Original Article

National Journal of Society of Medical Anatomists

journal homepage: https://njsoma.societyofmedicalanatomists.com/about/

Comparative Study of Pancreatic Head and Body Size between Diabetic and Non Diabetic Individual 35-65 Years by Ultrasonography

Sisodiya H[1], Barjatya R[2], Solanki BS[3], Mathur R[4]

[1]Resident, Department of Anatomy, JLN Medical College, Ajmer, Rajasthan, India
[2]Senior Professor and Head, Department of Anatomy, JLN Medical College, Ajmer, Rajasthan, India
[3]Resident, Department of Community Medicine, JLN Medical College, Ajmer, Rajasthan, India
[4]Senior Professor and Head, Department of Radiology, JLN Medical College, Ajmer, Rajasthan, India

Keywords:
Diabetes Mellitus,
Fatty pancreas,
Echogenicity,
Ultrasound,
Insulin,
Pancreatic head,
Pancreatic body

ABSTRACT

Introduction: T2DM is characterised by variable insulin resistance leading to hyperglycemia due to impaired insulin secretion. Fatty pancreas, influenced by factors like alcohol consumption and obesity, can lead to infiltration of fat around the pancreas and other tissues. Ultrasound, employing graded compression, is an effective tool and cost-effective for scanning the pancreas. From a sonographic perspective, the optimal visualization of the pancreas is typically achieved in a transverse plane. **Methodology:** A comparative cross-sectional study was carried out at Jawahar Lal Nehru Medical College and Hospital, Ajmer, and involved a sample size of 150 individuals. 75 diabetic and 75 non-diabetic individuals, with random sugar levels measured in both groups. The Samsung HS 70A with frequency probe ranging from 2.5 to 5MH equipment was utilised to compare the sonographic characteristics of diabetic and non-diabetic subjects, encompassing the anteroposterior pancreatic head and body measurements. R**esults:** Among diabetics, pancreatic echogenicity was 29.3% isoechoic, 13.3% hypoechoic, and 57.3% hyperechoic. Non-diabetics showed 9.3% isoechoic, 90% hypoechoic, and 0% hyperechoic echogenicity. Pancreatic head size averaged 23.31 ± 3.80 mm in non-diabetics and 21.13 ± 1.68 mm in diabetics, showing a significant difference ($p < 0.05$). The pancreatic body measured 22.05 ± 2.06 mm in non-diabetics and 20.17 ± 1.16 mm in diabetics, also showing a significant difference. The data highlights variations in pancreatic size and echogenicity, sugar levels, and demographic characteristics, providing a foundation for further medical research and analysis. **Conclusion:** A significant difference was found in the mean anteroposterior diameter of the pancreatic head and body between diabetic and non-diabetic individuals. The study found that pancreatic size decreases with age and is smaller in diabetics compared to non-diabetics, with no significant gender association. These findings enhance our understanding of factors affecting pancreatic size and their implications for diabetes management.

Introduction

Diabetes mellitus stands as one of the most prevalent chronic diseases across nearly all regions. Globally, the prevalence of diabetes in the elderly (ages 20–79) was 6.4%, impacting 285 million adults of all ages in 2010. It is projected to rise to 7.7%, affecting 439 million adults by 2030.[1] The recent incidence of type 2 diabetes mellitus is 11.77%, with a higher prevalence among males in urban areas compared to females in rural regions.[2] The pancreas, located behind the stomach in the upper mid-region, plays a crucial role in diabetes as it was associated with faults in insulin secretion and action, resulting in elevated blood glucose levels.[3]

Type 2 diabetes mellitus (T2DM) was characterised by variable insulin resistance leading to hyperglycemia due to impaired insulin secretion.[4] Fatty pancreas, influenced by factors like alcohol consumption and obesity, could lead to infiltration of fat around the pancreas and other tissues. Overweight individuals had a higher likelihood of a fatty pancreas, but studies suggested that weight loss and a healthier diet can reverse this condition.[5] Screening for T2DM involved using an Oral glucose tolerance test and fasting plasma glucose test on asymptomatic individuals at high risk. Diabetes mellitus risk assessment questionnaires typically considered factors such as sex, age, family history, and biometric measurements like body mass index (BMI) and waist-to-hip ratio.[6]

Ultrasound, employing graded compression, was an effective tool for scanning the pancreas, clearly visualising its various parts. Fasting for at least 6 hours enhanced image contrast during transabdominal ultrasound scans.[7] The first-line imaging modality for parenchymal changes in the pancreas was transabdominal ultrasonography, known for its real-time, non-invasive, widely available, and cost-effective nature.[8] Fatty changes in the pancreas, indicative of potential pancreatic cancer development, could be detected through increasing echogenicity on abdominal ultrasound.[9] The pancreas was positioned amidst specific anatomical references that included (i) its posterior side lies the porto-splenic axis, (ii) anteriorly, it is associated with the gastric antrum, (iii) the left lobe of the liver.

From a sonographic perspective, the optimal visualization of the pancreas was typically achieved in a transverse

*Sisodiya H, Resident, Department of Anatomy, JLN Medical College, Ajmer, Rajasthan, India.
Email ID: trace.me.hiru@gmail.com

Received 27 Feb 2024; Received in revised form 30 Jun 2024; Accepted 30 Jun 2024
Available online 1 Sept 2024

Published by Society of Medical Anatomists at https://www.societyofmedicalanatomists.com/

plane. With the patient in a supine position, the transducer is positioned subxiphoidally and slightly oblique, spanning from the patient's left shoulder to the right hip. An alternative approach involved angling slightly caudally, using the left lobe of the liver as an acoustic window. Additionally, imaging the pancreas with the patient in deep inspiration aided in moving the pancreas downward and distending the surrounding venous landmarks (Figure 1).[10] Studies had shown that fatty pancreas was associated with higher insulin resistance. Diabetic individuals exhibited a smaller pancreatic size compared to non-diabetic individuals.[11] Accurate and cost-effective detection of a fatty pancreas can be achieved through ultrasonography.[12]
In sonographic appearance of healthy pancreatic tissue there will be uniformity in echotexture of the gland, and similarity in echotexture to the left lobe of the liver overlying it.

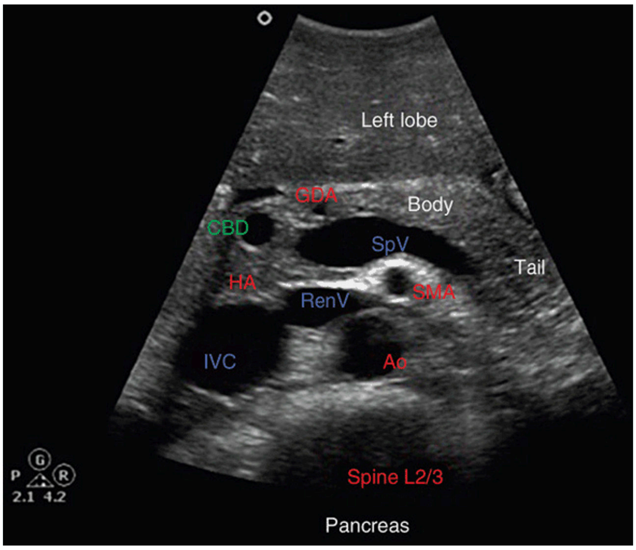


Fig. 1: Transverse transabdominal ultrasound view of the normal pancreas. [CBD = common bile duct; HA = hepatic artery; GDA = gastroduodenal artery; SpV = splenic vein; RenV = renal vein; SMA = superior mesenteric artery; Ao = aorta; IVC = inferior vena cava]

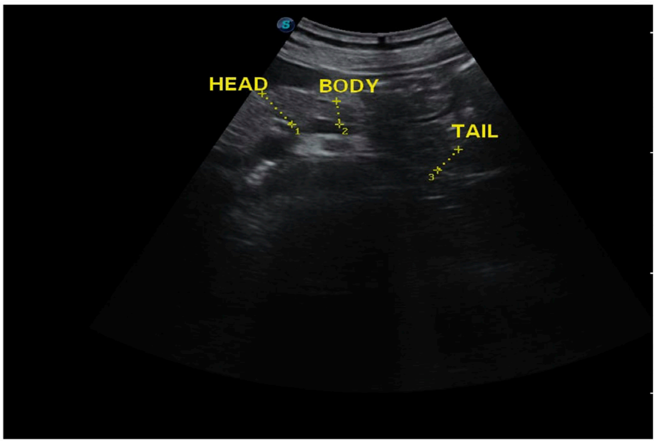


Fig. 2: Ultrasound measurement of head, body and tail of normal pancreas

Material and Methods

A comparative cross-sectional study was carried out at Jawahar Lal Nehru Medical College and Hospital, Ajmer, and involved a sample size of 150 individuals. Non-probability sampling procedures were employed for participant selection, and the inclusion of 150 patients was approved by the Institutional Review Board (IRB) following the acceptance of the synopsis. The sample comprised 75 diabetic and 75 non-diabetic individuals, with random sugar levels measured in both groups. Gel and additional compression were applied during the ultrasound examinations to enhance image resolution.
Inclusion criteria included healthy adult males and females aged 35-65 years and diabetic patient males and females aged 35-65 years. Exclusion criteria were for the subjects below 35 years of age and above 65; clinical history suggestive of pancreatic or liver disease, that is, jaundice, pancreatitis and epigastric pain, presence of systemic or metabolic disease; major anatomic variation of the pancreas; pregnant women; individuals who had a history of intake of drugs for long period; a subject that could not withstand 6–8 hours fasting for whatever reason; history of recent barium meal study; and the patients with fatty pancreas due to causes other than diabetes were excluded by taking detailed clinical as well as personal history of the patient.
The Samsung HS 70A equipment was utilised to compare the sonographic characteristics of diabetic and non-diabetic subjects, encompassing the anteroposterior (AP) pancreatic head and body measurements (Figure 2). The pancreatic appearance and dimensions were evaluated through transabdominal ultrasound, utilising a frequency probe ranging from 2.5 to 5 MHz (Figure 1). Pancreatic head is visualised and demarcated anterior to the vena cava and right renal artery. Section displayed above the aorta, superior vena mesenteric artery and splenic vein is considered as body of pancreas. In instances where excessive bowel gases interfered with the scans, repeat examinations were performed for select patients. Subsequently, the collected data were tabulated and analysed using SPSS version 28.0.

Result

In this study, a total of 150 patients were enrolled, consisting of 75 diabetic and 75 non-diabetic individuals (Figure 3 and 4). The analysis of pancreatic echogenicity in diabetic individuals revealed that 29.3% were isoechoic, 13.3% were hypoechoic, and 57.3% were hyperechoic. Among non-diabetic individuals, 9.3% exhibited isoechoic pancreatic echogenicity, 90% were hypoechoic, and none were hyperechoic. Combining both diabetic and non-diabetic groups, 19.3% had isoechoic pancreatic echogenicity, 52.0% were hypoechoic, and 28.7% were hyperechoic (Table 1).

Among the 150 patients, diabetic males accounted for 46.7%, while diabetic females constituted 53.3% of the 75 diabetic individuals. In the non-diabetic group, 45.3% were males, and 54.7% were females out of the 75 individuals. Overall, the count of diabetic and non-diabetic males was 46%, and females were 54% (Table 2).

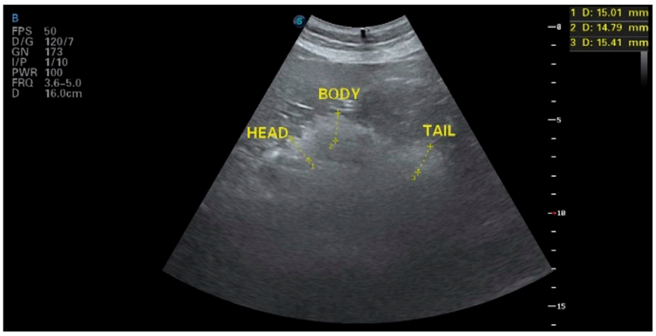


Fig. 3: Ultrasound measurement of head, body and tail of pancreas in the control group

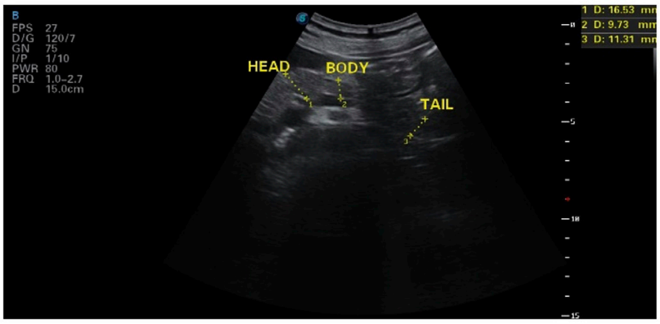


Fig. 4: Ultrasound measurement of head, body and tail of pancreas in the diabetic group

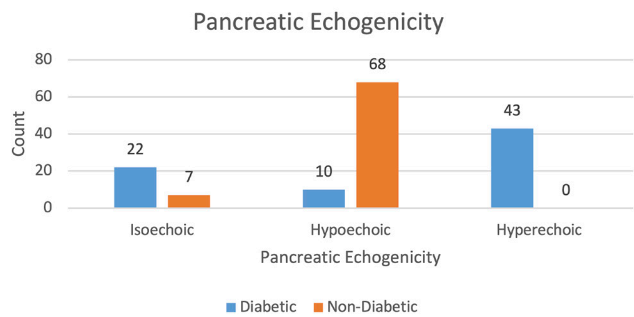
Table 1: Pancreatic echogenicity in both diabetic and non-diabetic individuals with isoechoic count, hypoechoic count and hyperechoic count

Pancreatic Echogenicity		Diabetic (n = 75)	Non diabetic (n = 75)	Total (n = 150)
Isoechoic	Count	22	7	29
	%	29.3%	9.3%	19.3%
hypoechoic	Count	10	68	78
	%	13.3%	90.7%	52.0%
hyperechoic	Count	43	0	43
	%	57.3%	0.0%	28.7%

The pancreatic body exhibited a mean size of 21.11 ± 1.92 mm, with a minimum measurement of 14.20 mm and a maximum measurement of 26.10 mm. The range of sizes within the pancreatic body was 11.90 mm. The distribution of pancreatic echogenicity across both diabetic and non-diabetic individuals showed that 28.7% were hyperechoic, 52% were hypoechoic, and 19.3% were isoechoic among the total 150 patients. The average measurement of the pancreatic body was 21.11 ± 1.92 mm. The smallest observed size of the pancreatic body was 14.20 mm, while the largest recorded size reached 26.10 mm. Consequently, the range of variation in pancreatic body sizes was 11.90 mm (Table 3).

Among the 150 patients, the average sugar level was 160.58 ± 66.44 mg/dl. The lowest recorded sugar level was 65 mg/dl, while the highest reached 310 mg/dl, resulting in a sugar level range of 245 mg/dl. The mean age among the 150 patients was 49.91 ± 3.22 years. The youngest patient was 45 years old, and the oldest was 55 years old, resulting in an age range of 10 years (Table 4).

The pancreatic head size in non-diabetic individuals had a mean of 23.310 ± 3.80. In contrast, the pancreatic head size in diabetic individuals showed a mean of 21.13 ± 1.68, and a statistically significant difference was observed with a p-value of 0.000, which is less than the significance level of 0.05. The pancreatic body measurements for non-diabetic individuals exhibited a mean of 22.05 ± 2.06. In contrast, diabetic individuals demonstrated a significant difference with a mean of 20.168 ± 1.162, as indicated by a p-value of 0.000, less than the significance level of 0.05.



Graph. 1: Pancreatic echogenicity of the diabetic and non-diabetic individuals cross-tabulation

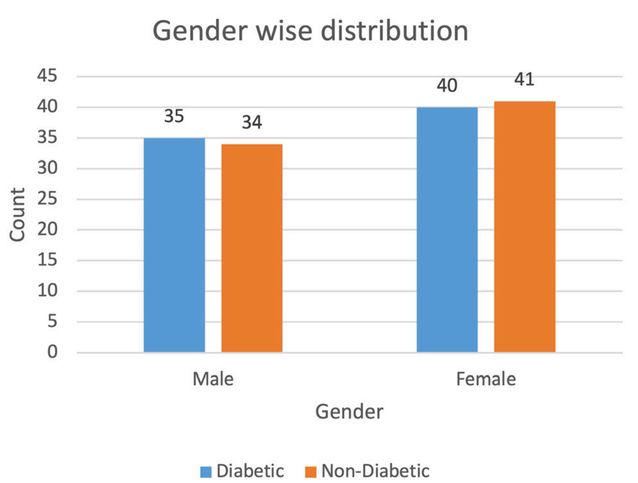
Table 2: Gender-wise distribution

Gender		Diabetic	Nondiabetic	Total
Male	Count	35	34	69
	%	46.7%	45.3%	46.0%
Female	Count	40	41	81
	%	53.3%	54.7%	54.0%
Total	Count	75	75	150

This bar chart compares the echogenicity of the pancreas between diabetic and non-diabetic individuals. The chart categorizes echogenicity into three types: Isoechoic, hypoechoic, and hyperechoic. Among the diabetic group, the majority of individuals have hyperechoic pancreas (43), followed by isoechoic (22) and hypoechoic (10). In the non-diabetic group, the majority have hypoechoic pancreas (68), with fewer individuals having isoechoic pancreas (7), and none with hyperechoic pancreas

This graph depicts that the number of diabetic and non-diabetic individuals is nearly equal among males and females. There is a slightly higher percentage of diabetic and non-diabetic individuals among females compared to males. In the overall population, females represent a larger portion than males, both in diabetic and non-diabetic groups. The slightly higher percentage of diabetic and non-diabetic females suggests that in this particular sample, females are marginally more affected or represented than males. This could be due to a variety of factors, including health-seeking behavior, genetic predispositions, or social determinants of health that might influence the prevalence of diabetes.

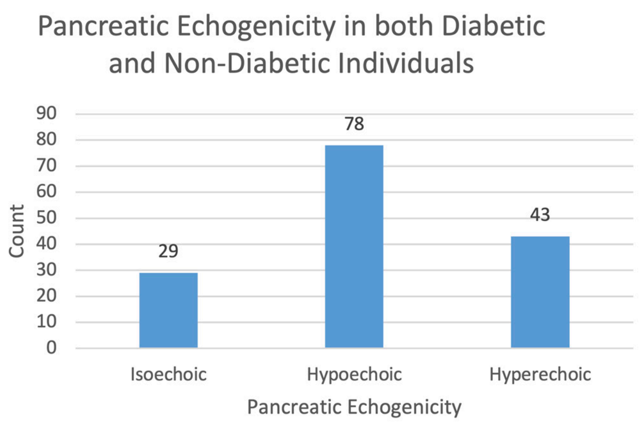
This graph depicts that hyperechoic pancreatic echogenicity was present in 28.7% of the sample, indicating that a significant minority of the population has pancreatic tissue that is brighter than normal on ultrasound. The hypoechoic pancreatic echogenicity was present in 52.0% of the sample, indicating that over half of the population has darker pancreatic tissue



Graph. 2: Gender count of both diabetic and non-diabetic individuals

Table 3: Frequency and percentage of pancreatic echogenicity in all individuals

Pancreatic echogenicity	Frequency	Percent
hyperechoic	43	28.7
hypoechoic	78	52.0
isoechoic	29	19.3
Total	150	100.0



Graph. 3: Pancreatic echogenicity in both diabetic and non-diabetic individuals

on ultrasound, which might suggest an underlying medical condition. The isoechoic pancreatic echogenicity was present in 19.3% of the sample, indicating that a smaller proportion has normal or non-distinguishable pancreatic tissue on ultrasound. This data provides valuable insights into the prevalence of different pancreatic tissue characteristics within the studied group, which can be used for further medical research and diagnosis.

The descriptive statistics provided in Table-4 offer valuable insights into the characteristics of the sample population concerning pancreatic body size, pancreatic head size, sugar levels, and age. The pancreatic body size of the sample population has a moderate range from 14.20 mm to 26.10 mm. The mean pancreatic body size is 21.11 mm, with a standard deviation of 1.92 mm, indicating that most individuals have body sizes close to this average, with relatively low variability. The pancreatic head size varies more widely, ranging from 13.10 mm to 32.70 mm.

The mean pancreatic head size is 22.224 mm, and the standard deviation is 3.13 mm, suggesting a broader distribution and greater variability in head sizes compared to body sizes. The sugar levels in the sample range significantly from 65.00 to 310.00, with a mean of 160.5867. A high standard deviation of 66.44 indicates substantial variability in sugar levels among the individuals, reflecting a diverse range of blood sugar control or diabetic status within the group. The ages of the individuals span from 45 to 55 years, with an average age of 49.9133 years. The standard deviation is 3.23 years, indicating that the age distribution is relatively narrow and most individuals are close to the mean age. Hence, the data reveals a moderate variation in pancreatic body size and a greater variation in pancreatic head size among the sample population. Sugar levels show high variability, suggesting diverse health conditions related to blood sugar control. The age distribution is relatively consistent, with most participants falling within a narrow age range. These findings provide a comprehensive overview of the pancreatic and demographic characteristics of the sample, which can be useful for further medical research and analysis.

Table 4: Descriptive statistics of pancreatic variables

Descriptive statistics						
Parameter	N	Range	Min.	Max.	Mean	SD
Pancreatic body size (mm)	150	11.90	14.20	26.10	21.1100	1.92077
Pancreatic head size (mm)	150	19.60	13.10	32.70	22.2240	3.13098
Sugar level	150	245.00	65.00	310.00	160.5867	66.44271
Age	150	10.00	45.00	55.00	49.9133	3.22727

Discussion

In a recent investigation, it was observed that a hyperechoic fatty pancreas is predominantly identified in individuals with diabetes mellitus, and its size tends to be slightly diminished compared to a normal pancreas. A study conducted in the Chinese population by Wang CY et al. highlighted a robust association between both nonalcoholic fatty liver disease and fatty pancreas with diabetes. Their findings suggested that fatty pancreas serves as a significant independent factor for newly diagnosed diabetes, irrespective of age and gender.[13]

Another study carried out in Jakarta, Indonesia, by Lesmana CR et al. reported that fatty pancreas is a prevalent discovery during medical checkups, with a prevalence of 35%. Fatty pancreas demonstrated a substantial association with metabolic function and appeared to play a crucial role in the risk of malignancy.[14] Similar results were reported in the study by Azza S. Khalaf et al., indicating a significant reduction in pancreatic head size among diabetic individuals.15 Additionally, individuals diagnosed with both type 1 and type 2 diabetes mellitus exhibited a reduction in pancreas size compared to control subjects. Specifically, patients with type 2 diabetes mellitus demonstrated an increase in pancreatic fat content.[14]

The prevalence of a fatty pancreas among these individuals can be attributed to a combination of factors including obesity, insulin resistance, age, diet, lifestyle, and genetic predisposition. The descriptive statistics from the table highlight the significant variability in sugar levels, which is closely linked to insulin resistance and type 2 diabetes—both key contributors to the development of a fatty pancreas. Additionally, the age range of the population suggests that these individuals are at a stage in life where metabolic disorders become more common, further explaining the higher incidence of pancreatic steatosis. Understanding these contributing factors is essential for developing targeted interventions and managing the associated health risks.

The deduction drawn was that an echogenic pancreas observed on ultrasound signifies the presence of a fatty pancreas. Increased echogenicity in the pancreas is linked to diabetes mellitus (DM). Furthermore, a statistically significant difference in the mean anterior-posterior diameter was identified in the pancreatic head and body between individuals with diabetes and those without diabetes. Understanding that females represent a slightly higher proportion in both diabetic and non-diabetic categories can help tailor public health interventions and research efforts. Programs aimed at diabetes prevention and management might need to address gender-specific factors and ensure that both males and females receive adequate attention and resources.

In conclusion, our study sheds light on several significant findings regarding pancreatic size among individuals aged 35–65 years. We observed that pancreatic size tends to decrease with age and is not significantly associated with gender. Notably, diabetic individuals exhibit smaller pancreases compared to normal controls. These findings contribute to our understanding of factors influencing pancreatic size and may have implications for the management of diabetes and related conditions.

Further research is warranted to explore the underlying mechanisms and clinical implications of these associations. This study brings significant advancements by focusing on a specific and crucial demographic, employing a practical and widely applicable imaging technique, and providing detailed quantitative and qualitative analyses. These novel aspects not only enhance the understanding of the relationship between diabetes and pancreatic morphology but also pave the way for improved diagnostic and therapeutic strategies tailored to specific populations. The limitations of the present study included gaseous distention of the stomach, duodenum and colon provides difficulty in visualization of the pancreas. This was overcome by asking the subjects to take water to eliminate air in the stomach and duodenum. It also includes limitations as in obese participants the pancreas is difficult to visualize and the tail of pancreas is intraperitoneal which is difficult to visualise and measure by ultrasound.

References

1. Dimcevski G, Erchinger FG, Havre R, Gilja OH. Ultrasonography in diagnosing chronic pancreatitis: new aspects. World J Gastroenterol. 2013;19(42):7247-57.
2. Jeon JH, Kim JH, Joo I, Lee S, Choi SY, Han JK. Transabdominal ultrasound detection of pancreatic cysts incidentally detected at CT, MRI, or endoscopic ultrasound. AJR Am J Roentgenol. 2018;210(3):518-525. Mamatha T, Pai SR, Murlimanju BV, Kalthur SG, Pai MM, Kumar B. Morphology of glenoid cavity. Online J Health Allied Scs. 2011;10(3):7.
3. Atkinson MA, Campbell-Thompson M, Kusmartseva I, Kaestner KH. Organisation of the human pancreas in health and in diabetes. Diabetologia. 2020;63(10):1966-1973. .
4. Mayberry LS, Osborn CY. Family support, medication adherence, and glycemic control among adults with type 2 diabetes. Diabetes Care. 2012;35(6):1239-45.Prescher A, Klumpen T. The glenoid notch and its relation to the shape of the glenoid cavity of the scapula. J Anat. 1997;190:457-60.
5. Coccia P, Ruggiero A, Attina G, Maurizi P, Lazzareschi I, Molinari F, Riccardi R. Shwachman Diamond Syndrome: an emergency challenge. Signa Vitae. 2007;2(2):10-3.Gandhi Kusum Rajendra, Siddiqui Abu Ubbaida, Verma Virendra Kumar.The Glenoid Cavity: its morphology and clinical significance. Int J Biol Med Res.2016;7(2):5552-5.
6. Rickets S, Malfertheiner P. Echo-enhanced sonography--an increasingly used procedure for the differentiation of pancreatic tumors. Dig Dis. 2004;22(1):32-8.Mahto AK, Omar S. Dimensions of Glenoid Fossa of Scapula: Implications in the Biomechanics of an Implant Design. International J Scientific Study. 2015;3(4):146-8.

Table 5: Comparison of pancreatic size among different studies

Study (Sample size)	Diabetic participants		Controls	
	Mean pancreatic head size	Mean pancreatic body size	Mean pancreatic head size	Mean pancreatic body size
Saraswathi Selvaraju et al. (n = 66) > 18 years	2.86 ± 0.39 cm	1.73 ± 0.26 cm	3.03 ± 0.33 cm	1.82 ± 0.23 cm
Chavva Siva Prasad et al. (n = 90) > 20 years	1.75 ± 0.25 cm	0.74 ± 0.16 cm	2.62 ± 0.4 cm	1.41 ± 0.26 cm
M E Silva et al. (n = 136) > 25–60 years	1.9 ± 0.3 cm	0.9 ± 0.2 cm	2.4 ± 0.4 cm	1.1 ± 0.3 cm
Azza s. Khalaf et al. (n = 120) 40–65 years	2.00 ± 0.19 cm	1.05 ± 0.13 cm	2.29 ± 0.1 cm	1.39 ± 0.18 cm
Safa Abdulrahman et al., (n = 122)	1.78 ± 0.29 cm	1.09 ± 0.20 cm	1.80 ± 0.16 cm	1.13 ± 0.23 cm
Migdalis et al. (n = 164) 45–55years	4.60 ± 1.10 cm	5.92 ± 1.53 cm	6.09 ± 1.62 cm	7.43 ± 2.14 cm
Reza Basiratnia et al., (n=120)	1.72 ± 0.28 cm	0.79 ± 0.16 cm	2.42 ± 0.4 cm	1.35 ± 0.21 cm
Shazaly N. Khojaly et al. (n=70) > 20 years	1.76 cm	1.7 cm	2.24 cm	2.15 cm
Iqra Ilyas (n=102) 35–50 years	1.19 ± 0.17 cm	1.02 ± 0.14 cm	1.02 ± 0.23 cm	2.28 ± 0.9 cm
JO Agabi et al. (n=300) 10–60 years	1.91 ± 0.26 cm	0.95 ± 0.12 cm	2.32 ± 0.22 cm	1.43 ± 0.19 cm
Present study (n=150) 35–65years	2.11 ± 0.68 cm	2.02 ± 0.12 cm	2.33 ± 0.38 cm	2.21 ± 0.21cm

7. Gonçalves B, Soares JB, Bastos P. Endoscopic ultrasound in the diagnosis and staging of pancreatic cancer. GE Port J Gastroenterol. 2015;22(4):161-71.Wael Amin NE, Mona HMA. A Morphometric Study of the Patterns and Variations of the Acromion and Glenoid Cavity of the Scapulae in Egyptian Population. Journal of Clinical and Diagnostic Research. 2015;9(8):AC08-11.
8. CRA, Gani RA, Lesmana LA. Non-alcoholic fatty pancreas disease as a risk factor for pancreatic cancer based on endoscopic ultrasound examination among pancreatic cancer patients: a single-center experience. JGH Open. 2017;2(1):4-7.Dhindsa GS, Singh Z. A Study of Morphology of the Glenoid Cavity. J Evol Med Dental Sci 2014;3(25):7036-43.
9. Abid A, Ahmad S, Waheed A. Screening for type II diabetes mellitus in the United States: the present and the future. Clin Med Insights Endocrinol Diabetes. 2016;9:19-22.
10. Dimcevski G, Erchinger FG, Havre R, Gilja OH. Ultrasonography in diagnosing chronic pancreatitis: new aspects. World J Gastroenterol. 2013;19(42):7247-57.
11. Ou HY, Wang CY, Yang YC, Chen MF, Chang CJ. The association between nonalcoholic fatty pancreas disease and diabetes. PLoS One. 2013;8(5).
12. Meo SA, Zia I, Bukhari IA, Arain SA. Type 2 diabetes mellitus in Pakistan: Current prevalence and future forecast. J Pak Med Assoc. 2016;66(12):1637-42.
13. Garcia TS, Rech TH, Leitão CB. Pancreatic size and fat content in diabetes: A systematic review and meta-analysis of imaging studies. PLoS One. 2017;12(7).
14. Lesmana CR, Pakasi LS, Inggriani S, Aidawati ML, Lesmana LA. Prevalence of non-alcoholic fatty pancreas disease (NAFPD) and its risk factors among adult medical check-up patients in a private hospital: a large cross-sectional study. BMC Gastroenterol. 2015;15:174.
15. Khalaf AS, Mohammed H, Ezzat SE, Abdallah AS. Ultra sonographic evaluation of the pancreatic size in type II Egyptian diabetic patients. Med J Cairo Univ. 2019;87(2):1717-21.

Acknowledgement: None

Conflict of Interest: None

Financial Support: Nil

How to cite this article:

Sisodiya H, Barjatya R, Solanki BS, Mathur R. Comparative Study of Pancreatic Head and Body Size between Diabetic and Non Diabetic Individual 35-65 Years by Ultrasonography. Natl J Soc Med Anatomists 2024;1(2):60-65.