

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

Sudan University Of Science & Technology
College of Medical Radiological Science

**Characterization of Pancreatic Changes in Sudanese diabetic
Patients Using Ultrasonography**

توصيف تغيرات البنكرياس لدى مرضى السكر السودانيين باستخدام التصوير بالموجات فوق
الصوتية

*A thesis submitted in partial fulfillment for the requirement of
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Prepared by:

**Ali abd alwahab Ali
Rayan Mustafa Eltagi
Khadija Ibrahim mohamed**

Supervisor By:

Ustaz: Shazaly Nadir khojaly

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الآية

قال تعالى :

(قَالَ رَبِّ اشْرَحْ لِي صَدْرِي * وَبَسِّرْ لِي أَمْرِي * واحْلُلْ عُقْدَةً مِنْ لِسَانِي * يَفْقَهُوا قَوْلِي)

صدق الله العظيم

سوره طه (25-28)

Dedication

To Our Parents....

To Our families....

To Our friends....

*Special Thanks
To Our Teachers*

Acknowledgment

First of all, we thank Allah the Almighty for helping us to complete this project. we thank, our supervisor, for his help and guidance.

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List of abbreviations

DM	Diabetes Mellitus
IDDM	Insulin Dependent Diabetes Mellitus
NIDDM	Non Insulin Dependent Diabetes Mellitus
SPSS	Statistical Package for Social Sciences
U/S	Ultrasound
MHz	Megahertz

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Abstract

Abdominal ultrasound is a method for evaluating internal structures of abdomen, and one of them measure the pancreatic size generally and in diabetic patient specially.

Our purpose in this study was to evaluate the change in pancreatic size and the effect of age and duration of diabetic on diabetic patient using ultrasound compare with healthy patient (control group).

The study was conducted at Noreen diabetic center(Khartoum-Sudan) during the period from June up to September 2015. Seventy consecutive subjects were selected in both gender and with different ages, 50 diabetic patients and some healthy people (control group). All subjects were scanned for Abdominal Ultrasound (Mindary DP 2200), curvilinear transducer (3.5Mhz) in Transvers section. Images were obtained at areas including Head, body and tail of pancreas. And measured the pancreatic size and studied the relationship between it and type of patient, age of patient and duration of diabetic.

Results showed that there is significant invert relationship between the Diabetic and size of pancreas , significant invert relationship between the duration and age of diabetic patient and pancreatic size, compare with control group.

The results showed that there has been a significant correlation between the Diabetic and decrease in pancreatic.

The result showed there no effect of patient gender on the pancreatic size for diabetic patient or healthy control group.

The abdominal Ultrasound is the one of best modalities to evaluate the pancreatic size and pancreatic disease.

ملخص الدراسة

تعتبر الموجات فوق الصوتية للبطن وسيلة لدراسة وتقييم الاجزاء التشريحيه للبطن ,ومنها تقييم شكل وحجم البنكرياس خاصه عند مرضى السكري.

كان الهدف من الدراسة تقييم حجم البنكرياس لمرضى السكري وتأثير عمر المريض والفترة الزمنية لظهور السكري مقارنة مع الاشخاص الاصحاء(المجموعه السليمة) اجريت الدراسه في مركز نورين للسكري(السودان – الخرطوم) في الفترة من أبريل إلى أكتوبر 2015م.تم قياس 50 عينه ,25 عينه من مرضى السكري و 25 أناس أصحاء(المجموعه السليمة) ,بواسطة جهاز الموجات فوق الصوتيه(مينداري دي بي 2200) ومسبار ممنحي (3.5 ميغاهيرتز).

أظهرت النتائج أن هناك علاقة عكسية بين حجم البنكرياس والفترة الزمنية لظهور السكري ,وعلاقة عكسية بين حجم البنكرياس وعمر المريض. كما أوضحت ان هنالك فرق بين حجم البنكرياس لمرضى السكري والمجموعه الضابطة.

كما أوضحت الدراسع أن الجنس لا يؤثر في حجم البنكرياس لمرضى السكري أو الأصحاء(المجموعه السليمة).

تعتبر الموجات فوق الصوتيه من أهم الوسائل الأمانة نسبيا الحديثه لتقييم شكل وحجم البنكرياس الطبيعى والمرضى.

الإهداء

الى معنى الحب والى معنى التفاني

الى بسمة الحياة وسر الوجود

الى من كان دعائها سر نجاحي

وحنانها بلسم جراحي

"أمي الحبيبة نرهرة الصاق"

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الى من تذاقت معه أجمل اللحظات

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الى من هم أقرب الي من مروحي

وبهم أستمد عزتي واصرارمي

"الابناء محمد ومنة"

الى

"الاخوان والاخوات"

الى

الاصدقاء وكل من

ساعدني في هذا البحث

إهداء خاص جداً الى

حبيبي وأختي الغالية إسلام

Chapter one

1.1 Introduction

The pancreas lies in the epigastric and left hypochondriac region. The anterior surface is covered by the lesser sac of (omental bursa). The posterior surface is adherent to the paratal peritoneum of the dorsal body wall. Anatomically is divided into head measured 2.5cm (width) body measured 2cm (width), and tail measured 2cm (width) (April Ernest, 1997)

The pancreas is both exocrine and endocrine glands, its exocrine function is to produce pancreatic juice. The endocrine pancreas consists of the 1 million microscopic clusters of endocrine cells, the islets of the Langerhans of the pancreas. Three cells synthesize insulin and alpha cells elaborate glucagon (Green 1978)

Diabetes mellitus is a chronic disorder of carbohydrate, fat, and protein metabolism, relative or absolute deficiency in the insulin secretory response is characteristic features of the diabetes mellitus, as is the resulting hyperglycemia (Vinay Kumar et al 2002).

Diabetes mellitus has been classified into two major categories; these differ in their pattern of inheritance, insulin responses and origin. Type 1 diabetes, insulin dependent diabetes mellitus (IDDM) or juvenile-onset diabetes, caused by autoimmune destruction of the beta cells, and type 2 diabetes, non insulin dependent (NIDDM) is a more complex than 1 diabetes because there is combination of resistance to the actions of insulin in liver and muscle together with impaired pancreatic B-cell function leading to relative insulin deficiency. Insulin resistance appears to come first, and leads to elevated insulin secretion in order to maintain normal blood glucose levels. The primary cause of insulin resistance remains unclear. Intra abdominal (central) adipose tissue is metabolically active and releases large quantities of FFAs which may induce insulin resistance. Physical activity is another important determinant of insulin sensitivity (Nicki R. et al 2010).

Pre-diabetic pancreas in type 1 diabetes are include insulinitis (infiltration of the islets with mononuclear cells containing activated macrophages, helper cytotoxic and suppressor T lymphocytes B lymphocytes), initial patchiness of this lesion with, until a very late stage, lobules containing heavily infiltrated islets seen adjacent to unaffected lobules and B-cell specificity of the destructive process.

In the early stage of type 2 diabetes, reduction in the total mass of pancreatic islet tissue is modest. At the time of diagnosis, around 50% of B-cell function has been lost and this declines progressively with time. Deposition of fat in the liver is a common association with central obesity and is exacerbated by insulin resistance and/or deficiency (Nicki R. et al 2010).

Pancreas could be investigated by different modalities e.g.: computed tomography magnetic resonance imaging and ultrasound.

CT and MRI are good informative type of investigation but they are quite expensive. Ultrasound is becoming widely used in investigation of abdominal Organs including pancreas.

1.2 Problem of the study

Pancreatic morphology changes in diabetic patient who use insulin medication

1.3 Objective of the study

1.3.1 General objective

To evaluate the pancreatic change in diabetic patient using ultrasonography.

1.3.2 Specific objective

- To measure the pancreatic size in the diabetics
- To measure and note the head of pancreas, and the body of pancreas, and tail of the pancreas.

- To compare the morphology of pancreas of the diabetics with the standard reference values
- To test the difference in pancreatic size between the normal and the diabetic patient.

1.4 Overview of study

This study consisted of five chapters with chapter one is an introduction which includes (problem and objective of the study). Chapter two is a literature review which includes (anatomy, physiology, pathology, and previous study), chapter three about research methodology. Chapter four deal with result and chapter five include discussion, conclusion and recommendation.

Chapter Two

Literature review

2-1 Anatomy of Pancreas:

The pancreas is an encapsulated retroperitoneal structure that lies in the anterior pararenal space between the duodenal loop and the splenic hilum

The total length from head to tail is 12.5 to 15 cm. The pancreas is draped transversely over the spine and great vessels. The anterior surface of the pancreatic body borders the lesser sac which is a potential peritoneal space. The stomach is anterior to the lesser sac (Deam et al 2005).

The pancreas is a compound racemose gland, analogous in its structure to the salivary glands, though softer and less compactly arranged than those organs. Its secretion (the pancreatic juice), carried by the pancreatic duct to the duodenum, is an important digestive fluid. In addition, the pancreas has an important internal secretion, probably elaborated by the cells of Langerhans, which is taken up by the blood stream and is concerned with sugar metabolism (Henry Gray 1995)

2-1-1 The head

Flattened anteroposteriorly, it lies within the duodenal curve, its upper border overlapped by the superior segment of the duodenum. The other borders being grooved by the adjacent margin of the duodenum from the lower and the left part of the head, the hook-like uncinate process projects upwards and to the left behind the superior mesenteric vessels. In the anterior surface, the head is at first in contact with the transverse colon, separated only by loose connective tissue. The boundary between the head and neck on the right is a groove for the gastroduodenal artery, on the left and behind it is a deep incisure containing the union of the superior mesenteric and splenic veins to form the portal vein. The head is related posteriorly to the inferior vena cava which ascends behind it and covers

almost all of this aspect, it also related with the terminal parts of renal veins and the right crus of the diaphragm .the bile duct is lodged either in a superolateral groove on the posterior surface or in a canal within the glands substance (Williams L.peter et al 1955).

2-1-2 The neck

It is about 2cm long, and is directed at first upward and forward ,and to the left from the head to join the body, it is somewhat flattened from above downward and backward .Its Antero-superior surface supports the pylorus ;it postero-inferior surface is in relation with the commencement of the portal vein ,on the right it is grooved by the gastroduodenal artery.

2-1-3 The body

Is prismatic in shape ,and has three surfaces: anterior posterior and inferior the anterior surface is somewhat concave and is directed forward and upward ,it is covered by the postero-inferior surface of the stomach which rests upon it, the two organs being separated by the omental bursa . where it joins the neck there is well-marked prominence, the tuber omentale, which abuts against the posterior surface of the lesser momentum .

The posterior surface is devoid of peritoneum ,and is in contact with the aorta, the lineal vein ,the left kidney and its vessels, the left suprarenal gland ,the origin of superior mesenteric artery, and the crura of the diaphragm. the inferior surface is narrow on the right but broader on the left ,and is covered by peritoneum; it lies upon the the duodenojejunal flexure and on some coils of the jejunum ;its left extremity rests on the left colic flexure.

The superior border is blunt and flat to the right ;narrow and sharp to the left, near the tail .it commences on the right in the omental tuberosity ,and is in relation with the celiac artery from which the hepatic artery courses to the right just above the gland , while the lineal artery runs toward the left in a groove along this border ,the body measured 2cm(width) (April Ernest,1997)

2-1-4 The Tail

Is narrow usually reaching the inferior part of the gastric surface of the spleen, lying in the spleno-renal (lienorenal) ligament, together with the splenic vessels (Williams L. Peter et al 1995). It measured 2cm (with) (April Ernest, 1997)

2-1-5 Main pancreatic duct

Extends transversely from left to right through the substance of the pancreas. It commences by the junction of the small ducts of the lobules situated in the tail of the pancreas, and running from left to right through the body, it receives the ducts of the various lobules composing the gland. Considerably augmented in size, it reaches the neck and turning downward backward, and to the right toward bile duct, which lies to its right side leaving the head of the gland, the main duct, passes very obliquely through the mucous and muscular coats of the duodenum, and unites in the short dilated hepato-pancreatic ampulla or ampulla of bile duct, the narrow distal end of this opens on summit of the major duodenal papilla, which lies posterior medial of this part in the duodenum and 8-10cm distal to the pylorus. Usually the two ducts do not unite until very near the orifice on the major papilla. Sometimes they open separately. Frequently an accessory pancreatic duct drains the lower part of the head, ascending in front of main duct with which it communicates and opening in a small round minor papilla, about 2cm anterior superior to major. The duodenal end of the accessory duct may fail to expand, secretion is then diverted along the connecting channel into the main duct (Williams L. Peter et al 1995)

In structure the pancreas is composed of a large number of lobules, and the whole gland is surrounded by areolar tissue which forms septa between the lobules.

Each lobule is composed of a number of tubular alveoli lined by columnar epithelial cells, which secrete the pancreatic juice. The alveoli drain into duct which unite to form a single lobular duct, the duct from each lobule drain into the main pancreatic duct. The orifice of the common bile duct and the pancreatic duct is surrounded by sphincter which is called the sphincter of

Oddi. The lobule of the lower part of the head of pancreas drain into an accessory pancreatic duct.

Interspersed, between the alveoli are groups of cells called the islets of the pancreas is developed in two parts ,a dorsal and a ventral .the former arises as a diverticulum ,and growing upward and back ward into the dorsal mesogastrium ,forms part of the head and uncinata process and the whole of the body and tail of the pancreas .the ventral part appears in the form of a diverticulum from the primitive bile –duct and forms the remainder of the head and uncinata process of the pancreas .the duct of the dorsal part (accessory pancreatic duct)therefore opens independently into the duodenum, while that of the ventral part (pancreatic duct)opens with the common bile –duct .about the sixth week the tow parts of the pancreas meet and fuse and communication is established between their duct. After this has occurred the terminal part of the accessory duct , the part between the duodenum and the point of the meeting of the tow ducts ,undergoes little or no enlargement ,while the pancreatic duct increases in size and forms the main duct of the gland .the opening of the accessory duct into the duodenum is sometimes obliterated, and even when it remains patent it is probable that the whole of the pancreatic secretion is conveyed through the pancreatic duct (Henry Gray 2013).

Langerhans .there are three main types of cell in each islet ,A-cells,B-cells and D-cells (April Ernest,1997).

Normal sonographic appearance of the pancreas

The echogenicity of the pancreas is usually compared with that liver parenchymal the same distance from the transducer .the echo texture of the normal pancreas is either similar to or slightly greater than that of the liver, but less echogenic than the renal sinus echo complex or surrounding retroperitoneal fat .

The echogenicity of the pancreas gradually increases with age because of fatty.

Replacement of the gland parenchyma .Eventually ,the pancreas becomes small atrophied ,and hyper echoic.

The main duct is often identified in the body of the pancreas. It is seen as anechoic line or as tubular structure with two parallel echogenic lines separated by an anechoic .it is about 2mm in AP diameter.

The pancreas is localized by identifying the adjacent vassals in the cross section scan view .the portal spleen confluences is seen coursing posterior to the body and tail of the pancreas ,while the uncinata process are wrapped around the proximal superior mesenteric vein (krebsA.et al 1993).

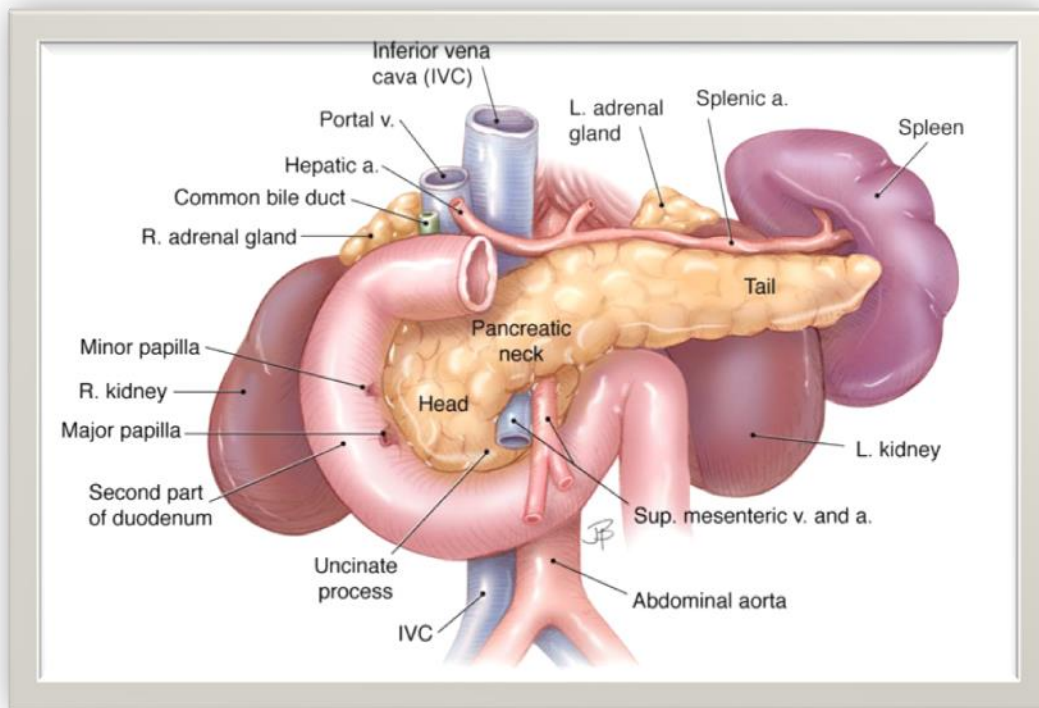


Figure.2.1 Anatomic relationships of the pancreas with surrounding organs and structures [Daniel S, et al, 2014]

2-2 The physiology of the pancreas

Pancreas is both an endocrine and an exocrine gland, in that it functions to produce endocrine hormones released into the circulatory system (such as insulin, and glucagon), to control glucose metabolism ,and also to secrete digestive/exocrine pancreatic juice ,which is secreted eventually via the

pancreatic duct into duodenum ,digestive or exocrine function of pancreas is as significant to the maintenance of health as its endocrine function.

2-2-1 Exocrine pancreas

Two population of cells in the pancreatic parenchyma make up its digestive enzymes , that is are , ductal cells which are mainly responsible for production of bicarbonate (HCO_3^-) , which acts to neutralize the acidity of the stomach chime entering duodenum through the pylorus . ductal cells of the pancreas are stimulated by the hormone secret into produce their bicarbonate-rich secretions , in what is essence a bio-feedback mechanism , highly acidic stomach chime entering the duodenum stimulates duodenal cells called “ S cells “ to produce the hormone secretion and release it to the bloodstream . secretion having entered the blood eventually comes into contact with the pancreatic duct cells , stimulating them to produce their bicarbonate – rich juice . interesting to note that secretion also inhibits production of gastrin by “ G cells “ , and also stimulates acinar cells of the pancreas to produce their pancreatic enzyme .

The other type of cells are acinar cells , are mainly responsible for production of the inactivate pancreatic enzymes (zymogens) that once present in the small bowel ,become activated and perform their major digestive functions by breaking down proteins , fat ,and DNA /RNA . Acinar cells are stimulated by cholecystokin in (CCK) which is hormone/neurotransmitter produce by the duodenal cells called the “ I cells “ CCK stimulates production of the pancreatic zymogens .

Pancreatic juice compose of the secretions of both ducts and acinar cells .the volume of pancreatic juice secreted per day is about 1.2_1.5 liters. Pancreatic juice is isotonic ,with a specific gravity of 1.008_1.030,it has alkaline PH of about 8 it has 1% inorganic materials (electrolytes) and 1_2%organic materials, mostly enzymes (SukarM.Y.et al 2000).

2-2-2 Electrolytes

The electrolytes are produced by centroacinar and duct cells .include the cations Na^+ , K^+ and Ca^{+2} and anion Hco_3^- and Cl the grater bulk of electrolytes is in the form of NaHco_3 .when pancreatic secretion is stimulated ,the concentration of Na^+ and K^+ are near to their level in the blood and remain fairly constant ,but Hco_3^- and Cl^- vary with the rate of flow of secretion . Hco_3^- concentration rises and that of Cl^- drops as the rate of flow increases, such that their some remain constant.

NaHco_3 in pancreatic juice makes a major contribution to the neutralization of acid chyme, along with bile and duodenal secretion ,in order to create a suitable medium for the action of pancreatic enzyme(Sukar M.Y.et al 2000).

2-2-3 Enzymes

The pancreas secretes enzymes that act on all the major types of foodstuff. All pancreatic enzymes are protein include ,trypsin, chymotrypsin, elastase and carboxy _peptidase they are all secreted in an inactive precursor zygomenform, which is converted to the active enzyme in the intestinal lumen(SukarM.Y.et al 2000).

2-3Pathology

2-3-1 Diabetes mellitus

Diabetes mellitus is group of metabolic disorders manifested by abnormally high level of glucose in the blood (Mealy et al 2000).

Over the past two decades ,total cases of diabetes mellitus have risen dramatically in almost every country (Pickup et al 1998).

Several distinct types of DM exist and are caused by a complex interaction of genetics ,environmental factors, and life-style choices. Depending on the etiology of the DM ,factors contributing to hyperglycemia may include glucose production (Harrison T.R et al 2005).

DM is classified on the basis of the pathogenic process that lead to hyperglycemia.type1ADM results from autoimmune beta cell destruction,

which ideas to insulin deficiency. Individual with type 1BDM lack immunologic makers indicative of an autoimmune destructive process of the beta cells.

However, they develop insulin deficiency by unknown mechanisms and are ketosis pron. relatively few patients with type1B idiopathic category(Harrison .T.R et at 2005).

Type2DM is aheterogeneous group of disorders characterized by variable degrees of insulin resistance, impaired insulin secretion ,and increased glucose production. Distinct genetic and metabolic defects in insulin action and/or secretion give rise to the common phenotype of hyperglycemia in type 2DM distinct pathologic process in type 2 DM have important potential therapeutic implication ,as pharmacologic agents that target specific metabolic derangement have become available (Harrison .T.R et.al 2005)

Tow features of the current classification of DM diverge from previous classification .first the terms insulin –dependent diabetes mellitus (IDDM) and noninsulin –dependent diabetes mellitus (NIDDM) are obsolete. Since many individuals with type 2DM eventually require insulin treatment for control of glcemia the use of term NIDDM generated considerable confusion .A second difference is that age is not a criterion in the classification system .Although type 1 DM most commonly develops before the age of 30,an autoimmune beta cell destructive process can develop at any age ,type 2DM more typically develops with increasing age ,but it also occurs in children .Others etiologies for DM include specific genetic defect in insulin secretion or action ,metabolic abnormalities that impair insulin secretion ,mitochondrial abnormalities, and a host of condition that impair glucose tolerance(Harrison .T.R et al 2005).

DM can result from pancreatic exocrine disease when the majority of pancreatic islets (80%)are destroyed .Hormones that antagonize the action of insulin can lead to DM. thus ,DM is often a feature of endocrine pathies ,such as acromegaly and Cushing’s disease glucose intolerance may develop during pregnancy. insulin resistance related to the metabolic changes of late pregnancy increases insulin requirements, most women revert to normal

glucose tolerance post-partum but have a substantial risk(30to60%) of developing DM later in life(Harrison .T.R et al 2005

2-4 Previous study

Basiratnia et al. (2006) discuss ultrasonographic alterations of pancreas in diabetic patients in two groups of 60 diabetic patients and healthy controls , the diameter and echogenicity of pancreas was determined. Pancreas head body diameter was measured by 3.5 MHZ curve transducer. The echogenicity of pancreas was compared to that of liver. One-way Anova test and student's T-test were used to compare the size of head and body of pancreas and pancreas echogenicity indifferent groups. Person correlation was used to evaluate the relationship of these two variables with the duration of disease. A statistically significant difference in mean pancreas head anterior-posterior diameter was observed between case (all diabetic patients and control groups, likewise, comparing mean pancreatic body size of diabetic patients group (type I and II) to that of control group demonstrated a significant difference. Mean pancreatic head and body size were $17.2 \pm 2.8\text{mm}$ and $7.9 \pm 1.6\text{mm}$, respectively, in insulin-dependent diabetic patients, whereas these measurements were $20.9 \pm 3.6\text{mm}$ and $9.4 \pm 2.1\text{mm}$, respectively, in noninsulin dependent diabetic patients, and $24.2 \pm 4\text{mm}$ and $13.5 \pm 2.1\text{mm}$, respectively, in the control group. The concluded that there was a statistically significant difference among the three groups. In type I diabetes, decrease in the size of pancreas was more prevalent than in type II diabetes and these change become more prominent over time. Another study by Alzaid A etal 1993 they studied evaluation of pancreas in diabetic by ultrasound, This study was in USA and the method was tested on 57 diabetic patients: 14 with Type 1 (insulin-dependent) diabetes, 10 insulin-treated and 33 tablet-treated patients with Type 2 (non-insulin-

dependent) diabetes, and 19 non-diabetic subjects. In this study, we measured the head (area medially to SMA) and body (area anterior to SV) of the pancreas. The result of this study: The pancreas of patients with Type 1 diabetes was markedly smaller ($p < 0.0001$) than the pancreas in non-diabetic subjects. The pancreas of patients with Type 2 diabetes was more moderate in size: larger ($p < 0.001$) than that of Type 1 diabetic patients but smaller ($p < 0.5$) than the pancreas of the control group. Pancreatic size of patients with Type 2 diabetes was also related to basal insulin secretion with insulin-deficient patients (low or undetectable C-peptide) having smaller ($p < 0.05$) pancreases than those with normal insulin secretion. There was no difference in the size of the pancreas in the different treatment groups of Type 2 diabetic patients. Pancreatic size did not correlate with age, body mass index or the duration of diabetes. We conclude that the pancreas is a smaller organ in patients with diabetes mellitus and that the decrement in size is maximal in insulin-dependent/insulin-deficient subjects. Ultrasonography, therefore, can potentially serve to discriminate between the different types of diabetes. [Alzaid A et al 1993].

And A. Alzaid et al 1993 studied The Size Of the Pancreas in Diabetes by ultrasound, their study was in Saudi Arabia and tested on diabetic patients: 14 with Type 1 (insulin-dependent) diabetes, 10 insulin-treated and 33 tablet-treated patients with Type 2 (non-insulin-dependent) diabetes, and 19 non-diabetic subjects. The result of their study: the pancreas of patients with Type 1 diabetes was markedly smaller ($p < 0.0001$) than the pancreas in non-diabetic subjects. The result of this study: The pancreas of patients with Type 2 diabetes was more moderate in size: larger ($p < 0.001$) than that of Type 1 diabetic patients but smaller ($p < 0.5$)

than the pancreas of the control. Pancreatic size did not correlate with age, body mass index or the duration of diabetes. We conclude that the pancreas is a smaller organ in patients with diabetes mellitus and that the decrement in size is maximal in insulin-dependent insulin-deficient subjects. Ultrasonography, therefore, can potentially serve to discriminate between the different types of diabetes.[Alzaid A etal 1993]

3- Chapter three

Materials and methods

3-1materials:

3-1-1Area of study and duration:

It was conducted in Khartoum- Sudan, Noreen diabetic center, during the period from APRIL up to OCTOUBER 2015.

3-1-2 population of study:

fifty adult diabetic patients were investigated(Ranges between 20-75), and about thirty healthy controls were also studied with different ages (Ranges between (25-50 years old) were selected consecutively on this study.

3-1-3 machine used:

A real time convex array system (3.75 MHz electronic transducer –Mindary DP-2200).



3-1-4 Data collecting sheet:

Data collecting sheet is use to collect the date from number of patient.

3-2-Methods:

3-2-1 technique used:

Scans were performed with the patients supine or erect. The head (defined as the area medial to the superior mesenteric vein) and the body of the pancreas were measured separately, since these were often visualized to best advantage in different views .As the head is often oriented in the longitudinal plane parallel to the inferior vena cava, measurements were made in this plane below the portal veins well as in the transverse or oblique plane (taking the midpoint of the confluence of the superior mesenteric and splenic veins as the marker point). The tail of the pancreas was well seen as it passed anterior to the left kidney, but the more distal portion extending into the splenic helium (which represents a very small part of the pancreatic mass) was rarely seen. The scans were recorded on photographic paper.

3-2-2 Data collection:

Three regions were selected the head, body and tail of pancreas, type of diabetic, duration, age and gender.

3-2-3 Data analysis:

Microsoft Excel and SPSS program version 16 were used to analyze the data of this study. T- Test and F-test was used to examine the correlation between the variables, the correlation is significant at p value <0.05.

Chapter four

The results

Table (4.1) shows the Mean \pm Std. Deviation for patient related variables.

Descriptive Statistics	
Variable	Mean \pm Std. Deviation
Age of the patient (yrs.)	35.54 \pm 11.843
Duration of Diabetic (yrs.)	7.957 \pm 5.5458
Age of control group (yrs.)	29.40 \pm 8.605

Table (4.2) shows the Mean \pm Std. Deviation for pancreatic measurement using ultrasound

Variables	Mean \pm STD normal control group	Mean \pm STD diabetic patient
Head of pancreas	2.2400 \pm 0.02981	1.7689 \pm 0.46944
Body of pancreas	2.1550 \pm 0.16325	1.7057 \pm 0.45546
Tail of pancreas	2.1690 \pm 0.13218	1.7454 \pm 0.46682

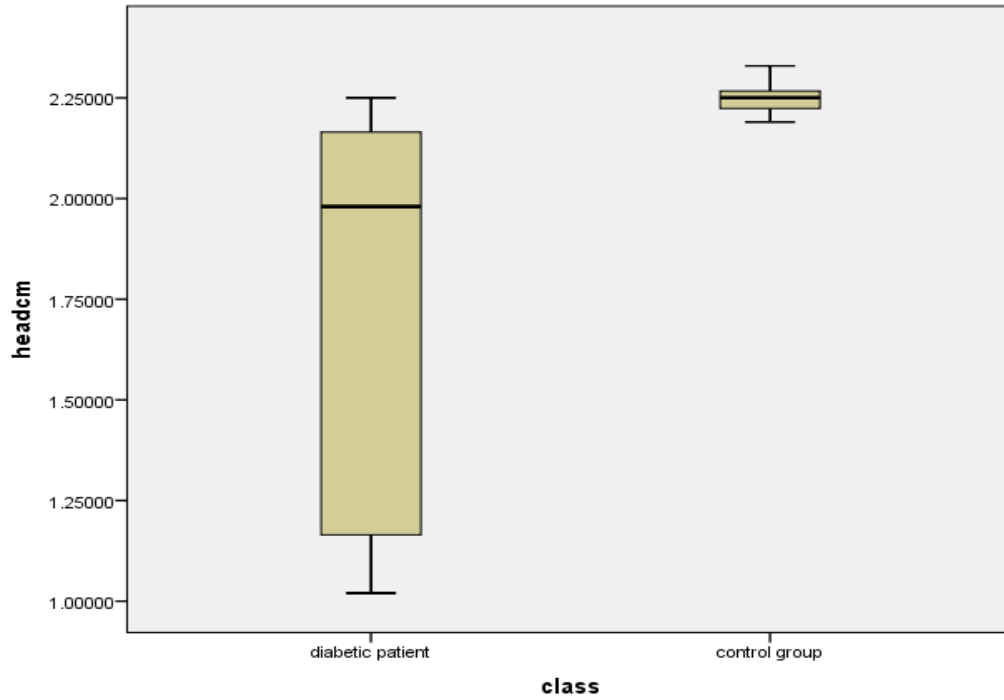


Figure 4.1 boxplot show measure the head of pancreas in control and diabetic group.

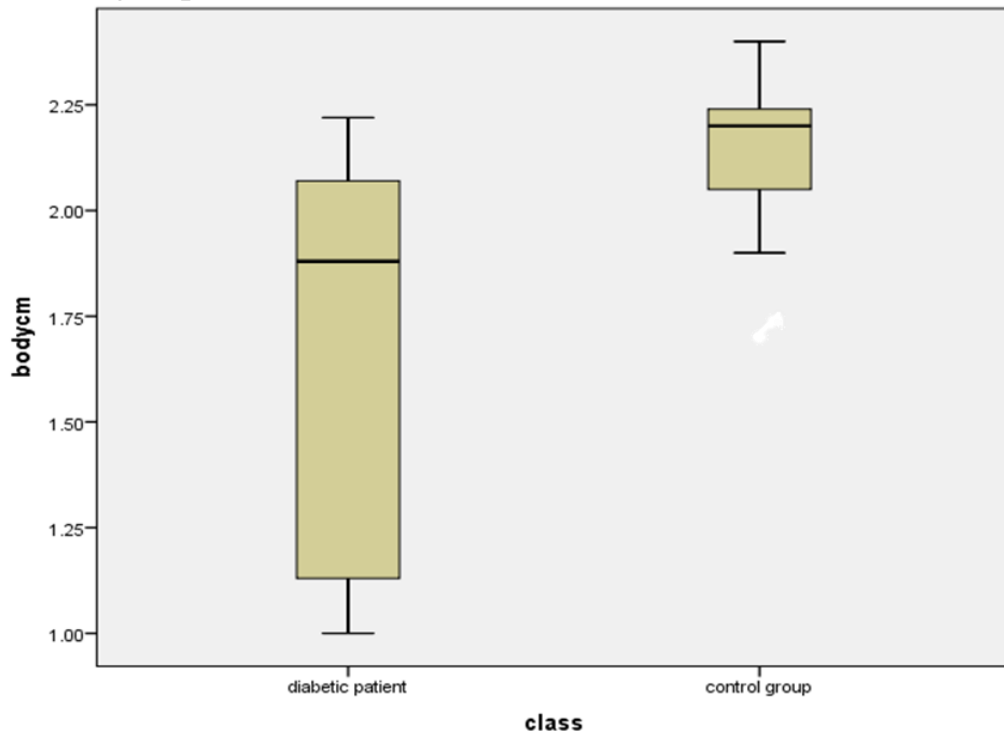


Figure 4.2 boxplot show measure the body of pancreas in control and diabetic groups

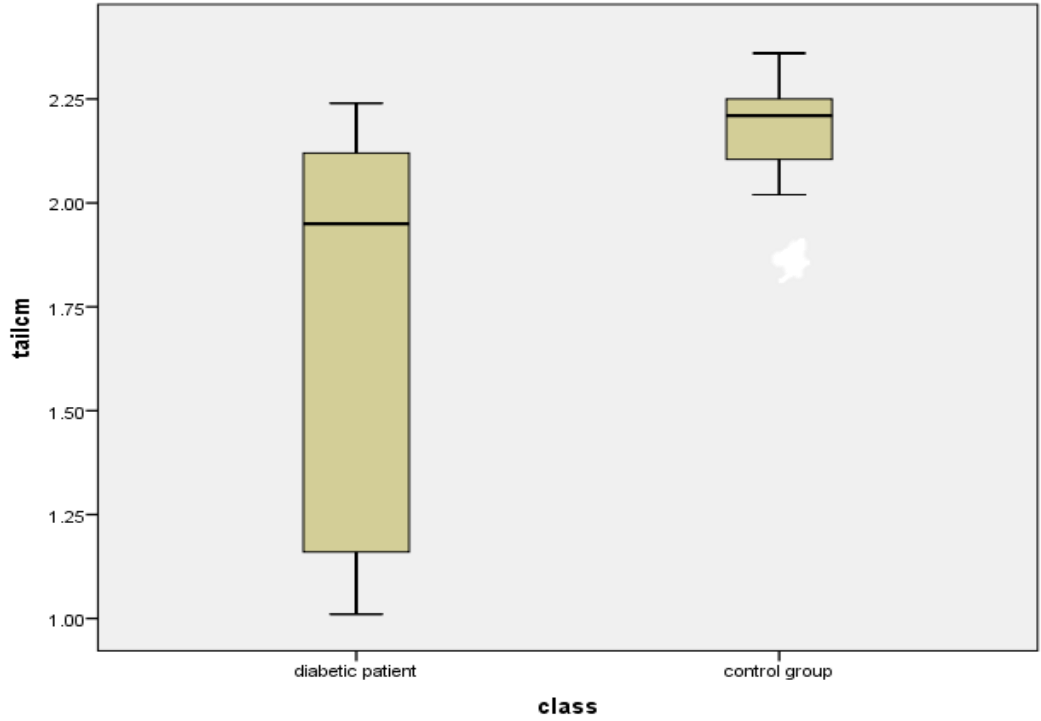


Figure 4.3 box plot show measure the tail of pancreas in control and diabetic groups.

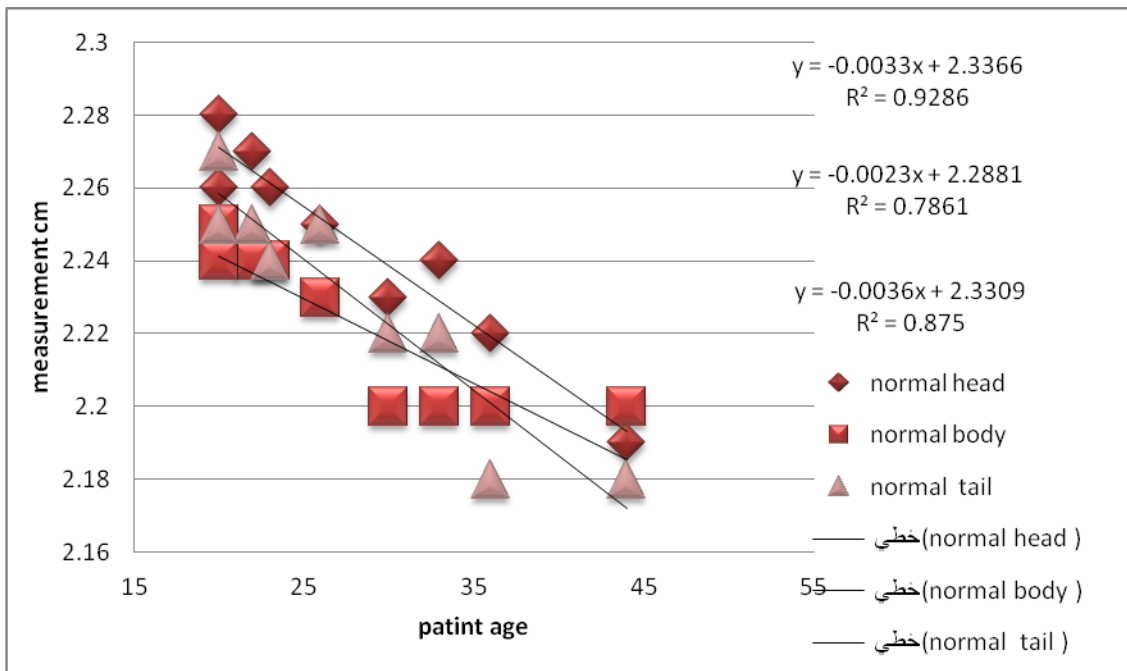


Figure 4.4 Scatter plot showed the linear relation between the measurement of normal control group and the patient age.

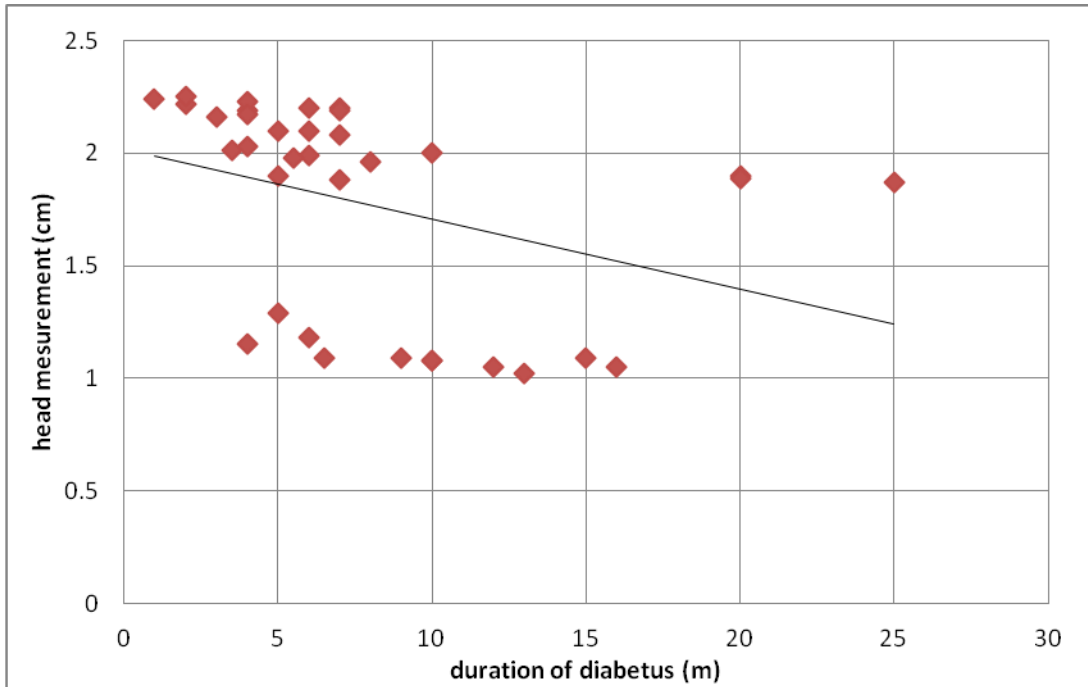


Figure 4.5 Scatter diagram demonstrate the relationship between head measurement (cm) and the duration of diabetes $y=-0.0311x+2.0162$, $R^2 = 0.1349$

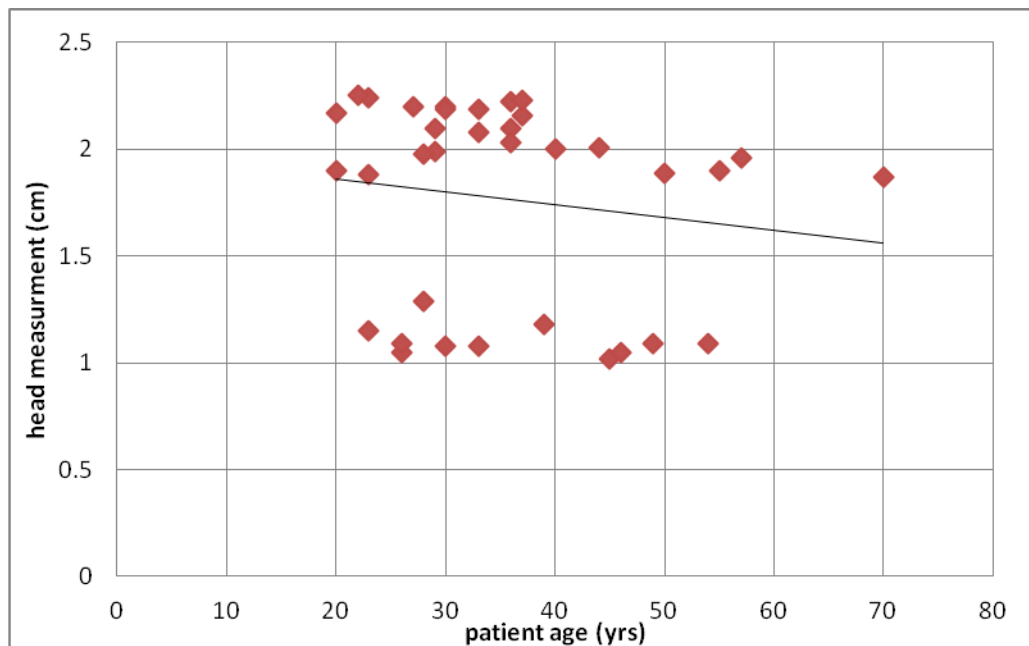


Figure 4.6 scatter diagram Demonstrate the relationship between head measurement (cm) and age of the patient $y=-0.0061x+1.9843$, $R^2 = 0.0234$

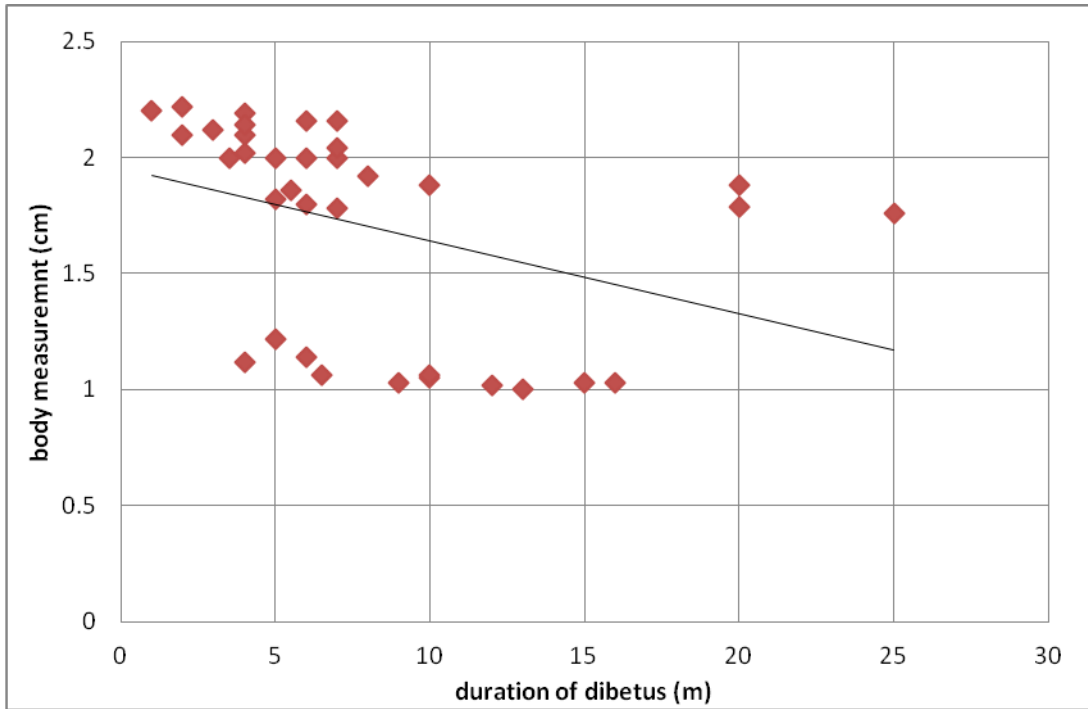


Figure 4.7 scatter diagram demonstrate the relationship between body measurement (cm) and duration of diabetes (month) $y = -0.0313x + 1.9544$, $R^2 = 0.1448$

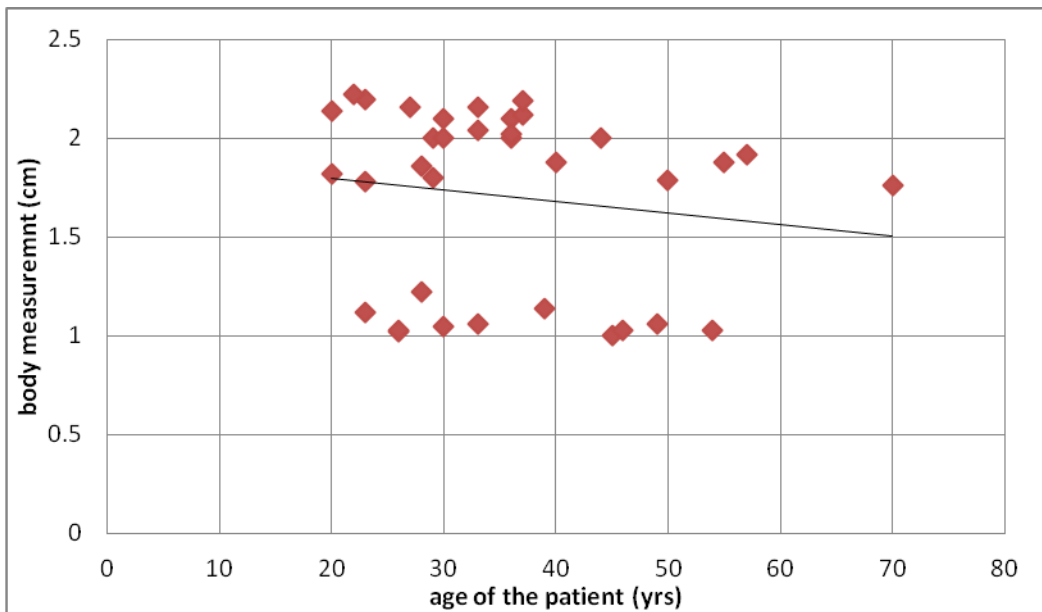


Figure 4.8 Scatter diagram demonstrate the relationship between body measurement (cm) and patient age (yrs.) $y = -0.0058x + 1.9107$, $R^2 = 0.0225$

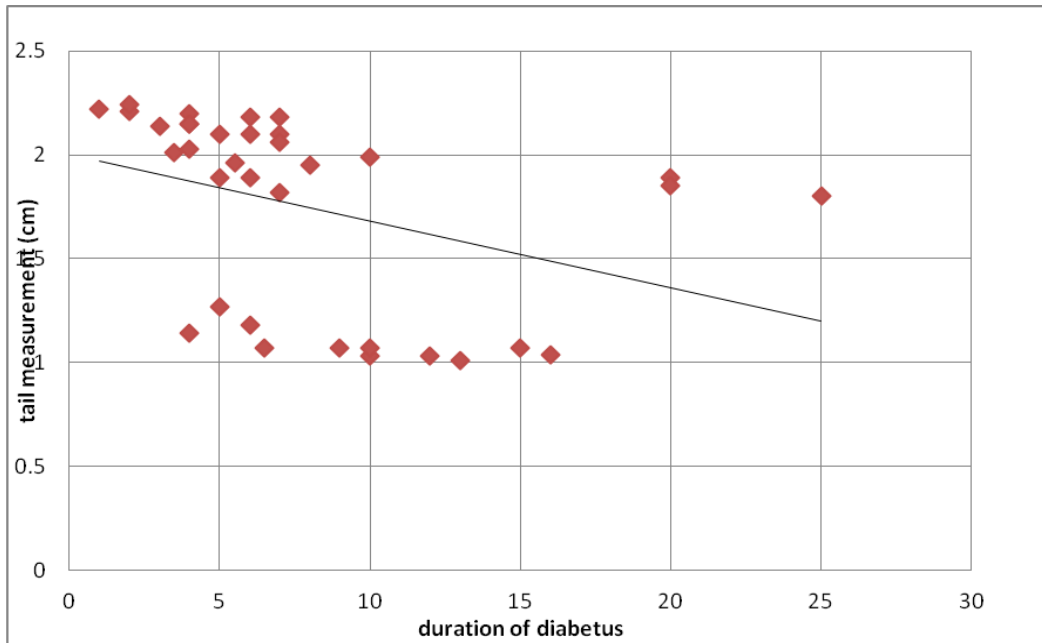


Figure 4.9 Scatter diagram demonstrate the relationship between tail measurement (cm) and duration of diabetes (month) $y = -0.032x + 2.0002$, $R^2 = 0.1447$

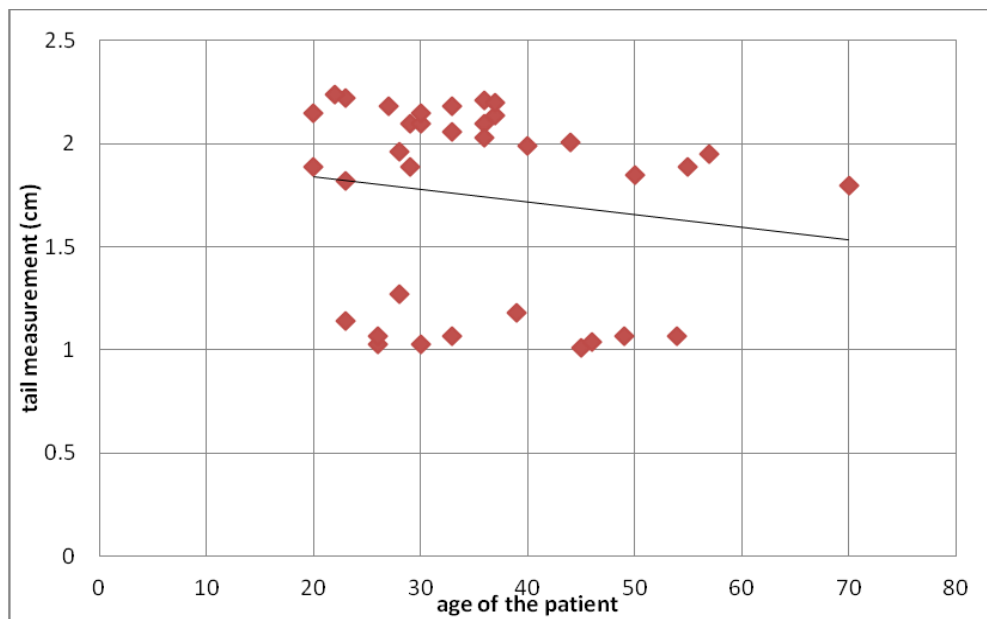


Figure 4.10 Scatter diagram demonstrate the relationship between body measurement (cm) and duration of diabetes (yrs.) $y = -0.0061x + 1.9606$, $R^2 = 0.0236$

Chapter five
Discussion ,Conclusion
And Recommendations

5.1 Discussion

The main objective of this study was to evaluate the change of pancreatic size in diabetic patient using abdominal ultra sound. the data was collected from 50diabetic patient in both male and female. The pancreas was evaluate in an patient in sagittal, and transverse sectional, also same number of the healthy population was examined using the same technique and the head, body and tail was measured using the U/S machine in order to taste the different between these groups the data were collected from Khartoum state ,Noreen center diagnostic radiology department (U/S section)the result of this study showed that there is difference between the mean $S \pm TD$ age of these patient was 35.54 ± 11.843 and 29.408 ± 6.605 years for the patient and the healthy people respectively .

Measurement was performed for head ,body and tail mean $\pm STD$ of these was;

2.24000 ± 0.02981 , 2.19900 ± 0.07325 and 2.22000 ± 0.04422 and 1.76890 ± 0.46944 , 1.70570 ± 0.45546 and 1.74540 ± 0.46682 for normal and diabetic patient respectively significant different noted between the diabetic patient and control group of healthy people and this agree with in Gould et al study witch state that significantly different in diabetic patients and control group in pancreatic size measurement. a linear correlation was done in order to assess these relationship between the pancreatic size and the age of control group that result:

There is a strong invers linear relation between the pancreatic size and the age in the normal subject this described as:

The head decreased by -0.0033 (cm) per year while the body decrease by 0.0023 cm per year and the tail size decrease by 0.0036 cm per year this may be due to normal anatomical variant with age of the people.

XAS Also measurement was correlated with the duration of diabetes in order to investigate the effect of these duration on the size of pancreas, the result showed significant strong inverse relationship between the pancreatic size and the duration of diabetic which the head decreased by 0.0311 cm per year while the body decrease by 0.0311 cm per year ,and the tail decrease by 0.032 cm per and H his study was aimed to evaluate the size of pancreas in diabetes patient a study based on ultrasound.

5.2 Conclusion

The main objective of the study is to determine the change of the size of the pancreas in diabetes patient .the size of the pancreas are varies from a person to other as in normal condition.

50 diabetic patients examined by 3.75MHz electronic transducer-Mindery DP-2200 ultrasound machine and compared their result with normal person.

All subjects were scanned for abdominal ultrasound and measurement were obtained at areas including Head ,body and tail of pancreas and analysis the data by Microsoft Excel and SPSS program

This study was tasted and The data collected from Noreen Diabetic Center (Khartoum, Sudan) from April to October 2015.

This study find there are significant invert relationship between the size of pancreas and the diabetic ,invert relationship between the size of pancreas and diabetic duration , and invert relationship between the size of pancreas and the age of patient compare with healthy control group for careful investigation of this theory study with more data are need.

Real-time sonography can assess the pancreas and its accuracy in diagnosis of pancreatic disease.

5.3 Recommendations

1-Another study with more diabetes patients and correlate that study with non-ketotic patients who has to take insulin because of inadequacy of diabetes control may be use full

2- The pancreatic duct diameter in diabetic patients must be studied

3-The researcher notes that the size of the pancreas is different in normal Sudanese people so suggest study of that theory.

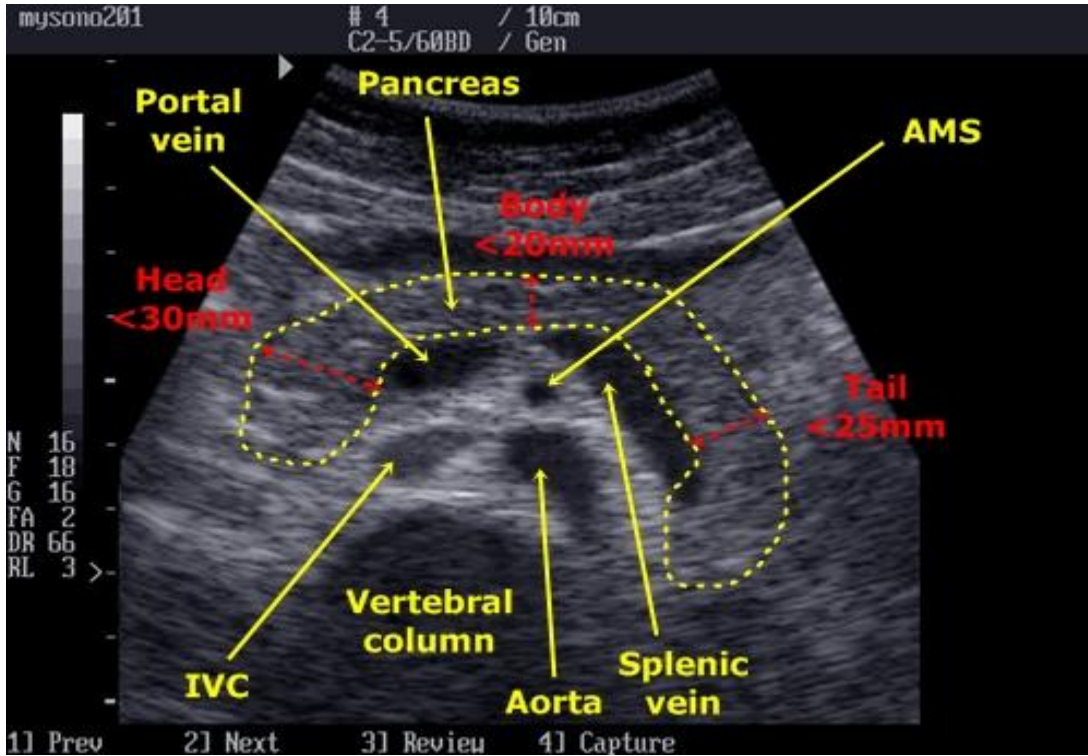
4-The measurements of pancreatic size for diabetic patient must be record and to help the specialist to follow-up the patient treatment plan.

5-According to location of pancreas may be obscure by gases, so that the full preparations of patients give good result.

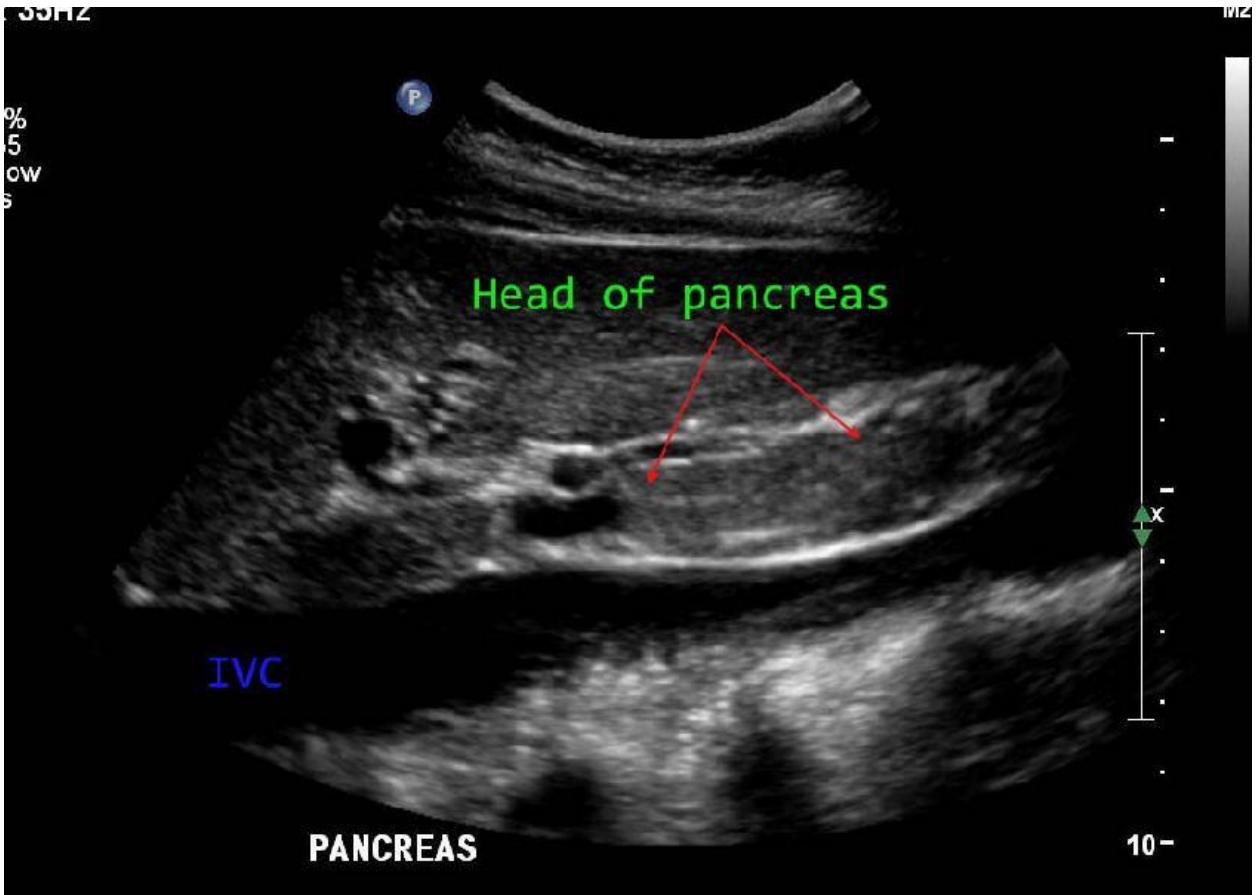
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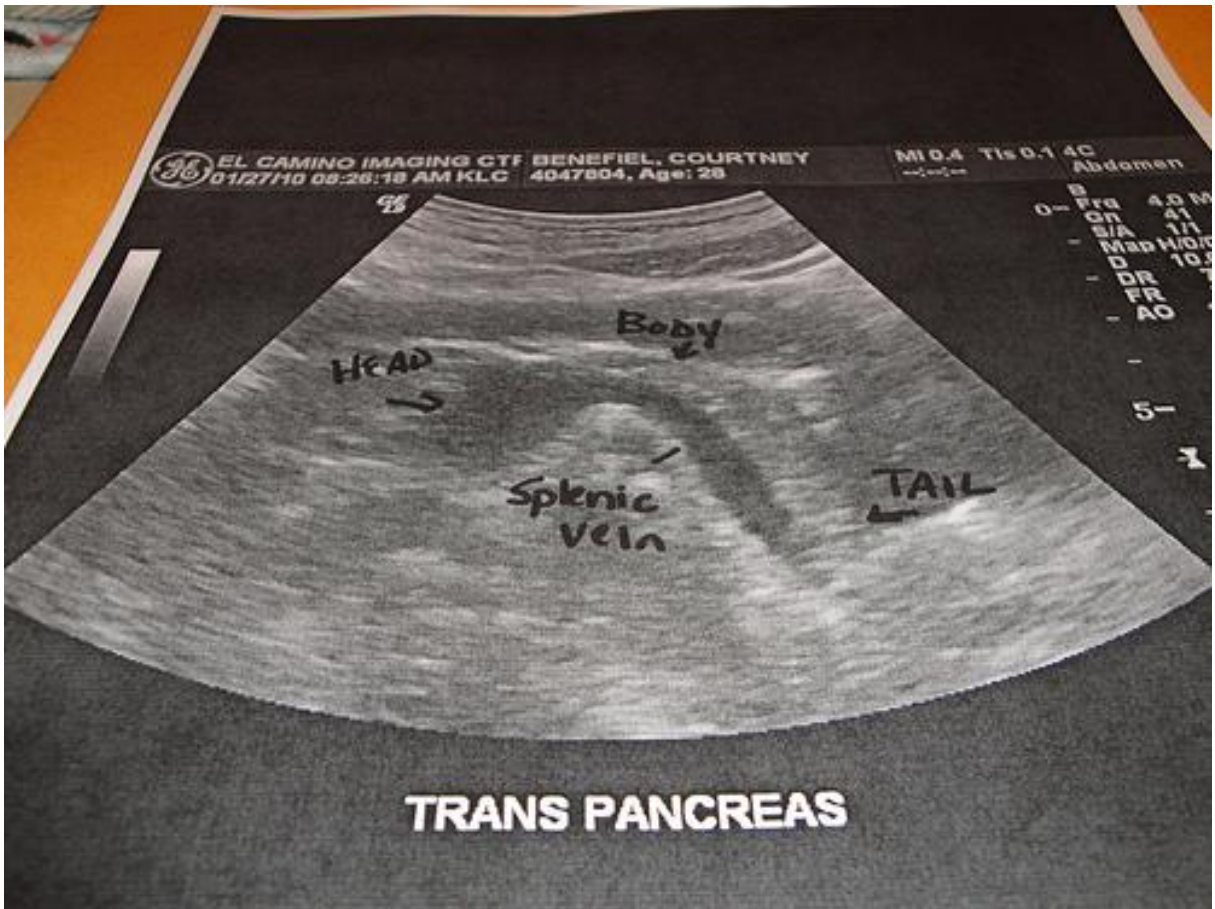
Appendix:



Pancreatic Ultrasound ,transvers section, show normal pancreas components(Head, Body and Tail)



Pancreatic Ultrasound Longitudinal section, show Head of pancreas.



Pancreatic Ultrasound transverse section, patient with diabetic.