitus:

Table (14): Distribution of the study group according their knowledge about the definition of diabetes mellitus

N = 109

Item	Before intervention		After intervention		P value
Knowledge about the definition of the diabetes mellitus	**Frequency**	**Percentage %**	**Frequency**	**Percentage %**	
Good knowledge	48	44	75	68.8	
Satisfactory knowledge	19	17.4	13	11.9	
Poor knowledge	32	29.4	21	19.3	
Don't know	10	9.2	0	-	
Total	**109**	**100**	**109**	**100**	**0.01***

* = the value is significant

This table shows that good knowledge of the study's group regarding definition of diabetes increased from (44%) in pretest to (68.8%) with significant variation

(P=0.01), while poor knowledge and don’t know score level decreased from (29.4%) to (19.3%) and from (9.2%) to (0%) after intervention.

Table (15): Distribution of the study group according to their knowledge about symptoms and signs of diabetes mellitus, before and after intervention

N = 109

Item	Before intervention		After intervention		P .value
Knowledge about Signs and symptoms of diabetes	**Frequency**	**Percentage %**	**Frequency**	**Percentage %**	
Good	82	75.2	**97**	**89**	**0.01***
Satisfactory	17	15.6	**10**	**9.2**	
Poor	5	4.6	**2**	**1.8**	
Don't know	5	4.6	**0**	**-**	
Total	109	109	**109**	**100**	

* = The value is significant

Table (15) shows that, poor score level of knowledge improved from (4.6% to 1.8 %), and good knowledge rises from (75.7% to 89 %) after intervention with statistically significant test (P=0.01).

Table (16): Distribution of the study group according to their knowledge about the appropriate response during hyperglycemia

N = 109

Item	Before intervention		After intervention		
Appropriateness of knowledge	**Frequency**	**Percentage %**	**Frequency**	**Percentage %**	***P* value**
Good	17	15.6	59	54.1	**0.01***
Satisfactory	33	30.3	25	22.9	
Poor	58	53.2	25	22.9	
Don't know	1	0.9	0	-	
Total	**109**	**100**	**109**	**100**	

* = The value is significant

The table shows that poor knowledge regarding response during hyperglycemia constituted (53.2%) among the participants before intervention, this percentage decreased to (22.9%) after intervention, while good knowledge increased from (16.6%) to (54.1%) after intervention with significant P value (P=0.01).

Table (17): Distribution of the study group according to the perfectness of the response to hypoglycemia

N = 109

Item	Before intervention		After intervention		
Perfectness of response	**Frequency**	**Percentage %**	**Frequency**	**Percentage %**	***P* value**
Good	26	23.9	56	51.4	**0.01***
Satisfactory	47	43.1	42	38.5	
Poor	36	33	11	10.1	
Total	**109**	**100**	**109**	**100**	

* = The value is significant

This table showed that about one third of study population (33%) had poor attitude regarding response during hypoglycemia before intervention, this percentage decrease to (10.1%) after intervention, while good attitude increased from (23.9%) to about half (51.4%) after intervention (P=0.01)

Table (18): Distribution of the study group according to their knowledge about the importance of the results of blood glucose test, before and after intervention

N = 109

Item	Before intervention		After intervention		
Knowledge about the importance of test result	**Frequency**	**Percentage %**	**Frequency**	**Percentage %**	***P* value**
Good	47	43.1	66	60.6	
Satisfactory	21	19.3	21	19.3	
Poor	37	33.9	22	20.2	
Don't know	4	3.7	0	-	
Total	**109**	**100**	**109**	**100**	**0.01***

* = The value is significant

The table shows that good knowledge of studied group about the importance the results of blood glucose test increased from (43.1%) before intervention to (60.6%) after intervention, while the poor knowledge decrease from (33.9%) to (20.2%) with significant P value (***p*** 0.01).

Table (19): Distribution of studied group according to their response to the

result of urine glucose test

N = 109

Item	Before intervention		After intervention		*P* value
Response to urine test result	**Frequency**	**Percentage %**	**Frequency**	**Percentage %**	
Good	5	(4.6%)	37	(33.9%)	**0.01***
Satisfactory	7	(6.4%)	27	(24.8%)	
Poor	24	(22%)	44	(40.4%)	
No response	73	(67%)	1	(0.9%)	
Total	**109**	**100**	**109**	**100**	

* = The value is significant

Good response to urine glucose test result increased from (4.6%) to (33.9%) after intervention, but the poor attitude increase from (22%) to (40.4%) because it encompassed the participants who had never know the response before intervention (***p*** 0.01).

Table (20): Distribution of the study group according to the differences in

their knowledge about the normal range of blood glucose before and after intervention

N = 109

Item	Before intervention		After intervention		*P* value
Knowledge about the normal range	**Frequency**	**Percentage %**	**Frequency**	**Percentage %**	
Know	40	36.7	91	83.5	**0.05***
Don't know	69	63.3	18	16.5	
Total	**109**	**100**	**109**	**100**	

* = The value is significant

Table (20) shows that (83.5%) of the participants know the normal range of blood glucose after the educational program in contrast to (36.7%) before it with significant P value (***p***=0.05).

Table (21): Knowledge of participants about conditions which need checking of blood glucose during the day

N = 109

Item	Before intervention		After intervention		
Condition	**Frequency**	**Percentage %**	**Frequency**	**Percentage %**	***P* value**
In hypoglycemia and hyperglycemia and exercise	43	39.4	78	71.6	
In hypoglycemia and or hyperglycemia and or exercise	56	51.4	31	28.4	**0.01***
I don't know	10	9.2	0	-	
Total	**109**	**100**	**109**	**100**	

* = The value is significant

Before the intervention; about half of the participants (51.4%) know that either hypoglycemia or hyperglycemia or exercise need checking of blood glucose during the day, while (39.4%) know that all these cases need check; but after intervention (71.6%) of participants become aware that all these condition need check of blood glucose during the day (***p***=0.01).

Table (22): Distribution of the study group according to their knowledge about the time of testing blood glucose in relation to meals

N = 109

Item	Before intervention		After intervention		
Timing of glucose test regarding meal	**Frequency**	**Percentage %**	**Frequency**	**Percentage %**	***P* value**
Before and 2 hours after meal	39	35.8	79	72.5	**0.01***
Before or 2 hours after meal	67	61.5	30	27.5	
Don't *know*	3	2.8	0	-	
Total	**109**	**100**	**109**	**100**	

* = The value is significant

This table shows that, more than one third (35.8%) of the participants know that the blood glucose is to be tested before and after meal during the pretest test, this percentage increased to (72.5%) after intervention. In testing their responses about only before or after meal, the score decrease from (61.5%) to (27.5%) after intervention (***p***=0.01).

Table (23): Knowledge of studied group about the effectiveness of using glucometer

N = 109

Item	Before intervention		After intervention		
Knowledge about the benefits of using glucometer	**Frequency**	**Percentage %**	**Frequency**	**Percentage %**	***P* value**
Good	18	16.5	47	43.1	**0.01***
Satisfactory	35	32.1	29	26.6	
Poor	50	45.9	33	30.3	
Don't know	6	5.5	0	-	
Total	**109**	**100**	**109**	**100**	

* = The value is significant

Table (23) shows that (16.5%) of the participants had good knowledge regarding effectiveness of using glucometer before intervention, this percentage increase to (43.1%) after intervention , while poor knowledge decrease from (45.9%) to (30.3) after intervention with significant variation (***p***=0.01).

Table (24): Distribution of the studied group according to their ability to interpret the blood glucose test result, before /after intervention in the study group

N = 109

Item	Before intervention		After intervention		*P* value
Ability for interpretation	**Frequency**	**Percentage %**	**Frequency**	**Percentage %**	
Able	43	39.4	93	85.3	**0.000****
Unable	66	60.6	16	14.7	
Total	**109**	**100**	**109**	**100**	

** = The value is a highly significant

Table (24) shows that (39.4%) were able to interpret the result before intervention, this percentage increased to (85%) after intervention, compared with those who were unable (60%) before and (14.7%) after intervention with highly significant P value (***p***=0.000).

Table (25): Distribution of studied group according to the appropriateness of performance of self-monitoring of urine glucose

N = 109

Item	Before intervention		After intervention		
Appropriateness of self-testing of urine Glucose	**Frequency**	**Percentage %**	**Frequency**	**Percentage %**	***P* value**
Appropriate	24	22	109	100	**0.01***
Not appropriate	85	78	0	-	
Total	**109**	**100**	**109**	**100**	

* = The value is significant

Table (25) shows that (22%) of the participants were appropriately monitoring their urine glucose by themselves before intervention this percentage increased to (100%) after intervention with statistically significant P value (**p**=0.01).

Table (26): Distribution of the study group according to their ability to interpret the results of urine glucose test, before /after intervention

N = 109

Item	Before intervention		After intervention		
Ability for interpretation	**Frequency**	**Percentage %**	**Frequency**	**Percentage %**	***P* value**
Able	25	22.9	107	98.2	**0.01** *
Unable	84	77.1	2	1.8	
Total	**109**	**100**	**109**	**100**	

* = The value is significant

Table (26) shows that (22%) of the participants were able to interpret urine test result by themselves before intervention this percentage increased to (98.2%) after intervention while unable group from 77.1% to 1.8% with significant P value (***p***=0.01).

4.4: Cross tabulation between variables of the study

Table (27): Cross tabulation between age of the study group and their knowledge about the definition of diabetes mellitus before and after intervention

N = 109

Item	Pre intervention				Post intervention		
	Score level of knowledge						
Age(years)	**Good**	**Satisfactory**	**Poor**	**Not know**	**Good**	**Satisfactory**	**Poor**
15 – 25	1 (25%)	1 (25%)	1 (25%)	1 (25%)	2 (50%)	1 (25%)	1 (25%)
26 – 40	18 (58%)	5 (16.1%)	5 (16.1%)	3 (9.8%)	22 (71%)	3 (9.7%)	6 (19.4%)
41 – 65	28 (45.2%)	11 (17.7%)	19 (30.6%)	4 (6.5%)	46 (74.2%)	8 (12.9%)	8 (12.9%)
More than 65	1 (8.3%)	2 (16.7%)	7 (58.3%)	2 (16.7%)	5 (41.7%)	1 (8.3%)	6 (50%)
Total	**48 (44%)**	**19 (17.4%)**	**32 (29.4%)**	**10 (9.2%)**	**75 (68.8%)**	**13 (11.9%)**	**21 (19.3%)**
***p*- value**	***0.016***				***0.212***		

Table (27) shows that, most of the participants of all age group (48) (44%) displayed good knowledge about the definition of diabetes mellitus before intervention, this percentage increases to (75) (68.8%) after intervention, while poor knowledge decreased from (32) (29.4%) to (21) (19.3%) with no statistical significance after intervention (***P***= 0.212). The age group of (26-40) years showed good knowledge about the definition of diabetes mellitus, while the participant aged over 65 years have poor knowledge before and after intervention.

Table (28): Cross tabulation between age of the study's group and their knowledge about signs and symptoms of diabetes mellitus before and after intervention

N = 109

Item	Pre intervention				Post intervention		
	Score level of knowledge						
Age(years)	**Good**	**Satisfactory**	**Poor**	**Not know**	**Good**	**Satisfactory**	**Poor**
15 – 25	3(75%)	1(25%)	0	0	3(75%)	1(25%)	0
26 – 40	24(77.4%)	4(12.9%)	2(6.5%)	1(3.2%)	27(87.1%)	4(12.9%)	0
41 – 65	48(77.4%)	9(14.5%)	2(3.2%)	3(4.8%)	58(93.5%)	3(4.3%)	1(1.6%)
More than 65	7(58.3%)	3(25%)	1(8.3%)	1(8.3%)	9(75%)	2(16.7%)	1(8.3%)
Total	**82(75.2%)**	**17(15.6%)**	**5(4.6%)**	**5(4.6%)**	**97(89%)**	**10(9.2%)**	**2(1.8%)**
***p*- value**	***0.015***				***0.362***		

Table (28) shows that, most of the participants of all age groups had increase their good knowledge regarding signs and symptoms of diabetes from (82) (75.2%) before intervention to (97) (89%) after intervention, while only (2) (1.8%) of participants had poor knowledge after intervention and their age more than 40 years, with no

statistical significance after intervention (***P***= 0.362) while before intervention (***P***= 0.015). The age group of (41-65) years showed good knowledge regarding signs and symptoms of diabetes, while the group of more than 65 years showed poor knowledge before and after intervention.

Table (29): Cross tabulation between age of the studied group and the performance of blood glucose test before and after intervention

N = 109

Item	Pre intervention			Post intervention		
	Score level of performance					
Age(years)	**Good**	**Satisfactory**	**Poor**	**Good**	**Satisfactory**	**Poor**
15 – 25	1(25%)	1(25%)	2(50%)	4(100%)	0	0
26 – 40	1(3.2%)	8(25.8%)	22(71%)	29(93.5%)	1(3.2%)	1(3.2%)
41 – 65	3(4.8%)	10(16.1%)	49(70%)	52(83.9%)	8(12.9%)	2(3.2%)
More than 65	0	0	12(100%)	10(83.3%)	2(16.7%)	0
Total	**5(4.6%)**	**19(17.4%)**	**85(78%)**	**95(87.16%)**	**11(10.1%)**	**3(2.75%)**
***p*- value**	**0.087**			**0.554**		

Table (29) shows the relation between patient age and their performance regarding blood glucose test before and after intervention. It shows that the participants whose their age ranged between (15-25 year) their good performance improve from (1) (25%) before intervention to reach (4) (100%) after intervention and all of those

of age group (more than 65 year) never know how to perform the blood glucose test before intervention but their good performance reach (10) (83.3%) after intervention, in-spite of that, there are no statistical relation before (***P*=0.087)** and after intervention (***P*= 0.554**).The age group of (41-65) years showed good performance before intervention but after intervention was showed poor one, while poor performance had shown by the participant over 65 years, and after intervention the good performance done by the group of (15-25) years.

Table (30): Correlation between age of the studied group and the performance of urine glucose test before and after intervention

N = 109

Item	Pre intervention			Post intervention		
	Score level of performance					
Age(years)	**Good**	**Satisfactory**	**Poor**	**Good**	**Satisfactory**	**Poor**
15 – 25	0	1(25%)	3(75%)	4(100%)	0	0
26 – 40	0	5(16.1%)	26(83.9%)	27(87.1%)	3(9.7%)	1(3.2%)
41 – 65	1(1.6%)	11(17.7%)	50(80.6%)	55(88.7%)	7(11.3%)	0
More than 65	0	2(16.7%)	10(83.3%)	11(91.7%)	1(8.3%)	0
Total	**1(0.9%)**	**19(17.4%)**	**89(81.7%)**	**97(88.99%)**	**11(10.09%)**	**1(.92%)**
***p*- value**	**0.094**			**0.740**		

Table (30) shows the relation between patient age and their performance regarding urine glucose test before and after intervention. It revealed that, participants of age ranged between (15- 25)year, (26-40) year, and those who have (more than 65 year)had poor performance of urine glucose test before intervention as follow 3(75%),26(83.9%),10(83.3%) respectively, but after intervention their good performance become (4)

(100%),(27) (87%),(11) (91%) respectively and only (1) participant of age (41-65 year) showed poor performance after intervention , with no statistical significance before intervention **(*P*=0.094)** and after intervention **(*P*= 0.740).**Before intervention the age group of (41-65) years showed good performance while (26-40) years most poor one, after intervention, the good performance had shown by (15-25)years while the poor one was (26-40) years.

Table (31): Cross tabulation between age of the studied group and their ability to interpret the result of urine glucose test before and after intervention

N = 109

Item	Pre intervention		Post intervention	
	Score level of knowledge			
Age(years)	**Able**	**Unable**	**Able**	**Unable**
15 – 25	1(25%)	3(75%)	4(100%)	0
26 – 40	5(16.1%)	26(83.9%)	31(100%)	0
41 – 65	17(27.4%)	45(72.6%)	61(98.4%)	1(1.6%)
More than 65	2(16.7%)	10(83.3%)	11(91.7%)	1(8.3%)
Total	**25(22.9%)**	**84(77.1%)**	**107(98.17%)**	**2(1.83%)**
***p*- value**	**0.089**		**0.418**	

Table (31) shows that, almost all the participants of different age groups were able to interpret the results of urine glucose test except two of them after intervention. Most of participants of age group (15-25 year) and (26-40 year) never able to interpret urine glucose test result (3) (75), (26) (83) respectively before intervention, all of them become able for interpretation. In-spite of the relation is not statistically significant (P= 0.089) before intervention and (***P*= 0.418)**, put there are a relation between age and ability of interpretation of urine glucose

test result. The age group (41-65) years showed good ability of interpretation of urine glucose test result before intervention, while after intervention for age group (15-40) years. But the poor ability had shown by age group (26-40)years, (more than 65)years before and after intervention respectively.

Table (32): Correlation between level of education of the studied group and their knowledge about definition of diabetes before and after intervention

N = 109

Item	Pre intervention				Post intervention		
	Score level of knowledge						
Level of education	**Good**	**Satisfactory**	**Poor**	**Don't know**	**Good**	**Satisfactory**	**Poor**
Illiterate	7(15.2%)	9(19.6%)	22(47.8%)	8(17.4%)	21(45.7%)	8(17.4%)	17(37%)
Primary school	24(70.6%)	4(11.8%)	5(14.7%)	1(%)	28(82.3%)	3(8.8%)	3(8.8%)
Secondary school	13(72.2%)	4(22.2%)	1(5.6%)	1(%)	17(89.5%)	1(5.3%)	1(5.3%)
Graduate	4(50%)	2(25%)	2(25%)	0	8(100%)	0	0
Post graduate	0	0	2(100%)	0	1(50%)	1(50%)	0
Total	**48(44%)**	**19(17.4%)**	**32(29.4%)**	**10(%)**	**75(68.8%)**	**13(11.9%)**	**21(19.3%)**
***p*- value**	**0.027**				**0.001****		

** = *The value is a highly significant*

Table (32) showed that there was highly significant relation between educational level and knowledge about definition of diabetes (***P*=0.027**) before **(*P*=0.001)** after intervention. The educated patient (secondary (24) (72.2%), graduated (4) (50%) displayed good knowledge regarding the definition of diabetes mellitus before intervention, this percentage reach (17) (89%) and (8) (100%) respectively after intervention, in contrast to the illiterates (45.7%) and those of primary education (82.3%) after intervention. in-spite of intervention there are (17) (37%) illiterate had poor knowledge. The graduate showed good knowledge after intervention while illiterate shown poor one, before intervention secondary school shown good knowledge and post graduate appeared poor one.

Table (33): Correlation between the level of education of the study group and their knowledge regarding signs and symptoms of diabetes before and after intervention

N = 109

Item	Pre intervention				Post intervention		
	Score level of knowledge						
Level of education	**Good**	**Satisfactory**	**Poor**	**Not know**	**Good**	**Satisfactory**	**Poor**
Illiterate	28(60.9%)	11(23.9%)	3(6.5%)	4(8.7%)	37(80.4%)	7(15.2%)	2(4.4%)
Primary school	32(94.1%)	1(2.9%)	1(2.9%)	0	33(97.1%)	1(2.9%)	0
Secondary school	15(78.9%)	2(10.5%)	1(5.3%)	1(5.3%)	17(89.5%)	2(10.5%)	0
Graduate	6(75%)	2(25%)	0	0	8(100%)	0	0
Post graduate	1(50%)	1(50%)	0	0	2(100%)	0	0
Total	**82(75.2%)**	**17(15.6%)**	**5(4.6%)**	**5(4.6%)**	**97(89%)**	**10(9.2%)**	**2(1.8)**
***p*- value**	**0.020**				**0.297**		

Table (33) shows that the educated patient (graduated (6) (75%) displayed good knowledge regarding the signs and symptoms of diabetes mellitus more than the illiterates (28) (60.9%) before intervention, the percentage of graduate increase to (8) (100%) while illiterate become (37) (80%). Only illiterate had poor knowledge about

sign and symptoms of diabetes after intervention (2) (4.4).The statistical significance relation appear in pre intervention **(*P*=0.020)** but after intervention **(*P*=0.297).**The graduates and post graduates showed good knowledge after intervention while illiterate shown poor one, before intervention primary school shown good knowledge and illiterate appeared poor one.

Table (34): Correlation between level of education of the study's group and the knowledge of diabetic patients regarding normal range of blood glucose before and after intervention

N = 109

Item	Pre intervention		Post intervention	
	Score level of knowledge			
Level of education	**Know**	**Not know**	**Know**	**Not know**
Illiterate	6(13%)	40(87%)	32(69.6%)	14(30.4%)
Primary school	14(41.2%)	20(58.8%)	30(88.2%)	4(11.8%)
Secondary school	12(63.2%)	7(36.8%)	19(100%)	0
Graduate	6(75%)	2(25%)	8(100%)	0
Post graduate	2(100%)	0	2(100%)	0
Total	**40(36.7%)**	**69(63.3%)**	**91(83.5%)**	**18(16.5%)**
***p*- value**	**0.077**		**0.002****	

** = The value is a highly significant

Table (34) shows highly significant relation between educational level and knowing the normal range of blood glucose. The participants of secondary school (12) (63.2%) and graduate (6) (75%) had known the normal range of blood glucose before intervention with no significant relation **(*P*=0.077),** but after intervention they totally

(100%) know it, while 18 participants still not know the normal range; (14) (30%) of them were illiterate with highly significant relation **(*P*=0.002).**The secondary school, graduates and post graduates showed good knowledge after intervention while illiterate shown poor one, before intervention post graduates shown good knowledge and illiterate had shown poor one.

Table (35): Cross tabulation between level of education of the studied group and the performance of blood glucose test before and after intervention

N = 109

Item	Pre intervention			Post intervention		
	Score level of knowledge					
Level of education	**Good**	**Satisfactory**	**Poor**	**Good**	**Satisfactory**	**Poor**
Illiterate	0	1(2.2%)	45(97.8%)	39(84.8%)	6(13%)	1(2.2%)
Primary school	2(5.9%)	7(20.6%)	25(73.5%)	39(84.8%)	4(11.8%)	2(1.83%)
Secondary school	0	6(31.6%)	13(68.4%)	19(100%)	0	0
Graduate	2(25%)	4(50%)	2(25%)	7(87.5%)	1(12.5%)	0
Post graduate	1(50%)	1(50%)	0	2(100%)	0	0
Total	**5(4.6%)**	**19(17.4%)**	**85(78%)**	**95(87.2%)**	**11(10.1%)**	**3(2.8%)**
***p*- value**	**0.072**			**0.453**		

Table (35) shows that there is a relation between educational level and performance of blood glucose test in spite of no statistical significance. Regardless of the level of education, about (85) (78%) of the study group demonstrated poor performance regarding blood glucose test, (19) patients (17.4%) and only (5) patients (4.6%)

good performance before intervention (***P***=0.072), after intervention the poor performance decrease to (3) (2.8%) while the good performance improved from (5) (4.6%) to (95) (87.2%), (***P***=0.453). before and after intervention, the good performance shown by post graduates and illiterate shown poor one.

Table (36): Correlation between level of education of the studied group and their response to hyperglycemia before and after intervention

N = 109

Item	Pre intervention				Post intervention		
	Score level of attitude						
Level of education	**Good**	**Satisfactory**	**Poor**	**Not know**	**Good**	**Satisfactory**	**Poor**
Illiterate	3(6.5%)	10(21.7%)	32(69.6%)	1(2.2%)	15(32.6%)	14(30.4%)	17(37%)
Primary school	12(35.3%)	12(35.3%)	10(29.4%)	0	22(64.7%)	9(26.5%)	3(8.8%)
Secondary school	1(5.3%)	8(42.1%)	10(52.6%)	0	13(68.4%)	1(5.3%)	5(26.3%)
Graduates	1(12.5%)	3(37.5%)	4(50%)	0	7(87.5%)	(12.5%)	0
Post graduate	0	0	2(100%)	0	2(100%)	0	0
Total	**17(15.6%)**	**33(30.3%)**	**58(53.2%)**	**1(0.9%)**	**59(54.1%)**	**25(22.9%)**	**25(22.9%)**
***p*- value**	**0.055**				**0.001****		

** = The value is a highly significant

This table revealed that, there was highly significant relation between education and the attitude of participants regarding hyperglycemia after intervention compared with the illiterates, it shows the percentage of good attitude pre and after intervention respectively as follow: post graduated (0%) to (100%), graduated (12.5%) to

(87.5%), secondary education (5.3%) to(68.4%), primary education (35.3%) to (64.7%) and illiterates (6.5%) to (32.6%) with highly significant relation (***p***= 0.001) after intervention from (***P***=0.055) before intervention. the post graduates clarified poor response before intervention while shown good one, primary school shown good response before intervention and illiterate shown poor response after intervention.

Table (37): Cross tabulation between level of education of the studied group and the performance of urine glucose test before and after intervention

N= 109

Item	Pre intervention			Post intervention		
	Score level of knowledge					
Level of education	**Good**	**Satisfactory**	**Poor**	**Good**	**Satisfactory**	**Poor**
Illiterate	0	3(6.5%)	43(93.5%)	41(89.1%)	5(10.9%)	0
Primary school	0	4(11.8%)	30(88.2%)	27(79.4%)	6(17.6%)	1(2.9%)
Secondary school	0	7(36.8%)	12(63.2%)	19(100%)	0	0
Graduates	1(12.5%)	4(50%)	3(37.5%)	8(100%)	0	0
Post graduate	0	1(50%)	1(50%)	2(100%)	0	0
Total	**1(0.9%)**	**19(17.4%)**	**89(81.7%)**	**97(89%)**	**11(10.1%)**	**1(0.9%)**
p- value	**0.090**			**0.230**		

Table (37) shows that not only educated patient (secondary school to post graduate) demonstrated proper performance of urine glucose test (100%) after intervention, while their good performance before intervention (0%), (1) (12.5%), (0%) respectively, but also most of the illiterate participants (89.1%) from (0%).With no

statistical significant, before (P=0.090) and after intervention (P=0.230).The secondary school, graduates and post graduates showed good performance after intervention while only graduates before intervention, illiterate shown poor one before intervention but after intervention shown by primary school.

Table (38): Cross tabulation between occupation of the studied group and their knowledge about the definition of diabetes before and after intervention

N = 109

Item	Pre intervention				Post intervention		
	Score level of knowledge						
Occupation	**Good**	**Satisfactory**	**Poor**	**Not know**	**Good**	**Satisfactory**	**Poor**
Free worker	10(55.6%)	3(16.7%)	2(11.1%)	3(16.7%)	14(77.8%)	1(5.6%)	3(16.7%)
Employee	14(56%)	5(20%)	6(24%)	0	20(80%)	3(12%)	2(8%)
House wife	19(52.8%)	6(16.7%)	8(22.2%)	4(10.8%)	25(67.6%)	4(10.8%)	8(21.6%)
Student	1(33.3%)	0	1(33.3%)	1(33.3%)	2(66.7%)	0	1(33.3%)
Worker	2(28.6%)	2(28.6%)	3(42.9%)	0	5(71.4%)	2(28.6%)	0
Retired	2(10.5%)	3(15.8%)	12(63.2%)	2(10.5%)	9(47.4%)	3(15.8%)	7(36.8%)
Total	**48(44%)**	**19(17.4%)**	**32(29.4%)**	**9(8.3%)**	**75(68.8%)**	**13(11.9%)**	**21(19.3%)**
p- value	**0.015**				**0.246**		

Table (38) shows that, regardless of occupation; the participants had developed their knowledge about the definition of diabetes presented as follow: good knowledge (48) (44%) to (75) (68.8%), satisfactory knowledge (19) (17.4%) to (13) (11.9%) and poor knowledge (32) (29.4%) to (21) (19.3%) with no statistical significance after intervention (P= 0.246) but before intervention P value (0.015).Employee had shown good knowledge before and after intervention, while poor knowledge shown by students before intervention and after intervention by retired participant.

Table (39): Cross tabulation between occupation of the studied group and knowledge about the signs and symptoms of diabetes mellitus before and after intervention

N = 109

Item	Pre intervention				Post intervention		
	Score level of knowledge						
Occupation	**Good**	**Satisfactory**	**Poor**	**Not know**	**Good**	**Satisfactory**	**Poor**
Free worker	14(77.8%)	2(11.1%)	1(5.6%)	1(5.6%)	15(83.3%)	3(16.7%)	0
Employee	19(76%)	5(20%)	0	1(4%)	23(92%)	2(8%)	0
House wife	29(78.4%)	4(10.8%)	3(8.1%)	1(2.7%)	35(94.6%)	1(2.7%)	1(2.7%)
Student	2(66.7%)	1(33.3%)	0	0	2(66.7%)	1(33.3%)	0
Worker	7(100%)	0	0	0	7(100%)	0	0
Retired	11(57.9%)	5(26.3%)	1(5.3%)	2(10.5%)	15(78.9%)	3(15.8%)	1(5.3%)
Total	**82(75.2%)**	**17(15.6%)**	**5(4.6%)**	**5(4.6%)**	**97(89%)**	**10(9.2%)**	**2(1.8%)**
p- value	**0.016**				**0.438**		

Table (39) shows that almost all of the participants of different occupation displayed good knowledge regarding the signs and symptoms of diabetes mellitus after intervention with no statistical significance (P=0.438). The worker shown good knowledge and retired appear poor knowledge in before and after intervention.

Table (40): Cross tabulation between occupations of the studied group and the performance of blood glucose test before and after intervention

N = 109

Item	Pre intervention			Post intervention		
	Score level of knowledge					
Occupation	**Good**	**Satisfactory**	**Poor**	**Good**	**Satisfactory**	**Poor**
Free worker	0	5(27.8%)	13(72.2%)	16(88.9%)	1(5.6%)	1(5.6%)
Employee	3(12%)	6(24%)	16(64%)	22(88%)	3(12%)	0
House wife	1(2.7%)	6(16.2%)	30(81.1%)	31(83.8%)	5(13.5%)	1(2.7%)
Student	1(33.3%)	1(33.3%)	1(33.3%)	3(100%)	0	0
Worker	0	0	7(100%)	6(85.7%)	0	1(14.3%)
Retired	0	1(5.3%)	18(94.7%)	17(78.9%)	2(10.5%)	0
Total	**5(4.6%)**	**19(17.4%)**	**85(78%)**	**95(87.2%)**	**11(10.1%)**	**3(2.8%)**
p- value	**0.083**			**0.656**		

Table (40) shows that clear improvement appear in almost all of participants of different occupation in performing the blood test, properly done (95) (87.2%) wile in pre intervention (5) (4.6%), (11) (10.1%)

performed it satisfactory while in pre intervention (19) (17.4%) and only 3 of them (2.8%) of (85) (78%) poor performance with no statistical significant Pre (P=0.083) and post intervention (P=0.656). But good knowledge was found among students (100%).The students shown good performance and worker appear poor performance in before and after intervention.

Table (41): Cross tabulation between occupation of the study group and ability to interpret the result of blood glucose test before and after intervention

N = 109

Item	Pre intervention		After intervention	
	Score level of ability			
Occupation	**Able**	**Unable**	**Able**	**Unable**
Free worker	8(44.4%)	10(55.6%)	15(83.3%)	3(16.7%)
Employee	17(68%)	8(32%)	24(96%)	1(4%)
House wife	14(37.8%)	23(62.2%)	30(81.1%)	7(18.9%)
Student	3(100%)	0	3(100%)	0
Worker	1(14.3%)	6(85.7%)	6(85.7%)	1(14.3%)
Retired	0	19(100%)	15(78.9%)	4(21.1%)
Total	**43(39.4%)**	**66(60.6%)**	**93(85.3%)**	**16(14.7%)**
***p*- value**	**0.070**		**0.402**	

Table (41) shows that most of participants were able to interpret the result of blood glucose test except minority of them (16) (14.7%) after intervention from (66) (60.6%) in pre intervention. no statistical significance in pre and post intervention (P=0.070) (P=402) respectively. But good interpretation was appeared among students (3) (100%) and employee (24) (96%).The students shown good ability and worker appear poor ability in before and after intervention.

Table (42): Cross tabulation between occupations of the study group and their response to hyperglycemia before and after intervention

N = 109

Item	Pre intervention				Post intervention		
	Score level of reaction attitude						
Occupation	Good	Satisfactory	Poor	Not know	Good	Satisfactory	Poor
Free worker	2(11.1%)	5(27.8%)	11(61.1%)	0	6(33.3%)	8(44.4%)	4(22.2%)
Employee	5(20%)	9(36%)	11(44%)	0	20(80%)	2(8%)	3(12%)
House wife	10(27%)	10(27%)	17(45.9%)	0	23(62.2%)	7(18.9%)	7(18.9%)
Student	0	0	3(100%)	0	1(33.3%)	0	2(66.7%)
Worker	0	4(57.1%)	3(42.9%)	0	2(28.6%)	3(42.9%)	2(28.6%)
Retired	0	5(26.3%)	13(68.4%)	1(5.3%)	7(36.8%)	5(26.3%)	7(36.8%)
Total	**17(15.6%)**	**33(30.3%)**	**48(44%)**	**1(0.9%)**	**59(54.1%)**	**25(22.9%)**	**25(22.9%)**
***p*- value**	**0.054**				**0.021***		

* = The value is significant

Table (42) shows that more than half of the participants (59) (54.1%) of (17) (15.6%) of all occupation demonstrate good response to hyperglycemia, while (25) (22.9%) of (33) (30.3%) of them demonstrated satisfactory response and (25) (22.9) (48) (44%) poorly responded. Statistical relation is significant in pre intervention (P=0.054) and highly significant post intervention (P=0.021). The proper response appears in employee (20) (80%).Before intervention, the house wife shown good response and after intervention shown by employee, while the student shown poor response in before and after intervention.

Table (43): Cross tabulation between occupations of the studied group and the performance of urine glucose test before and after intervention

N = 109

Item	Pre intervention			Post intervention		
	Score level of knowledge					
Occupation	**Good**	**Satisfactory**	**Poor**	**Good**	**Satisfactory**	**Poor**
Free worker	0	6(33.3%)	12(66.7%)	15(83.3%)	3(16.7%)	0
Employee	1(4%)	7(28%)	17(68%)	23(92%)	2(8%)	0
House wife	0	2(5.4%)	35(94.6%)	33(89.2%)	3(8.1%)	1(2.7%)
Student	0	1(33.3%)	2(66.7%)	3(100%)	0	0
Worker	0	1(14.3%)	6(85.7%)	6(85.7%)	1(14.3%)	0
Retired	0	2(10.5%)	17(89.5%)	17(89.5%)	2(10.5%)	0
Total	**1(0.9%)**	**19(17.4%)**	**89(81.7%)**	**97(89%)**	**11(10.1%)**	**1(0.9%)**
p- value	**0.096**			**0.950**		

Table (43) shows that, before intervention (1) (0.9%) of participants had good performance regarding urine

glucose test and (89) (81.7%) of them had poor performance, while after intervention all of the participants performed the test properly except only one housewife who was unable to do it. No statistical significance in pre and after intervention (P=0.096), (P=0.950).Students (3) (100%) and employee (23) (92%) was properly performed the test. Employee had shown good performance before intervention and student after intervention, while house wife shown poor performance in before and after intervention.

Table (44): Cross tabulation between occupation of the studied group and their ability to interpret the result of urine glucose test before and after intervention

N = 109

Item	Pre intervention		After intervention	
	Score level of ability			
Occupation	**Able**	**Unable**	**Able**	**Unable**
Free worker	5(27.8%)	13(72.2%)	17(94.4%)	1(5.6%)
Employee	10(40%)	15(60%)	25(100%)	0
House wife	6(16.2%)	31(83.8%)	37(100%)	0
Student	1(33.3%)	2(66.7%)	3(100%)	0
Worker	1(14.3%)	6(85.7%)	7(100%)	0
Retired	2(10.5%)	17(89.5%)	18(94.7%)	1(5.3%)
Total	**25(22.9%)**	**84(77.1%)**	**107(98.2%)**	**2(1.8%)**
***p*- value**	**0.090**		**0.494**	

Table (44) shows that all participants were able to interpret the result of urine glucose testing except only two participants (free worker and retired one) after intervention, while in before intervention (84) (77.1%) unable for interpretation. No statistical significant in pre and post intervention (***P***=0.090), (***P***=0.494).Employee, house wife, students and worker had shown good ability after intervention while only employee in pre intervention, regarding poor ability, it shown by retired before intervention and free worker after intervention.

4.5: Performance of glucose test:

Table (45): Relation between the studied group skill regarding preparation steps of blood and urine glucose test before and after intervention

N = 109

Item			Blood				Urine			
			Before intervention		After intervention		Before intervention		After intervention	
Preparation of equipment										
Good	N	%	4	3.7	85	78.0	7	6.4	86	78.9
Sufficient	N	%	5	4.5	10	9.2	1	0.9	13	11.9
Poor	N	%	100	91.7	14	12.8	101	92.7	10	9.2
Mean			2.88		1.35		2.86		1.3	
Std. Deviation			0.424		0.699		0.499		0.631	
Result			Poor		Good		Poor		Good	
Hand washing										
Good	N	%	6	5.5	76	69.7	1	0.9	70	64.2
Sufficient	N	%	0	0	1	0.9	1	0.9	0	0
Poor	N	%	103	94.5	32	29.4	107	98.2	39	35.8
Mean			2.89		1.6		2.97		1.72	
Std. Deviation			0.458		0.914		0.213		0.963	
Result			Poor		Good		Poor		Sufficient	
Prepare lancet (either inserted in glucometer or free) / Collect urine sample										
Good	N	%	13	11.9	100	91.7	13	11.9	106	97.2
Sufficient	N	%	2	1.8	2	1.8	3	2.8	0	0
Poor	N	%	94	86.2	7	6.4	93	85.3	3	2.8
Mean			2.74		1.15		2.73		1.06	
Std. Deviation			0.658		0.506		0.662		0.329	
Result			Poor		Good		Poor		Good	

Table (45) shows the relation between skills of preparation steps of the studied group regarding blood glucose test and urine glucose test; most of them had poor preparation skills before intervention because the mean of all steps indicate that.

While the result after intervention revealed improvement; the step of hand washing in urine preparation showed sufficient skill but in over-all preparation; most of them prepare in good manner according to its mean.

Table (46): Distribution of the studied group according to their skill regarding performance of the main of blood glucose test before intervention

N = 109

The step	Good	Sufficient	Poor	Mean	Std. Deviation	Result
	N	N	N			
	%	%	%			
Insert the blood strip in the glucometer and insure that the code in the screen and strip are the same	13	2	94	2.74	0.424	Poor
	11.9	1.8	86.2			
Select the appropriate finger and wipe it with alcohol swab	7	5	97	2.83	0.458	Poor
	6.4	4.6	89.0			
Puncture the appropriate finger	20	0	89	2.63	0.658	Poor
	18.3	0	81.7			
Discharge of the first blood drop	4	0	105	2.93	0.658	Poor
	3.7	0	96.3			
Pressure the appropriate finger to collect the blood drop and put it on the blood strip	7	1	101	2.86	0.524	Poor
	6.4	9	92.7			
Put the dry cotton swab on the punctured site and apply pressure on it	3	0	106	2.94	0.778	Poor
	2.8	0	97.2			
Read the number witch display on the screen	21	0	88	2.61	0.378	Poor
	19.3	0	90.7			
Repeat the above steps if you doubt or the number is not clear	1	1	107	2.97	0.499	Poor
	0.9	0.9	98.2			
Register the result in the note book in accurate date and time	3	1	105	2.94	0.329	Poor
	2.8	0.9	96.3			
Discharge the lancet and blood strip in appropriate manner	5	2	102	2.89	0.792	Poor
	4.6	1.8	93.6			
Close the glucometer	1	1	107	2.97	0.213	Poor
	0.9	0.9	98.2			
Wash hands	1	0	108	2.98	0.341	Poor
	0.9	0	99.1			
Total Pre Application (Blood)				2.858	0.293	Poor

This table shows that, most of the studied group had poor performance of the main steps of blood glucose test before intervention with mean (2.858).

Table (47): Distribution of the studied group according to their skill regarding performance of the main of blood glucose test after intervention N = 109

The step	Good	Sufficient	Poor	Mean	Std. Deviation	Result
	N	N	N			
	%	%	%			
Insert the blood strip in the glucometer and insure that the code in the screen and strip are the same	96	6	7	1.18	0.53	Good
	88.1	5.5	6.4			
Select the appropriate finger and wipe it with alcohol swab	85	4	20	1.40	0.78	Good
	78.0	3.7	18.3			
Puncture the appropriate finger	104	1	4	1.08	0.39	Good
	95.4	0.9	37			
Discharge of the first blood drop	98	1	10	1.19	0.59	Good
	89.9	0.9	9.2			
Pressure the appropriate finger to collect the blood drop and put it on the blood strip	91	5	13	1.28	0.67	Good
	83.5	4.6	11.9			
Put the dry cotton swab on the punctured site and apply pressure on it	59	2	48	1.90	0.99	Sufficient
	54.1	1.8	44.0			
Read the number witch display on the screen	101	1	7	1.14	0.50	Good
	92.7	0.9	6.4			
Repeat the above steps if you doubt or the number is not clear	41	4	64	2.21	0.96	Sufficient
	37.6	3.7	58.7			
Register the result in the note book in accurate date and time	98	3	8	1.17	0.54	Good
	89.9	2.8	7.3			
Discharge the lancet and blood strip in appropriate manner	85	6	18	1.39	0.76	Good
	78.0	5.5	16.5			
Close the glucometer	53	3	53	2.00	0.99	Sufficient
	48.6	2.8	48.6			
Wash hands	58	4	47			Sufficient
	53.2	3.7	43.1	1.90	0.98	
Total Post Application				1.488	0.429	Good

This table shows that, the performance of blood glucose test among the studied group after intervention is good in most of the test steps, but in some steps revealed sufficient performance as in putting dry cotton swab on the punctured site, repeat the test steps if he doubt, close the glucometer and washing hands after performing. Over all mean is (1.49). In comparison between this result and that before intervention which showed in table (26), there is improvement among the studied group from poor performance before intervention to good after it, that indicate the effectiveness of the training of using glucometer.

Table (48): Distribution of the studied group according to their skill regarding performance of the main steps of the urine glucose test before intervention

N = 109

The step	Good	Sufficient	Poor	Mean	Std. Deviation	Result
	N	N	N			
	%	%	%			
Insert the urine strip to appropriate level in the urine sample	19	2	88	2.63	0.766	Poor
	17.4	1.8	80.7			
Remove the urine strip immediately to prevent dissolve of squires in the tip of strip	11	0	98	2.80	0.605	Poor
	10.1	0	89.9			
Wipe the urine strip on the top of urine container gently during removing the strip from the urine sample	5	0	104	2.91	0.42	Poor
	4.6	0	95			
Grasp the urine strip horizontally to prevent mixing of colors	3	2	104	2.93	0.352	Poor
	2.8	1.8	95.4			
Compare the color of the strip with the color on the strip container	13	1	95	2.75	0.655	Poor
	11.9	0.9	87.2			
Read the result in appropriate time	13	3	93	2.73	0.662	Poor
	11.9	2.8	85.3			
Repeat the above steps if you doubt or the number is not clear	1	0	108	2.98	0.192	Poor
	0.9	0	99.1			
Register the result in the note book in accurate date and time	1	0	108	2.98	0.192	Poor
	0.9	0	99.1			
Discharge the strip to prevent reuse	1	1	107	2.97	0.213	Poor
	0.9	0.9	98.2			
Wash hands	1	0	108	2.98	0.192	Poor
	0.9	0	99.1			
Total Pre Application				2.867	.315	Poor

Table (48) clarified that, the study group have poor performance regarding urine glucose test before intervention with mean (2.867).

Table (49): Distribution of the studied group according to their skill regarding performance of the main steps of the urine glucose test after intervention

N = 109

The step	Good	Sufficient	Poor	Mean	Std. Deviation	Result
	N	N	N			
	%	%	%			
Insert the urine strip to appropriate level in the urine sample	108	0	1	1.02	0.192	Good
	99.1	0	0.9			
Remove the urine strip immediately to prevent dissolve of squires in the tip of strip	86	4	19	1.39	0.769	Good
	78.9	3.7	17.4			
Wipe the urine strip on the top of urine container gently during removing the strip from the urine sample	79	4	26	1.51	0.857	Good
	72.5	3.7	23.9			
Grasp the urine strip horizontally to prevent mixing of colors	87	3	19	1.38	0.767	Good
	79.8	2.8	17.4			
Compare the color of the strip with the color on the strip container	106	0	3	1.06	0.329	Good
	97.2	0	2.8			
Read the result in appropriate time	99	5	5	1.14	0.461	Good
	90.8	4.6	4.6			
Repeat the above steps if you doubt or the number is not clear	46	9	54	2.07	0.959	Sufficient
	42.2	8.3	49.5			
Register the result in the note book in accurate date and time	91	1	17	1.32	0.731	Good
	83.5	0.9	15.6			
Discharge the strip to prevent reuse	78	2	29	1.55	0.887	Good
	71.6	1.8	26.6			
Wash hands	56	1	52	1.96	0.999	Sufficient
	51.4	0.9	47.7			
Total Post Application (Urine)				1.439	.4105	Good

This table shows that, the performance of urine glucose test among the studied group after intervention was good in most of the test steps, except in the steps of repeat the test steps if doubt and washing hands after performing the test revealed sufficient performance. Over all mean is (1.44).In comparison between this result and that before intervention which showed in table (28), there is obvious improvement among the studied group from poor performance before intervention to good after it, that indicate the effectiveness of the urine test training using urine strips.

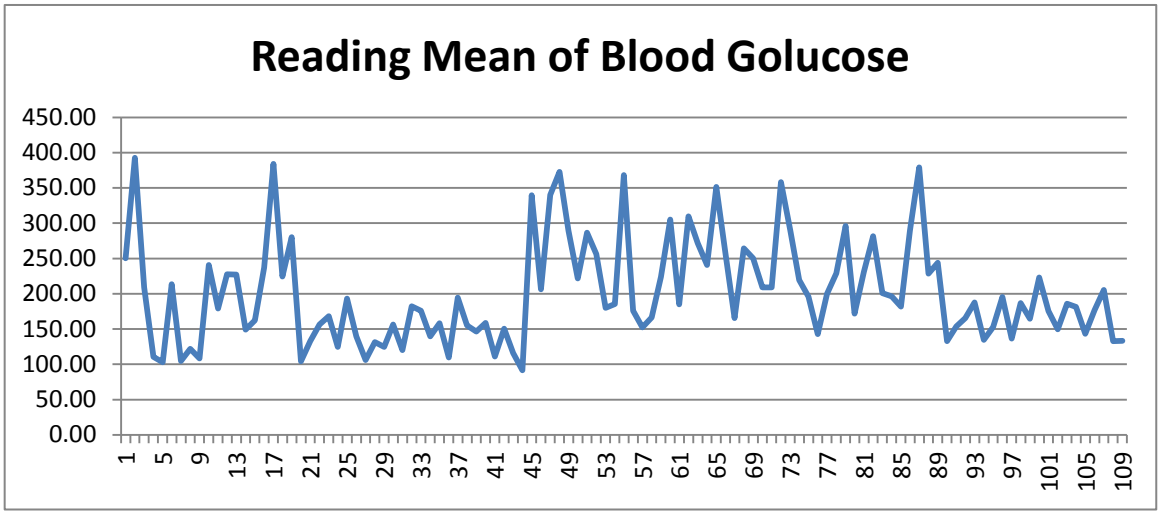


Figure (8): Distribution of the study group according to the level of their blood glucose test mean after the intervention

N = 109

This figure revealed that, most of the studied group their reading mean of blood glucose was high, about half of them their reading mean between (100-200) mg/dl.

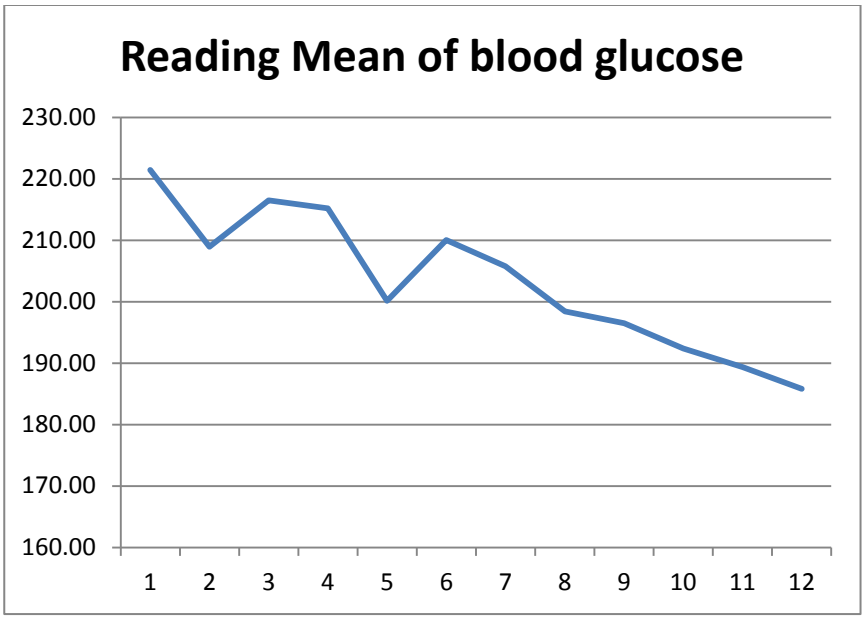


Figure (9): Distribution of the studied group according to the level of their blood glucose test mean after the intervention through the study period

N = 109

This figure showed that, there was gradual decreasing in blood glucose level of the studied group according to their reading mean of blood glucose test through-out the test time of the study after intervention.

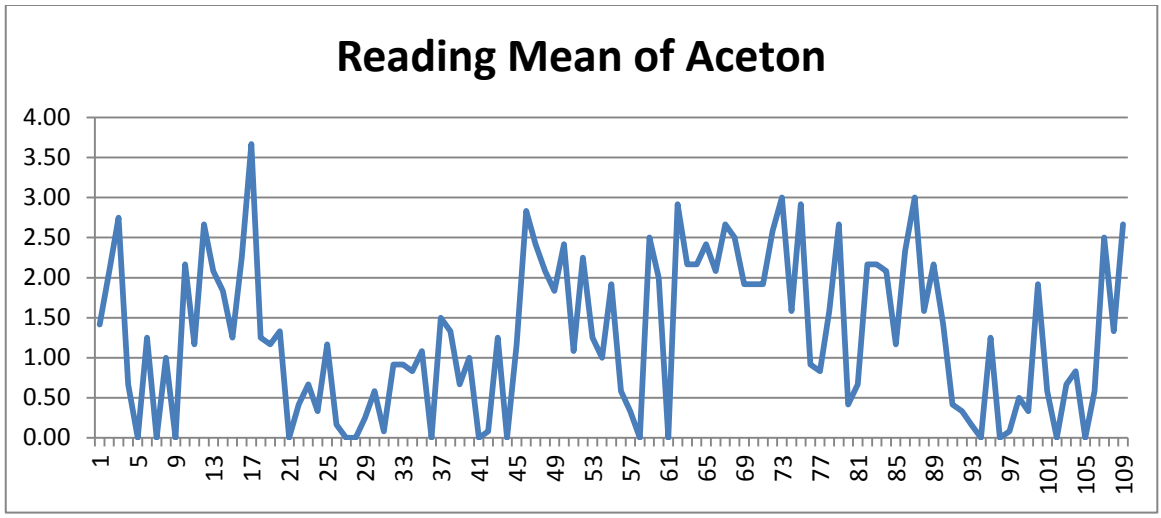


Figure (10): Distribution of the study group according to the level of their urine aceton test mean after the intervention

N = 109

This figure showed that, most of the studied group had reading mean of urine glucose above than one cross.

Chapter Five

- Discussion
- Conclusion
- Recommendation
- References
- Appendix

Discussion

Diabetic education is effective in enhancing knowledge, skills and behavioral change. It has been shown to improve self-care and clinical out-comes[34]

Self-monitoring of blood glucose is an important component of modern therapy for diabetes mellitus. It has been recommended for people with diabetes and their health care professionals in order to achieve a specific level of glycemic control and to prevent hypoglycemia. The goal of SMBG is to collect detailed information about blood glucose levels at many time points to enable maintenance of a more constant glucose level by more precise regimens. It can be used to aid in the adjustment of a therapeutic regimen in response to blood glucose values and to help individuals adjust their dietary intake, physical activity, and insulin doses to improve glycemic control on a day-to-day basis[35]

This study was a Quasi-experimental study conducted to assess the effect of a training program regarding self-monitoring of blood and urine glucose on the management of diabetes mellitus among diabetic patients attending Kassala Diabetic Centre. A total coverage sample was applied; encompassed 109 diabetic patients. Data was collected using predesigned questionnaire and checklist.

The study found that, age of the studied group range between (20 - 70) years but more than half of them (56.9%) were between (41-65) years. This because type II DM more common among this age group. The pancreas, according to some scientists, begins to produce insulin less effectively in older age. Furthermore, resistance to insulin increases with age[1],[38]. Generally, type II diabetes occurs in middle-aged adults, most frequently after age 45 years[1],[39] with regard to the fact that "*The burden of diabetes, both in terms of prevalence and number of adults affected, has increased faster in low-income and middle-income countries than in high-income countries*"[37]

The study revealed that, more than half of the participants (61) (56%) were female, (33.9%) of them were house wives. This may be due to the fact that most of the group was from diabetic clinic and the working time of the clinic, 8:00 to 2:00 which is not be suitable for those who are at work at this time and are mostly male, while this time is suitable for housewives. "*Among the different studies, prevalence rates of diabetes are not consistently higher among women, with the ratio of the prevalence in women versus men varying among populations studied, probably due to different distributions of risk factors such as body mass index, physical activity, and genetic differences (in contrast to presented study). Also due to differences in life expectancy there are more women than men with diabetes in older age groups (which is similar to this study"*[41].

The majority of participant (105) (96.3%) had type II diabetes. This finding reflects the fact that "*type II diabetes is the most common type, affecting 90% to 95% of people with the disease*"[30]. Regarding their level of education, most of the patients were illiterate (42.2%) and primary school (31.2%). The importance of this demographic variable is its` effect on the knowledge and practice of self-monitoring of blood glucose as reported by Hsaio & Salmon (1999) who stated that "*personal or demographic variables could be effective factors in adjustment to chronic illness*"[40]

In addition to that, the duration of the disease in more than one third of the study group (35.8%) was found in the range of (1- 5) years. This finding is consistent with the study which had been conducted in Shendi Town to assess the knowledge and practice of patients with type II diabetes mellitus regarding insulin use: the study showed that "*about half of the patients (48%) have the disease for 0 -5 years duration"*[89]. About more than two third (74.3%) of the study group on oral anti-diabetic agents, and according to the study findings there were newly discovered diabetic patients because as (3.6%) of the participants suffer from the disease for less than one year.

Regarding the knowledge study showed that, there was improvement in patient knowledge about definition of diabetes as the percentage increased from (44%) before intervention to (68.8%) after intervention, and knowledge concerning symptoms and signs of diabetes increased from (75.2% - 89%).This indicate that intervention had a positive effect on knowledge of the participants with clear statistical significant differences (***p*** = 0.01).This is in agreement with the finding of study which had been conducted in Kassala Town to assess the impact of Self-care Practice Training Program Regarding Foot Care and Insulin Injection among Diabetic Patients, it founded that *"Knowledge of patients in the study groups was poor regarding definition of diabetes (87.3%) and signs and symptoms of diabetes(43.6%) before intervention but Post intervention poor score decreased to(17.2% and 1%) respectively"* [(90).]Also it is consistent with the result from the study which was conducted in Elmek Nimer university hospital 2011 Sudan / Shendi regarding training program for nurses to teach diabetic patients self-care practice which showed that *"patients knowledge regarding foot care was (37%) during the pre-test phase, and (85%) in post-test, and (98.5%) in follow up phase"* *(103)*

Regarding the relation between patients age and their level of knowledge about definition of diabetes, less than half of the participants of all age group (48) (44%) displayed good knowledge before intervention, this percentage increases to (75) (68.8%) after intervention, while poor knowledge decreased from (32) (29.4%) pre intervention to (21) (19.3%) after intervention with no statistical significance after intervention (***P***= 0.212). The age group of (26-40) years showed good knowledge about the definition of diabetes mellitus, while the participant aged over 65 years have poor knowledge before and after intervention. Furthermore, data showed that, most of the participants of all age groups had increase their good knowledge regarding signs and symptoms of diabetes from (82) (75.2%) before intervention to (97) (89%) after intervention, and only (2) (1.8%) of

participants had poor knowledge after intervention and their age more than 40 years, with no statistical significance after intervention (***P***= 0.362) while before intervention (***P***= 0.015). The age group of (41-65) years showed good knowledge regarding signs and symptoms of diabetes, while the group of more than 65 years showed poor knowledge before and after intervention. Concerning the knowledge of participants regarding definition and signs and symptom of diabetes, the study reflect that, the good knowledge founded in the age group from 26-40 and 41 to 65 years, but the participants over 65 year still had poor knowledge after interventional program. Part of this result is consistent with result of research conducted in Kassala Town to assess the impact of Self-care Practice Training Program Regarding Foot Care and Insulin Injection among Diabetic Patients which founded that *"the participants whose knowledge was good their age ranged between 41 to 65 years"* [(90)]

The study founded that there was highly significant relation between educational level and knowledge about definition of diabetes before intervention (***P*=0.027**) and after intervention **(*P*=0.001)**. The educated patient (24) (72.2%) from the secondary level and (4) (50%) graduated displayed good knowledge regarding the definition of diabetes mellitus before intervention, this percentage reach (17) (89%) and (8) (100%) respectively after intervention, in contrast to, the illiterates (45.7%) and those of primary education (82.3%) after intervention. In-spite of intervention there are (17) (37%) illiterate had poor knowledge.

The study again showed that the educated patient (graduated 6 (75%) displayed good knowledge regarding the signs and symptoms of diabetes mellitus more than the illiterates (28) (60.9%) before intervention, the percentage of graduated increased to (8) (100%) while illiterate become (37) (80%) after intervention. Only two (4.4%) illiterate had poor knowledge about sign and symptoms of diabetes after intervention with statistical significance relation in pre intervention **(*P*=0.020)** and after intervention **(*P*=0.297).** There was clear evidence

the educational level of the participant is an important factor as the educated group; graduates and post graduates were much better than the others**.** These findings reflect that there is a relation between the level of education and gaining knowledge. This is consistent with the findings of a research which had been conducted in kassala Town to determine the impact of self-care practice training program regarding foot care and insulin injection among diabetic patients. It found that *"the educated patient (secondary, graduate and post graduate) were knew the importance of foot care for diabetic patient after intervention more than illiterate and primary education participants with statistical differences p-value (0.008)"*[90]

The study found that, regardless of occupation; the changes in the participants knowledge about the definition of diabetes as follow: good knowledge (48) (44%)pre intervention to (75) (68.8%)post intervention, satisfactory knowledge (19) (17.4%) pre intervention to (13) (11.9%)post intervention and poor knowledge (32) (29.4%) pre intervention to (21) (19.3%) post intervention with no statistical significance after intervention (P= 0.246) but before intervention P value (0.015). Employee had shown good knowledge before (14) (56%) and after intervention (20) (80%), while poor knowledge was shown by retired participants before intervention (12) (63.2%) and after intervention (7) (36.8%).

The study shows that, almost all of the participants of different occupation displayed good knowledge regarding the signs and symptoms of diabetes mellitus after intervention with no statistical significance (P=0.438). The worker showed good knowledge (7) (100%) and retired 1(5.3%) had poor knowledge before and after intervention.

Moreover, the participants had poor attitude regarding response when experiencing hypoglycemia (23.9%) or hyperglycemia (15.6%), this percentage increased to (51.4%-54.1%) respectively after conduction of the programmed intervention. Also their attitude regarding response to urine test result was very poor in pre intervention assessment as (67%) of them did not know the appropriate response, this percentage decreased to

(0.9%) after intervention while good attitude improve from (4.6% to 33.9%) with significant statistical value (***p***=0.01). The improvement in knowledge and attitude is expected to reduce the incidence of acute complications and improve the well-being of the patients.

The study revealed that, there was highly significant relation between education and the attitude of participants regarding hyperglycemia after intervention compared with the illiterates, it showed the percentage of good attitude pre and after intervention respectively as follow: post graduated (0%) to (100%), graduated (12.5%) to (87.5%), secondary education (5.3%) to(68.4%), primary education (35.3%) to (64.7%) and illiterates (6.5%) to (32.6%) with highly significant P value (***p***= 0.001) after intervention from (***P***=0.055) before intervention.

The study shows that, more than half of the participants (59) (54.1%) after intervention compared to (17) (15.6%)in pre intervention of all occupation displayed good response to hyperglycemia attack if occurred, satisfactory response (25) (22.9%) post intervention compared to (33) (30.3%) pre intervention, and poor response (25) (22.9) post intervention compared to (48) (44%) pre intervention. Statistical relation is significant in pre intervention (P=0.054) and highly significant post intervention (P=0.021). The proper response appears in employee (20) (80%). This result is supported by Cypress M. and Tomky D, who's reported that *"SMBG can help to identify factors associated with hyper- and hypoglycemia, facilitate learning, and empower patients to make changes to improve their glycemic control"*[(102)]

Furthermore, the study showed that, participants knowledge regarding conditions which need checking of blood glucose during the day had improved as in pre-test phase about half (51.4%) of them said that the blood glucose can only be checked in hypoglycemia or hyperglycemia or exercise; in addition to (9.2%) never know, while in post-test (71.7%) of participants became aware about the need to

check the blood glucose for all three conditions - hypoglycemia, hyperglycemia and exercise. In addition to that, (35.8%) of the studied group had known that the blood glucose can be tested both before and after meal during the pretest test, this score improved to be (72.5%) after intervention. and there was a significant improvement after the intervention with highly significant P value (***P***=0.000).

In the pre interventional phase about half of the participants were founded to be unfamiliar with glucometer (50.5%) and (31.2%) knew it but did not know how to be used. This is in agreement with the result of the survey which had been done in (2016)by V. Crishnan and J. Thirunavukkarasu to Assess the Knowledge of Self Blood Glucose Monitoring and the Extent of Self Titration of Anti-Diabetic Drugs among Diabetes Mellitus Patients which revealed that *"(24.1%) of patients were aware and had been following self-blood glucose monitoring appropriately"*[91]. The familiarity with and ability to use the glucometer dramatically changed and improved after intervention to reach (100%). Also, there was improvement in the knowledge of participants regarding normal range of blood glucose, as only (36.7%) knew it before intervention but after intervention (83.5%) were able to define it with statistically significant P value (***P***=0.05). Again this proves the beneficial effect of such educational program. Moreover, only (22%) of participants were able to test their urine glucose by them-selves using urine strips before intervention and after intervention all of them were able to do it. This improvement in knowledge and practice will be reflected positively on the degree of diabetic control and thereafter on the outcome of the disease.

Furthermore, regarding benefits of using glucometer, the good knowledge of participants increased from (16.5%) in pre-test to (43.1%) after intervention with highly statistically significant P value (***P***=0.01).The evidence from the obtained result suggest that, patient knowledge hadbeen improved widely and clearly regarding beneficial outcome and importance of using glucometer.

As practice of diabetic patient regarding blood and urine glucose testis of a great importance in improving the well-being of diabetic patients and in reducing complications, this study proved that such interventional program is needed for all diabetic patients particularly the newly discovered ones. The study showed that, most studied group skills regarding preparation steps of blood glucose and urine glucose tests; was poor before the intervention, while the result after intervention revealed significant improvement, more over their performance was poor before intervention with mean (2.858) regarding the main steps of self-monitoring of blood glucose, while the performance after intervention was good in most of the test steps, and it revealed sufficient performance as in using dry cotton swab on the punctured site, repeat the test steps if in doubt, close the glucometer and washing hands after performing. Over all mean was (1.49). In comparison between this result and that before intervention, there is improvement of the skills among the studied group from poor performance before intervention to good after it that indicates the effectiveness of the training of using glucometer. This result supports the effectiveness of such educational program. The accuracy of Self-monitoring of blood glucose helps patients to safely judge on their blood glucose levels as adjustments of diet and exercise.

About performance of the participants regarding the main test steps of self-monitoring of urine glucose before intervention, the study showed poor performance with mean (2.867), while the performance of the test after intervention was good in most of the test steps, except in the steps of repeat the test if in doubt and washing hands after performing the test revealed sufficient performance. Over all mean was (1.44). In comparison between this result and that before intervention, there is obvious improvement among the studied group from poor performance before intervention to good after it, and this indicate the effectiveness of the urine test training using urine strips.

In addition to that, this study reported improvement in participants ability regarding interpretation of blood test result from (36.6%)before implementation of the program to(85.3%) after it, and urine from 22% to 98.2%) with highly statistically significant P value (P=0.000) and (P=0.01) respectively. This reflected the fact that *"diabetes self-management education is defined as the ongoing process of facilitating the knowledge, skill, and ability necessary for diabetic self-care. This process incorporates the needs, goal, and life experiences of the person with diabetes and is guided by evidence-based standers"*[36]

The participants were divided into two sections every section with two groups; group one and two in town and group three and four from the rural area, the second and forth groups are the best group because their mean reading (100-200) mg/dl, those best two group, were encompasses the young and educated participant and most of them resident in Kassala town so they more aware about blood glucose control and have a chance to participate in an educating program. Also the study reviled that, there was gradual decrease in blood glucose level of the studied group according to their reading mean of blood glucose test through-out the duration after intervention. According to this evidence, the increase in blood glucose in some of the participants may be due to cultural reason, because most of the participants are poor and they were not able to comply with advised diabetic diet Also the study revealed that some patient may be at risk for complications of diabetes, and persistently high of blood sugar because diet control is important and have a vital role in management of diabetes and it's a key corner stone especially for type II diabetes. This result is correlated with the study which had been conducted in China to assess the Efficacy of blood glucose self-monitoring on glycemic control in patients with non-insulin-treated type II diabetes: the study showed that, blood glucose self-monitoring significantly reduced the glycated hemoglobin (HbA1c) level by 0.41%[(101)].Also reading mean

of urine glucose test founded that, be near negative in the two best group with mean reading of one cross rather than the other two.

Again the study revealed that, the participants whose age ranged between (15-25 year) their good performance regarding blood glucose test improve from (1) (25%) before intervention to reach (4) (100%) after intervention, and all of age group more than (65 year) never know how to perform the blood glucose test before intervention but their performance was good and reached (10) (83.3%) after intervention, in-spite of that, there was no statistical relation before intervention (***P*=0.087)** and after intervention (***P*= 0.554**).

Again the study showed that, there is a relation between educational level and performance of blood glucose test in spite of no statistical significance before and after intervention. Regardless of the level of education, about (85) (78%) of the study group demonstrated poor performance regarding blood glucose test,(19) (17.4%) had satisfactory performance and only (5) (4.6%) had good performance before intervention (***P***=0.072), after intervention the poor performance decreased to (3) (2.8%) while the good performance improved from (5) (4.6%) to (95) (87.2%) with p-value (0.453).

The study also showed that, clear improvement appeared in almost all of participants of different occupation in performing the blood test, properly done (95) (87.2%) in post intervention in contrast to pre intervention (5) (4.6%). satisfactory performance post intervention (11) (10.1%) while in pre intervention (19) (17.4%) and only 3(2.8%) poor performance of them in post intervention with no statistical significant Pre (P=0.083) and post intervention (P=0.656). But good performance was founded among students (100%). The students showed good performance and workers performed poorly in before and after intervention.

Regarding the interpretation of the results the study revealed that, most of participants were able to interpret the result of blood glucose test except minority of them (16) (14.7%) after intervention compared with (66) (60.6%) before

intervention. no statistical significance in pre and post intervention (P=0.070) (P=0.402) respectively. But good interpretation was noticed among students (3) (100%) and employee (24) (96%). This may be because the student and employee are in positions that enable them to reach media and educational programs more than retired patients and house wife.

Regarding performance of urine glucose testing, the study showed that, the participants of age ranging between (15-25year), (26-40 year) and those of more than (65 year)had poor performance before intervention 3(75%),26(83.9%), and10(83.3%) respectively, but after intervention their performance improved (4) (100%),(27) (87%), and (11) (91%) respectively and only (1) participant of age (41-65 year) showed poor performance after intervention, with no statistical significance before intervention **(*P*=0.094)** and after intervention **(*P*= 0.740).** Before intervention the age group of (41-65) years showed good performance while (26-40) years most poor one, after intervention, the good performance had been shown by age group(15-25) years while the poor one by (26-40) years.

The study revealed that age play an important role in adjustment and modification of life style and lead to easy adaptation, this study founded that, almost all the participants of different age groups were able to interpret the results of urine glucose test except two of them after intervention, The age group (41-65) years showed good ability of interpretation of urine glucose test result before intervention and they are more better after intervention of (15-25) years responded to the program better than the other groups, that may be due to young age and most of them are student who can learn better. This indicate that this group should not been at great risk to develop complications and they may be controlled well. In fact that, learning how to respond to the results, enables diabetic patients to adjust their treatment regimen to obtain optimal blood glucose control. Also allows for detection and prevention of hypoglycemia and hyperglycemia and plays a crucial role in normalizing blood glucose levels, which may reduce the risk of

long-term diabetic complications

In addition to that, not only educated patient; school, graduate, and post graduate demonstrated proper performance of urine glucose test (100%) after intervention, (their good performance before intervention (0%), (1) (12.5%), (0%) respectively,) but also most of the illiterate participants (89.1%) from (0%).With no statistical significance, before (P=0.090) and after intervention (P=0.230). The secondary school, graduates and post graduates showed good performance after intervention while only graduates before intervention, illiterate showed poor one before intervention.

The study also showed that, before intervention (1) (0.9%) of participants had good performance regarding urine glucose test and (89) (81.7%) of them had poor performance, while after intervention all of the participants performed the test properly except only one housewife who was unable to do it. No statistical significance in pre and after intervention (P=0.096), (P=0.950) respectively. Students (3) (100%) and employee (23) (92%) properly performed the test. Employee had shown good performance before intervention and student after intervention, while housewives showed poor performance in before and after intervention.

The study shows that, all participants were able to interpret the result of urine glucose testing except only two participants who were a free worker and a retired one after intervention, while in before intervention (84) (77.1%) were unable to interpret. No statistical significant in pre and post intervention (***P***=0.090), (***P***=0.494) respectively, while poor ability was even shown by retired participants before intervention

Finally this study showed that there was statistically significant relation between patient's knowledge and practice about self-monitoring of blood and urine glucose and the educational program which had been conducted among participants had very excellent impact on both patient knowledge and performance.

Limitation of the study

1. The diabetic center was stopped working after two months of starting the study that make the collection of the data was difficult which it collected from participants' home and their working place
2. As a result of participants death , divorce and leaving Kassala state, and travelling out of Kassala state for long time to seek diabetic related treatment the final sample size was decreased
3. There is no internal transport to access the participants in some places of the study area
4. Language barrier

Conclusion

Based on the result of the present study the following conclusions were made:-

1. Majority of the participants lacked knowledge about self-monitoring of blood and urine glucose before implementation of the program and the younger and educated participants are far better than the old and non – educated and so the students and employee
2. There is significant improvement in the knowledge, skills and behavior among the studied group after the conduction of the educational program which had been reflected on the degree of their diabetic control.
3. Educational and training programs for diabetics are beneficial and needed for the improvement of well-being of the diabetic, preventing the complication and reducing the economic burden of diabetes mellitus.

Recommendations

Based on the study findings, the following are recommended:

1. Provide out-patient diabetes educational and training program for reinforcement of self-management skills
2. Making available diabetic educators in each hospital to educate and train the self-monitoring of blood glucose
3. More specialized diabetic centers have to be establish particularly in primary health care centers to promote appropriate health care in diabetes and education of diabetic patients and those involved in their care
4. Health authority should encourage, support and spread the specialized diabetic centers.
5. In view of the prevalence of diabetes, it is essential to apply this program in the large groups of diabetic patients periodically to increase the awareness of diabetics and identify the high risk population to prevent or delayed the complication.
6. Researches concerning the issues of diabetic control, self-monitoring and self-management should be conducted and their results should be utilized to improve the well-being of the diabetics

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In the Name of Allah, the Most Gracious, the Most Merciful

Shendi University

Deanship of Graduate Studies

A Thesis for PhD Degree in Nursing

An Interview Form for Knowing The effect of Self-monitoring (Blood Glucose and urine for sugar) on the Management of Diabetic patient in Kassala Diabetic Centre

Personal Information:

1- Age:

a- 16 – 25 years ☐ b- 26 – 40 years ☐ c- 41 – 65 years ☐

d- More than 65 years ☐

2- Gender:

a- Male ☐ b- Female ☐

3- Educational level:

a- Illiterate ☐ b- Basic School ☐ c- Secondary School ☐

d- University ☐ e- Post Graduate ☐

4- Occupation:

a- Free business ☐ b- Employee ☐ c-Housewife ☐ d- Student ☐

e- Clerk ☐ f- Retired ☐

5.Social status:

a- Single ☐ b- Married ☐ c- Widowed ☐ d- Divorcee ☐

5- Type of diabetes:

a- Type 1 ☐ b- Type 2 ☐

6- Period of infection:

a- Less than a year ☐ b- 1 – 5 years ☐ c- 6 – 10 years ☐

d- More than 10 years ☐

7- The type of treatment that you are using:

a- Insulin ☐ b- Tablets ☐ c- Diet + physical exercise ☐

8- Period of treatment:

a- Less than a year ☐ b- 1 – 5 years ☐ c- 6 -10 years ☐

d- More than 10 years ☐

Second part / Domain Two:

For assessing disease information

9- What is diabetes?

a- A rise in the proportion of blood glucose from the normal rate ☐

b. Due to a lack of insulin in the body ☐ c. Hereditary disease ☐

d. Chronic disease ☐

10- What are the signs and symptoms of diabetes?

a- Fatigability ☐ b- Frequent urination ☐ c- Extreme thirs ☐

d- Extreme hunger ☐ e- Weight loss ☐

11- Have you received any information on how to measure your blood glucose using the device?

a- Yes ☐ b- No ☐

12- If the answer is yes; who is?

a- A doctor or a nurse ☐ b- Another patient ☐ c- A friend ☐

d- Media ☐ e- Seminars ☐

Third part / Domain 3:

For assessing information about blood glucose monitoring:

13- Do you know the blood glucose meter (Glucometer)?

a- I know the device and how to use ☐

b- I Know the device and I do not know how to use ☐

c- I do not know ☐

14- Do you check your blood glucose using your own device regularly?

a- Sometimes ☐ b- Always ☐ c- When I get sick ☐

d- I do not use it ☐

15- If the answer is no how do you measure blood glucose?

a- Check with healthservices facilities ☐

b- Check with the Diabetes Center ☐

c- Check with a friend or a neighbor ☐

d- I do not check ☐

16- Do you consider your blood glucose regular?

a- Sometimes ☐ b- Always ☐ c- Not regular ☐

17- Do you follow the blood glucose for yourself by the device? How?

a- Once a week ☐ b- More than once per a week ☐

c-Less than once per a month ☐ d- If necessary ☐

e- I do not follow ☐

18- Do you check your blood glucose by the device during the day?

a- Once per a day ☐ b- Twice ☐ c- Three times ☐

d- More ☐ e- according to the instruction ☐ f- In critical situations ☐

19- Do you know the normal rate of blood glucose?

a- Yes ☐ b- No ☐

20- What are the conditions that require blood glucose testing in a day?

a- When experiencing symptoms of decreased or increased of blood glucose levels ☐

b- When exercising any physical activity ☐

21- Checking the blood glucose for the meal will be:

a- Before the meal ☐ b- Two hours after the meal ☐

22- Can you interpret the test result?

a- Yes ☐ b- No ☐

23- The blood glucose test is used as an indicator:

a- To monitor the blood sugar rate ☐

b- To make sure that a decrease or an increase of the level of blood glucose occur ☐

c- To make sure of the effectiveness of treatment when changed ☐

d- To make sure of the blood glucose rate to do some activities ☐

24- What is response that you will carry out if the test result showed high blood glucose:

a- Increase the dose of diabetes treatment ☐ b- Physical exercise ☐

c-Minimize eating sugars ☐ d- See a doctor ☐

25- What is response that you will carry out if the test result shows low blood glucose?

a- Take a teaspoon of white sugar or a sweet or drink a glass of juice ☐

b- Reduce the dose of medication ☐ c- See a doctor ☐

26- Do you consider the use of the device to follow blood glucose for diabetics effective?

a- It's effective ☐ b- It's ineffective ☐ c- I do not know ☐

27- Using the device helps the patient on:

a- Adjust blood glucose ☐

b- Adjust the weight ☐

c- Decision making for physical activities ☐

d- Cases ofthe incidence of the illness ☐

<u>Fourth part / Domain 4</u>

For information about the observation of glucose in the urine

28- Do you know how to measure your own urine glucose using the test strip?

a- Yes ☐ b- No ☐

29- Have you received any information on how to measure your urine glucose?

a- Yes ☐ b- No ☐

30- If the answer is yes, who gave you the information:

a- A doctor or a nurse ☐ b- Another patient ☐

c-A relatives or a friend ☐ d- Media ☐

31- How do you follow up your urine glucose by using the test strips

a- Once a week ☐ b- More than once a week ☐

c-Less than once a month ☐ d- When necessary ☐

e- I do not check ☐

32- How often do you follow the urine glucose during the day?

a- Once a day ☐ b- Twice ☐ c- Three times ☐

f- More ☐

33- Can you interpret the result of a urine test?

a- Yes ☐ b- No ☐

34- How to respond to the result of a urine glucose test:

a- I do not know ☐ b- Re-test to be sure ☐

c- See a doctor ☐ e- Re-adjust the intake treatments ☐

Steps for urine analysis for glucose and Acetone for diabetics using strips

N.	step	Good	Sufficient	Poor
1	Equipment processing (urine sample container - test strip - notebook-follow-up note book- pen)			
2	Washing hands			
3	Collect the urine sample in the appropriate amount			
4	Dip the detection strip in the urine sample to the appropriate level			
5	Remove the detection strip immediately to avoid jamming the detection boxes at the end of the strip			
6	Wipe the strip on the edge of the urine bowl gently while removing it from the urine sample			
7	Hold the strip in a horizontal position so that the colors do not mix together			
8	Compare the colors on the strip with the color on the strip container			
9	Read the result at an appropriate time			
10	Repeat previous steps if the reading is unclear			
11	Record the result and record it in the follow-up book by time and date			
12	Dispose of the strip so it cannot be reused			
13	Washing hands			

Steps of checking blood glucose for diabetics using the device

N.	Step	Good	Sufficient	Poor
1	Equipment preparation: test device - strips- test needle - cotton or tissues - alcohol - watch time recording - follow-up book - pen			
2	Washing hands			
3	Preparing the test needle (either in the device or as available)			
4	Insert the test strip into the device and make sure that the number on the device screen matches the number in the strips box			
5	Choose the finger that needed to be examined and wipe it with cotton and alcohol			
6	Drill the finger that needed to be examined			
7	Get rid of the first blood point			
8	Press the finger to collect the appropriate point of blood and place it in the examination strip			
9	Put cotton in the place where the blood was taking and pressure it			
10	Reading the number on the screen device			
11	Repeat previous steps when reading is not clear or doubt			
12	Record the result in the observation book by its time and date			
13	Get rid of the needle and the test strip properly			
14	Turn the device off			
15	Washing hands			

بسم الله الرحمن الرحيم
جامعة شندي كلية الدراسات العليا
بحث لنيل درجة الدكتوراة في التمريض

إستمارة المقابلة الخاصة بمعرفة تاثير الفحص والمتابعة الشخصية لسكر الدم والبول لمرضى السكرى

The effect of self-monitoring (blood glucose and urine for sugar) on the Management of Diabetic patient in Kassala Diabetic Centre

الجذء الاول:

البيانات الشخصية:

1) العمر :

أ/ 16 –25سنة ☐ ب\ 26- 40سنة ☐ ج/ 41–65 سنة ☐ د/ أكثرمن65 سنة ☐

2) الجنس: أ- ذكر ☐ ب -أنثى ☐

3) المستوى التعليمي:

أ-أمي ☐ ب/ إبتدائي ☐ ج- ثانوي ☐ د- جامعي ☐ هـ - فوق الجامعى ☐

4) الوظيفة:

أ-اعمال حرة ☐ ب- موظف ☐ ج- ربة منزل ☐ د-طالب ☐ هـ - عامل ☐ و.لا اعمل ☐

الحالةالاجتماعية:

أ- أعذب ☐ ب- متزوج ☐ ج- أرمل ☐ ق ☐

5) نوع السكرى:

أ- النوع الاول ☐ ب- النوع الثاني ☐

6) فترةالاصابةبالمرض:

أ- أقل من سنة ☐ ب- من 1 – 5 سنوات ☐ ج- من 6 -10 سنوات ☐ د- أكثرمن 10 سنوات ☐

7) نوع العلاج الذى تستخدمه:

أ- انسولين ☐ ب- حبوب ☐ الحمية الغذائية + الرياضة البدنية ☐

8) فترة تناول العلاج:

أ- أقل من سنة ☐ ب- من 1 – 5 سنوات ☐ ج- من 6 -10 سنوات ☐ د- أكثرمن 10 سنوات ☐

الجزء الثاني:

خاص بتقييم المعلومات عن المرض :

9) ماهومرض السكر؟

أ- إرتفاع في نسبة السكرفي الدم عن المعدل الطبيعي ☐ ب. نتيجة لنقصان الأنسولين في الجسم ☐

ج- مرضوراثي ☐ د- مرض مزمن ☐

10) ماهي أعراض مرض السكر؟

أ-الفتور ☐ ب- كثرةالتبول ☐ ج- العطش الشديد ☐ د- الجوع الشديد ☐ نقص الوزن ☐

الجزءالثالث:

خاصب تقييم المعلومات عن مراقبة سكر الدم:

11) هل تعرف جهاز قياس سكر الدم (الجلوكوميتر):

أ. اعرف الجهاز وطريقة الاستخدام ☐ اعرف الجهاز ولا اعرف طريقة الاستخدام ☐ ج. لا اعرف ☐

12) هل تقوم بفحص سكر الدم باستخدام جهازك الخاصبانتظام:

أ. احيانا ☐ ب. دائما ☐ ج. عند المرض ☐ د. لا استخدم ☐

13) اذا كانت الاجابة بلا كيف تقوم بقياس سكر الدم:

أ.افحص بمرافق الخدمات الصحية ☐ ب. افحص بمركز السكرى ☐ ج. افحص مع صديق او جار ☐ د. لاافحص ☐

14) هل تلقيت اى معلومات عن كيفية قياس سكر الدم بنفسك باستخدام الجهاز:

أ. نعم ☐ ب. لا ☐

15) اذا كانت الاجابة بنعم؛ من:

أ.طبيب او ممرضة ☐ ب. مريض اخر ☐ ج. قريب او صديق ☐ د. اجهزة الاعلام ☐ هـ. الندوات ☐

16). هل تعتبر سكر الدم عندك منتظم:

أ. احيانا ☐ ب. دائما ☐ ج. غير منتظم ☐

17)هل تقوم بمتابعة سكر الدم لنفسك بالجهاز؟ كيف؟:

أ. مرة فى الاسبوع ☐ ب. اكثر من مرة فى الاسبوع ☐ ج. اقل من مره فى الشهر ☐ د.عند الضرورة ☐ هـ. لا اتابع ☐

18)هل تقوم بفحص سكر الدم بالجهاز خلال اليوم:

أ.مره فى اليوم ☐ ب. مرتين ☐ ج. ثلاث مرات ☐ د. اكثر هـ. حسب التعليمات ☐ و. فى الحالات الحرجة ☐

19) هل تعرف المعدل الطبيعى لسكر لدم:

أ. نعم ☐ ب. لا ☐

21) ماهى الحالات التى تستوجب فحص سكر الدم فى اليوم:

أ. عند الاحساس باعراض انخفاض اوارتفاع نسبة سكرالدم ☐ ب. عند ممارسة اى نشاط بدنى ☐

22) يكون فحص سكرالدم للوجبة:

أ. قبل الوجبة ☐ ب. بعد الوجبة بساعتين ☐

23) هل تستطيع تفسير نتيجة الفحص:

أ. نعم ☐ ب. لا ☐

24) تستخدم نتيجة فحص سكر الدم كمؤشر:

أ. لمراقبة معدل سكر الدم ☐ ب. للتاكد من حدوث نقصان او زيادة فى مستوى سكر الدم ☐

ج. للتاكد من فعالية العلاج عند تغييره ☐ د. للتاكد من معدل سكر الدم للقيام ببعض النشاطات ☐

25) ماهى الاستجابة التى تقوم بها اذا اظهرت نتيجة الفحص ارتفاع فى سكر الدم:

أ. زيادة جرعة علاجالسكرى ☐ ب. الرياضة البدنية ☐

ج. التقليل من اكل السكريات ☐ د. مراجعة الطبيب ☐

26) ماهى الاستجابة التى تقوم بها اذا اظهرت نتيجة الفحص انخفاض سكر الدم:

أ.اخذ ملعقة صغيرة من السكر الابيضاو حلاوهاو شرب كوب من العصير ☐ ب.نقص جرعة الدواءج. مراجعة الطبيب ☐

27) هل تعتبراستخدام الجهاز لمتابعة سكر الدم لمرضى السكرى فعال:

أ. فعال ☐ ب. غير فعال ☐ ج. لا اعرف ☐

28) استخدام الجهازيساعد المريض على:

أ. ضبط سكر الدم ☐ ب. ضبط الوزن ☐ ج. اتخاذ القرار للقيام بالنشاطات البدنية ☐

د. حالات الاصابة بالمرض ☐

<u>الجزءالرابع:</u>

خاص بتقيم المعلومات عن مراقبة السكر فى البول:

29) هل تعرف طريقة قياس سكر البول بنفسك باستخدام الشريط الخاص بالفحص

أ. نعم ☐ ب. لا ☐

30) هل تلقيت اى معلومات عن كيفية قياس سكر البول بنفسك:

أ. نعم ☐ ب. لا ☐

31) اذا كانت الاجابة بنعم من الذى ذودك بالمعلومات:

أ.طبيب او ممرضة ☐ ب. مريض اخر ☐ ج. قريب او صديق ☐ د. اجهزة الاعلام ☐

<u>32)</u> كيف تقوم بمتابعة سكر البول لنفسك باستخدام شرائط الفحص:

أ. مرة فى الاسبوع ☐ ب. اكثر من مرة فى الاسبوع ☐ ج. اقل من مره فى الشهر ☐ د.عند الضرورة ☐

هـ. لا افحص ☐

<u>33)</u> كم مرة تقوم بمتابعة سكر البول بالاشرطة خلال اليوم:

أ.مره فى اليوم ☐ ب. مرتين ☐ ج. ثلاث مرات ☐ د. اكثر ☐

34) هل تستطيع تفسير نتيجة فحص البول:

أ. نعم ☐ ب. لا ☐

35) كيف تستجيب لنتيجة فحص سكر البول:

أ. لا اعرف ☐ ب. اعادة الفحص للتاكد ☐ ج. مراجعة الطبيب ☐ د. اعادة ضبط تناول العلاجات ☐

خطوات تحليل البول للسكر والاستون لمرضى السكرى باستخدام الاشرطة

م.	الخطوة	جيد	وسط	ضعيف
1	تجهيز المعدات (حاوية لاخذ عينة البول – شريط الفحص – دفتر المتابعة - قلم)			
2	غسل اليدين			
3	جمع عينة البول بالحجم المناسب			
4	غمس شريط الكشف فى عينة البول للمستوى المناسب			
5	ازالة شريط الكشف فى الحال لتجنب ازابة مربعات الكشف فى طرف الشريط			
6	مسح الشريط على حافة وعاء البول برفق اثناء ازالة الشريط من عينة البول			
7	مسك الشريط فى وضع افقى حتى لا تختلط الالوان ببعضها			
8	مقارنة الالوان الموجودة على الشريط بالالوان الموجودة على حاوية الشرائط			
9	قراءة النتيجة فى وقت مناسب			
10	اعادة الخطوات السابقة فى حالة عدم وضوح القراءة			
11	تسجيل النتيجةوتسجيلها فى دفتر المتابعة بالوقت والتاريخ			
12	التخلص من الشريط حتى لا يعاد استخدامه			
13	غسل اليدين			

خطوات فحص سكر الدم لمرضى السكرى باستخدام الجهاز

م.	الخطوة	جيد	متوسط	ضعيف
1	تحضير المعدات: جهاز الفحص – الاشرطة – ابرة الفحص – قطن او مناديل – كحول - ساعة لتسجيل الوقت – دفتر المتابعة - قلم			
2	غسل اليدين			
3	تجهيز ابرة الفحص (اما فى الجهاز او حسب المتوفر)			
4	ادخال شريط الفحص فى الجهاز والتاكد من تطابق الرقم الموجود فى شاشة الجهاز مع الرقم الموجود فى علبة الاشرطة			
5	اختيار الاصبع المراد الفحص منه ومسحه بالقطن والكحول			
6	ثقب الاصبع المراد الفحص منه			
7	التخلص من نقطة الدم الاولى			
8	ضغط الاصبع لجمع نقطة مناسبة من الدم ووضعها فى شريط الفحص			
9	وضع قطن فى مكان اخذ الدم والضغط عليه			
10	قراءة الرقم الموجود على شاشة الجهاز			
11	اعادة الخطوات السابقة عند عدم وضوح القراءة او الشك			
12	تسجيل النتيجة فى دفتر المراقبة بالوقت والتاريخ			
13	التخلص من الابرة وشريط الفحصبطريقة سليمة			
14	قفل الجهاز			
15	غسل اليدين			


Patient program

البرنامج التدريبى للمتابعة الذاتية لسكر الدم وسكر البول واثرها على معالجة مرضى السكرى

اهمية البرنامج:

اصبح مرض السكرى من المشاكل المهددة للصحة فى كل المجتمعات، وهو مرض مزمن، ومكلف ماديا، ويغير النمط الطبيعى للحياة، كما انه مصحوب بمضاعفات مزمنة تؤدى الى تلف الكثير من اجهزة الجسم وقد يؤدى للموت المبكر.

ارتفعت معدلات انتشار مرض السكرى فى الدول النامية (مثل السودان) نسبة للتغير نمط سلوكهم بسلوكيات الدول المتقدمة فيما يتعلق بنوعية الغذاء، التدخين، قلة النشاط الرياضى. كما اوضحت الدراسات فى السودان ان حوالى ربع المرضى (26%)الذين يدخلون المستشفيات مصابون بمرضى السكرى.

ومن المعلوم ان مرض السكرى يستمر مع المريض طوال حياته لذا وجب على المريض الالمام بالمهارات الضرورية التى تمكنة من التعايش مع المرض.

الهدف العام:

يهدف هذا البرنامج التدريبى الى تذويد مرضى السكرى بالمعلومات الكافية عن الطريقة السليمة للفحص الذاتى لسكر الدم والبول.

الاهداف الخاصة:

بنهاية هذا البرنامج التدريبى سوف يكون المريض قادرا على:

- .....
- .....

مرض السكرى:

مقدمة:

يقوم الجسم بتحويل الغذاء الذي ناكله الي مادة تسمى جلكوز (سكر احادي) وهناك هرمون يسمى هرمونالانسولين ويفرز بواسطة البنكرياس وهو ضروري لعملية دخول الجلوكوز لخلايا الجسم حيث يتم تحويل الجلوكوز داخل الخلايا الي طاقة حتي تتمكن كل خلية من القيام بوظائفها.

تعريف مرض السكرى:

مرض السكري عبارة عن مرض مزمن وشائع ناتج عن زيادة مستوي السكر في الدم ويحدث عند إنعدام هرمون الانسولين او افرازهبكمية غيركافيةاو لقلة استقباله من قبل خلايا الجسم المختلفة مما ينتج عنه ارتفاع نسبة السكر في الدم عوضا عن دخوله لخلايا الجسم ويتم افرازه في البول عندما تتخطي كمية السكر في الدم180ملجم ويتم فقدان الطاقة وتؤثر فية عوامل وراثية وبيئية مختلفة كما انه يصيب كل الاعمار.

يتراوح المعدل الطبيعى لسكر الدم بين اقل من 110ملجم/دسلتر فى حالة الصيام واقل من 140 ملجم/دسلتر فى حالة العينة العشوائية.

ماهو البنكرياس:

هي غده تقع في اعلي البطن خلف المعدة ويوجد بها مجموعات من الخلايا التي تفرز الهرمونات بالاضافة اليغدد اخري تفرز انزيمات تساعد في الهضم.

ماهو الانسولين وماهى وظيفته:

الانسولين عبارة عن هرمون يفرز من خلايا بيتا فى البنكرياس.

وظيفتة فى الجسم:يؤثر علي العناصر الثلاث الاساسية في الطعام وكذلك في الجسم وهي: السكريات , الدهنيات، البروتينات.

السكريات: يساعد علي دخول سكر الجلوكوز من الدم الي الخلايا وكذلك علي عمليات التمثيل الغذائي له في الخلايا التي تنتهي بانتاج الطاقه التي يستخدمها الجسم في نشاطاته المختلفة.

البروتينات: يساعدعلي عمليات البناء في الجسم بمعني استخدام الاحماض الامينية الناتجة من هضم الطعام في بناء البروتينات في الخلايا.

الدهنيات: يقلل الانسولين من دهنيات الدم وذلك لتخزينها في اماكن تخزين الدهون تحت الجلد وحول الكليتين والامعاء.

ما الذى ينتج عن نقص الانسولين فى الجسم:

*تراكم الجلوكوز من الاطعمة السكرية والنشوية في الدم ، بدلا من استخدامه في الحصول علي الطاقة ويترتب علي ذلك مضاعفات كثيره باجزاء متفرقة من اجزاء الجسم سوف يلي الحديث عنها.

* إخراجالكبدلمزيدمنالجلوكوزإلتيارالدممنالمخزونلديهفيزيدارتفاعمستوى الجلوكوزبالدم.

*تحللالدهونالمختزنه بالجسم وخروجها الي تيار الدم (منها الكوليسترول والترايجلسريد) مما يعرض المريض للاصابة بتصلب الشرايين والازمات القلبية وايضا فقدان الوزن.

*هدم المواد البروتينية وتحويلها الي سكريات بدلا من الاستفادة بها في بناء العضلات وتجديد انسجة الجسم التالفة ، مما يضعف من حيوية الجسم ويزيد من فقدان الوزن.

*عدمقدرة العضلات على تجديد الطاقة المختزنة بها بتحويل الجلوكوز إلى جليكوجين،فيشعرالمريض بالتعب بسرعة عند القيام بنشاط عضليإذاماتم استهلاك الطاقة الموجودة بالعضلات.

ما هى أنواع السكري:

مرض السكرنوعان:

مرض السكري نوع 1:

وهوالسكرالمعتمد في علاجه على الإنسولين، وعادة مايصيب الأطفال صغارالسن والشباب مادون 30 سنة ويتميزهذاالنوع بعدم مقدرةالبنكرياس على إفرازالإنسولين ويمثل 10% من مرضى السكرى.

ويحتاجهذاالنوع فى علاجهإلى:

1- الانسولين.
2- الحمية الغذائية.
3- الرياضة.

مرض السكري نوع 2:

هوالنوع الأكثر شيوعا ويشكل% 90 من مرضى السكري ويسمى هذا النوع مرض السكري الغيرمعتمد على الأنسولينوهوالنوع الأكثرانتشاراً في الكبار فوق 40سنة أوالمصابين بزيادة الوزن .أحيانا يصيب الأطفال فوق العاشرة ويحدث نتيجة عدم مقدرة الجسم على إفرازهرمون الأنسولين أوعدم وجود كمية كافية من الأنسولين ولكنها غيرفعالة مما ينتج عنها ارتفاع السكرفي الدم.معظم المرضى المصابين بمرض السكري يتم تشخيصه عن طريق الصدفة وذلك لأنه في المراحل الأولى من المرض قد لا توجد أعراض او تكون غير كافية أو وجود بعض الأعراض المشابهة لأمراض أخرى.إذا ترك المرض دون علاج فإنه سوف يؤدي إلى فقدان البصر، أزمات قلبية،جلطات دماغية، فشل كلوي، القدم السكرى التى تنتهى بالبتر.

ويحتاج هذا النوع فى علاجه الى:

1- حمية غذائية.
2- رياضة.
3- حبوب.
4- او استخدام الانسولين فى حالة المرض او عدم الاستجابة للعلاج بالحمية الغذائية والحبوب.

ما هى العوامل المؤهبة للاصابة بمرض السكرى:

1. العمر اكثر من 45 سنة
2. الوراثة
3. قلة الرياضة البدنية او قلة الحركة
4. السمنة
5. الضغط
6. ولادة طفل وزنة اكثر من 4 كلجم

اعراض مرض السكري:

- العطش الشديد.
- كثرة التبول.
- الجوع الشديد.
- تعب وإرهاق وصعوبة في التركيز.
- ألم وتنميل في الأطراف.
- تأخرفي التئام الجروح.
- نقص الوزن لاسباب غير معروفة.
- حكة والتهابات جلدية.
- إضطرابات في البصر.
- حرارة في القدمين.

ويجب عنداستمرارالإحساس بواحدة أوأكثرمن الأعراض السابقة مراجعة الطبيب للكشف عن المرض وعلاجه.

الوقاية من مرض السكرى:

- الحرص على تغذية صحية
- زيادة النشاط البدني
- التخلص من الوزن الزائد.

مراقبة سكر الدم عند مرضى السكرى:

التحليل الذاتى لسكر الدم:

تعريفه: التحليل لنسبة السكر في الدم باستخدام جهاز الجلوكوميتر(Glucometer).

تعريف جهاز الجلوكوميتر:

هو جهاز كهروكيميائى يستخدم لقياس نسبة السكر فى الدم باستخدام قطرة دم من اصبع تشبه عينة فحص الملاريا.

معرفة المريض الدائمة لنسبة السكر بنفسه تجعله قادرا على إتخاذ الخطوات الضرورية للسيطرة على المرض والمحافظة على معدلات السكر في الدم أقرب للمعدلات الطبيعيةوذلك لتنظيم البرنامج العلاجي الخاص بالمريض ولتفادي الارتفاع أو الانخفاض الشديدين، ولمنع خطر المضاعفات المزمنة من مشاكل العين والقلب والكلى والأعصاب والقدمين. وذلك عن طريق عمل جدول خاص به وعرضه على طبيبه لعمل الخطة العلاجية المناسبه.

يجب عمل التحليل الذاتي لمستوى السكر في الدم بصفة منتظمة، ثم يقل تكرار عمل التحليل حينما يتم السيطرة على مستوى السكر في الدم.

اشرطة اجهزة الجلوكوميتر:

يتكون شريط الفحص من نقطة اختبار فى احد طرفى الشريط او فى وسطه وتحتوى على المادة الكيميائية الكاشفةوالطرف الاخر من الشريط يتم ادخالة فى الجهاز عند موضع الادخال.

توجد الاشرطة فى علبة محكمة القفل وبها مادة ماصة للرطوبة فى غطاء العلبة لتبقى الاشرطة جافة.

توجد ديباجة على العلبة توضح تاريخ الانتهاء.

عمل جهاز الجلوكوميتر:

يعمل جهاز قياس مستوى السكر فى الدم بمعيار ملجم/دسلتر او مليمول/لتر ومعظم الاجهزة فى السودان تعمل بملجم /دسلتر.

عند وضع نقطة الدم على شريط الاختباريحدث تفاعل بين المركب الكيميائى (الكاشف) الموجود فى شريط الاختبار(نقطة الاختبار) وبين الجلكوز فى قطرة الدم. يتكون نتيجة لذلكتيار كهربائى ضعيف تتناسب قوته مع كمية السكر الموجودةفى نقطة الدم. يقوم الجهاز بقياس هذا التيار الكهربائىومعالجته الكترونياليظهر النتيجة على شاشة الجهاز.

شفرة جهازالجلوكوميتر:

يوجد فى ديباجة العلبة رمز الشفرة (code) مع الاشرطة لبعض الاجهزة لمعايرة الجهاز.

هذه الشفرة بها معلومات مهمة ليتعرف الجهاز على الاشرطة ليعطى النتائج. ولابد من تطابق رقم الشفرة الموجود على الاشرطة مع الموجود فى الجهاز.

يجب مراعاة الاتى للحصول على نتيجة دقيقة:

- حفظ اشرطة الفحص داخل العلبة وعدم وضعها فى الثلاجة
- التاكد من تطابق شفرة الجهاز مع الاشرطةاستخراج شريط واحد فقط واغلاق العلبة فورا
- عدم نقل الاشرطة الى علبة اخرى
- عدم لبس نقطة الاختبار
- عدم استعمال الشريط اذا تغير لونه او تمزق فى نقطة الاختبار
- استعمال الشريط خلال 3 دقايق وعدم تكرار استعماله

* توجد انواع وموديلات صغيرة الحجم يمكن حملها فى الجيب.

المرضى الذين يحتاجون للتحليل الذاتيلسكر الدم :

- المرضى المعتمدين على الأنسولين أو الحبوب
- العلاج المكثف للأنسولين
- الحوامل
- المرضى الذين يواجهون صعوبات في التحكم بمستوى السكر في الدم

- المرضى الذين يواجهون صعوبات في تشخيص الدلائل التي تنذر بإنخفاض في مستوى السكر في الدم (الهيبوغلايسيميا) المرضى الذين يعانون إرتفاع السكر في الدم مع وجود أجسام كيتونية

الحالات التي تستوجب إختبارات إضافيةلسكر الدم:

- عندما تكون مريضا
- عند تناول وجبة خاصة (مخالفة لنظامك الغذائي)
- حين تشك أو تشعر بأعراض إنخفاض او ارتفاع جلوكوز الدم (الهيبوغلايسيمياو هايبرغلاسيميا)
- قبل البدء بقيادة السيارة (عندما تتعاطى الأنسولين)
- حين تقوم بجهد جسدي أو الرياضة
- عند تغيير نظام حقن الأنسولين التي تأخذها أو جرعة الأدوية التي تتناولها عن طريق الفم
- حين تفقد من وزنك ، أو حين يزداد وزنك.

فوائد التحليل الذاتي لسكر الدم:

- معرفة مستوى السكر في الدم
- معرفة ان كان المريض يحتاج إلى تعديل في طعامه أو تمريناته الرياضية أو علاجه

العوائق التحليل الذاتي لسكر الدم:

- التكلفة
- الإحساس بالألم بسبب الوخز الدائم
- عدم اقتناع المريض بأهمية التحليل الذاتي وفوائده في عملية مراقبة التحكم في مستوى السكر في الدم سواءً بسبب قلة التوعية الصحية للمريض أو تأثير الآخرين عليه .
- يحتاج الجهاز لصيانة بصفة مستمرة للتأكد من دقته من قبل الطبيب ومن قبل المريض

ماهي أوقات القياس الذاتي لسكر الدم:

- ❖ قبل الوجبات الغذائية الرئيسية الثلاث (فطور – غداء - عشاء)
- ❖ بعد الوجبات بساعتين (ابتداءا من بداية الوجبة)

- ❖ قبل النوم
- ❖ او يوميا
- ❖ مرتين فى اليوم

* المريض الذي يكون لديه السكر مستقر بصورة جيدة قد لا يحتاج كل هذه الاوقات للفحص.

ارشادات عامة لاستخدام جهازتحليل السكر فى الدم (جلوكوميتر):

يتوفر في الصيدليات هناك أنواع كثيرة من أجهزة تحليل السكر في الدم ويتوفر في الصيدليات يجب التأكد من دقة الجهاز وجودته أو قراءة الكتيب المرفق معه لمعرف الطريقة الصحيحة لتشغيله وصيانته قبل استخدامه.

أن النتائج قد تختلف من جهاز لآخر وأن هناك نسب (10% - 15%) بين نتائج المعمل ونتائج الأجهزة المنزلية وذلك لأن عينة الدم المستخدمة تؤخذ من الشعيرات الدموية الدقيقة في حالة الجهاز المنزلي بينما ترسل عينة الوريد إلى المعمل.

- التأكد من تاريخ صلاحية الأشرطة والتشديد على أهمية إحكام غلق الأشرطة بعد كل استعمال.

- التأكد على ضرورة الاتصال بالأخصائية إذا كان مستوى السكر في الدم مرتفعا أكثر من 240 مج أو منخفضا اقل من 60 مج ومن ثم طرق التصرف السليم في الحالتين.

- التأكد على أن التحاليل يجب أن تتم باتباع نظام يومي أو أسبوعي يتفق عليه المدرب بما يتناسب مع حاجة كل مريض.

المعدات اللازمة للتحليل الاتى لسكر الدم:

- o جهاز الفحص
- o اشرطة الفحص
- o أداة لإخراج الدم
- o قطن طبي أو مناديل ورقية
- o ساعة لتحديد الوقت

- ورقة وقلم لتسجيل نتيجة الفحص

<u>خطوات تحليل السكر فى الدم باستخدام الجلوكوميتر:</u>

تحضير المعدات

غسل اليدين

تجهيز ابرة الفحص (اما فى الجهاز او حسب المتوفر)

ادخال شريط الفحص فى الجهاز والتاكد من تطابق الرقم الموجود فى شاشة الجهاز مع الرقم الموجود فى علبة الاشرطة

مسح الاصبع المراد الفحص منه بالقطن والكحول

ادخال ابرة الفحص فى الجهاز (حسب الرغبة)

ادخال شريط الفحص فى الجهاز والتاكد من تطابق الرقم الموجود فى شاشة الجهاز مع الرقم الموجود فى علبة الاشرطة

اختيار الاصبع المراد الفحص منه ومسحه بالقطن والكحول

ثقب الاصبع المراد الفحص منه

التخلص من نقطة الدم الاولى

ضغط الاصبع لجمع نقطة مناسبة من الدم ووضعها فى شريط الفحص

وضع قطن فى مكان الفحص والضغط عليه

قراءة الرقم الموجود على شاشة الجهاز

اعادة الخطوات السابقة عند عدم وضوح القراءة او الشك

تسجيل النتيجة فى دفتر المراقبة بالوقت والتاريخ

التخلص من الابرة وشريط الفحص

قفل الجهاز

غسل اليدين

مراقبة سكر البول عند مرضى السكرى:

التحليل الذاتى لسكر البول:

يظهر السكر في البول عندما يتجاوز مستوى السكر في الدم نسبة 180 مج ولكن هذه النسبة غير ثابتة وتؤثر عليها عوامل كثيرة ولهذا فإن الكشف على نسبة السكر في البول غير دقيقة وذلك لصعوبة تحديد مدى الارتفاع والانخفاض المصاحب في سكر الدم ولكنها تكشف عن وجود الاستون .

يلجأ الكثيرون إلى تحليل السكر في البول لسهولة عمله ولكن من الأفضل عدم اعتماد المريض على النتائج في تغيير أو تعديل البرنامج العلاجي الا فى حالة وجود الاستون.

ماهى الحالات التى يتم فيها فحص البول للسكر:

- حالات الالتهابات المختلفة - حرارة - زكام - إسهال. قيء...
- حالات الارتفاع الشديد في مستوى السكر في الدم أكبر من 250 مج.
- حالات الضغوط النفسية والأزمات.
- عدم وجود إمكانيات لفحص الدم

ماهى الحالات التى يتم فيها فحص البول للسكر:

- قبل الثلاث وجبات الاساسية(الفطور والغذاء والعشاء) والنوم
- او مرتين يومياً،ويفضل في فحص الصباح أخذ العينة الثانية من البول أي بعد حوالي نصف ساعة من التبول في المرة الأولى، ويجب تسجيل النتائج.

ماهادوات او معدات فحص البول للسكر:

حاوية لاخذ عينة البول – شريط الفحص – دفتر المتابعة – قلم– ساعة

* يجب حفظ اشرطة البول فى مكان بارد وجاف وان تغاق العلبة بااحكام للحصول على نتائج سليمة

* عدم استخدام الشريط بعد انتهاء مدة صلاحيته.

عمل شريط البول:

يتفاعل سكر الجلكوز فى عينة البول مع المادة الكاشنة فى شريط الفحص فيتكون نتيجة لهذا التفاعل لون معين على الشريط يتناسب مع تركيز السكر فى عينة البول.

تتدرج الالوان فى الشريط حسب تركيز السكر من الاصفر الى الاخضر الفاتح ثم الداكن. يعبر عن تركيز السكر فى البول بعلامة الصليب (+).

اللون الاصفر يعنى خلو البول من السمر، واللون الاخضر الفاتح يعنى صليب واحد (+)، واللون الاخضر الداكن يعنى 4 صلايب (++++).

ماهخطوات فحص البول للسكر:

1. تجهيز المعدات
2. غسل اليدين
3. جمع عينة البول بالحجم المناسب
4. غمس شريط الكشف فى عينة البول للمستوى المناسب
5. ازالة شريط الكشف فى الحال لتجنب ازابة مربعات الكشف فى طرف الشريط
6. مسح الشريط على حافة وعاء البول برفق اثناء ازالة الشريط من عينة البول
7. مسك الشريط فى وضع افقى حتى لا تختلط الالوان ببعضها
8. مقارنة الالوان الموجودة على الشريط بالالوان الموجودة على حاوية الشرائط
9. قراءة النتيجة فى وقت مناسب
10. اعادة الخطوات السابقة فى حالة عدم وضوح القراءة
11. تسجيل النتيجةوتسجيلها فى دفتر المتابعة بالوقت والتاريخ

12. التخلص من الشريط حتى لا يعاد استخدامه
13. غسل اليدين

تفسير نتيجة فحص البول:

اذا كان البول خالى من السكر هذه نتيجة مثلى، سكر خفيف او صليب واحد تعتبر نتيجة مقبولة، اكثر من صليب تعنى ارتفاع سكر الدم وهذه نتيجة غير مقبولة، اكثر من صليبين مع الاستون يعنى ارتفاع سكر الدم غير مقبول وعرضة لحدوث احماض السكرى الكيتونية.

بسم الله الرحمن الرحيم

جامعة شندي

كلية الدراسات العليا

استمارة الموافقة علي المشاركة في البحث

عنوان البحث :- **معرفة تاثير الفحص الذاتى لسكر الدم والبول لمرضى السكربعلى معالجة مرضى السكرى**

The effect of self-monitoring (blood glucose and urine for sugar) on the Management of Diabetic patient in Kassala Diabetic Centre

اسم الباحث :- أمنة أحمد الطيب عباس

إسم المشارك :.....**العمر:**.....

الوظيفة :.....**السكن :**.....

طبيعة و اهداف البحث :-

1. تقييم مدي معرفة المريض بالداء السكري
2. للتحقق من مدى ممارسة المريض للفحص الذاتى لسكر الدم والبول
3. لتطبيق برنامج تعليمي و تدريبى لمرضى السكري عن كيفية الفحص الذاتى لسكر الدم والبول
4. تحسينضبط مستوى سكر الدملمرضى السكرى

- **المدة التي يشارك فيها المريض:-** سيشارك المريض لمدةلا تقل عن ست أشهر من خلاله يتعرض لبرنامج تعليمي و متابعة من قبل الباحث .
- **إحتمالات الخطورة :-** لا يتعرض المشارك لأي تدخلات من شانها التاثير في العلاج او حدوث مضاعفات , بينما يحدث العكس حيث يكون المشارك تحت رعاية.
- **الفوائد للمريض و المجتمع :-**
- سيستفيد المشارك من تعلم معلومات متعلقة بالمرض و مضاعفاته , اضافة الي امكانية المساعدة في تعليم افراد اخرين مصابين بالمرض و لذا يقلل من حدوث المضاعفات و يساعد في التحكم بالمرض.
- يتعلم المريض الطريقة السليمة لفحص السكر والاستجابة لنتائج الفحص
- **حق المشارك في التوقف عن المشاركة بدون فقدان فوائد** :- للمشارك الحق في رفض المشاركة في البحث متي ما رائ ذلك
- سيتم تمليك المشارك أيّ معلومات جديدة عن البحث مع توضيح الحقائق

أنا ..... البالغ من العمر ..... بكامل وعيي و قواي العقلية و بعد التعرف علي البحث و طبيعه المشاركة و كل الموجهات الخاصة بمشاركتي سالفة الذكر أوافق علي المشاركة في هذا البحث مع الاحتفاظ بحقي في التوقف في اي وقت اشاء .

امضاء المشارك .....التلفون.....

امضاء الباحث ..... التاريخ :- .... / 2014

برنامج تدريب مرضى السكرى على الفحص الذاتى

لسكر الدم بإستخدام جهاز الجلوكوميتر وسكر البول باستخدام الاشرطة

مفكرة مريض السكرى

التاريخ: .....

إسم المريض: .....

العمر: .....

نوع السكرى: .....

نوع العلاج: .....

إسم جهاز قياس الدم:.....

رقم التلفون: .....

جدول فحص سكر الدم وسكر البول فى المنزل

معدل السكر المطلوب لمريض السكرى

صائم	بعد الاكل
110 - 80	140 - 110

التاريخ	اليوم	الصباح الباكر (صيام)		قبل النوم	وقت
		الدم	البول	البول	اخر
	السبت				
	الاحد				
	الاثنين				
	الثلاثاء				
	الاربعاء				
	الخميس				
	الجمعة				
	السبت				
	الاحد				
	الاثنين				
	الثلاثاء				
	الاربعاء				
	الخميس				
	الجمعة				

التاريخ	اليوم	الصباح الباكر (صيام)		قبل النوم	وقت
		الدم	البول	البول	اخر
	السبت				
	الاحد				
	الاثنين				
	الثلاثاء				
	الاربعاء				
	الخميس				
	الجمعة				
	السبت				
	الاحد				
	الاثنين				
	الثلاثاء				
	الاربعاء				
	الخميس				
	الجمعة				

Pictures during conducting the study

Data collection:

Educational Program