Impact of Structured Teaching Program on Nurses Knowledge Regarding Type1 Diabetes Mellitus And Insulin Administration Amongst Nurses Working In Kosti Teaching Hospital 2018 White Nile State – Sudan.

A thesis submitted for the fulfillment of PhD

In pediatric nursing

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بسم الله الرحمن الرحيم

اقرأ بِسَم رَبِّ الْأَكْرَمِ (١) خَلَقَ الْإِنسَانَ مِنْ عَلْقٍ (٢) إِنَّكَ عَلِيمَ الْأَعْرَافِ (٣)

الَّذِي عَلِمَ الْقُلُوبَ وَلَا يُعْلَمُ الْإِنسَانُ مَا لَمْ يُبْلَهْ (٤)

صدق الله العظيم

سورة العلق الآيات (١-٥)
Dedication

To my parents ...

... 

To my brothers and sisters ...
To my children 

... 

To my husband

... 

To my colleagues and friends ...
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1. Introduction

Diabetes mellitus is a chronic disorder characterized by abnormalities in the metabolism of carbohydrate, protein and fat. (1)

Diabetes management in children and adolescents requires multiple daily management tasks which can challenge caregiver. Nevertheless, the scientifically proven long - term health benefits of optimal diabetes control mandate that best efforts be made to control diabetes at school as well as at home. (2,3,4) Diabetes is one of the most common diseases in school – age children. According to the 2011 national diabetes fact sheet , about 215/000 young people in the US under age 20 had diabetes in 2010. This represents 0.26 percent of all people in this age group. (5)

Based on data from 2002 to 2005 , the SEARCH for diabetes in youth study reported that approximately 15,600 US youth less than 20 years of age were diagnosed annually with type 1 diabetes and the estimated overall prevalence for type 1 diabetes in youth is approximately 154 cases per 100/000 youth. (6,7) The National Diabetes Education Program estimated 75 % of all newly diagnosed cases occur in individual under 18 years of age. (8)

Today, almost a century after the discovery of insulin, the most common cause of death in a child with diabetes, from a global perspective, is lack of access to insulin or improper use of insulin. Many children die even before their diabetes is diagnosed. Around the world, forces have united to make it come true that no child should die from diabetes or its complications. (9)

Elamin A et al studied during 10 years period clinical pattern of type 1diabetes among children admitted to the department of the university hospital in Khartoum , Sudan .Family history of type 1 diabetes was reported in (4-9%) of patients. Diabetic ketoacidosis was presenting symptom in 82 patient (81.2%) and 93 patients (92.1%) have at least two documented episodes of ketoacidosis during the follow up
period. The average daily dose of insulin by the patient was greater than 2 u/kg body weight and the mean HBA was 13.4%. Seventeen patients (16.8%) were known to have died during years of observation resulting in mortality rate of 42 per 1000 person-years of follow up. The study emphasize the need for urgent measures to increase public awareness of diabetics and to improve methods of case–finding and management of diabetic patients.\(^{(10)}\)
1.2. Problem statement:

Diabetes Mellitus in children is a chronic medical problem, with many complications affecting the growth and development in early and late childhood. Children are now developing type 1 diabetes at an earlier age. The overall incidence of type 1 diabetes in 2010 is predicted to be approximately 40% higher than the incidence recorded in 1997. Evidence has been accumulating that demonstrates a worldwide increase in the incidence of type 1 diabetes mellitus, with incidence rising especially in areas where type 1 diabetes was previously low. Type 1 diabetes is increasing steeply in some central and eastern European countries, where the disease remains less common than in other regions.\(^{(11)}\)

If these trends continue, it is inevitable that the total prevalence of people with type 1 diabetes will increase in coming years. Europe is followed closely by South-East Asia, with 23% of the world’s young people with type 1 diabetes, and North America and the Caribbean, with 19%. However, the lack of data in other parts of the world makes it difficult to estimate the true burden. In sub-Saharan Africa and many low-resource countries, diagnosis may be missed and children may be dying from a lack of insulin before they are identified. One study in Sudan showed a mortality rate of 42.6 deaths per 100,000 children with type 1 diabetes\(^{(10)}\). This is compared to 0.63 deaths per 100,000 children with type 1 diabetes in the USA.\(^{(12)}\)

It is almost impossible to determine the true incidence and prevalence in these regions; special efforts must be made to record and report on this problem. Regardless, even in studies from high-income countries, children with type 1 diabetes had at least twice the mortality rate of children without the disease.\(^{(13)}\) The prevalence of diabetes mellitus in Sudan dramatically increased from 3.4% in 1996 to 8.05% in 2012 according to IDF (international diabetic federation) and MENA (Middle East and North Africa). With the increasing
of diabetes prevalence, the diabetes related-complications will also increase.
Efficient diabetic care and then subsequent optimal control is difficult for many reasons, health multidisciplinary care centers are only available in two small centers in Khartoum (the capital). There are four private diabetic clinics but the high fees and cost limit their use.
1.3. justifications:

Two large international collaborative projects, the Diabetes Mondialestudy (DiaMond) and the Europe and diabetes study (EURODIAB) have been instrumental in monitoring developments in the incidence of type 1 diabetes in children. According to the latest edition of the Diabetes Atlas, an estimated 490,100 children below the age of 15 years are living with type 1 diabetes.\(^{(14)}\)

Incidence of type 1 diabetes varied from 0.1/100,000 per year in China and Venezuela to 36.8/100,000 per year in Sardinia and 36.5/100,000 per year in Finland. This represents a >350-fold variation in the incidence among the 100 populations worldwide. The global pattern of variation in incidence was evaluated by arbitrarily grouping the populations with a very low (<1/100,000 per year), a low (1–4.99/100,000 per year), an intermediate (5–9.99/100,000 per year), a high (10–19.99/100,000 per year), and a very high (>20/100,000 per year) incidence. The lowest incidence (<1/100,000 per year) was found in the populations from China and South America. In most populations, the incidence increased with age and was the highest among children 10–14 years of age.\(^{(16)}\)

The problems of diabetes care in Sudan include the deficiency of diabetes care centers, deficiency of specially trained personnel and diabetes nurse educators and educational material in care settings; however, no traced studies in Sudan examined the effectiveness of education intervention given to the children or their carers, comparing to the prevalence of the disease in Sudan.

- Medical personnel trained in diabetes care, e.g. educators or dietitians, are few, as are diabetes logiest.
- Adequate nurses knowledge about diabetes improves diabetes care and management for diabetic children. \(^{(17)}\)
Objectives

**General objective:**
To assess the impact of structured teaching program on nurses knowledge regarding type1 diabetes mellitus and insulin management among nurses working in Kosti Teaching Hospital

**Specific objectives:**
1. To determine the demographic characteristic of nurses dealing with diabetic patients.
2. To assess the basic knowledge of nurses about type 1 diabetes mellitus.
3. To assess the nurse’s knowledge and performance regarding insulin administration for type 1 diabetes.
4. To design and implement training program for nurses about insulin administration.
5. To evaluate the effect of designed program on the achievement of nurses knowledge and practice regarding type 1 diabetes and insulin administration post-intervention.
2. Literature review

Diabetes mellitus is a chronic illness, characterized by hyperglycemia resulting from impairment in insulin secretion, defects in insulin action, or both. \(^{(18)}\)

Type 1 diabetes is due to autoimmune B-cell destruction, usually leading to absolute insulin deficiency. \(^{(19)}\) This results in abnormally high levels of glucose in the blood and widespread disturbances to metabolism. \(^{(20)}\)

Type 1 diabetes can develop rapidly and occurs after illness, but symptoms may be mistaken for the flu or other common conditions.

2.1. Causes:

Diabetes type 1 is induced by one or more of the following:

2.1.1. Genetics:

Type 1 diabetes is polygenic disease, meaning different genes contribute to its onset. Depending on locus or combination of loci, it can be dominant or recessive, or somewhere in between. The strongest gene, IDDM1, is located in the MHCclass11 region on chromosome 6. \(^{(21)}\)

The risk of child developing type 1 diabetes is about 10% if the father has it, about 10% if a sibling has it, about 4% if the mother has type 1 diabetes and was aged 25 or younger when the child was born, and about 1% if the mother was over 25 years old when the child was born. \(^{(22)}\)

2.1.2. Environment:

Environmental factors can influence expression of type 1 diabetes for identical twins, when one twin had type 1 diabetes, the other twin only had it 30%-50% of the time. Despite having exactly the same genome, one twin has the disease where the environmental factors in additional to genetic factors, can influence disease prevalence. \(^{(22)}\)
2.1.3. **Virus**:  
Type 1 diabetes is a virus – trigger autoimmune response in which the immune system attacks virus – infected cells along with the beta cells in the pancreas. The coxsackie virus family or rubella is implicated, although the evidence is inconclusive. In type 1, pancreatic beta cells in the islets of Langerhans are destroyed decreasing endogenous insulin production, this distinguishes type 1 diabetes origin from type 2. The type of diabetes a patient has is determined only by the cause – fundamentally by whether the patient is insulin resistance (type 2) or insulin deficient without insulin resistance (type 1). This vulnerability is not shared by every one for not everyone infected by the suspected virus develops type 1 diabetes. This has suggested presence of genetic vulnerability (21), and there is indeed an observed inherited tendency to develop type 1. It has been traced to particular HLA genotypes, through the connection between there and triggering of an autoimmune reaction is still poorly understood.  

2.2. **Pathophysiology**:  
The pathophysiology in diabetes type 1 is basically a destruction of beta cells in the pancreas regardless of which risk factors or causative entities have been present. (21) Type 1 diabetes is defined by the presence of one or more of these autoimmune markers. Glutamic acid decarboxylase autoantibodies (GADA), tyrosine phosphatases IA 2 and IA - 2b, zinc transporter (ZnT 8) and insulin autoantibodies (IAA). This process occurs in genetically susceptible subjects. Usually progresses over many months or years during which the subject is asymptomatic and hyperglycemic. Hyperglycemia develops when 80 %-90 % of β cells are destroyed. The rate of progression is dependent on the age at first detection of antibody, number of antibodies, antibody specificity, and antibody titer. Glucose and HA 1 C levels rise well before the clinical onset of diabetes, making diagnosis feasible well before the onset of diabetic ketoacidosis. (24)
Insulin can be thought of as a compound that opens the doors to body cells, allowing them to admit the glucose needed to function. It does not play a major role in glucose transport into the brain, erythrocytes, leukocytes, intestinal mucosa, or kidney epithelium. These cells can survive insulin deficiency but not glucose deficiency. If glucose is unable to enter body cells because of a lack of insulin, it builds up in the blood stream (hyperglycemia), and this underlying defect leads to other metabolic consequences. When the kidneys detect hyperglycemia (greater than the renal threshold of about 180 mg/dL), the kidneys attempt to lower it to normal levels by excreting excess glucose into the urine, causing glycosuria. While attempting to excrete this excess glucose, the body also excretes a large amount of fluid (polyuria). Excess fluid loss, in turn, triggers the thirst response (polydipsia) producing the three cardinal symptoms of diabetes: polyuria, polydipsia, and hyperglycemia. Because body cells are unable to use glucose but still need a source of energy, the body breaks down protein and fat for cell utilization. If large amounts of fat are metabolized in this way, weight loss occurs and ketone bodies, the acid end-product of fat breakdown, begin to accumulate in the bloodstream and spill into the urine. Because the blood bicarbonate cannot effectively continue to buffer this high an acid level, the pH of the blood becomes acidic, resulting in severe acidosis.

The breakdown of fat also leads to increased serum cholesterol levels. Potassium and phosphate, attempting to serve as buffers, pass from body cells into the bloodstream. As they are evacuated, the body loses these important electrolytes. Untreated diabetic children, therefore, lose weight, are acidotic , dehydrated, and experience an electrolyte imbalance because of the loss of electrolytes in urine. Because large amounts of protein and fat are being used for energy instead of glucose, these children lack the necessary components for growth; they therefore remain short in stature and underweight.  

(25)
2.3. Clinical manifestations:

The classic symptoms of Type 1 diabetes are frequent urination, bed wetting in a previously dry child, excessive thirst, excessive tiredness and weight loss.

Children and young people will not necessarily display all symptoms at the same time, and symptoms may vary depending on the age of the child. For example: Bedwetting in a previously “dry” child is the earliest symptom of diabetes occurring in 89% of children over the age of four\(^ {26,27}\).

Weight loss occurs in 50% of children aged 10-14 years but only in 5% of those under the age of two. Lethargy occurs in 10 - 20% of children of all ages. Constipation occurs in around 10% of children under the age of five and is secondary to chronic dehydration\(^ {26}\). While oral and vulval thrush has been reported, recurrent infections are uncommon as a presentation, occurring in only 2%.\(^ {28}\) Other symptoms include urinary tract infections and yeast infections, slow healing or sores, mood swing or irritability, dizziness or fainting.\(^ {1,29,30}\).

The symptoms are characteristic and the diagnosis is seldom in doubt if hyperglycemia, glycosuria and ketonuria are detected. Young diabetics always require prompt diagnosis and therapy, but the correct diagnosis may be confused by a coincidental febrile illness and the hyperventilation mistakenly interpreted as being due to pneumonia.

Early diagnosis saves lives and allows an organized introduction to the principles of diabetic management; often an out – patient-ketoacidosis obviously necessitates urgent admission.\(^ {31}\)

2.4. Diagnostic tests for diabetes:

Diabetes may be diagnosed based on plasma glucose criteria, either the fasting plasma glucose (FPG) or the 2-h plasma glucose (2-h PG) value during a 75-g oral glucose tolerance test (OGTT), or A1C criteria.
Generally, FPG, 2-h PG during 75-g OGTT, and A1C are equally appropriate for diagnostic testing. (23-32)

**Criteria for diagnosis of diabetes:** (24-33)

- FPG > 120 mg/dl (11.1)mmol/L, fasting is defined as stop caloric intake for at least 8 hours.
- 2 HPG > 200mg/dL(7.0)mmol/L during OGTT.

The test should be performed as described by WHO, using glucose load containing the equivalent of 75g anhydrous glucose dissolve in water.

- HbA1C.6.55(48)mmol/L.

- in patient with classic symptoms of hyperglycemia or hyperglycemic crisis, random plasma glucose > 200mg/dL.

Other laboratory tests for known autoantibodies that can indicate an autoimmune attack against the insulin production beta cells of pancreas may be ordered, such as glutamic acid decarboxylase(GAD-65), insulin autoantibodies, and islet cell cytoplasmic autoantibodies.\(^5\) Glycated hemoglobin A1C,HbA1c,A1c, or Hb1c; sometimes also refer to as being Hb1c or HGBA1C) is a form of hemoglobin that is measured primarily to identify the three – months average plasma glucose concentration. The test is limited to a three- months average because the life span of red blood cell is a four month (120 days)- since red blood cells do not all undergo lysis at the same time, HbA1c is taken as limited measure of three months. It is formed in anon – enzymatic glycation pathway by hemoglobin's exposure to plasma glucose.

HbAc1 is a measure of the beta –N-1-deoxyfructosyle component of hemoglobin. (34) Normal level of glucose produce a normal amount of Glycated Hb. As the average amount of plasma glucose increase , the fraction of Glycated Hb increase in a predictable way. This serve an indicator that blood sugar is increasing and that action should be taken.

In diabetes mellitus, a higher amount of Glycated Hb, indicate poorer control of blood glucose levels, have been associated with cardiovascular disease, nephropathy, neuropathy, and retinopathy.
A-trial on group of patients with type 1 diabetes found that monitoring by care giver of HbAc1 led to change in diabetes treatment and improvement of metabolic control compared to monitoring only of blood or urine glucose.\textsuperscript{(31)}

The A1C has several advantages compared with the FPG and OGTT, including greater convenience (fasting not required), greater pre analytical stability, and less day-to-day perturbations during stress and illness. However, these advantages may be offset by the lower sensitivity of A1C at the designated cut point, greater cost, limited availability of A1C testing in certain regions of the developing world, and the imperfect correlation between A1C and average glucose in certain individuals. National Health and Nutrition Examination Survey (NHANES) data indicate that an A1C cut point of > or equal 6.5% (48 mmol/mol) identifies a prevalence of undiagnosed diabetes that is one-third of that using glucose criteria.\textsuperscript{(35)}

Careful history is necessary to rule out a stress-related illness, corticosteroid use, fracture, acute infection, cystic fibrosis, pancreatitis, or liver disease\textsuperscript{(25)}.

2.5. Management of diabetes mellitus:

Type 1 diabetes is managed by insulin replacement and balancing of diet and exercise in order to maintain glycemic control and prevent the occurrence of complications.\textsuperscript{(36)} In order to effectively manage diabetes, education about components of management such as blood glucose monitoring, insulin replacement, diet, exercise, must be delivered to the patients, education is important both at diagnosis, where there is usually no knowledge base and patient and family are given basic skills for controlling the disease.\textsuperscript{(37)}

2.5.1. Nutrition therapy

Weight loss is recommended for all insulin-resistant/overweight or obese individuals. Either low-carbohydrate, low-fat calorie restricted diets. Saturated fat should be < 7% of total calories.
Monitoring carbohydrate intake by carbohydrate counting, exchanges, or experienced estimation is recommended to achieve glycemic goals. Routine supplementation with antioxidants, such as vitamins E and C is not advised due to lack of efficacy. (38)

2.5.2. Physical activity
150 minutes/week of moderate intensity exercise (brisk walking) spread over at least 3 days and with no more than 2 days without exercise. Resistance training of large muscle groups should be \( \geq 2 \) times/week. (39)

2.5.3. Insulin management of diabetes
Insulin is an endogenous hormone, secreted by the beta cells of the pancreas, that enhance the trans-membrane passage of glucose across cell membranes. Insulin lowers the blood glucose level by stimulating glucose passage across cell membranes and uptake into the cells. It also promotes the conversion of glucose to glycogen and inhibits hepatic glucose production from glycogen. It's used as a regular management of type 1 and type 2 diabetes, and for emergency care of diabetic ketoacidosis. Insulin human injection is extracted from beta cells of pork pancreas or synthesized by recombinant DNA technology. (25)

Insulin plays a key role in the regulation of carbohydrate, fat, and protein metabolism. It is a polypeptide hormone of complex structure. There are differences in the amino-acid sequence of animal insulin's, human insulin's and human insulin analogues. Human sequence insulin may be produced semisynthetically by enzymatic modification of porcine insulin (emp) or biosynthetically by recombinant DNA technology using bacteria or yeast. (40)

2.5.3.1. Insulin requirement
Most prepubertal children require around 0.6 – 0.8 unit /kg / day of insulin after the initial temporary remission phase. Unless the child leads a very sedentary life-style, a requirement for higher doses my indicate poor compliance or poor absorption of insulin from injection site(e.g. because of
lipohypertrophic sites). During puberty up to 1.5 – 2 units/kg/day of insulin may be required, especially during growth spurts. Around 1 year after menarche or after growth spurt in boys, the dose may need to be adjusted to avoid excessive weight gain. Insulin requirements may be increased by infection, stress, accidental or surgical trauma. Insulin requirement may be decreased in very active individual’s and in those with hepatic or renal impairment, some endocrine disorders (e.g. Addison’s disease, hypopituitarism) or coeliac disease. Insulin requirement should be assessed frequently in all these circumstances. *(40)*

**2.5.3.2. Types of Insulin**

**Short acting insulin** :-

Is a short – acting form of insulin. For maintenance regimens it is usual to inject it 15 to 30 minutes before meals.

**Soluble insulin :**

Is the most appropriate form of insulin for use in diabetic emergencies and at the time of surgery. It can be given intravenously and intramuscularly, as well as subcutaneously. When injected subcutaneously, soluble insulin has a rapid onset of action(30- 60 minutes), a peak action between 2 and 4 hours, and a duration of action of up to 8 hours. When injected intravenously, soluble insulin has a very short half-life of only about 5 minutes and its effect disappears within 30 minutes.

**The human insulin analogues:**

Insulin aspart and insulin Lispro, have faster onset(10 to 20 minutes) and shorter duration of action(2- 5 hours) than soluble insulin; as a result, compared to soluble insulin, fasting and pre-prandial blood glucose concentration is a little higher, post prandial blood glucose concentration is a little lower, and hypoglycemia occurs slightly less frequently.

-Insulin a sprat (recombinant human insulin analogue)

In children under 6 years (use only if benefit likely compared to soluble insulin). Insulin Lispro(recombinant human insulin analogue), they may be useful in children prone to pre-lunch
hypoglycemia and those who eat late in the evening and are
borne to nocturnal hypoglycemia. Insulin a sprat and insulin
Lispro may also be administered by subcutaneous infusion.
Neonate 0.01-0.1 units/kg/hour, adjusted according to blood
-glucose concentration.
Children 1 month – 18 years 0.025-0.1 units / kg/hour,
adjusted according to blood glucose concentration..

**Intermediate and long-acting insulin:**

When given by subcutaneous injection, intermediate-
and long –acting insulin's have an onset of action of
approximately 1-2 hours, a maximal effect at 4-12 hours, and
a duration of 16 – 35 hours. Some are given twice daily in
conjunction with short- acting(soluble) insulin, and others
are given once daily. They can mixed with soluble insulin in
syringe( except insulin detemir and insulin glargine),
essentially retaining the properties of the two components,
although there may be some blunting of the initial effect of
the soluble insulin component ( especially on mixing with
protamine zinc insulin). Close monitoring of blood glucose
is essential when introducing a change to the insulin
regimen; the total daily dose as well as any concomitant
treatment may need to be adjusted.

**-Isophane insulin:**

Is a suspension of insulin with protamine's which is of
particular value for initiation of twice- daily insulin regimens.
Isophane may be mixed with soluble insulin before
injection but ready – mixed preparations may be more
appropriate(biphasic Isophane insulin, biphasic insulin a
sprat, or biphasic insulin Lispro).

**-Insulin zinc suspension** (crystalline): Has amore prolonged
duration of action ; it may be used independently or in
insulin zinc suspension(30% amorphous, 70% crystalline).

**-Protamine zinc insulin:** Is usually given once daily with-
short acting( soluble) insulin. It has the drawback of binding
with rapid –acting insulin when mixed in the same syringe
and is now rarely used.
**-Insulin detemir and insulin glargine:** Are human insulin analogues with prolong duration of action; insulin detemir is given once or twice daily and insulin glargine is given once daily. They may help to reduce nocturnal hypoglycemia in those using multiple daily injection regimens.

**-Insulin zinc suspension:** (insulin zinc suspension(mixed ; I.z.s. – long acting). A sterile neutral suspension of bovine insulin or human insulin in the form of a complex obtained by the addition of suitable zinc salt; consists of rhombohedral crystals(10-40 microns) and of particles of no uniform shape (not exceeding 2 microns. (41)

**2.5.3.3.Insulin storage and suspension**

Store injectable medication in current use at room temperature( for maximum of one month after initial use ) , and with expiry date. Avoid direct sun light and areas of temperature extreme.

Store unopened injectable medication in an area of the refrigerator where freezing is unlikely to occur. (42)

Cloudy insulin (e.g NPH and pre- mixed insulin must be gently rolled ten times and inverted ten times (not shaken ) until the crystals go back into suspension and the solution become milky white. (43)

**2.5.3.4.Absorption rates**

**-Human insulin**

The abdomen is the preferred site for soluble human insulin , since absorption is fastest there. (44)

Massaging the site before or after injection may speed up absorption and is not recommended. (44-45-46)

**-Premixed insulin**

Premixed insulin(human or analogue ) should be given in the abdomen in the morning to increase the speed of absorption of short- acting insulin in order to cover post breakfast glycemic excursions. (47)

Rapid- acting analogues should not be give IM , because the risk of sever hypoglycemia or erratic control. (47-48-49)
-Long-acting insulin

Insulin analogues may be given at any of the injection sites, as possible rates do not appear to be site-specific. (44) Cloudy insulin (e.g. NPH and pre-mixed insulin) must be gently rolled ten times and inverted ten times (not shaken) until the crystals go back into suspension and the solution become milky white. (49)

2.5.3.5. Needles for injection:

Children and adolescents: There is no clinical reasons for recumbently needles longer than 6 mm for children and adolescents. (50) Children and adolescents using a 5/6 mm needle should lift a skin fold with each injection. (48-49;50-51) In the majority of cases 4 mm needle may insert at 90 degree without a lifted skin fold. (51) If children have only an 8 mm needle available it is essential to use a lifted skin fold or give injections into the buttocks. (51)

2.5.3.6. Injection process

Tips for making injections less painful include:
- Keeping injectable therapy in use, at room temperature. (48)
- Using needles of shorter length and smaller diameter. (48)
- Using anew needle at each injection. (45)

2.5.3.7. Insulin injection technique:

-Insulin injection site

The best places to inject insulin are upper arms, the thighs, the buttocks, and the abdomen (at least two inches away from the navel). Because the rate of absorption vary considerably from one body region to another, the American Diabetes Association (ADA) currently recommends rotating injection sites within body regions rather than rotating to a different region with each injection. Insulin absorbed fastest from the abdomen, followed by the arm, the thighs, and the buttocks. (however, exercising an arm or leg after an injection can increase blood flow and speed insulin absorption from those areas). The ADA recommends taking this variability into account when choosing injection sites. Every one absorbs insulin somewhat differently, so the best
way to find out what effect a given injection site is having is to monitor blood glucose levels. Paying close attention to how rotate injection sites can help to eliminate high and low swings in blood glucose level. (55)

-Injection site care

The site should be inspected and palpated by the individual prior to injection. (45) Avoid using a site showing signs of lipohypertrophy, inflammation, edema or infection until the problem has been resolved. (56) Injection should be given into a clean site using clean hands. The site should be cleaned with soap and water when found to be unclean. (57) Disinfection of the site is unusually not required; however alcohol swabs may be used prior to injection given in the hospital or care home setting. (51)

-The correct use of syringes

A syringe should be used once and disposed safely. (41-45, 46-58, 59) Lipohypertrophy it is build-up of fat under the skin, which can slow the absorption of insulin. (55) Injection Site should be inspected and any abnormalities documented by the health care provider within the individuals care plan. At minimum, each site should be examined annually (preferably at each visit for children). If lipohypertrophy is already present the site should be monitored at every review. Individual should be taught to examine their own injection sites and how to detect lipohypertrophy. (60) Individual should be advised (and rational explained) not to inject into areas of lipohypertrophy until abnormal tissue return to normal (which can take months to years). (61-62) The best current preventive and therapeutic strategies for lipohypertrophy includes rotation of injection site with each injection, and non-reuse of needles. (61, 63-64)
- **Rotation of injecting sites:**
  Individual should be taught an easy – to – follow rotation scheme from the onset of injection therapy. One scheme with proven effectiveness involves dividing the injection site into quadrants (or half when using one thighs or buttocks); using one quadrant per week and moving always in same direction, either clockwise or anti-clockwise. Injecting within any quadrant or half should be spaced at least 1 cm from each other in order to avoid repeat tissue trauma. Health care provider should verify that the rotation scheme is begin followed at each visit and should provide advise where needed; use a variation of educational approaches and available tools to inform how to detect for lipo-hypertrophy. 

- ** Lifted Skin Folds:**
  All people with diabetes /careers should be taught the correct technique for lifting a skin fold from the onset of injection therapy. The lifted skin fold should not be squeezed so tightly that causes skin blanching or pain.
  The optimal sequence should be:-
  - Lifted skin fold
  - Insert needle into skin at 90 degree angle.
  - Administer therapy.
  - Leave the needle in the skin for at least 10 second after the thumb button plunger is fully depressed.
  - Withdraw needle from the skin.
  - Release lifted skin fold.
  - Dispose of needle safely. 

2.5.4. **Surgical treatment for type 1 diabetes:**
  Pancreas and Islet transplantation have been shown to normalize glucose levels but require life-long immunosuppression to prevent graft rejection and recurrence of autoimmune islet destruction. Given the potential adverse effects of immunosuppressive therapy, pancreas transplantation should be reserved for patients with type 1 diabetes undergoing simultaneous renal transplantation, following renal transplantation, or for those with recurrent
ketoacidosis or severe hypoglycemia despite intensive glycemic management.\(^{38}\)

2.6. Acute complications of type 1 diabetes:

2.6.1. DKA:

Diabetic ketoacidosis is the common and potentially life threatening condition that occurs in children with type 1 diabetes when the body must burn fat for energy because no insulin is available to metabolize glucose. DKA is associated with severe metabolic, electrolyte, and fluid imbalances.

The biochemical criteria for the diagnosis of DKA:

- Hyperglycemia - blood glucose greater than 250 mg/dL,
- Ketosis - ketones present in blood and/or urine, acidosis pH less than 7.3 and/or bicarbonate less than 15 mmol/L.\(^{68}\)

Potential causes of DKA include incorrect or missed insulin doses or administration just under the skin, an illness, trauma, or surgery. Insulin deficiency is accompanied by a compensatory increase in hormones (epinephrine, norepinephrine, cortisol, growth hormone, and glucagon) which are released when inadequate glucose is delivered to the cells. The muscle cells break down protein into amino acids that are then converted to glucose by the liver, leading to hypoglycemia. The adipose tissue releases fatty acids that are transformed by the liver into ketone bodies. Their accumulation leads to ketoacidosis. The hyperglycemia causes an osmotic diuresis resulting in dehydration, acidosis, and hyper osmolality. Altered consciousness occurs as symptoms progress.

2.6.1.1. Clinical presentation:

Characteristic signs of DKA include dehydration, weight loss, tachycardia, flushed ears and acetone breath, altered level of consciousness, and hypotension. Hyperglycemia, glycosuria, and ketonuria are also present. In response to metabolic acidosis, children complain of abdominal or chest pain, nausea, and vomiting. The disorder may progress to electrolyte disturbances, arrhythmias, altered consciousness, shock, and death if untreated. Cerebral edema is a life
threatening complication, thought to be related to hyperosmolality. Sign and symptoms include headache, lethargy, tachycardia or bradycardia, and widening pulse pressure.\(^{(19)}\)

**2.6.1.2. Laboratory diagnosis:**

DKA is present with the following findings:
- Blood glucose level greater than 200mg/dL, serum ketones present in blood and/or in urine
- Acidosis (PH less than or equal to 7.3
- Bicarbonate less than 15 mmol/L
- Glycosuria, and ketonuria.\(^{(68)}\)

**2.6.1.3. Classification of DKA:**

DKA is generally categorized by the severity of the acidosis.

**Mild:** Venous pH less than 7.3 and/or bicarbonate concentration less than 15 mmol/L.

**Moderate:** Venous pH less than 7.2 and/or bicarbonate concentration less than 10 mmol/L.

**Severe:** Venous pH less than 7.1 and/or bicarbonate concentration less than 5 mmol/L.

Electrolyte disorders also occur hyperkalemia, hyperchloremia, Hyponatremia, hypophosphatemia, hypocalcaemia, and hypomagnesaemia. The blood urea nitrogen (BUN) and creatinine are elevated due to dehydration. Diabetic coma occurs when the serum osmolality exceeds 350 mOsm/kg. Normal serum osmolality is 275 to 295 mOsm/kg. The child with ketoacidosis is usually hospitalized. Medical management includes intravenous fluids and electrolytes for dehydration acidosis. Regular insulin is given by continuous infusion pump to decrease the serum glucose level at a rate not exceed 100 mg/dL/hr. Faster reduction of hyperglycemia and serum osmolality increase the risk for cerebral edema. Manitol is kept on standby for treatment of neurologic deterioration. Bicarbonate is no longer used for treatment of DKA as it place the child at risk for increased acidosis and hyperosmolality. As insulin is administered, potassium shifts to the cells, resulting in hypokalemia. Potassium supplementation is given only after confirmation of renal
function. Cerebral edema occurs in about 3% of children with DKA, but is accounts for 30% of DKA death and 20% of overall childhood mortality. (25)

The risk for morbidity and mortality is higher in severe DKA. These patients require close physician monitoring, frequently utilizing central venous and intra-arterial pressure monitoring as well as frequent blood chemistry determinations to direct therapy. Physicians experienced in the care of children with DKA (pediatric endocrinologists or pediatric intensivists) should direct management, whenever possible. (69)

**2.6.1.4.Nursing management:**

Continuously monitor the child's vital signs, respiratory status, and perfusion, and mental status. Assess for changes in neurologic status, respiratory pattern, blood pressure, and heart rate. Attach a cardiac monitor and observe for arrhythmias associated with hypokalemia. Frequently monitoring the electrolytes and acid-base status, the blood glucose levels, and the urine ketone levels. Monitor intake and output and assess for dehydration. Give intravenous fluids in boluses of 10 to 20 ml/kg rapidly over 5 minutes if the child is in shock. Replace electrolytes as needed. The insulin infusion must be carefully maintained to control the gradual reduction in hyperglycemia. When the child off intravenous insulin and transition to subcutaneous insulin and clinically stable, oral feeding is introduced when the child is alert and the glucose level is stabilized.

**2.6.1.5.Nursing practice:**

Insulin binds IV tubing, let 50 to 100 ml run through IV tubing to saturate all the binding sites. This ensures that full dose of insulin reaches the child from the outset. The prevention of future episodes of DKA is important. The parents and child need to learn strategies to keep hyperglycemic episodes from progressing to DKA. For example the child's urine should be tested for ketones if three or four consecutive blood glucose reading are higher than 200 mg/dL, or if the child is sick. If the child has a high blood
glucose and moderate or large amounts of ketones, treatment with extra insulin and fluids can be initiated. (19)

2.6.2. Hypoglycemia:

The desire to avoid hypoglycemia is one of the major barriers to achieving near-normal glycemic control. (70) Hypoglycemia is the major limiting factor in the glycemic management of type 1 and type 2 diabetes. (71)

2.6.2.1. Classification of hypoglycemia:

Classification of hypoglycemia. (72)

International hypoglycemia study group. Glucose concentration of less than 3.0 mmol/L should be reported.

Level (level 1):

Hypoglycemia alert value.

Glycemic Criteria: <70 mg/dl (3 mmol)

Description: Sufficiently low for treatment with fast-acting glucose-lowering therapy.

Level (2): Clinical significant hypoglycemia.

Glycemic criteria: < 45 mg/dl (3 mmol/L).

Description: Sufficiently low to indicate serious clinically improve hypoglycemia.

Level (3): Severe hypoglycemia.

Glycemic criteria: No specific glucose threshold.

Description: Hypoglycemia associated with sever cognitive impairment requiring external assistance for recovery.

Hypoglycemia is classified according to the International Hypoglycemia Study Group. The classification scheme considers a blood glucose, >54 mg/dL (3.0 mmol/L) detected by SMBG, CGM (for at least 20 min), or laboratory measurement of plasma glucose as sufficiently low to indicate serious, clinically significant hypoglycemia that should be included in reports of clinical trials of glucose-lowering drugs for the treatment of diabetes. (72)

However, a glucose alert value of >70 mg/dL (3.9 mmol/L) can be important for therapeutic dose adjustment of glucose-lowering drugs in clinical care and is often related to symptomatic hypoglycemia. Severe hypoglycemia is defined
as severe cognitive impairment requiring assistance from another person for recovery. \((73)\)

**2.6.2.2.Clinical presentation:**

Symptoms of hypoglycemia include, but are not limited to, shakiness, irritability, confusion, tachycardia, and hunger. Hypoglycemia may be inconvenient or frightening to patients with diabetes. Severe hypoglycemia may be recognized or unrecognized and can progress to loss of consciousness, seizure, coma, or death. It is reversed by administration of rapid-acting glucose or glucagon. Clinically significant hypoglycemia can cause acute harm to the person with diabetes or others, especially if it causes falls, motor vehicle accidents, or other injury. A large cohort study suggested that among older adults with type 2 diabetes, a history of severe hypoglycemia was associated with greater risk of dementia. \((74)\)

Evidence from DCCT/EDIC, which involved adolescents and younger adults with type 1 diabetes, found no association between frequency of severe hypoglycemia and cognitive decline. \((75)\)

With mortality in participants in both the standard and the intensive glycaemia arms of the ACCORD trial, but the relationships between hypoglycemia, achieved A1C, and treatment intensity were not straight forward. An association of severe hypoglycemia with mortality was also found in the ADVANCE trial. \((76)\) An association between self-reported severe hypoglycemia and 5-year mortality has also been reported in clinical practice. \((77)\) Young children with type 1 diabetes and the elderly are noted as particularly vulnerable to clinically significant hypoglycemia because of their reduced ability to recognize hypoglycemic symptoms and effectively communicate their needs. Individualized glucose targets, patient education, dietary intervention (e.g. bedtime snack to prevent overnight hypoglycemia), exercise management, medication adjustment, glucose monitoring, and routine clinical surveillance may improve patient outcomes. \((78)\).
In 2015, the ADA changed its pre-prandial glycemic target from 70 130 mg/dL (3.9 – 7.2 mmol/L) to 80 – 130 mg/dL (4.4 – 7.2 mmol/L). This change reflects the results of the ADAG study, which demonstrated that higher glycemic targets corresponded to A1C goals (71). An additional goal of raising the lower range of the glycemic target was to limit overtreatment and provide a safety margin in patients titrating glucose-lowering drugs such as insulin to glycemic targets.

2.6.2.3. Hypoglycemia treatment:
Providers should continue to counsel patients to treat hypoglycemia with fast-acting carbohydrates at the blood glucose alert value of 70 mg/dL (3.9 mmol/L) or less.

Hypoglycemia treatment requires ingestion of glucose-or carbohydrate-containing foods. Glucose (15 – 20 g) is the preferred treatment for the conscious individual with hypoglycemia (glucose alert value of ≤ 70 mg/dL). Fifteen minutes after treatment, if BG shows continued hypoglycemia, the treatment should be repeated. Once BG returns to normal, the individual should consume a meal or snack to prevent recurrence of hypoglycemia. Injectable glucagon should be prescribed for all individuals at increased risk of clinically significant hypoglycemia (79). The acute glycemic response correlates better with the glucose content of food than with the carbohydrate content of food. Pure glucose is the preferred treatment, but any form of carbohydrate that contains glucose will raise blood glucose. Added fat may retard and then prolong the acute glycemic response. Ongoing insulin activity or insulin secretagogues may lead to recurrent hypoglycemia unless further food is ingested after recovery. Once the glucose returns to normal, the individual should be counseled to eat a meal or snack to prevent recurrent hypoglycemia. The use of glucagon is indicated for the treatment of hypoglycemia in people unable or unwilling to consume carbohydrates by mouth. Those
in close contact with, or having custodial care of, people with hypoglycemia-prone diabetes (family members, roommates, school personnel, child care providers, correctional institution staff, or coworkers) should be instructed on the use of glucagon kits including where the kit is and when and how to administer glucagon. An individual does not need to be a health care professional to safely administer glucagon. Care should be taken to ensure that glucagon kits are not expired.

2.6.2.4. Nursing management:
Nursing assessment and diagnosis:
Physiological assessment:
Children are generally admitted to the hospital at the time of diagnosis. Assess the child physiological status, focusing on vital signs and level of consciousness. Assess hydration by checking mucous membranes, skin turgor and urine output. Blood initially is collected hourly to monitor blood gases, glucose and electrolytes. Once the child is stable, assess dietary and caloric intake and the ability of the child or family to manage care.

2.7. Education process and support:
Support for commencement of an injectable therapy. Initiation of injectable medicines can be overwhelming for many people. People with type 1 diabetes, including children, adolescents and adults, will be required to commence insulin at the time of diagnosis. People of any age can struggle with injections and may require support and assistance to develop the skills required for improved diabetes management. Others may need support on an ongoing basis to achieve the required glycaemic management. Recommendations to support the education process include:
- Distraction techniques or play therapy for children (e.g. injecting into a stuffed animal).
- Cognitive behavior therapy techniques for older children (e.g. guided imagery, incentive scheduling).
- Health care professionals or parents/careers demonstrating and self-injecting saline to help alleviate anxiety. 
- Always using positive language to discuss injection of diabetes medicines. 
- Allowing the person with diabetes to be open and honest regarding their feelings and emotions towards injections, including their frustrations and struggles. \(^{81}\)
- Understanding that children have a lower pain threshold than adults, and therefore asking questions regarding pain at each diabetes education review. 
- Referral to a psychologist for input if the person with diabetes has significant fear around injections. 
- Where other careers are involved in the administration of insulin, their involvement in the education process is essential. They should be offered the same education as the person with diabetes and this also requires documentation. Examples of those who may be involved in the administration of an injectable medicine include family (spouse, children, partners), health care professionals (diabetes educators, general practitioners, practice nurses, domiciliary nurses and community care workers). \(^{81}\)
- Structured self-blood glucose monitoring, including appropriate frequency and timing in relation to injection regimen and documentation in a diary/logbook or meter download. 
- Hypoglycaemia, including symptoms, prevention and treatment. 

Where required, discussion of the considerations for flying and travelling when taking injectable medicines. \(^{81}\)

2.8. Education about insulin (key topics):

Research has shown that people with diabetes do not always receive education about the injection of diabetes medications, and when they do, not all essential topics are covered. \(^{82-83}\)

In (2008-2009) insulin Injection Technique Questionnaire survey, 25% of participants reported wanting more education regarding Injection Technique. \(^ {83}\) While there was some
variation between countries, many participants did not recall a number of key topics being adequately covered during their education and training. (83 Raz I, et al (In 2009) revealed almost 70% of nurses were wanting to learn more about insulin injection technique. Education in correct injection technique should cover the following essential topics. (80):

- The injection regimen including the timing and action of prescribed medicines and dose(s) required.
- The choice, and training in use of insulin pen device and/or syringe Assembly of the device including loading of insulin cartridge if applicable - Preparation of the device for injection, including attaching pen needle and priming - Drawing up of insulin for syringes .Choice of injection site(s) and importance of site rotation. Note that different sites can illicit different rates of insulin absorption.
- The importance of single use of needles and syringes , including angle of injection and use of a lifted skin fold, where required.
- Injection complications and how to avoid these.
- Storage of injectable medicines according to the manufacturers’ instructions.
- Safe disposal of sharps.
- Preparation of skin prior to injecting. Hands should be washed prior to preparing the device and injecting.
3. Materials and Methods

3.1. Study design:
This is an interventional Quasi hospital-based study including preprogram and post program.

3.2. Study area / setting:
This study was conducted in Kosti teaching hospital, White Nile State.
White Nile state has an area of 30,411 km² & an estimated population of approximately 1.188,707 (2006). Since 1994 Rabak is the capital of the state. Other important cities include Kosti & Elduiem. The state lies between longitudes 33.5 to 35 E & latitudes 17 to 19 N. It is surrounded by Khartoum state in the north-east, in the north – west by the Gazera and Sinar states, in the south by the south Sudan country & in the west by north Kordufan.

Kosti is one of the major cities (population in 1993 was estimated173-549). Kosti teaching hospital is the largest governmental hospital in white Nile state. It was established since 1942 and became teaching hospital in 1993. Hospital capacity about 427 beds in 9 departments & there are three other departments which were separated and become a hospital e.g. obstetric & gynecological hospital, ophthalmological hospital & renal hospital. The study was done in emergency department, pediatric ward, pediatric casualty, medical ward (male & female), surgical wards (male & female), intensive care unit and theater. The total graduated employed nurses were 63.

3.3. Study duration:

3.4. Study population:-
Qualified employed nursing staff working in the hospital during the study period.

3.4.1. Inclusion criteria:
- Nurses with qualification for at least three years
- Nurses with permanent job
- Nurses who attend the educational program
- Nurses working in Kosti teaching hospital

3.4.2. Exclusion criteria:
- Nurses who refused to participate in the study
- Nurses who did not fully complete the program till the evaluation phase.

3.5. Sample selection and sample size:
A total convenient sample of all available employed nurses (63) who met the inclusion criteria were included in the study.

3.6. Variables under study:
3.6.1. Nurses knowledge:
3.6.1.1. Nurse's knowledge regarding Type 1 diabetes mellitus:
Etiology of diabetes mellitus
Distinguish type 1 diabetes from type 2
Laboratory diagnosis of diabetes
Management of type 1 diabetes mellitus
Treatment of hypoglyceania
Hyperglycemia
Diagnostic test to assess long term control
Normal range of HAb1c
Targeted blood glucose when treating hypoglycemia

3.6.1.2. Nurses knowledge about insulin:
Insulin sensitivity in type 1 diabetes
Storage of open insulin vial
Dividing area of injecting insulin
Peak action of soluble insulin
Position of needle when injecting insulin
Rotating mixed insulin vial
Fast area of insulin absorption
Space between injection sites
Inject in lipohypertrophyied
Rotation area of injection.

3.6.2. Nurses' Practice:

3.6.2.1. Insulin preparation:

1. Wash hands
2. Gather supplies (insulin-syringe- insulin, gloves, cotton ball, alcohol wipe)
3. Check 6th rights of medication administration:
   - Right patient
   - Right time
   - Right medication
   - Right rout
   - Right dose
   - Right documentation
4. check insulin expiration and appearance, clear or color
5. clean rubber stopper with alcohol
6. pull plunger back to pull air into syringe until the tip of plunger is at the line for the number of units required for the dose
7. push the needle through the rubber stopper- making sure the tip of the needle is not in the insulin
8. press the plunger to push air into the vial of insulin
9. turn the vial and syringe upside down so that the top of the needle is in the insulin
10. holding the vial with one hand, pull back the plunger to pull insulin into the syringe until has reach the line of the proper dose

3.6.2.2. Insulin injection technique:

1. The lifted skin fold
2. Insert needle into skin at 90 degree angle
3. Administer therapy
4. Leave the needle in the skin for at least 10 second after the thumb button plunger is fully depressed.
5. Withdraw needle from the skin.
6. Release lifted skin fold.
7. Massaging the site after injection.
3.7. Data collection tools:

**Tools 1:** structured questionnaire which consist of three parts:

- **Part one:** Questions about demographic data of the study populations. It consists of information about age, sex, education level, working area, years of experience and attending of training courses about type 1 diabetes mellitus.

- **Part two:** Questions about general knowledge about type 1 diabetes mellitus.

- **Part three:** Questions about general knowledge about insulin.

**Tool 2: observational checklist**

This tool was developed in order to assess nurse's performance during the clinical practice. There were 10 items about general concepts in insulin preparation and 7 items about administration and technique of insulin injection.

3.8. Scoring system

3.8.1. Scoring for knowledge:

Scoring of knowledge using the following:

- Score of 0-1 point classified as poor knowledge.
- Score of 2 points classified as satisfied knowledge.
- Score of 3-4 points classified as good knowledge.

3.8.2. Scoring for performance:

3.8.2.1. Insulin preparation technique:

Insulin preparation technique consist of 10 steps of total score 10 points:

- Score of (0-4) classified as poor performance.
- Score of (5-7) classified as fair performance
- Score of (8-10) classified as good performance

3.8.2.2. Insulin injection technique:

Insulin injection technique consist of 7 steps of total score 7 points:

- Score of (0-3) classified as poor performance.
- Score of (4-5) classified as fair performance
- Score of (6-7) classified as good performance
3.9. Validity and reliability:
The tools was reviewed by experts in the field of study to test validity. A pilot study was carried out on 7 nurses working in Rabak teaching hospital before embarking on the actual study (data collection).

3.10. Data collection technique:
The study was done in three phases:

3.10.1. Phase 1 (Pre-interventional phase):
In this phase the designed questionnaire was filled by the study population and their practice regarding insulin was tested using the check list. Questionnaire was filled in their rest time and at rest room. The time required to fill the questionnaire was about 10 - 15 minutes.

3.10.2. Interventional phase (Educational program) phase two:
In this phase the educational program regarding type 1 diabetes and insulin administration was applied. The nurses were divided into four number groups. The education was in the form of lectures, each lecture took about 2 Hours. The injection technique was demonstrated using models. This interventional phase took 6 months. Orientation to the educational program format, including: the lecture’s time, and the educational materials. Each lecture time was one and half hour, and there was about half hour time offered for discussion after each lecture for further clarification about what is missing or not understood by the participants. An intense educational program had been designed by the researcher to raise nurses knowledge about type 1 diabetes and insulin preparation, administration and technique of injection in the light of the available researches and literature. The intervention had been developed in Arabic language to cover the relevant theoretical and practical aspects of knowledge about type 1 diabetes insulin preparation and administration technique of injection. Different teaching methods as discussion, demonstration, re-demonstration and supervised practice have been used.
The researcher used audiovisual aids and instructional videos to provide knowledge and technique of insulin administration. The intervention had been implemented to nurses in four groups ( group1 contain 15 nurses , group2 contain 15 nurses , group three consist of 15 nurses and group four contains 18 nurses ( were divided into small group during demonstration and re - demonstration). The program had been implemented in two sessions per day ( four days per week for each group) for four weeks for theoretical and practical sites . Each session had taken about two hours and at the end of each session each nurse has been assessed for his/her understanding of the instructions. The impact of the program was based on the improvement of the nurses knowledge about diabetes mellitus and practice about insulin preparation , administration and technique of injection.

3.10.3. Phase three (Evaluation phase):
The same tools used in phase 1 were repeated to evaluate the effect of the educational program.
Evaluation of the educational program through post- tests :
Post- test(1): was carried out one month after implementing the educational program.
Post- test (2): was carried out after two months from the post- test one.
After analysis of data the researcher had explanation of the incorrect items, and the nurses were thanked for participating in the study.

3.11.Data entry and statistical analysis:
Statistical Package for Social Science (SPSS) version 20 was used for data entry. Tests used for analysis were chi² and T.test. Confidence level was 95%.

3.12.Ethical consideration:
Official letter from the faculty of graduate studies was delivered to the responsible authorities of hospital to take their approval to conduct this study. It was obtained after explaining the purpose of the study. Nurses formal agreement to participate in the study was obtained after
explanation of the study purpose. Each nurse was reassured that confidentiality and privacy will be maintained and his or her right to withdraw at any time.

3.13. Difficulties:
Collection of nurses for educational program during working hours take longer time.
4. Results

Table 1: Characteristics of the study group (age, duration of work, attendance of course in diabetic care, area of working)

<table>
<thead>
<tr>
<th>Age</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-30 years</td>
<td>23</td>
<td>36.5%</td>
</tr>
<tr>
<td>31-40 years</td>
<td>28</td>
<td>44.5%</td>
</tr>
<tr>
<td>41-50 years</td>
<td>6</td>
<td>9.5%</td>
</tr>
<tr>
<td>More than 50 years</td>
<td>6</td>
<td>9.5%</td>
</tr>
<tr>
<td>Total</td>
<td>63</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration of work</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 5 years</td>
<td>24</td>
<td>38.1%</td>
</tr>
<tr>
<td>6-10 years</td>
<td>11</td>
<td>17.5%</td>
</tr>
<tr>
<td>11-20 years</td>
<td>20</td>
<td>31.7%</td>
</tr>
<tr>
<td>More than 20 years</td>
<td>8</td>
<td>12.7%</td>
</tr>
<tr>
<td>Total</td>
<td>63</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Attendance of course in diabetic care</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attended</td>
<td>8</td>
<td>12.7%</td>
</tr>
<tr>
<td>Not attended</td>
<td>55</td>
<td>87.3%</td>
</tr>
<tr>
<td>Total</td>
<td>63</td>
<td>100%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Area of work</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pediatric ward</td>
<td>12</td>
<td>19.0%</td>
</tr>
<tr>
<td>Medicine ward</td>
<td>22</td>
<td>34.9%</td>
</tr>
<tr>
<td>Surgery ward</td>
<td>15</td>
<td>23.8%</td>
</tr>
<tr>
<td>Casualty</td>
<td>14</td>
<td>22.3%</td>
</tr>
<tr>
<td>Total</td>
<td>63</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

N: 63

1. Demographic information's:

4.1. Demographic characteristics of the study group:
The table showed that (36.5%) of studied group ages range between (20-30) years, (44.5%) between (31-40) years, (9.5%) between (41-50) years and (9.5%) above 50 years. Regarding duration of work (38.1%) working for less than 5 years, and (12.7%) for more than 20 years. Also this table illustrated that (87.5%) of studied group didn't attend a course in diabetes mellitus care. About area of working, (19%) work in pediatric ward, (34.9%) in medicine ward, (23.8%) in surgery ward and (22.2%) in the casualty.
**N:63**

Figure (1): Showed gender of study group with female predominance (69.8%).

**N:63**

Figure (2): Illustrated nurse's degree of graduation. Majority (82.5%) had diploma while only (1.5%) had master degree.
N:63

Figure (3): Clarified years of experience in diabetic care, (76.2%) of study group had no experience in diabetic care and (9.5%) had experience more than three years.
2- Nurses knowledge about diabetes mellitus:

Table 2: Nurse's knowledge about etiology for type 1 diabetes mellitus.

<table>
<thead>
<tr>
<th>Etiology</th>
<th>Pre –Test</th>
<th>Post-test1</th>
<th>Post-test2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F   %</td>
<td>F   %</td>
<td>F   %</td>
</tr>
<tr>
<td>Poor</td>
<td>38  60.3%</td>
<td>13  20.6%</td>
<td>5   8%</td>
</tr>
<tr>
<td>Fair</td>
<td>19  30.2%</td>
<td>8   12.7%</td>
<td>6   9.5%</td>
</tr>
<tr>
<td>Good</td>
<td>6   9.5%</td>
<td>42  66.7%</td>
<td>52  82.5%</td>
</tr>
<tr>
<td>Total</td>
<td>63 100%</td>
<td>63 100%</td>
<td>63 100%</td>
</tr>
</tbody>
</table>

P. value 0.000
N:63

The table clarified the knowledge of nurses regarding etiology of type 1 diabetes. Only (9.5%) had good knowledge pre-test, and (60%) had poor knowledge. Whereas the good knowledge was increased after applying the program to (66.7%) in post-test 1 and to (82.5%) in post-test 2. There was high statistical significant relation (P. value 0.000).

Figure (4): Illustrated that there was statistical relation between nurses degree of graduation and knowledge.
regarding etiology of type 1 diabetes. P value was.004 in posttest 2

Table 3: Nurse's knowledge about distinguishing type 1 from type 2 diabetes

<table>
<thead>
<tr>
<th>Distinguishing from type 2</th>
<th>Pre-test</th>
<th>Post-test1</th>
<th>Post-test2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>%</td>
<td>F</td>
</tr>
<tr>
<td>Poor</td>
<td>25</td>
<td>39.7%</td>
<td>8</td>
</tr>
<tr>
<td>Fair</td>
<td>26</td>
<td>41.3%</td>
<td>14</td>
</tr>
<tr>
<td>Good</td>
<td>12</td>
<td>19.0%</td>
<td>41</td>
</tr>
<tr>
<td>Total</td>
<td>63</td>
<td>100%</td>
<td>63</td>
</tr>
</tbody>
</table>

**P. value 0.02**

**N:63**

The table clarified the knowledge of nurses regarding distinguishing between type 1 and type 2 diabetes. Only (19.0%) had good knowledge pre-test, while (41.3%) had fair knowledge. The good knowledge was increased to (65.1%) in post-test 1 and to (79.7%) in post-test 2. There was statistical significance (P. value 0.02).
Table 4: Nurse's knowledge about laboratory diagnosis of type 1 diabetes

<table>
<thead>
<tr>
<th>Knowledge about laboratory diagnosis of diabetes</th>
<th>Pre test</th>
<th>Post-test</th>
<th>Post-test2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>%</td>
<td>F</td>
</tr>
<tr>
<td>Poor</td>
<td>19</td>
<td>30.2%</td>
<td>10</td>
</tr>
<tr>
<td>Fair</td>
<td>30</td>
<td>47.6%</td>
<td>15</td>
</tr>
<tr>
<td>Good</td>
<td>14</td>
<td>22.2%</td>
<td>38</td>
</tr>
<tr>
<td>Total</td>
<td>63</td>
<td>100%</td>
<td>63</td>
</tr>
</tbody>
</table>

P. value: 0.7
N: 63

The table illustrated nurse's knowledge regarding the laboratory diagnosis of type 1 diabetes. In pre-test, post-test 1 & post-test 2 the fair knowledge was (47.6%), (23.8%) and (15.9%) respectively. Whereas the good knowledge had increased from (22.2%) in pretest to (71.4%) in post-test 2.
**P value: 0.038**

**N:63**

Figure (5) : Illustrated that was statistical relation between nurse's degree of graduation and knowledge about laboratory diagnosis of diabetes in post-test 2. P value was 0.038

**Table 5: Nurse's knowledge about treatment of type 1 diabetes.**

<table>
<thead>
<tr>
<th>Treatment of type 1 diabetes</th>
<th>Pre test</th>
<th>Post-test 1</th>
<th>Post-test 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>Percentage</td>
<td>Frequency</td>
</tr>
<tr>
<td>Poor</td>
<td>35</td>
<td>55.5%</td>
<td>15</td>
</tr>
<tr>
<td>Fair</td>
<td>19</td>
<td>30.2%</td>
<td>7</td>
</tr>
<tr>
<td>Good</td>
<td>9</td>
<td>14.3%</td>
<td>41</td>
</tr>
<tr>
<td>Total</td>
<td>63</td>
<td>100%</td>
<td>63</td>
</tr>
</tbody>
</table>

**P. value 0.03**

**N:63**

The table clarified the knowledge of nurses regarding treatment of type 1 diabetes. Only (14.3 %) had good knowledge while (55.5%) had poor knowledge in pre-test. The poor knowledge was decreased in post-test 1 and post-test 2 to (23.8%) and
(14.3%) respectively. There was statistical significant relation between pre-test, post-test1 and post-test2 (P. value 0.03).

![Graph](image_url)

N:63
P value :0.000

Figure (6): Illustrated that there was relation between nurses years of experience and knowledge about treatment of type 1 diabetes mellitus. P value was 0.036 in post-test 2.
Table 6: Nurse's knowledge about initial intervention in hypoglycemia (blood glucose <70 mg/dl).

<table>
<thead>
<tr>
<th>Nurses intervention</th>
<th>Pre- test</th>
<th>Post- test 1</th>
<th>Post- test2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>%</td>
<td>F</td>
</tr>
<tr>
<td>Wait For Doctor Order</td>
<td>17</td>
<td>26.9%</td>
<td>13</td>
</tr>
<tr>
<td>Notify Doctor</td>
<td>37</td>
<td>58.7%</td>
<td>18</td>
</tr>
<tr>
<td>Give Patient Sweaty Drink</td>
<td>9</td>
<td>14.4%</td>
<td>32</td>
</tr>
<tr>
<td>Total</td>
<td>63</td>
<td>100%</td>
<td>63</td>
</tr>
</tbody>
</table>

P value: 0.004  
N:63

The table showed the knowledge of nurses regarding their action in case of hypoglycemia, only (14.4%) their response is giving the patient sweaty drinks while (26.9%) wait for the doctor and (58.7%) notify the doctor in pre-test. Those responding by giving sweaty drinks were increased to (59.4%) in post-test2 (P. value .0.004).
Figure (7): Showed that there was statistical relation between nurses years of experience and knowledge about action when blood treating hypoglycemia. P value was .042 in posttest 2.

Figure (8): Showed that (44.4%) of nurses their action when blood glucose reach 300 mg is testing urine for acetone,(39.7%) their action they didn't give patient insulin in pre-test, where as the result of urine test for acetone was increased after implementing program to(87.3%) in post-test1 and (100%) in post-test2 respectively.
Figure (9): Illustrated that (14.3%) of nurses thought that the glucose level when treating hypoglycemia should reach 100 mg/dl in pretest, while in posttest 1 and 2 increased to (50.8%) and (59.4%) respectively.
Table 7: Nurse's knowledge regarding the test used to identify diabetic control during last 3-4 months and normal range of HbA1C.

<table>
<thead>
<tr>
<th>Knowledge regarding the test used</th>
<th>Pre- test</th>
<th>Post- test 1</th>
<th>Post- test2</th>
<th>P. value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
<td>F</td>
<td>%</td>
<td>F</td>
<td>%</td>
</tr>
<tr>
<td></td>
<td>23</td>
<td>36.5%</td>
<td>19</td>
<td>30.2%</td>
</tr>
<tr>
<td>Satisfied</td>
<td>34</td>
<td>54%</td>
<td>12</td>
<td>19%</td>
</tr>
<tr>
<td>Good</td>
<td>6</td>
<td>9.5%</td>
<td>32</td>
<td>50.8%</td>
</tr>
<tr>
<td>Total</td>
<td>63</td>
<td>100%</td>
<td>63</td>
<td>100%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Knowledge regarding normal range of HbA1C</th>
<th>Pre- test</th>
<th>Post- test 1</th>
<th>Post- test2</th>
<th>P. value</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-6.5%</td>
<td>31</td>
<td>49.2%</td>
<td>20</td>
<td>31.7%</td>
</tr>
<tr>
<td>6.6-7%</td>
<td>22</td>
<td>34.9%</td>
<td>22</td>
<td>34.9%</td>
</tr>
<tr>
<td>&gt;7%</td>
<td>10</td>
<td>15.9%</td>
<td>21</td>
<td>33.3%</td>
</tr>
<tr>
<td>Total</td>
<td>63</td>
<td>100%</td>
<td>63</td>
<td>100%</td>
</tr>
</tbody>
</table>

N:63

The table clarified that only (9.5%) of studied group had good knowledge about the test used to assess diabetic control during the last 2-3 months ,(54%) had satisfied knowledge and (36.5%) had poor knowledge , whereas the knowledge was increased in post-test 1 to (50.8%) & (69.8) post-test. Regarding normal range of HbA C1, there was (15.9%) had good knowledge and(34.9%) had satisfied knowledge ,whereas still less than half of studied group had good
knowledge after implementation of program to (33.3%) post-test 1 and (50.8%) post-test 2, P Value was 0.000

3. Nurses knowledge about insulin:

![Bar chart showing knowledge levels before and after the program]

**P value 0.008**

N: 63

Figure (10): Clarify that only (14.3%) of nurses they had a good knowledge about insulin sensitivity in type 1 diabetes (26.9%) had poor knowledge and (58.7%) had fair knowledge, while this result increased after application of program to (40%) in post-test 1 and (84.4%) in post-test 2.
Table 8: Nurse's knowledge regarding potency of opened insulin vial

<table>
<thead>
<tr>
<th>Knowledge about potency of opened insulin vial</th>
<th>Pre test</th>
<th>Post- test 1</th>
<th>Post- test2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>%</td>
<td>F</td>
</tr>
<tr>
<td>Three weeks</td>
<td>18</td>
<td>28.6%</td>
<td>4</td>
</tr>
<tr>
<td>One month</td>
<td>11</td>
<td>17.4%</td>
<td>43</td>
</tr>
<tr>
<td>3 months</td>
<td>34</td>
<td>54%</td>
<td>16</td>
</tr>
<tr>
<td>Total</td>
<td>63</td>
<td>100%</td>
<td>63</td>
</tr>
</tbody>
</table>

**P. value: 0.03**  
**N:63**

The table clarified the knowledge of nurses regarding potency of opened insulin vial, there was good knowledge in only (17.4 %) pre- test, which was increased after applying the program to(68.3%) in post-test 1 and(80.9%) in post-test2 , (P .Value 0.03).
P-value: 0.002

N: 63

Figure (11): Clarified that there were is statistical relation between nurse's years of experience and knowledge about potency of opened insulin vial in post-test 2. P value was 0.002
Table 9: Nurses knowledge regarding position of the needle during injection and rotating of mixed insulin vial.

<table>
<thead>
<tr>
<th>Knowledge regarding Position of the needle</th>
<th>Pre- test</th>
<th>Post- test 1</th>
<th>Post- test 2</th>
<th>P. value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>F</td>
<td>%</td>
<td>F</td>
</tr>
<tr>
<td>45 degree</td>
<td>21</td>
<td>33.3%</td>
<td>11</td>
<td>17.5%</td>
</tr>
<tr>
<td>75 degree</td>
<td>31</td>
<td>49.2%</td>
<td>12</td>
<td>19%</td>
</tr>
<tr>
<td>90 degree</td>
<td>11</td>
<td>17.5%</td>
<td>40</td>
<td>63.5%</td>
</tr>
<tr>
<td>Total</td>
<td>63</td>
<td>100%</td>
<td>63</td>
<td>100%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Knowledge regarding rotation of mixed insulin vial</th>
<th>Pre- test</th>
<th>Post- test 1</th>
<th>Post- test 2</th>
<th>P. value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
<td>33</td>
<td>52.4%</td>
<td>18</td>
<td>28.6%</td>
</tr>
<tr>
<td>Satisfied</td>
<td>17</td>
<td>27%</td>
<td>11</td>
<td>17.4%</td>
</tr>
<tr>
<td>Good</td>
<td>13</td>
<td>20.6%</td>
<td>34</td>
<td>54%</td>
</tr>
</tbody>
</table>

**P value 0.000**

**N:63**

The table illustrated that only (17.5%) know the proper position of the needle when injecting insulin, the knowledge improved in (63.5%) and (82.5%) post-test 1 & post-test 2, and also clarified the knowledge of nurses regarding rotating of mixed insulin vial, only (20.6 %) had good knowledge pre-test, whereas the knowledge increased after applying program to (54%) post-test 1and to (69.8%) in post-test2,(P. value 0.00)
Figure (12): Clarified that third (30.2%) of them had a good knowledge about site of fast absorption (abdomen), while this result increased slightly after application of program to (31.7%) in post-test 1 and (49%) in post-test 2.

Figure (13): Illustrated statistical association between nurses years of experience and knowledge about area of fastest insulin absorption. (P value was 0.001).
Table 10: Nurses knowledge regarding space between injection sites and insulin injection in hypertrophied area.

<table>
<thead>
<tr>
<th>Knowledge regarding the space between injection</th>
<th>Pre test</th>
<th>Post- test 1</th>
<th>Post- test2</th>
<th>P. value</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>%</td>
<td>F</td>
<td>%</td>
<td>F</td>
</tr>
<tr>
<td>2inch</td>
<td>30</td>
<td>47.7%</td>
<td>7</td>
<td>11.1%</td>
</tr>
<tr>
<td>2cm</td>
<td>20</td>
<td>31.7%</td>
<td>8</td>
<td>12.7%</td>
</tr>
<tr>
<td>1cm</td>
<td>13</td>
<td>20.6%</td>
<td>48</td>
<td>76.2%</td>
</tr>
<tr>
<td>Total</td>
<td>63</td>
<td>100%</td>
<td>63</td>
<td>100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Knowledge regarding injection in hypertrophied area</th>
<th>Pre –test</th>
<th>Post- test 1</th>
<th>Post- test2</th>
<th>P. value</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>%</td>
<td>F</td>
<td>%</td>
<td>F</td>
</tr>
<tr>
<td>Poor</td>
<td>46</td>
<td>73%</td>
<td>15</td>
<td>23.8%</td>
</tr>
<tr>
<td>Satisfied</td>
<td>7</td>
<td>11.1%</td>
<td>7</td>
<td>11.1%</td>
</tr>
<tr>
<td>Good</td>
<td>10</td>
<td>15.9%</td>
<td>41</td>
<td>65.1%</td>
</tr>
<tr>
<td>Total</td>
<td>63</td>
<td>100.0%</td>
<td>63</td>
<td>100</td>
</tr>
</tbody>
</table>

**P value: 0.000**

**N: 63**

The table clarified that the space between injections was known only by (20.6 %) of studied group this knowledge was improved in posttest 1 and posttest 2 to (76.2%) and to (88.8%) respectively. Whereas the knowledge of nurses regarding insulin absorption when injected in hypertrophied area. Near three quarters (73%) were having poor knowledge, after the program it was reduced to (23.8 %) in posttest 1 and (11.1%) in post-test 2. (P. value 0.000).
Table 11: Nurse's knowledge regarding the effect of rubbing the site of injection and rotation of injection site.

<table>
<thead>
<tr>
<th>Knowledge at rubbing injection site</th>
<th>Pre- Test</th>
<th>Post- Test 1</th>
<th>Post- Test2</th>
<th>P. value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>%</td>
<td>F</td>
<td>%</td>
</tr>
<tr>
<td>Poor</td>
<td>35</td>
<td>55.6%</td>
<td>9</td>
<td>14.3%</td>
</tr>
<tr>
<td>Satisfied</td>
<td>15</td>
<td>23.8%</td>
<td>9</td>
<td>14.3%</td>
</tr>
<tr>
<td>Good</td>
<td>13</td>
<td>20.6%</td>
<td>45</td>
<td>71.4%</td>
</tr>
<tr>
<td>Total</td>
<td>63</td>
<td>100%</td>
<td>63</td>
<td>100%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Knowledge regarding rotation of injection site</th>
<th>Pre- test</th>
<th>Post- test 1</th>
<th>Post- test2</th>
<th>P. value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
<td>18</td>
<td>28.6%</td>
<td>16</td>
<td>25.4%</td>
</tr>
<tr>
<td>Satisfied</td>
<td>25</td>
<td>39.7%</td>
<td>13</td>
<td>20.6%</td>
</tr>
<tr>
<td>Good</td>
<td>20</td>
<td>31.7%</td>
<td>34</td>
<td>54%</td>
</tr>
<tr>
<td>Total</td>
<td>63</td>
<td>100.0%</td>
<td>63</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

**P value: 0.000**

N:63

The table clarified the knowledge of nurses regarding the effect of rubbing area of injection on insulin absorption, only (20.6%) had good knowledge pre-test, whereas the knowledge increased after applying the program to (71.4%) in post-test 1 and (78.1%) in post-test 2 (P. value .000). Also it clarified the knowledge of nurses regarding rotation of injecting site in pretest , posttest 1 and posttest 2 , the satisfied knowledge was (39.7%), (20.6%) and (19%) respectively. Whereas the good knowledge was increased from (31.7%) in pretest to (54%) in posttest 1 and posttest 2 (65.2%) P value: 0.000
4. Nurse's performance regarding insulin administration:
A. Insulin preparation:

Figure (14): Illustrated the performance regarding hand washing (23.8%) did hand washing pre-test whereas this result increased to (84.1) in 2. Also showed equipment collection third of studied group (33.3%) collected equipment in pre-test, while the result was increased to (76.2) in 2. Regarding 6\(^{th}\) wrights of medication administration only(22.2%) did them in pre-test.
Figure (15): Clarified that only (9.5%) of study group in pretest clean rubber of vial with alcohol, but still less than half of them performed it after implementation of the program. Regarding pulling plunger back to take air only (1.6%) performed it, whereas performance improved in post-test 2 to (76.2%). About pressing needle through stopper, only (1.6%) did pre-test. Performance regarding pushing air into the vial only (1.6%) did it pre-test whereas was done by (79.1%) in post-test 2. Pulling insulin into syringe until reaching line of the proper dose were done by (84.1%) in pre-test.
Table 12: General nurses performance regarding steps of insulin preparation.

<table>
<thead>
<tr>
<th>Nurses performance</th>
<th>Pre-test</th>
<th>Post-test1</th>
<th>Post-test2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>%</td>
<td>F</td>
</tr>
<tr>
<td>Poor</td>
<td>54</td>
<td>85.7%</td>
<td>22</td>
</tr>
<tr>
<td>Fair</td>
<td>7</td>
<td>11.1%</td>
<td>30</td>
</tr>
<tr>
<td>Good</td>
<td>2</td>
<td>3.2%</td>
<td>11</td>
</tr>
<tr>
<td>Total</td>
<td>63</td>
<td>100%</td>
<td>63</td>
</tr>
</tbody>
</table>

N:63

The table illustrated that the general performance of nurses about insulin preparation was good in only (3.2)% in pretest whereas the general performance were improved after implementing program to be good in (61.9%) in post-test 2.
Figure (16): Illustrate the performance regarding insulin injection: lifted skin fold there was (22.2%) lifted skin pre-test whereas the result increased to (60.3%) in post-test2. About inserting needle at 90 degree only (30.7%) insert needle in pre-test while this result increased in post-test 2 to (98.4%) respectively. Regarding leave needle in the skin about at least 10 seconds only (1.6%) did it in pre-test whereas the result was increased in 2 to (61.9%).

Figure (17): Showed that (93.7%) of studied group withdraw needle from the skin in pre-test, (34.9%) they released skin fold pre-test, and about massaging area of injection one third of studied group do it pre-test while the result was raised in post-test 2 to 76.2%.
Table 13: General performance regarding insulin injection

<table>
<thead>
<tr>
<th>Nurses performance</th>
<th>Pre-test</th>
<th>Post-test1</th>
<th>Post-test2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>%</td>
<td>F</td>
</tr>
<tr>
<td>Poor</td>
<td>40</td>
<td>63.5%7%</td>
<td>14</td>
</tr>
<tr>
<td>Fair</td>
<td>18</td>
<td>28.6%11%</td>
<td>34</td>
</tr>
<tr>
<td>Good</td>
<td>5</td>
<td>7.9%14%</td>
<td>15</td>
</tr>
<tr>
<td>Total</td>
<td>63</td>
<td>100%17%</td>
<td>63</td>
</tr>
</tbody>
</table>

N:63

The table illustrated that the general performance of nurses about insulin injection in pretest in more than half of studied group (63.5%) was poor whereas this result decreased after implementing program to(22.2%),(1.6%) in posttest 1 & posttest 2 respectively.
Figure (18): Illustrated there was no statistical relation between nurses' degree of graduation and performance regarding hand washing. P. value 0.091 in post-test 2.

Figure (19): Illustrated that there was no statistical relation between attending a course in diabetes and performance of the studied group regarding equipment collection. P. value 0.213 in post-test 2.
Figure (20): Illustrated there was statistical significance relation between duration of working and performance regarding 6\textsuperscript{th} wrights of medication administration. P. value 0.046 in posttest2

Figure (21): Clarified that there was statistical relation in pre & post- test intervention between nurses years of experience and performance regarding check insulin expiration date. P value 0.031 in post-test 2.
Figure (22): Illustrated that there was no statistical relation between duration of working and performance regarding clean rubber of insulin vial before withdrawal of insulin. P value was .0143 & .080 pretest and post-test 2 respectively.

Figure (23): Clarified that there was no relation between pre & post intervention between attending course in diabetes and performance regarding pull plunger back to pull air into syringe. P value 0.213 in post-test2.
P value: 0.005  
N:63

Figure (24): Clarified that there was statistical relation in pre & post intervention between years of experience in diabetes and performance regarding pull plunger back to pull air into vial. P value 0.005 in post-test2.

P value:0.168
N:63

Figure (25): Showed that there was no statistical relation in pre- test & post-test intervention between degree of graduation and nurses performance about lifted skin fold. p value -0.030- & 0.168 in pre-test and post-test. 
insert needle at 90 degree. p value -0.060- & 0.168 in pre-test and post-test.
P value: 0.060
N:63

Figure (26) :Illustrated that there was an statistical relation between years of experience and nurses performance regarding insert needle at 90 degree.

P value 0.043
N:63

Figure (27) Clarified that there was statistical association between duration of working and performance regarding left needle about at least 10 seconds in post-test 2.
P value : 0.031
N:63

Figure (28): Clarified that there was statistical relation between years of experience and performance regarding massaging area of injection P value in post-test 2 was 0.031.
5.Discussion

The role of clinical nurse with increase of diabetic patients has become important in the care needs for diabetic patients. It is reported to decrease the reliability of the patients on the nurses with the inconsistent care for the diabetes patients. (86)

This study was carried out to assess nurses’ knowledge about diabetes focusing on type 1 diabetes mellitus, insulin management and performance regarding insulin administration. Adjustment of the content of the questions was carried out, according to the latest guidelines of European diabetes association and American diabetes association. (87-88)

Diabetes knowledge was assessed in 63 nurses working in Kosti hospital. (36.5%) of them their ages range between (20-30) years, (38.1%) were working for less than 5 years and (87.5%) of them didn't attend a course in diabetes mellitus care. This may be reflected in their knowledge and experience. About area of working only (19%) work in the pediatric ward. They had no experience in diabetic care (23.8%) of study group had experience and (9.5%) had experience more than three years.

There is evidence of genetic, autoimmune and environmental factors contributing for occurrence of type1 diabetes. (89) This fact was known by (9.5%) of study group initially which increased to (82.5%) after the program. The degree of graduation was mainly diploma so the knowledge about the etiology of diabetes was affected by their academic qualification (P value =0.000). In addition minority (19%) can distinguish between type 1 and type 2 diabetes. type 1 diabetes is due to autoimmune B-cell destruction, usually leading to absolute insulin deficiency. (90) Laboratory diagnosis of diabetes was based on the diagnostic criteria for diabetes. (90) one third (30.2%) didn't know this criteria pre intervention, decreased to (12.7%) in post-test 2. This result of deficient knowledge was supported by Roman et al in their
study to assess the diabetic related knowledge of medical and nursing house staff focus in patient diabetes management and insulin therapy, and found that knowledge was highest for physicians in internal medicine and surgery, with nurses in internal medicine and surgery had the same level of knowledge. Additionally the knowledge about treatment of type 1 diabetes among studied nurses was poor and this will lead to reduced knowledge of patients. This was supported by Indi S, finding in 2015 who revealed that the majority of studied subjects had inadequate knowledge before nursing intervention that had improved after nursing intervention. Nurses demonstrated deficient knowledge regarding initial management of hypoglycemia (26.9%) better than reported by Engvall et al, who found that (10%) of nurses responded by using a quick – acting carbohydrate. Only (14.3%) of nurses responded correctly to questions of knowledge related to treatment of type 1 diabetes in pretest whereas this knowledge was increased in post test2 to (79.4%). Statistical significant effect of the program was justified (p value was 0.03). All people with type 1 diabetes require regular insulin therapy to live. Knowledge regarding intervention in case of hyperglycemia is better were (44.4%) responded correctly.

Proper diabetic control is important to maintain glycemic control and hence prevent complications. Hb ALc is used to assess control in the last 3 Months. Nurses had poor knowledge regarding this test and it’s normal range. Nurses in Turkey concluded that they feel uncomfortable in guiding clients regarding the monitoring of glycemic test and Glycated hemoglobin.

Injectable medicines including insulin should be stored according to the manufacturer’s instructions, considering length of time medicine can be stored when open, and the expiry date of the medicine. Insulin should be discarded if it is past the expiry date on the bottle or if the vial has been open for more than a month. (17.4%) know the potency of open insulin vial but the knowledge improved to
(80.9%) after implementing the program Good knowledge of dividing area of injection was found in only (20.6%) of the responders. This corresponds to what found in Northern Ireland, that practitioners presented knowledge deficits in relation to the technique, the need for rotation of the injection site and the pharmacological action. In addition (49.2%) of study sample responded wrong in the area of position of needle when injecting insulin. The needle should be at a 90 degree angle if the person of is normal weight or heavy or at a 45 degree angle if the person is thin. Inadequate knowledge also was found in relation to time of rotating mixed insulin vial. The recommended method is gentle mixing by tipping (rocking) and rolling the insulin 10-20 times until the mixture is even in color without any visible particles. Correct mixing of insulin suspensions reduces the risk of hypoglycemia and variability in the action of the injected medicine.

One third (30.2%) responded correctly to question of knowledge related to site of faster absorption. Also poor knowledge about space between injection & injection in hypertrophied was found in (47.7%) and (73 %) respectively. Injecting within any quadrant or half should be spaced at least 1 cm from each other in order to avoid repeat tissue trauma. This is supported by Namita SA, who said that lack of organized health education and negligence of health care workers on diabetes and insulin self—administration and inadequate knowledge regarding site of insulin injection may lead to develop complication of insulin therapy. Additionally nurses demonstrated deficient knowledge (55.6%) on the effect of rubbing the site of injection and (31.7%) had deficient knowledge related to rotation of injection site. Rotation within one area rather than rotating to a different area for each injection is recommended. Continued use of sites already affected with lipohypertrophy has been shown to hamper insulin absorption. Frid A et al described effective method of rotation is to divide the injection site into quadrants
(abdomen) or halves (buttock or thigh), using one quadrant per week and moving clockwise around this area.\(^{(103)}\)

This study also revealed that there was a positive correlation in post-intervention between degree of graduation and nurses knowledge about laboratory diagnosis (p. value 0.004). The duration of experience didn't affect nurses knowledge regarding initial intervention in case of hypoglycemia as there was a negative correlation between years of experience and nurses knowledge about initial action in case of hypoglycemia.

Healthcare professionals and nurses are responsible for people insulin administration for hospitalized patients with diabetes therefore the knowledge , practice , and commitment are key factors for controlling patients' blood sugar levels and for educating patients and their relatives for correct insulin injection technique.\(^{(96)}\) However , present study showed in consistency between insulin injection practice of nurses and insulin deliver recommendation , consistent with what was described in Ireland and Pakistan.\(^{(91-96)}\)

This study revealed poor performance pre- program concerning hand washing(76.2%), compared to, Robb,B et al in 2016 who reported better performance of hand washing(92.5%).\(^{(96)}\) The performance increased to (84.1% %) after the program. Moran B and Arnott S ,suggested in the guidelines for the administration of insulin that both clean, washed hands and the use of gloves should be practiced routinely within a hospital environment.\(^{(104)}\) Although these gloves are not sterile, American Diabetes Association recommended that they can be used to help prevent the transfer of resident bacteria from the fingers to the vial or injection site, thus minimizing infection.\(^{(101)}\)

Nurses performance was poor in collecting equipment, performing 6\(^{th}\) wright of medication administration, checking insulin expiry date and cleaning the rubber. Frid A H et al observed better nurses performance in their study (92%) did it.\(^{(108)}\) As clearly observed, when insulin withdrawals were made from a single vial and without the flacon top being
disinfected between each withdrawal, microorganisms could potentially colonize in the contents of the vial. The practice of disinfecting the flacon top before aspiration was not followed routinely by the majority of nurses in this sample. Yet, according to the American Diabetes Association wiping the rubber cover of the insulin vial with a 70% alcohol swab is a standardized measure for infection prevention. Additionally (98.4%) they didn't pull plunger back to take air, whereas this result was decreased after implementing program to (23.8%).

Regarding lifting skin fold (77.7%) didn't perform it. A better but not good performance was reported by A. H. Hirsh L.J et al. who reported that (50.7%) of studied nurses were found not to be lifting the skin when injecting insulin. Proper lifting improved to (60.1%) after intervention. The purpose of using a lifted skin fold is to reduce the risk of IM injection by increasing the space between the skin and muscle fascia. All people with diabetes/carers should be taught the correct technique for lifting a skin fold from the onset of injection therapy. Two fingers should be used to lift the skin away from the muscle fascia. Ideally this should be the thumb and first or second finger. Regarding angle of injection (58.7%) of study sample insert needle at 90° degree which is the recommended needle angle for subcutaneous injections; a 45° angle may be used for very thin patients or young children. For either angle, injecting into a skinfold created using the index finger and thumb only is recommended in both cases. Nurses performance regarding lifting the needle after injection for seconds was very poor as less than 5% did it. This is a lower knowledge than what was described by (Pledger J et al) as (52.2%) of nurses keep the needle under the skin for at least 5 seconds after completely inserting the required dose of insulin. This skill was performed by (61.9%) after the program.

Massaging the site before or after injection may speed up absorption and is not recommended. About third (33.3%)
of studied sample did it pretest. this performance was improved after the program to (55.6%), (76.2%) in post-test 1 & post-test2 respectively.

General performance regarding insulin preparation was improved as the good performance raised from (3.2%) in pre-test to (61.9%) in post-test2. General performance regarding insulin injection technique was improved as the good performance raised from (9.5 %) in pre-test to (55.5%) in post-test2.

The study revealed that there was no statistical association between degree of graduation and hand washing, attending course in diabetes and equipment collection duration of working performance regarding 6th write of medication administration, p. value was (0.091), (0.213), (0.046) respectively. But there was a positive correlation between duration of working and 6th write of medication administration in post-test2 (p value was 0.046). Also there was a statistical significant association between years of experience and performance regarding checking insulin expiratory date. P value 0.031.

The study results supports that overall compliance with international guidelines regarding insulin administration techniques was not reflected in the current research findings, nor in practice guidelines and evidence based care recommendations.
Conclusion

The study concluded that based on the finding:

- Nurse studied were predominantly females, (76.2%) didn't attend courses on diabetes care and (82.2%) their graduation was diploma degree.
- Nurses knowledge about etiology of type1 diabetes and distinguishing between type 1 and type 2 was poor before intervention which improved to good after the program with statistical significance Pvalue 0.000
- Despite the education intervention, knowledge regarding initial management in case of hypoglycemia remained inadequate as (60.3%) of nurses were able to identify the correct intervention by giving sweaty drinks.
- Years of experience had no effect on nurses knowledge regarding initial intervention in case of hypoglycemia p valu:0.172
- Nurses didn't know the potency of opened insulin vial, rotation of the vial of mixed insulin and position of the needle, their knowledge became good after the program
- Less than quarter of nurses did hand washing before the program after the program(84.1%) washed their hands before insulin injection
- The nurses knowledge about targeted blood glucose when treating hypoglycemia despite education intervention increased from (14.3%) in pre-test to (50.8%) and (59.4%) in post -test 1 and 2 respectively. -Nurses performance regarding checking insulin expiry date and cleaning the rubber of insulin vial was poor but improved after intervention.
- (1.6%) of nurses were leaving the needle in the skin for at least 10 seconds increased to (61.9%) after the program
- (39.7%) were injecting insulin at 90 degree increased to(98.4%) post intervention
- Overall performance regarding insulin preparation was good in(3.2%) increased to (17.8%) in post- test 1 and to (61.9%) in post -test 2
- The general performance regarding technique of injection was good in only (7.9%) increased to (55.5%) after intervention.
- Over all nurses knowledge about diabetes and performance regarding insulin preparation and injection were improved significantly after the program.
Recommendations:

Based on the conclusion of the present study, the following is recommended:
- It is imperative to organize training program to ameliorate the knowledge and skills of nurses on the care of people with diabetes.
  – Establishment of well-organized programs that use various forms of learning and teaching, can contribute to improving knowledge of nurses on issue related to the diabetes mellitus.
  – Great emphasis should be directed towards the educational aspects on insulin preparation, administration and injection technique by providing educational posters, guidelines, manual and modern educational facilities.
  – Alcohol swap should be applied when clean rubber of an insulin vial.
  – Re-teaching and upgrading of available nurses should be carried out by other researcher
  – Collaboration between institutions and federal ministry of health to perform annual insulin administration conference and workshop for nurses as a tool that help ensure consistent application of key elements of evidence practice in insulin administration.
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Impact of Structured Teaching Program on Nurses Knowledge Regarding Type1 Diabetes Mellitus and Insulin administration
White Nile State, Kosti Teaching Hospital 2013-2018

1. Demographic information

1. Age
   a- 20-30 years ( )
   b- 31-40 years ( )
   c- 41-50 years ( )
   d- above 51 years ( )

2. Gender:
   a- male ( )
   b- female ( )

3. Degree of graduation:
   a- Diploma ( )
   b- bachalrio ( )
   c- Master degree ( )
   d- PhD ( )

4. Duration of the work as a nurse:
   a- < 5 years ( )
   b- 5 - 10 years ( )
   c- 11 - 20 years ( )
   d- more than 30 years ( )

5. Attending of training courses on diabetic care:
   a- attended ( )
   b- not attended ( )

6. Years of experience on diabetic care:
   a- less or equal to 1 year ( )
   b- 2 years c-3 years ( )
   d- more 3 years ( )
   e- not experience ( )
7. Ward of working:
a- medicine ward ( )
b- surgery ward ( )
c- pediatric ward ( )
d- casualty ( )

2. Nurses knowledge about diabetes mellitus:

8. Type 1 diabetes thought to be:
a- an inherited genetic predisposition ( )
b- process stimulated by an environmental trigger, such as toxin drugs or chemical ( )
c- the production of endogenous insulin is not affected ( )
d- all of the above ( )

9. Type 1 diabetes distinguished from type 2 diabetes only by:
a- patient insulin resistance ( )
b- insulin deficient without insulin resistance ( )
d- none of the above ( )

10. Diagnostic criteria for type 1 diabetes mellitus:
a- Fast ing plasma glucose(FPG) >126 mg \( \text{dl} \) (7.0 mmol\( \text{L} \)) ( )
b- 2 hours postprandial glucose >200 mg \( \text{dl} \) (11.1mmol\( \text{L} \)) ( )
c- random plasma glucose > 200 mg \( \text{dl} \) in patient with classic symptoms of diabetes. ( )
d- all of the above ( )

11. Management of type 1 diabetes:
a- insulin ( )
b- oral hypoglycemic tabs alone ( )
c- insulin, exercise and nutrition ( )
d- all of the above ( )

12. When the blood glucose level reach 70 mmol the patient should:
a- take sweaty meal ( )
b- notify the doctor ( )
c- wait until the other result of blood ( )
d- all of the above ( )
13. When the blood glucose level reach 300mg(11,6mmol) the nurse should do?
   a- urine test for acetone ( )
   b- b-not give insulin ( )
   c-take meal not containing sugar ( )

14. Investigation used to identify diabetes control within the last 3 months:
   a- urine for acetone ( )
   b- blood glucose ( )
   c- HbA1C ( )
   d- none of the above ( )

15. Normal level of HBAC1:
   a- 6% - 6.5% ( )
   b- 6.6- 7% ( )
   a- >7% ( )

16. When treating hypoglycemia during day the blood glucose should reach?
   a/70mg/dl ( )
   b/100mg/dl ( )
   c- more than 100mg/dl ( )

3. Nurses knowledge about insulin
17. In type 1 diabetes insulin sensitivity by the body
   a. Increased ( )
   b- Normal ( )
   c- decreased ( )
   d- c- do not affected ( )

18. The intermediate insulin remains potent and effective after the bottle has been opened (if keep in the refrigerator between injection for up to:
   a.1 month ( )
   b-2 months ( )
   c- 3 months ( )
   d- 3weeks ( )
19. When injecting insulin into abdomen the abdomen should divided into:
   a- halves ( )
   b- quadrants ( )
   c- not important to divide the area ( )

20. The peak action of soluble insulin is :
   a- 2-4 hours ( )
   b- half an hour – 2 hours ( )
   c- 7 hours ( )
   d- none of the above ( )

21. When injecting insulin the needle should be:
   a- at 90 degree ( )
   b- at 45 degree ( )
   c- At 75 degree ( )

22. When you want to inject mixed insulin you can rotate the vial:
   a- 3 times ( )
   b- 5 times ( )
   c- 10 times ( )

23. The injection site with faster insulin absorption is:
   a/ abdomen ( )
   b/ arms ( )
   c/ thigh ( )

24. Space between injection sites should be at least:
   a. 1cm ( )
   b. 2 inch ( )
   c. 2cm ( )

25. When insulin injected in lipohypertrophy area the absorption will be:
   a- Fast ( )
   b- slowly ( )
   c- not affected by lipohypertrophic area ( )
26. To reduce the pain during insulin injection you should:
   a- use fine needle
   b- use short needle
   c- both short and fine.

27. Rubbing the skin after insulin injection cause insulin absorption to be:
   a. Slow
   b. rapid
   c. not affected

28. Best injection site for morning dose of mixture insulin is:
   a. gluteal muscle
   b. deltoid muscle
   c. abdomen
   d. thigh

29. The site of injection should be rotated to prevent:
   a- lipohypertrophy
   b- hypertrophy
   c- skin blanching
   d- none of the above
بسم الله الرحمن الرحيم

جامعة شندي

كلية الدراسات العليا والبحث العلمي

الأخ / المحترم

السلام عليكم ورحمة الله تعال وبركاته

الموضوع: استبيان

أرجو من سيادتكم التكرم بالإجابة على أسئلة الاستبيان المرفقة وذلك لاستكمال
دراسة لنيل درجة الدكتوراه في تربية الأطفال بعنوان :
تقييم مرضى مستشفى كوستي عن معرفتهم بمرض السكر النوع الأول

وحقن الأنسولين

ونقدر دوركم الفاعل في البحوث العلمية، علمًا بأن البيانات سيتم
استخدامها لأغراض البحث العلمي فقط وستتعامل بسرية تامة.

ونقبلوا وافر الشكر والمقدار ،،،
أولاً: البيانات الشخصية:
الرجاء التكرم بوضع علامة (✓) أمام الخيار المناسب:

1/ العمر:
أ - 20 - 30 سنة ( )
ب - 31 - 40 سنة ( )
ج - 41 - 50 سنة ( )
د - أكثر من 50 سنة ( )

2/ النوع:
أ - ذكر ( )
ب - أنثى ( )

3/ درجة التخرج:
أ - دبلوم ( )
ب - بكالوريوس ( )
ج - ماجستير ( )

4/ فترة العمل في التمريض:
أ - فترة العمل في مهنة أقل من 5 سنوات ( )
ب - 5 - 10 سنوات ( )
ج - 10 - 20 سنة ( )
د - أكثر من 20 عام ( )

5/ تعمل في عبر:
أ - بابتيشية ( )
ب - جراحة ( )
ج - أطفال ( )
د - الحوادث ( )

6/ لديك سنوات خبرة في رعاية مرضى السكر النوع الأول:
أ - نعم ( )
ب - لا ( )

7/ المشاركة في كورسات لرعاية مرضى السكري
أ - شاركت ( )
ب - لم تلتقي للفترة ( )

ثانياً: معلومات عن مرضى سكري الأطفال:

8/ العوامل التي تساعد على الإصابة بمرض السكر النوع الأول:
أ - عوامل وراثية ( )
ب - عوامل بيئية مثل المواد الكيميائية والأدوية ( )
ج - الالتهابات الفيروسية ( )
د - عدم كفاية إنتاجية الأنسولين ( )
ه - كل ما ذكر صحيح

9/ التمييز بين مرض السكر النوع الأول من النوع الثاني ب :
أ - مقاومة المريض للأنسولين ( )
ب - نقصان الأنسولين مع عدم مقاومته ( )
ج - لا توجد إجابة ( )

10/ يتم تشخيص مرض السكر عندما يكون :
أ - معدل الجلوكوز في الدم عشائريا أكثر من 100 ملغ/ديسيلتر ( )
ب - معدل الجلوكوز بعد ساعتين من إعطاء جلوكوز 5% يعادل أو أكثر من 200 ملغ/ديسيلتر ( )
ج - فحص السكر في حالة الصيام أكثر من أو يساوي 180 ملغ/ديسيلتر

11/ يعالج مرض السكر النوع الأول ( السكر الأطفال ) :
أ - أنسولين فقط ( )
ب - حبوب السكر ( التنظيم) ( )
ج - تغذية وأنسولين مع الرياضة ( )
د - كل ما ذكر صحيح ( )

12/ إذا كان تحليل الدم في السكر أقل من 70 ملغ (4ملل) يجب إعطاء
على الممرض :
أ - إعطاء المريض شراب محلي ( )
ب - إخطار الطبيب فوراً ( )
ج - الانتظار حتى زمن الجرعة القادمة ( )
1/13 إذا كان تحليل السكر في الدم 300 ملغ (11.6 ميليمول) يجب على الممرض:
أ - فحص البول للأستون ( ) ب - عدم اخذ الأنسولين والاتصال بالطبيب فوراً ( )
ج - إعطاء الطفل وجبة إضافية أخرى ( )

4/1/ التحليل الذي يجري لمعرفة نسبة السكر في الدم خلال 2-3 شهور السابقة هو:
أ - البول للأستون ( ) ب - الدم للسكر ( ) ج - الهيموغلوبين السكري ( )

5/15 المعدل الطبيعي للهيموغلوبين السكري في الدم هو:
أ - 6% - 6.5% ( ) ب - 6.6% - 7% ( ) ج - أكثر من 7% ( )

6/1/ عند معالجة نقصان السكر يجب ان يكون معدل الجلوكوز في الدم:
أ - 70 ملغ/ديسيلتر ( ) ب - 100 ملغ/ديسيلتر ( )
ج - أكثر من 100 ملغ/ديسيلتر ( )

ثالثًا: معلومات عن الأنسولين

17/1 تكون حساسية الأنسولين في النوع الأول:
أ - طبيعية ( ) ب - تزداد ( ) ج - تنقص ( ) د - لا تتأثر ( )

18/1 الأنسولين متوسط المفعول يحتفظ بفعاليته وهو مفتوح في التلجة لمدة:
أ - شهر ( ) ب - شهرين ( ) ج - ثلاثة أشهر ( ) د - ثلاثة أسابيع ( )

19/1 عند حفظ الأنسولين في البطن يجب تقسيم البطن الي:
20/ يسري مفعول الأنسولين الصافي:
أ - 6 - 4 ساعات ( )
ب - سعاتان 4 ساعات ( )
ج - 7 ساعات ( )
د - كل ما ذكر خطاً ( )

21/ عند إعطاء حقنة الأنسولين يجب أن تكون الإبرة:
أ - في خط موازي للجلد ( )
ب - في زاوية 90 درجة ( )
ج - في زاوية 45 درجة ( )

22/ كم مرة يجب أن يفرك الأنسولين المخلوط حتى يكون لونه خالص اللبن؟
أ - 3 مرات ( )
ب - 5 مرات ( )
ج - 10 - مرات ( )

23/ يكون امتصاص الأنسولين سريع اذا تم حقنه:
أ - البطن ( )
ب - العضل ( )
ج - الفخذ ( )

24/ إذا كان هناك تقسيم منطقة الحقن فيجب أن تكون المسافة بين النصفين
أ - أربع ( )
ب - 1 بوصة ( )
ج - 2 سم ( )

25/ إذا تم حقن الأنسولين في مكان به دهون تكون نسبة امتصاصه كالاتي:
أ - سريع ( )
ب - بطيء ( )
ج - لا يتأثر الامتصاص اذا تم الحقن في مكان به دهون ( )

26/ لتقليل الألم عند حقن الأنسولين يجب:
أ - استخدام إبرة رفيعة ( )
ب - استخدام إبرة قصيرة ( )
ج - كل ما ذكر صحيح ( )
27/ فرك منطقة الحقن يتسبب في:
أ - زيادة سرعة امتصاص الأنسولين ( ) ب - نقصان سرعة امتصاص الأنسولين ( )

ج - لا يتأثر امتصاص الأنسولين بفرك منطقة الحقن ( )

28/ أفضل منطقة لحقن الأنسولين المخول في الصباح هي:
أ - عضلة الالثية ( ) ب - عضلة الفخذ ( )
ج - عضلة البطن ( ) د - عضلة اليد ( )

29/ يجب تغيير منطقة الحقن وذلك لتفادي:
أ - بناء الشحوم تحت الجلد ( ) ب - ابيضاض الجلد ( ) ج - كل ما ذكر صحيح ( )
4. Nurses performance regarding insulin management:
A. Checklist for insulin preparation

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Done</th>
<th>Not done</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-Wash hand</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-Gather supplies(insulin-syringe- insulin ,gloves , cotton ball, alcohol wipe)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-Check 6 rights of medication administration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right patient</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right medication</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right rout ,Right dose ,Right documentation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4-check insulin expiration and appearance, clear or color.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5-clean rubber of vial with alcohol.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6- pull plunger back to pull air into syringe until the tip of plunger is at the line for the number of units required for the dose.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7-push the needle through the rubber stopper- making sure the tip of the needle is not in the insulin.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8-press the plunger to push air into the vial of insulin.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9-turn the vial and syringe upside down so that the top of the needle is in the insulin.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-holding the vial with one hand, pull back the plunger to pull insulin into the syringe until has reach the line of the proper dose.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## B. Check list for technique of insulin injection

<table>
<thead>
<tr>
<th>Technique</th>
<th>Done</th>
<th>Not done</th>
</tr>
</thead>
<tbody>
<tr>
<td>The lifted skin fold should not be squeezed tightly that it cause skin blanching or pain.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insert needle into skin at 90 degree angle.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Administer therapy.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leave the needle in the skin for at least 10 second after the thumb button plunger is fully depressed.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Withdraw needle from the skin.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Release lifted skin fold.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Massaging the site after injection is not generally recommended.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Teaching program:

التعليمي:

بسم الله الرحمن الرحيم

مرض الأطفال

برنامج اليوم الأول

المحاضرة الأولى

تعريف مرض السكري وكيفية العلاج:

ما هو مرضى السكري؟

هو ذلك المرض الذي يحدث نتيجة للنقص إفراز هرمون الأنسولين وينتج عنه تأثير في قدرة الجسم على تخزين واستهلاك المواد التشوية والسكرية

هو مريض يصبح فيه دم الطفل المريض وبوله محتويان على كميات زائدة من السكر (الجلوكوز) مما يسبب للمرض عدد من الأعراض والمضاعفات أن لم يعالج.

جسم الإنسان يمكن تشبئه بالآلة التي لا تعمل إلا بوجود الوقود لإعطاء الطاقة اللازمة و مصدر وقود الإنسان هو الطعام. وعندما نتناول الطعام يتم هضمه بواسطة الأمعاء و يتكون في النهاية سكر الجلوكوز الذي تمتزجه الخلايا المبطنة لجدار الأمعاء ومنها يتسبب في مجري الدم ويساعد هرمون الأنسولين الذي تفرزه غدة البنكرياس علي دخول السكر في الدم الي خلايا الجسم للاستفادة منه. وإذا حصل هناك خلل في غدة البنكرياس ينتج عن ذلك نقص في الأنسولين وبالتالي يفقد الجسم قدرته علي استهلاك السكر ومن ثم ترفع نسبته في الدم وسبب ذلك

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يعاني المريض من كثرة النبول والعطش ونقص الوزن وضعف عام هذا الي جانب عدد اخر من المضاعفات وإذا استمرت الحالة دون علاج فإنها قد تتطور الى غيبوبة عميقة.

ما هي غدة البنكرياس: هي غدة منشورية الشكل توجد في أعلى البطن فوق قسم الأثني عشر من الأمعاء الدقيقة وراء المعدة. غدة البنكرياس غدة مختلطة تفرز عصارة الهضم. وفي داخل أنسجة غدة البنكرياس جزر لانترهانس وهي من الغدد الصغيرة وهي التي تفرز هرمون الأنسولين الذي ينظم عملية استقلاب المادة السكرية.

هل هناك فرق بين سبب مرض السكر عند الأطفال والكبار: نعم - مرض السكر عند الأطفال وغالبا ما يكون النوع الأول المعتمد على الأنسولين ينتج عن حدوث نقص في مورد الأنسولين اما عند الكبار وغالبيتهم يعانون من النوع الثاني أو غير المعتمد على الأنسولين ولكن يكون هناك نقص في درجة حساسية خلايا الجسم له وبالتالي يبطل مفعوله وهناك اختلافات كثيرة في الأسباب وعلاج الداء بين الكبار والصغار.

أنواع مرض السكر:
نسبة مرض السكر (النوع الأول)

سلسة عن مرض السكري

ما هي أنواع مرض السكري؟

النوع الثاني
غير المعتمد على الأنسولين
ويصيب البالغين

النوع الأول
المعتمد على الأنسولين
ويصيب الأطفال

@Bntesham
نوع السكر عند الأطفال:

كما ذكرنا سابقاً فان أكثر أنواع داء السكر عند الأطفال هو النوع الأول أو المعتمد
على الأنسولين ولكن هناك إعداد قليلة من الأطفال يصابون بالنوع الثاني غير
المعتمد على الأنسولين.

ما هي أسباب النوع الأول من السكري؟

يحدث النوع الأول من السكري نتيجة التهاب ومن ثم تليف الخلايا التي تفرز
الأنسولين في غدة البنكرياس وهي خلايا لانغرانس.

وماهي الأسباب التي تؤدي الى التهاب وتليف هذه الخلايا:

ينتج هذا الالتهاب عندما يكون الطفل مهيئًا وراثيًا ومن ثم يتعرض الي بعض
العوامل البيئية ويؤدي ذلك الى إفراز الجسم لبعض الأجسام المضادة ضد غدة
البنكرياس والتي تؤدي الى التهاب وثم تليف هذه الخلايا.

ما هو دور الوراثة في هذا النوع من السكر:

رغم أن 10% فقط من الأطفال المصابين بعانون تاريخ مرض داء السكر النوع
الأول في الأسرة فإن الأبحاث قد دلت للوراثة دور هام وبالتالي فان هناك أطفال
معرضين وراثياً لهذا المرض ويمكن تحديد ذلك بالكشف على الكروموسومات ويزداد

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احتمال الإصابة بهذا المرض إذا كان هناك أفراد آخرين من الأسرة مصابين بهذا المرض مثل الأب والأم والأخوة.

ما هي العوامل البيئية التي تؤدي إلى الإصابة بمرض السكر:

هناك عوامل بيئية كثيرة يظن ان لها دور بالإصابة بهذا النوع مثل الفيروسات.
وايضا نقل نسبة الإصابة بين الأطفال الذين يرضعون من ذوي الأم ومن هنا تكمن تشجيع الأمهات على الرضاعة الطبيعية.

ماذا نقصد بالالتهاب المناعي الذاتي:

ان الجسم الإنسان يفرز اجسام مضادة لبعض اجزاء الجسم وهى التي تؤدي الى التهابات. حيث اطفال مرض السكر أيضا معرضون للإصابة بالتهابات في اجزاء أخرى من الجسم كالغدة الدرقية التي يمكن ان تتضخم وتصاب بالكسل.. اياضا النوبات الغشاء المخاطي للأنف التي تنتج عن حساسية لأكل القمح.

الأعراض:

أعراض مرض السكر عند الأطفال

1- كثرة التبول كما وعدها ( في حال كون الطفل يريجا تفضل ملاحظة ذلك خاصة إذا كان يستعمل حفاضاته )

( كثرة تغير الحفاضات)

2- العطش الشديد وشراب الماء بكميات كثيرة

التشخيص:

يعتمد الإطباء في تشخيص هذا المرض على الآتي التالي:

1- التاريخ المرضي للحالة وهي الأعراض التي ذكرناها من قبل وفي معظم الحالات تكون الأعراض حادة بمعنى انها بدأت في ظرف ايام أو أسابيع قليلة.

2- الكشف السريري على المريض وربما تكون هنالك أعراض الحامض الكيتوتي ونقص الوزن

3- تحليل الدم للسكر والبول للسكر والاستون.. ويؤكد التشخيص عن طريق تحليل السكر للدم بالطريقة التالية:
إذا كان الطفل يعاني من أعراض مرض السكر التي ذكرت سابقاً فان تحليل عينة
عشوائية تكفي للتشخيص المرض حيث انه إذا كانت نسبة السكر في الدم 0.02 مل pageNumber (11) ميليومول أو أكثر فهذا يؤكد التشخيص.

ب - أما إذا كانت الأعراض غير واضحة فيمكن تأكيد التشخيص.

بطرقتين:

أخذ عينة دم والطفل صائم فإذا كانت النسبة 0.026 ملpageNumber (7) ميليومول هو أكثر فهذا يشير أن الطفل مصاب بالسكري ولكن يجب اعادة التحاليل مرة أخرى للتأكد.

إمضا إذا النسبة تساوي أو أكثر من 0.02 ملpageNumber (11 ميليومول) بعد ساعتين من الوجبة أو اعطاء جلوكوز.. فهذا أيضاً يشير الي التشخيص ولكن لابد من اعادة الفحص مرة اخرى للتأكد في بعض الحالات. كيف نعرف إذا كان الطفل مصاب بالنوع الأول ( المعتمد علي الأنسولين) أو النوع الثاني غير المعتمد علي الأنسولين.

معظم حالات السكر عند الأطفال تكون من النوع الأول و تكون الأعراض حادة اما في بعض الحالات خاصة إذا كان الطفل مصاب بالسمنة الزائدة وكان هناك تاريخ مرضي في الأسرة فمكن أن يكون الطفل مصاب بالنوع الثاني...

ويؤكد ذلك التشخيص بقياس نسبة الأنسولين في الدم، ففي حالة النوع الأول تكون النسبة منخفضة اما في حالة النوع الثاني تكون طبيعية أو مرتفعة بالإضافة الي بعض التحاليل الأخرى كقياس نسبة الجسم المضادة لعجلة لينكريس.

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المحاضرة الثانية
علاج مرض السكري النوع الأول

علاج النوع الأول:
- يتكون علاج السكري النوع الأول كما يلي:
  - حقن الأنسولين
  - التغذية الجيدة
  - الرياضة
  - الاهتمام بحالة المريض النفسية والاجتماعية
  - مراقبة وعلاج المضاعفات

ولتحقيق هذه الأهداف لابد من أن يكون هناك فريق متكامل من أطباء "صيادة" اخصائي تغذية "مرشدة السكر" وأخصائية اجتماعية ونفسية وكوادر تمريضية.

تغذية أطفال مرضى السكري: بالإضافة للأنسولين يشكل الغذاء أحد أهم الأعمدة الرئيسية لعلاج مرضى السكر عند الأطفال.
متطلبات الغذاء الجيد:
- يكون الغذاء كافياً لنمو الطفل وأن يحتوي على كل المواد الغذائية كالبروتينات والنشويات والدهنيات والفيتامينات بالإضافة إلى السعرات الحرارية المطلوبة لنمو الطفل بصورة طبيعية.
- يجب أن يتناول الطفل وجباته الغذائية في أوقات منتظمة.
- التعود على اخذ ثلاثة وجبات رئيسية، وثلاثة وجبات خفيفة بين الوجبات الرئيسية.
- التقليل من تناول المواد السكرية كالحلوى والشوكولاتة والمشروبات الغازية كالبيبسي كولا.

أغذية مريض السكري:
الفصل 50: أطعمة مرضي السكري:
1- الفاصوليا
2- الخضروات الورقية
3- الفواكه الحمضية
4- البطاطس الحلوة
5- التوت
6- الطماطم
7- السمك المشوي
8- الحبوب الكاملة
9- المكسرات
10- منتجات الحليب منزوع الدسم

Twitter & Instagram: @AskBesTen
المحاضرة الثالثة
الأنسولين وأنواعه

الأنسولين هو هرمون تفرزه غدة البنكرياس في الإنسان.

وظيفة الأنسولين:
الأنسولين يساعد السكر (الجلوكوز) على الدخول إلى خلايا الجسم المختلفة و
بالتالي يستفيد الجسم من مادة الجلوكوز كوقود للطاقة ولبناء خلايا الجسم المختلفة
بالإضافة إلى وظيفته في بناء الجسم من البروتينات والدهنات.

ماذا يحدث للأنسولين في مرض السكر:
عندما تتلف خلايا بيتا والتي تفرز الأنسولين في غدة البنكرياس فإن الغدة لا
تستطيع إفراز الأنسولين.

هل هناك بديل للأنسولين الذي يفرز بواسطة البنكرياس عند تعطل الغدة:
في الوقت الحالي هناك أنسولين مشابه لأنسولين الإنسان تماما تم صنعه
بتخسيس البكتيريا واستعمال الجينات الوراثية للأنسولين ولسنوات طويلة كنا نستعمل
الأنسولين المستخرج من البقر والخنزير.
ما هي أنواع الأنسولين الموجودة في السودان الآن:
هناك عدة مستحضرات من الأنسولين وتختلف علي حسب بداية وذروة ومدة
مفعولها كما هو موضح في الجدول أدناه:
جدول يوضح أنواع الأنسولين ومفعولها:
كثر أنواع الأنسولين استعمالا في السودان في الوقت الحالي هو الأنسولين قصير
المفعول(الصافي) ومتوسط المفعول (العكر) أو الأنسولين المخلوط.
- الأنسولين قصير المفعول (الصافي): و هذا يبدأ مفعوله بعد ١half ساعة بعد
الحقن ويستمر مفعوله تقريبا من ٣ - ٦ ساعات. في العادة يخلط هذا الأنسولين مع
انسولين متوسط المفعول قبل حقنه اثناء الجرعات العادية ولك له فوائد مهمة أخرى
حيث يمكن حققه لوحده في حالات ارتفاع السكر وأيضا يمكن اعطاءه بالورد.
ويعطاء هذا الأنسولين اسماء تجارية مختلفة علي حسب الشركة المصنعة مثل
و لا بد من اقتناء هذا النوع من الأنسولين في المنزل actrapid Humulin ®

باستمرار لعلاج حالات ارتفاع السكر بالإضافة للجرعات العادية.
- الأنسولين متوسط المفعول (العكر): و يبدأ مفعوله بعد ٤ - ٦ ساعات من
الحقن ويستمر مفعوله من ١٠ - ١٦ ساعة (متوسط ١٢ ساعة) وبالتالي فإنه
يعطي حوالي مرتين في اليوم... وفي الغالب يعطي بعد خله من الأنسولين
قصير المفعول، وهنالك أسماء تجارية مختلفة له مثل Insulatard و Humulin

- الأنسولين المخلوط: وهذا خليط من الأنسولين القصير المفعول والمتوسط المفعول بنسب متفاوتة ولكن أكثر الخلطات شيوعًا هو الذي يحتوي على 30% من الصافي و70% من العكر ويغطي مثل هذا النوع مرتين في اليوم، مرة أخرى لابد من الاحتفاظ بالأنسولين الصافي في المنزل للحالات الطارئة إذا كان الطفل يستخدم الأنسولين المخلوط.

- الأنسولين سريع المفعول: وهذا النوع من الأنسولين يبدأ مفعوله في ظرف 10 دقيقة ويستمر مفعوله لمتسط 2-3 ساعات، يمتاز هذا النوع من الأنسولين بأنه يمكن إعطائه مع الوجبة - أو بعد الوجبة مباشرة خاصة في صغار الأطفال إذا لم تكون الام متاحة أن الطفل سيتناول وجبته. وهنالك أسماء تجارية مختلفة له و يمكن أن يعطي بالوريد في الحالات الطارئة Humalog أو Novo rapid مثل أو يستعمل في المضخات.

- الأنسولين طويل المفعول: هنالك أنواع مختلفة من الأنسولين طويل المفعول ولكن أحدث هذه الأنواع ويمكن استعماله في الأطفال فوق سن الست سنوات هو ما يسمى بالانسولين فلارفينين (Lantus) والاسم التجاري لانتس أو Glargine (Glargine) والاسم التجاري Detemir أو leuvermir و يمتاز هذا النوع بأنه يبدأ مفعوله في ظرف ساعة ويستمر مفعوله لفترة 24 ساعة تقريبا وفي الغالب يمكن مرة واحدة يوميا عند النوم أو الصباح ولكن لابد من استعمال أنسولين قصير وسريع المفعول معه قبل كل وجبة رئيسية.

يعطي الأنسولين عن طريق الحقن أو الأقلام أو المضخات: 1 طريقة الحقن: وهي الطريقة المستخدمة في معظم الاحيان. الأنسولين الموجود في السوق هو تركيز 100 وحدة في كل وحدة مل، والسبح الي خط 10 مثلا يعني سحب عشرة وحدات بالحقنة الخاصة لإعطاء الأنسولين. طريقة الأقلاام: هنالك زجاجات خاصة لهذه الأقلاام تختلف عن زجاجات الأنسولين العادية، توضع هذه الزجاجات داخل الأقلاام بطريقة وضع الرصاص في المسدس
ثم تحدد الجرعة الطولية بواسطة زر معين ومن ثم تعطى الجرعة بواسطة الضغط على مفتاح اخر، وهذه الأقلام يمكن حملها داخل جيب القميص أو الجلابية كالمقلم ويسهل من حركة المريض حيث يمكن اخذ الأقلام خارج المنزل دون الاحتياج الي حفظ الأنسولين في التلج.

طريقة المضخات:

مضخات الأنسولين معظمها في حجم علبة الكبرييت أو الجوال الصغير وهي خفيفة ولذلك يمكن حملها علي الحزام أو الجيب، والمضخة ترسل الأنسولين من خلال انبوة بلاستيكية مربعة موزونة الي ابرة صغيرة توضع وتثبت تحت الجلد ولابد من تغير الانبوة والانبوة كل 3 أيام تقريباً. وتعطي المضخة الأنسولين بطريقة جرعة ثابتة بسرعة ثابتة خلال 24 ساعة ثم يمكن اعطاء جرعات اضافية من الأنسولين قبل كل وجبة عن طريق تشغيل زر معين وتحديد تلك الجرعة بناء علي نتيجة قياس الدم للسكر وأيضا عدد السرعات الحرارية التي ستوكل في كل وجبة وبالتالي إذا اختار الشخص استعمال المضخة فلابد من تحليل الدم للسكر 4 مرات في اليوم. وتحتاج المضخة التي اشراف من الفريق المعالج للسكر للاتصال بهم لو كانت هناك مشكلة في أي وقت خلال ال24 ساعة. ودلت الابحاث ان الاشخاص الذين يستخدمون المضخة أو يستعملون حقن ; 6 مرات يوميا تكون نسبة المضاعفات المزمنة عندهم اقل بكثير من أولئك الذين يستعملون ابرتين يوميا.

4 - الأنسولين عن طريق الاستنشاق: ما زال في مرحلة البحث بالنسبة للأطفال ولكن النتائج الأولية ادت نتائج جيدة وهو يستعمل كبديل للأنواع سريع المفعول وقصير المدى

بجلاخ الأنسولين...
اكتشاف جديد لمرضى السكر
مواضيع حقن الأنسولين: يحقن الأنسولين في أماكن مختلفة في اليدين والرئتين والبطن والأخذان، ويجب تغيير هذه الأماكن بصورة دورية عند ذلك فانه يحدث ورم دهني أو ضمور في أماكن الحقن وفي حالة حدوث التورم الدهني فإننا نتحاشى الحقن في نفس الموضع لمدة شهرين أما في حالة الضمور الدهني فان الأنسولين يحقن حول المنطقة المضمورة.

تخزين الأنسولين: يجب أن يخزن الأنسولين في الجزء الأسفل من الثلاجة أو باب الثلاجة. احذر وضع الأنسولين في قسم الفريزر في الثلاجة (الجزء السفلي). في حالة عدم وجود ثلاجة يمكن وضع الأنسولين في منطقة باردة أو رطبة حسب الزيز مثلا بعد وضعه داخل قمامة مبلن نظيف أو يمكن شراء بركة صغيرة وملئها حتى النصف بالماء ثم ربط عنق الزجاجة الأنسولين بليقة وتعلق داخل البرمة دون أن تصل الزجاجة الي الماء، وهذه الطريقة تبعد الاضواء وتحفظ الأنسولين في مكان بارد.

مدة صلاحية زجاجة الأنسولين: الزجاجات غير المفتوحة يمكن تخزينها حتى انتهاء الصلاحية المكتوب في صندوق الأنسولين. أما الزجاجات المفتوحة فيمكن وضعها في الثلاجة لفترة 30 يوم بعد الفتح.

برامج تعاطى الأنسولين: هناك برامج مختلفة لإعطاء الأنسولين تتناسب مع مختلف المرضى باختلافات احتياجاتهم وظروفهم وذلك وفقا لمدى سهولة التحكم في تذبذب مستوى الجلوكوز وتأثير ذلك بالوزن والسن والحركة والتغذية والمرض وتنظيم الوجبات.

أكثر البرامج شيوعا هو إعطاء جرعتين يوميا قبل الفطور والعشاء من خليط الأنسولين قصير أو سريع المفعول مع متوسط المفعول (ام مخلوطا جاهزا)، وذلك
الابحاث الحديثة اكثرا مفعولاً في منع المضاعفات المزمنة فهي التي تعتمد على اعطاء الأنسولين حوالي اربع مرات يومياً مثلًا: 40 مرات أنسولين قصير أو سريع المفعول قبل الوجبات لوحدها أو اعطاء أنسولين طويل المفعول مثل اللانتس أو الدتمر واعطاء جرعة صغيرة من الأنسولين سريع أو قصير المفعول قبل كل وجبة أو استعمال مضخات الأنسولين.

تعطى جرعة الأنسولين حوالي 30 – 90 دقيقة من الوجبة وذلك لإعطاء وقت للجسم لامتصاص الأنسولين ليكون موجوداً بالدم قبل دخول سكر الجلوكوز بعد امتصاصه من الامعاء. اما الأنسولين سريع المفعول فيمكن اعطاءه قبل الوجبة بحوالي عشرين دقيقة أو مع أو بعد الوجبة مباشرة.
بسم الله الرحمن الرحيم

المحاضرة الرابعة

قواعد إعطاء الأدوية

أوامر الطبيب فيمل يتعلق بالأدوية الوصفية:
الطبيب هو الشخص الذي يحدد احتياج المريض لتناول أدوية معينة ويقوم بوصف الدواء اللازم له. وعادة ما تكون الوصفة الطبية مكتوبة.

أنواع وصفات الأدوية:
هناك أربعة أنواع من الوصفات الدوائية وهي العاجلة، الجرعة الوحيدة، العادية والتي يتم وصفها عند الضرورة.

امر دوائي عاجل:
وهو الذي يشير إلى ضرورة تناول الدواء بصورة فورية لمرة واحدة.

الجرعة الوحيدة:
يتم إعطاءها لدواء يجب تناوله مرة واحدة فقط وفي وقت محدد.

الأمر الدوائي إذا احتاج الأمر (عند الاحتيال): وهو الذي يسمح للممرض/ الممرضة بإعطائه عندما يرى/ترى أن المريض يحتاجه.

الأجزاء الأساسية للعلاج الدوائي:
الأمر الطبي لإعطاء دواء يتكون من 6 أجزاء:

1. الاسم الكامل للمريض
2. تاريخ وصف الدواء
3. اسم الدواء الذي سيتم تناوله
4. جرعة الدواء
5. طريقة التناول
6. إمضاء الطبيب (توقيع)
ان إعطاء الدواء هو مسئولية كبيرة وغالباً ما يتم الاعتماد عليه لفترات طويلة. فلا
يجب أن نقلل من أهمية هذا العمل، لأن الاستعمالات التي تفقد الدقة والتركيز
قد تؤدي إلى تعرض حياة المريض إلى الخطر.
سنقوم بعرض النصائح العامة التي يجب أن تؤخذ في الاعتبار عند إعطاء دواء
وما إلى ذلك كي تتم العملية بسلام.
اعتبات خاصة بالمريض:
تجنب الأخطاء فما يتعلق بإعطاء الأدوية، يجب التركيز في العمل الذي تقوم به
دون انشغال بأمور أخرى.
قبل إعطاء الدواء يجب أولاً أن نتعرف على المريض ونتأكد أنه هو الخاضع لهذا
العلاج، لأنه هناك بعض المرضى المضربين الذين قد يختلط عليه الامر ويجيبوا
علي نداء اسم مريض آخر في محل اسمه.
لا يجب نهائياً أن يتم تسجيل تناول الدواء قبل القيام بإعطائه، يجب أن يقوم /
تقوم/ الممرض / الممرضة يستحيل تناول الدواء ، في اقرب وقت ممكن بعد
إعطاء مباشرة حتى يتجنب أن يحصل المريض على جرعة مضاعفة.
إذا اعتقد (أعرب) المريض أن الدواء الذي سيتم إعطائه مختلف عن ذلك الذي
يتناوله ، يجب أن نتأكد مما يقوله المريض.
عندما لا يتم تناول الدواء عمداً نتيجة لقيامه بتحليل أو نتيجة للصيام ، يجب تدوين
هذا الحدث و تسجيله في تقرير المريض الخاص بالأدوية.
يجب الإبلاغ الفوري عن اخطاء إعطاء الأدوية أو عن إغفال إعطائها.
إذا كان لدى الممرض ادني شك حول احدي الاوامر الطبية بإعطاء دواء ما ،
يجب أن يقوم بالاستشارة قبل أن يقوم بإعطاء ذلك الدواء للمريض.
المضاعفات سريعة الحدوث:
1. الهبوط السكري: هو انخفاض نسبة السكر في الدم الاقل م 70 مليجرام (3.5 مليمول) في كبار الأطفال أو الاقل من 80 مليجرام في صغار الأطفال و الرضع وفي بعض الأحيان تحدث أعراض انخفاض السكري ازا انخفضت نسبة السكر في الدم بصورة مفاجئة من نسبة عالية مثلا من 300 إلى 100 مليجرام
خطورة انخفاض السكر في الدم: بما ان المخ الإنسان يعتمد على السكر للنغذية فان انخفاض السكر يؤدي الى الأعراض الخاصة بنهاية نتيجة لخلل في وظيفة المخ وربما تؤدي النوبات المتكررة علي تأثير مزمن في وظيفة خلايا المخ خاصة عند الأطفال.
ما هي الأسباب التي تؤدي الى انخفاض السكر:

لا يمكن تناول وجبة كافية خاصة بعد اخذ الأنسولين أو نتيجة المرض الشعور بالتعب والدواء والألم الراس، اضطرابات في التركيز فقدان الوعي الغيبوبة أما الأعراض الناتجة عن وظيفة الجهاز العصبي الودي فتمثل في العرق وضربات القلب السريعة، القلبان، التقيؤ والخوف والرفعة. في حالة عدم العلاج يمكن أن يحدث اعماء أو تشنجات بنية في معظم الحالات يشعر الطفل بالأعراض السابقة قبل التشنجات أو الاعماء ولكن في حالات قليلة يمكن ان يحدث اعماء أو تشنج دون وجود أعراض اولية كالارتعاش وخفقان القلب.
علاج انخفاض السكر: يجب رفع الجلوكوز في الدم عن طريق اطعام المصاب أي شئ يحتوي على الجلوكوز كعصير محلي (أما ملعقة كبيرة في ½ كأس ماء صغير أو عصير أو عسل) وفي الغالب يتحن الطفل وبعدها يعطى وجبة طعام.
اما إذا دخل الطفل في حالة غيبوبة فيمكن اعطاءه حقنة الفلوكانون وهو هرمون يساعد على تكسير السكريات المخزنة في الكبد وخروجها الي الدم يقوم بوظيفة عكسية للأنسلرين حيث يؤدي الي تحليل مادة الجليكوجين وهي مخزن السكر في الجسم الي مادة الجلوكوز وبالتالي تؤدي الي ارتفاع نسبة السكر في الدم وبدا مفعول الحقيقة في ظرف 15-20 دقيقة، اما في حالة عدم توفر الفلوكانون يمكن مسح عسل أو مرية داخل الفم ولكن بحذر من محاولة اعطاء سائل للطفل ان كان في حالة غيبوبة.

الإجراءات الوقائية اللازمة لتفادي الهبوط السكري:
خذ الوجبات بصورة منتظمة والتأكد من اخذ الوجبة بعد حقن الأنسولين التأكد من الجرعة الصحيحة للأنسولين قبل الحقن التأكد من اخذ عصير أو سكر عند الخروج من المنزل
خذ وجبات صغيرة قبل وبعد التمارين الرياضية
تعليم الطفل والآسرة والمدرسة واصدقاء الطفل على أعراض وعلاج الهبوط السكري والتتأكد من وجود مصدر جلوكوز مثل العصير أو الحلوى في حقيبة الطفل وفي بولين (كما
في حالات الحمى والالتهابات أو عند اخذ كميات كبيرة من السكريات والنشويات دون اخذ الأنسولين
- أعراض ارتفاع السكر: التبول بكميات كبيرة والشعور بالعطش وجفاف الفم
- الم بالبطين استفراغ

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فقدان الشهية
القلق
الشعور بالضعف والهذيان
ظهور رائحة الاستون في فم المريض
دوخة، زيادة في معدل التنفس وضيق التنفس
في حالة عدم الاماع يتيح المريض ان يدخل في حالة غيوبية وهده من اخطر
مضاعفات السكر
في هذه الحالة يجب فحص البول للأستون والدم للسكر.

وعلي ضوء النتائج يمكن عمل الاتي:

- إذا كان نسبة السكر في الدم منخفضة مع وجود استون في البول فيجب اعطاء
  الطفل وجبة طعام ان تقبلها، اما اذا رفضها فيمكن اعطائه عصير أو حليب بسكر
  أو شاي بسكر

- إذا كان ارتفاع السكر في الدم مع وجود ستون طفيف (+) في البول وحالة المريض
  العامة غير سيئة فيمكن معالجة هذه الحالة في المنزل بإعطاء أنسولين صافي 0.1
  وحدة لكل كيلو من وزن المريض واطعاء الطفل سوائل بكميات أكبر

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المحاضرة السادسة

3. الحاضر الكيتوني السكري:

تحدث حالة الحاضر الكيتوني السكري عند مصابي السكر الأطفال، وسببها هو نقص الأنسولين وارتفاع السكر في الدم، انعدام الأنسولين يتسبب في عدم قدرة خلايا الجسم على استقلال السكر الموجود في الدم فتبدأ الخلايا بتحليل دهنيات الجسم وعضلات البطن موانع قابلة لاستقلاله كمصدر طاقة، وتدفع هذا الود بالكيتونات.

وتوجد العديد من الأسباب لهذه الحالة، ومنها تقصير المصاب في اخذ الكمية الكافية من الأنسولين، أو تعرضه لحالة جسمانية معينة، كالحمض، أو حالة نفاسية ادت إلى رفع معدل السكر في دمه دون رفع كمية الأنسولين، مما يؤدي إلى اختلال التوازن.

الأعراض:

تشمل أعراض الحاضر الكيتوني السكري في الأذن في منطقة البطن، التبول الكثير والنتيجة الناتجة، التنفس بسرعة وعمق، انبعاث رائحة الفم شبيهة برائحة الإسبيدون، وإصابة المريض بالجفاف نتيجة فقدان السوائل، وفقدان الوعي، وقد تؤدي هذه الحالة إلى اضرابات في نظم القلب.

 bahwa السكر: نسبة السكر في هذه الحالة تكون مرتفعة تصل الى 120 ملجر/دلك، وكثيرا ما تقلل عن 400 ملجر/دلك.

العلاج:

عند إصابة المريض بهذه الحالة يجب نقله فورا الي غرفة الطوارئ ويجري الطبيب الفحوصات اللازمة لتحدي وجود الكيتونات في بول المريض، ويتضمن العلاج اعطاء الأنسولين عن طريق الوريد بشكل بطئ لتقليل معدل السكر، وإعادة السوائل والكهرباء التي فقدها المصاب.
ماهي مضاعفات مرض السكري؟

- يسبب الماء الأبيض في عدسة العين و يؤثر على الشبكية.
- التهابات في المسالك البولية والكليتين وقد يؤدي إلى الفشل الكلوي.
- أمراض القلب والدورة الدموية.
- الالتهابات الجلدية المتكررة.
برنامج اليوم الرابع

المحاضرة السابعة

التدريب العملي الأسوسيلين لتجهيز قبل الحقن / موديل

الطريقة الصحيحة لتجهيز الأسوسيلين قبل الحقن:

1- تجهيز المعدات المطلوبة
2- غسل اليدين جيدا
3- خلط الأسوسيلين العكر. الخلط بطريقة الريح مثلا يؤدي إلي ظهور فقاعات هوائية
4- تنظيف غطاء الزجاجة بمطهر أو ماء نظيف
5- سحب غطاء الابرة
6- سحب كمية هواء مساوية لكمية الأسوسيلين العكر المطلوب أو حقن الهواء في زجاجة الأسوسيلين ثم سحب الابرة

سحب كمية هواء تساوي جرعة الأسوسيلين قصير المدى (الصافي) وحلفه في زجاجة الأسوسيلين الصافي، ترك الابرة في مكانها وقلب زجاجة الأسوسيلين قصير المدى (الصافي) والأبرة بداخلها ثم سحب كمية الأسوسيلين قصير المدى (الصافي) اولا ثم سحب الابرة.

7- أما في حالة استعمال الأسوسيلين المخلوط فيجب سحب كمية هواء تساوي جرعة الأسوسيلين المخلوط ووضعه في الزجاجة ثم نقل الزجاجة وسحب كمية الأسوسيلين المخلوط المطلوبة.

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المحاضرة الثامنة

التدريب العملي لحقن الأنسولين / موديل

طريقة حقن الأنسولين بالإبرة: الخطوات التي تتبع لحقن الأنسولين كالآتي:

- نظف مكان الحقن بالماء
- ارفع الجلد بين اصبعين ولا تضغط علي الجلد بشدة
- ادخل الإبرة كلها الي تحت الجلد بزاوية 90 درجة، اما اذا كان الشخص ضعيفا فيمكن استعمال زاوية 45 درجة ان وضع الإبرة في اتجاه موازي للجلد شيء خاطئ.

حقق الأنسولين سريعا ولا داعي للمسح الموضعي بعد حقن الأنسولين.
- اترك البرة لمدة حوالي 10 ثانية
- اخرج البرة من الجلد
- فك الجلد
- لا داعي لمسح الجلد كما في حالة الحقن بالعسل
- اذا لاحظت نزف بسيط فلا تزعج ، ايضا اذا كانت هناك كمية بسيطة من الأنسولين خرجت الي سطح الجلد، اما اذا كانت الكمية كبيرة فيجب اعادة تحليل الدم بعد 2-4 ساعات ويمكن اخذ جرعة اضافية م الصافي اذا كانت نسبة السكر مرتفعة.
2. Practice
Insulin preparation and administration in kosti teaching hospital

Introduction:
A highly effective strategy in increasing healthcare awareness-associated preparation and administration of insulin in hospitals is through the proper implementation and practice of policies and procedures on insulin injection by healthcare providers committed to this insulin preparation, injection technique and administration.
, when consistently applied and integrated into all systems and processes will yield the desired outcome. i.e. reduced injection error, to identify the areas of injecting insulin, to administer insulin in proper way.
Aim of program; The primary aim of insulin administration program is to prevent error of injection technique, proper preparation of insulin: thereby assisting health care workers in the provision of quality insulin administration.

Educational objectives: By the end of this program the nurses should be able to:
1. prepare insulin for injection.
2. Know the importance of hand washing.
3. know the 6 rights of medication
4. Application of insulin administration technique.
5. Discuss massaging the site after injection is not generally recommended, check insulin expiration and appearance, clear or color, leave the needle in the skin for at least 10 second after the thumb button plunger is fully depressed
Day one (session 1): 2 hours theory from 10am to 12MD.

<table>
<thead>
<tr>
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Non-pharmacological Therapy

Medical nutrition therapy

Non-pharmacological Therapy

Physical activity

Pinch-up method

**DO**

Correct pinch-up

**DON’T**

Incorrect pinch-up

A good pinch-up is performed with only 2 or 3 fingers to avoid taking the muscle from underneath.
**Insulin Counseling Tips**

To inject SC, patient should be instructed to:

- Firmly pinch up the area to be injected and quickly insert the needle perpendicularly (90°) into the center of this area and 45° used for infants and individuals with little SC fat.
- Then, skin pinch is released and insulin is injected.

Rotate injection site within the same anatomic region.

- Recommended to avoid lipodystrophy effect

Abdominal area injection site is the least affected by exercise and the most predictable.

Factors altering SC absorption: site of injection, exercise of injected area, temperature, local massage, smoking, lipohypertrophy, insulin preparation.

---

**FIGURE 48.5** According to the American Diabetes Association, insulin injection sites in children and adults are the upper outer portions of the arms; the thighs—4 inches below the hip and 4 inches above the knee (adjusted proportionally for children); and the abdominal area just above and just below the waist. The navel and a circular area just around it are excluded as injection sites. In some children, the abdominal area may not be an appropriate injection site.
Acknowledgement

I would specially like to thank Dr. Ahlam Mohammed Haj Ibrahim for her critical supervision, valuable direction and criticism throughout this thesis.

I am thankful to Dr. Lamya Altayb for her supervision.

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I am wishing to thank Dr. Gamalt Gebril dean faculty of nursing ,Al Emam Almahdi university.

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I am grateful to the study participants for their cooperation and active participations during the training program.
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<td>U.S</td>
<td>United State</td>
</tr>
<tr>
<td>IDF</td>
<td>International Diabetic Federation</td>
</tr>
<tr>
<td>MENA</td>
<td>Middle East And North Africa</td>
</tr>
<tr>
<td>IDDDMI</td>
<td>Insulin-Dependent Diabetes Mellitus Susceptibility Type 1</td>
</tr>
<tr>
<td>MHC</td>
<td>Major Histocompatibility</td>
</tr>
<tr>
<td>HLA</td>
<td>Human Leucocyte Antigen</td>
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<tr>
<td>GADA</td>
<td>Glutamic Acid Decarboxylase Autoantibodies</td>
</tr>
<tr>
<td>IA-2</td>
<td>Tyrosine Phosphatase - Like Molecule</td>
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<tr>
<td>ZNT</td>
<td>Zinc Transporter</td>
</tr>
<tr>
<td>IAA</td>
<td>Insulin Auto Antibodies</td>
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<tr>
<td>HA1C</td>
<td>Glycated Haemoglobin A1c</td>
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<tr>
<td>PH</td>
<td>Potential Hydrogen</td>
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<tr>
<td>FPG</td>
<td>Fasting Plasma Glucose</td>
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<td>2HPG</td>
<td>2 Hours Post Prandial Glucose</td>
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<td>OGGTT</td>
<td>Oral Glucose Tolerance Test</td>
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<td>NHANES</td>
<td>National Health And National Examination Survey</td>
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<td>Hb</td>
<td>Hemoglobin</td>
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<tr>
<td>DNA</td>
<td>Deoxyribonucleic Acid</td>
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<tr>
<td>EMP</td>
<td>Enzymatic Modification Of Porcine</td>
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<td>I,Z,S</td>
<td>Insulin Zinc Suspension</td>
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<td>Neutral Ph Hagedron</td>
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<tr>
<td>IM</td>
<td>Intramuscular</td>
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<tr>
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<td>American Diabetes Association</td>
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<td>Diabetic Ketoacidosis</td>
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<td>IV</td>
<td>Intra-venous</td>
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<td>SMBG</td>
<td>Self-Monitoring Blood Glucose</td>
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<tr>
<td>CGM</td>
<td>Continuous Glucose Monitoring System</td>
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<tr>
<td>ACCORD</td>
<td>Action To Control Cardio Vascular Risk In Diabetes</td>
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<td>DCCT</td>
<td>Diabetic Control And Complication Trial</td>
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<td>EDIC</td>
<td>Epidemiology Of Diabetes International And Complication</td>
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Abstract

The national service framework for diabetes indicate nurses knowledge on insulin dependent diabetes mellitus could be achieved through training and retraining of non – specialized nursing staff on diabetes and insulin administration.

This quasi experimental hospital-based study was aimed at assessing the effect of structured teaching program about type 1 DM & insulin administration on nurse’s knowledge. The study was done in Kosti teaching hospital in the period (2013-2018). The sample size was by the total coverage consisted of 63 nurses. The data was collected using predesigned questionnaire & observational check-list. The data was analyzed using statistical package of social science (SPSS).

The present study showed that the nurses had deficient knowledge regarding type 1 diabetes. The nurses were acquired knowledge after intervention specially in relation to etiology, tests used to assess diabetes control and potency of opened insulin vial (82.5%,69.8%,80.9%) respectively. Nurse’s skills and technique concerning checking insulin expiry date, cleaning the rubber, lifting the skin and insertion of the needle were poor which were improved during post - test 2 to (87.3%,52.4%,60.3%,98.4%). General performance regarding insulin preparation was improved as the good performance from (3.2%) in pre-test to (61.9%) in post-test2 and skills about insulin administration improved after intervention to good in (55.5%). The study concluded that the knowledge and performance of all study group were improved after intervention. The study recommended organizing training programs to ameliorate the knowledge and skills of nurses on the care of diabetic children and insulin administration.
ملخص الدراسة

مهنة التمريض وضعت جودة الرعاية الصحية وتمثل في معرفة طبيعة الأمراض ومضاعفاتها وإعطاء الأدوية بالطرق الصحية في طبيعة اهتماماتها مع إبرام اهتمام خاص بالتدريب وتعليم القوة العاملة لديها. عالميا كان المجلس الدولي للتمريض أثبت أن الإعلام بمعرفة حقن الأسولين أمر أساسي لجودة الرعاية الصحية والتمريض. هدفت هذه الدراسة إلى معرفة تأثير تصميم برنامج للممرضين عن السكري النوع الأول وكيفية حقن الأسولين وتقديم تأثيره على معرفتهم وأدائه. هذه الدراسة شبة التجريبية مستشفى كوسنتي التعليمي في الفترة بين 2013-2018 تضمنت ثلاثة وستون من الممرضين حيث تم استخدام استبان وقائمة تحقق لجمع البيانات. تم جمع البيانات الأولية باستخدام الاستبيان ثم تم ملاحظة كل ممرض بواسطة قائمة تحقق أثناء أدائه ثم تم تدريب الممرضين عن السكري النوع الأول وكيفية حقن الأسولين لمدة ثمانية أسابيع. تم تحليل البيانات باستخدام برنامج التحليل الحزيمي للبيانات الحيوية بالحاسب.

واظهرت النتائج قصراً في معرفة الممرضين عن مرض السكر النوع الأول وحقن الأسولين اما بعد اجراء البرنامج التعليمي، فزادت معرفة الممرضين خصوصا فيما يتعلق بأسباب المرض، الفحص الذي يجري لمعرفة التحكم في السكر وفعالية الأسولين بعد فحش قن الکاسولين وشد الجلد (67.3%)(4.2%)(100.0%)

(98.4).

إذما تحسن اداء الممرضين في تجهيز حقن الأسولين الي (91.9) اما مهارات حقن الأسولين فتحسنت بنسبة (55.05%) بعد البرنامج التعليمي الثاني.

لخصت الدراسة ان معرفة واداء الممرضين تحسن بعد التدخل الدراسي. اوصت الدراسة بتنظيم برنامج تعليمي لزيادة معرفة ومهارات الممرضين برعاية اطفال السكري و حقن الأسولين.