Ultrasonographic Evaluation of Gallbladder in Type II Diabetes Mellitus Patients as well as Determining if there is any Correlation with Duration of DM and Associated Gall Bladder Stone

[1]Dr. Arunachalam Ashwin, [2]Dr. Gautam M

[1] Junior Resident-3, [2]Professor and HOD
[1, 2]Department of Radiology, Rajarajeswari Medical College and Hospital, Kambipura, Karnataka, India
Corresponding Author: Dr. Arunachalam Ashwin

Introduction

One of the most prevalent non-communicable illnesses in the world is diabetes mellitus (DM). After eating fatty meals, diabetics with autonomic neuropathy typically have enlarged gallbladders (GBs) that contract poorly, making them more susceptible to gallstones and cholecystitis. The most prevalent endocrine condition is type 2 diabetes mellitus (T2DM), which is marked by a dysregulated metabolism and long-term consequences that affect the kidneys, eyes, nerves, and gastrointestinal tract, increasing the risk of morbidity and death. Approximately 90% of all cases worldwide are T2DM instances, with a higher incidence rate in males than in women. Globally, the prevalence of diabetes mellitus was 2.8% in 2000, and by 2030, it is predicted to increase to 4.4%. By 2035, there will be 592 million people worldwide with diabetes mellitus, up from 382 million at the end of 2013. The frequency of gallbladder disorders in people with type 2 diabetes has been the subject of a few investigations. Cholecystomegaly and poor gall bladder contraction have been linked to this.Age, female sex, genetic and family history, obesity, fast weight reduction, and physical inactivity are risk factors. Ultrasonography is a straightforward process with excellent diagnostic accuracy for gall bladder disorders. Due to its affordability, safety, and accuracy, ultrasonography is a useful imaging technique that is used to evaluate the gall bladder volume in both T2DM patients and controls.

One organ that may be impacted by autonomic neuropathy is the gall bladder since vagal parasympathetic fibers regulate its emptying and tone. Type 2 diabetes has been linked to alterations in the gall bladder, including an increased risk of cholesterol gallstones, insufficient emptying, and an increase in volume. The aim of this research was to identify any sonographic anomalies in the gall bladder of Indian patients with type 2 diabetes and to investigate any associations between these alterations and the length of the condition.

From cholecystography to more advanced modalities like dynamic ultrasound, dynamic cholescintigraphy, computed tomography scan, magnetic resonance cholangio-pancreatography, and endoscopic retrograde cholangio-pancreatography, radiological investigation of the gall bladder and biliary tree has progressed. Unfortunately, because of the ionising radiation, contrast media, expense, and length of time required to complete the investigation, most of these modalities are now less common. The purpose of this study was to compare and measure the gall bladder contractility index (GBCI) in adult diabetics while fasting and postprandial.

Objective

Evaluating gallbladder volume and contractility index in this patients, as well as determining if there is any correlation with duration of DM and associated gall bladder stone in patients admitted in Rajarajeswari Medical College and Hospital, Kambipura, Karnataka, India.

1. To evaluate gallbladder changes in patients with type II diabetes mellitus.
2. To determine the gallbladder volume (fasting & postprandial), and contractility index (ejection fraction) in patients with type II DM.
3. To determine the association between gall bladder volume, contractility index and duration of type II DM.
4. To evaluate associated gallstone prevalence in these patient.

Methodology

The study was conducted in type II diabetic mellitus patients admitted to RRMCH. Cases are selected based on inclusion and exclusion criteria admitted in RRMCH BENGALURU.

Inclusion criteria

- All Type II diabetic patients who come to the radiology department for ultrasound examination of abdomen.

Exclusion criteria:

- Congenital gallbladderanomalies, gallbladderinjuries, gallbladder disease.
- Post cholecystectomy cases.
- Non Indian patients are excluded.
- T2DM patients using antihypertensive drugs, cardiovascular diseases, pregnant ladies and malignant conditions

Ethical Statement

Study synopsis was submitted and approved by the ethical committee of Rajarajeshwari medical college, Bangalore Karnataka before the start of study.

Methods

Cross-sectional, hospital-based study was conducted at RajaRajeswari Medical College and Hospital for a period of 2 years from June 2022 to June 2024.

Manoeuvre

This study was carried out in Department of Radio Diagnosis, RajaRajeshwari Medical College and Hospital

Information for those that have clinical evidence of neuropathy, biomedical data as well as time of diagnosis was obtained from patient's case note. Autonomic neuropathy was tested for by taking patient's pulse rate at rest and a repeat pulse taken when patient has taken deep inspiration and increase his/her intra-abdominal pressure (valsalva maneuver). Patient then breaths normally and after a period of about 5-10 min the pulse rate is taken once again. The pulse rate is expected to normalize after this period to its resting state, impairment of the pulse rate implies autonomic neuropathy. A postural fall in the systolic blood pressure of 30mm Hg when patient changes from supine to recumbent position also indicates autonomic neuropathy. Peripheral neuropathy was diagnosed by impairment in fine touch, pin prick, vibration and position sense and deep tendon reflexes.

In the radiology department real time gray scale ultrasonography was performed using a Samsung RS80 system with a multi-frequency 3.5 to 5 MHz probe. Scanning was performed after an overnight fast and repeated 45 minutes after ingestion of fatty meal(bread and butter about 40-50g). The skin of the right upper quadrant was covered with ultrasound gel and the probe applied to it. The appropriate depth of focus, frame rate and gain setting were adjusted to obtain an optimal image. Patient was first scanned in the supine position, longitudinally with the probe beveled cephalad. This demonstrates the maximal gallbladder longitudinal outline as well as the anteroposterior dimension (height)

In the left lateral decubitus position (oblique) the maximum demonstrated transverse dimension (width) was obtained and measured by turning the probe transversely at 90 ° to the longitudinal plane. Each

measurement was taken thrice and the average obtained. Measurement was taken by a single person to reduce intra observer error.

Results

Table 1 Age distribution of the patients and their percentages

AGE DISTRIBUTION	NO. OF PATIENTS	PERCENTAGE (%)
<30 YEARS	1	1
31-40 YEARS	7	7
41-50 YEARS	24	24
51-60 YEARS	34	34
61-70 YEARS	27	27
71-80 YEARS	7	7
MEAN AGE	55.59±10.79 Years	

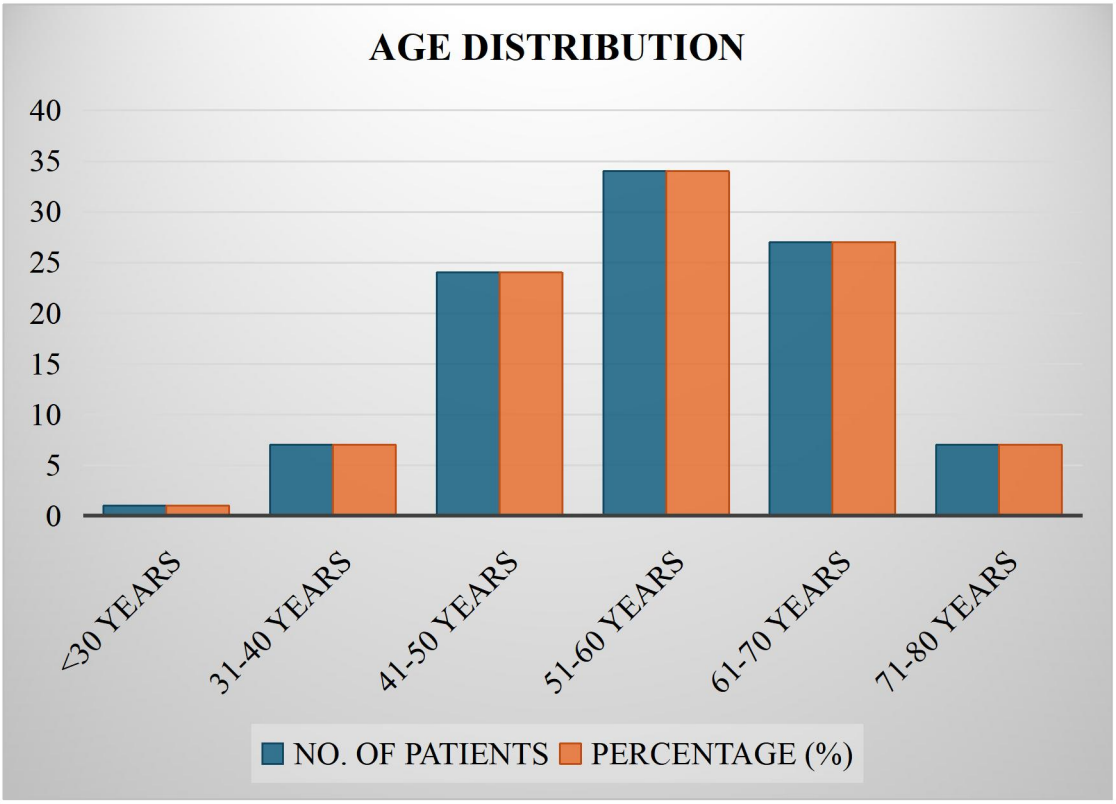


Figure 1 Comparison of the age distribution of the patients and their percentages

Age distribution of the patients and their percentages were calculated and tabulated in Table 1. The higher no. of patients was observed in the age group of 51-60 years followed by 61-70 years shown in Figure 1. The mean age of the patients is 55.59±10.79 years.

Table 2 Gender distribution of the patients and their percentages

GENDER DISTRIBUTION	NO. OF PATIENTS	PERCENTAGE (%)
MALE	66	66
FEMALE	34	34
TOTAL	100	100

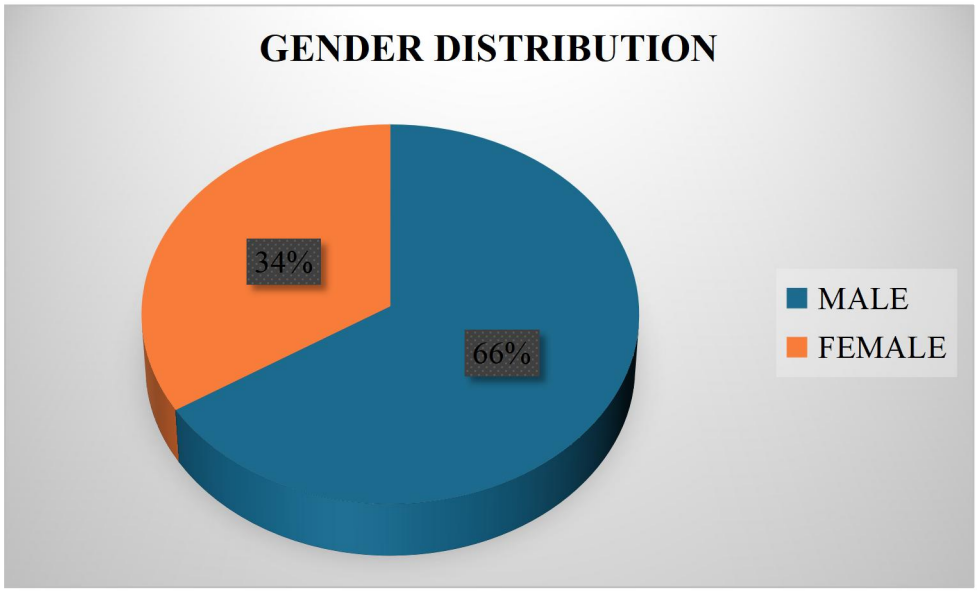


Figure 2 Comparison of the gender distribution of the patients and their percentages

Gender distribution of the patients and their percentages were determined and given in Table 2. In this study, the higher no. of male patients were observed and shown in and it's graphically represented in Figure 2.

The duration of diabetes of the patients and their percentages were calculated and given in Table 3. The higher no. of patients were observed in the duration was observed 5-10 years (53%) shown in Figure 3. Similarly, lower no. of patients was observed in the duration of 10-15 years; the mean duration is 9.02±5.06 years were observed.

Table 3 Duration of diabetes of the patients and their percentages

DURATION OF DIABETES	NO. OF PATIENTS	PERCENTAGE (%)
<5 YEARS	19	19
5-10 YEARS	53	53
10-15 YEARS	9	9
15-20 YEARS	19	19
MEAN DURATION	9.02±5.06	

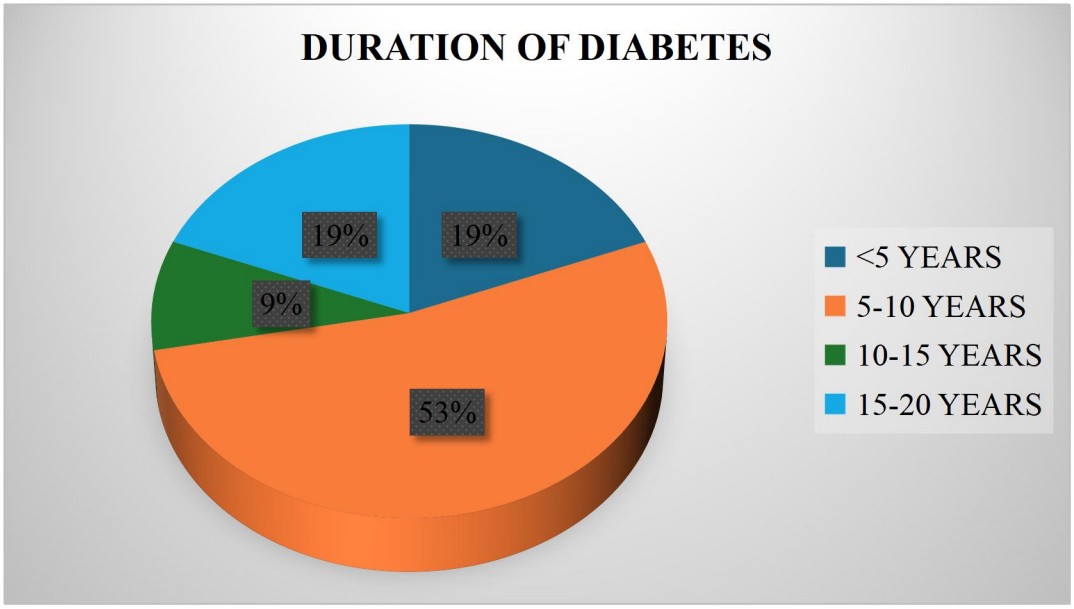


Figure 3 Comparison of the duration of diabetes of the patients and their percentages

Clinical parameters of the mean values and their standard deviation were calculated and given in Table 4 and it's graphically represented in Figure 4.

Table 4 Clinical parameters of mean values and their standard deviation

CLINICAL PARAMETERS	MEAN	SD
BMI (kg/m2)	25.49	3.23
SYSTOLIC BP (mmhg)	129.67	14.09
DIASTOLIC BP (mmhg)	82.87	8.35

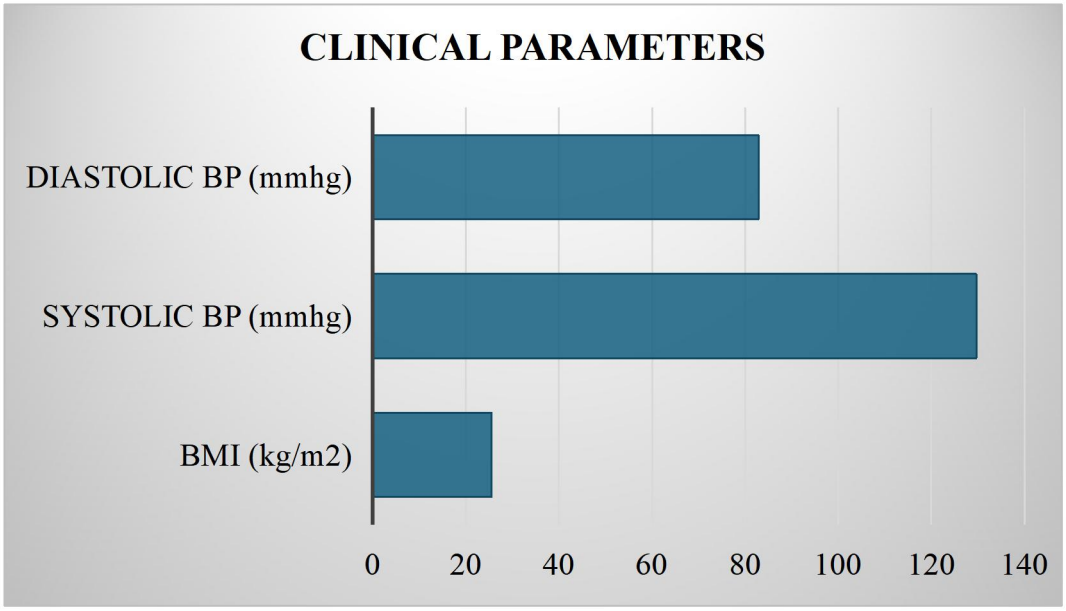


Figure 4 Graphical representations of the clinical parameters of mean values and their standard deviation

The biochemistry parameters were investigated and determined the mean value and it's given in Table 5 and it's clearly represented in Figure 5.

Table 5 Lab parameters of mean values and their standard deviation

LAB PARAMETERS	MEAN	SD
FBS (mg/dl)	154.04	26.28
PPBS (mg/dl)	197.59	19.94
Total cholesterol (mg/dl)	200.04	15.28
Triglycerides (mg/dl)	168.84	13.56
HDLC (mg/dl)	44.16	2.51
LDLC (mg/dl)	140.45	8.98

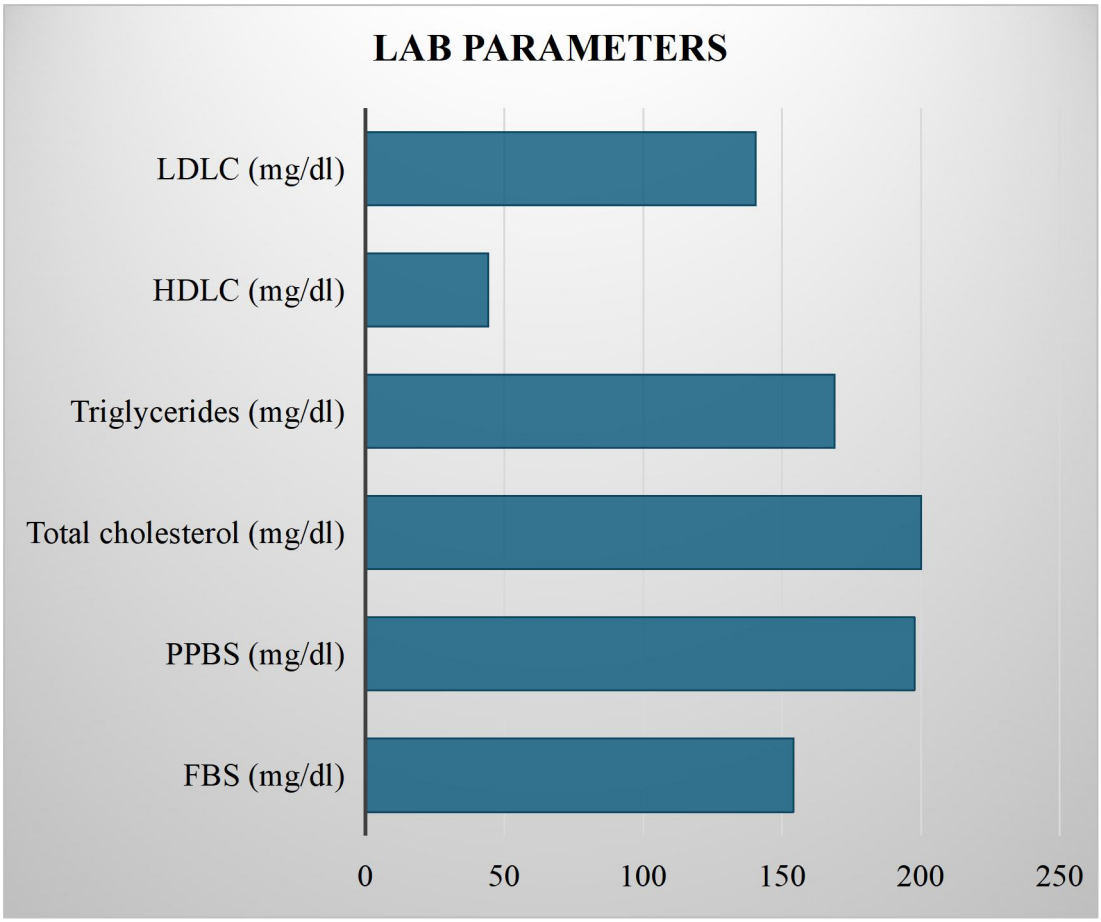


Figure 5 Graphical representations of the lab parameters of mean values and their standard deviation

The USG parameters of mean values and their standard deviation were calculated and given in Table 6 and it's graphically represented in Figure 6. Comparison between the fasting gallbladder volume and postprandial GB volume; the postprandial GB volume were decreased.

Table 6 USG parameters of mean values and their standard deviation

USG PARAMETERS	MEAN	SD
Fasting Gallbladder volume (ml)	26.37	4.37
Postprandial GB volume(ml)	18.57	4.37
GB contractility index	45.46	4.37

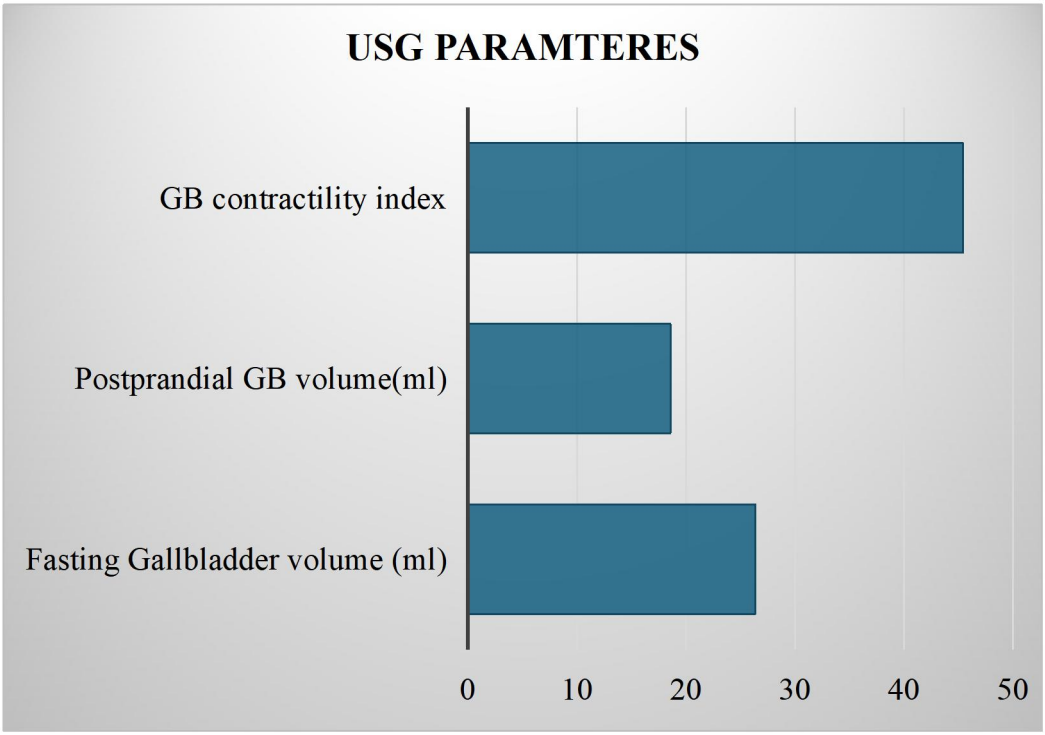


Figure 6 Graphical representations of the USG parameters of mean values and their standard deviation

The gallstone of the patients and their percentages were calculated and tabulated in table 7. The lower no. of patients was presents gallstone shown in Figure 6.7; the higher no. of absent was observed.

Table 7 Gallstone of the patients and their percentages

GALLSTONE	NO. OF PATIENTS	PERCENTAGE (%)
PRESENT	42	43
ABSENT	58	57
TOTAL	100	100

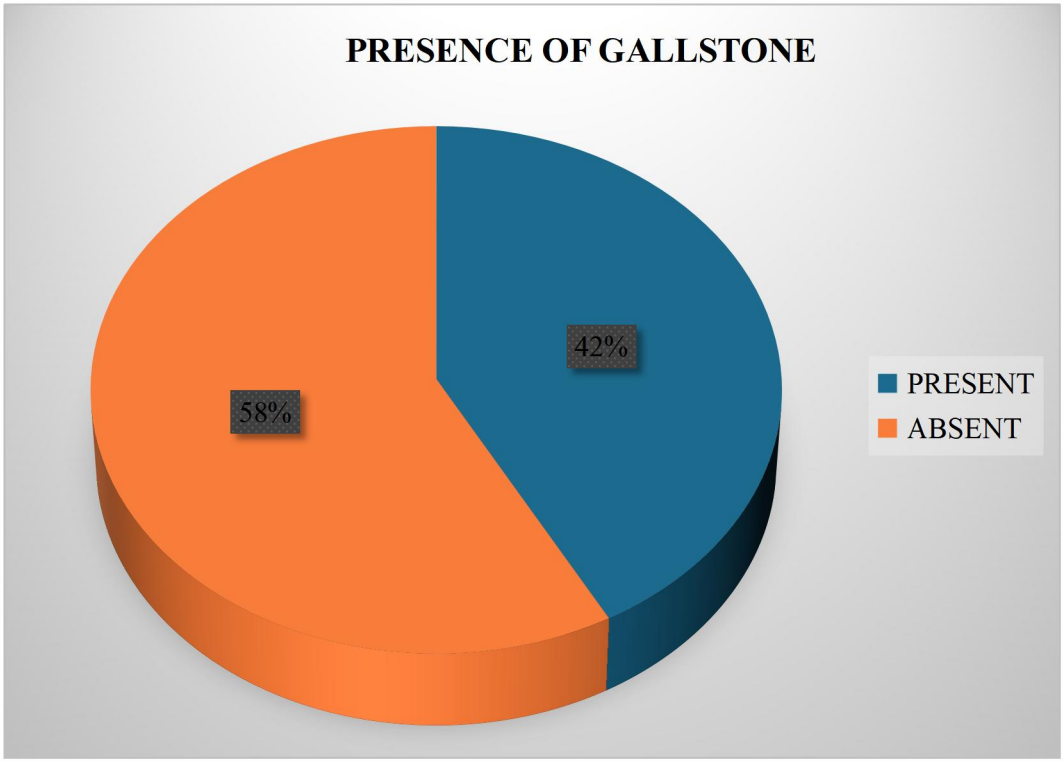


Figure 7 Comparison of the gallstone of the patients and their percentages

Comparison between the duration of diabetes and gallstone were observed given in Table 8. The higher no. of patient's gallstone presents in the duration of 5-10 years and 15-20 years patients shown in Figure 8. Similarly, very lower no. of patients were observed <5 years and 10-15 years patients. The p-value is 0.00001 < 0.05 statistically significant.

Table 8 Comparison between the duration of diabetes and gallstone

DURATION OF DIABETES	GALLSTONE	
	PRESENT	ABSENT
<5 YEARS	1	19
5-10 YEARS	18	34
10-15 YEARS	6	3
15-20 YEARS	18	1
X2 VALUE	36.08	
P VALUE	0.00001	

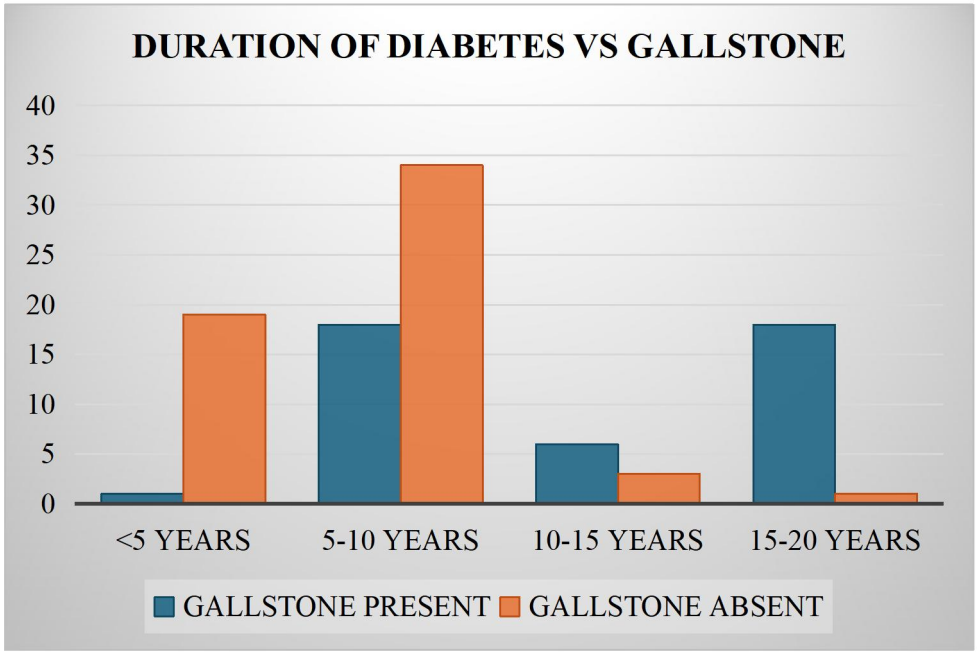
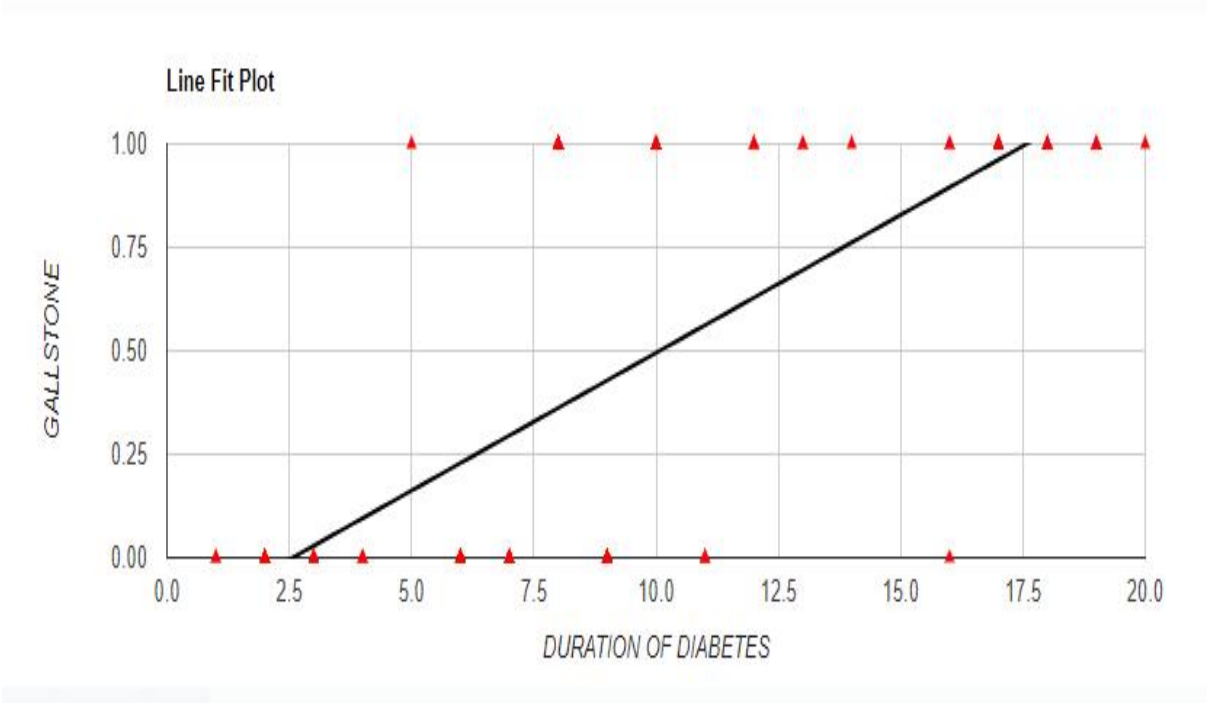


Figure 8 Comparison between the duration of diabetes and gallstone



Results of the pearson correlation indicated that there is a significant large positive relationship between duration of diabetes and gallstone, ($r(98) = .682$, $p < .001$).

Comparison between the duration of diabetes and fasting gallbladder volume were calculated and mentioned in Table 9. The higher mean fasting gallbladder volume were observed 15-20 years of patients shown in Figure 9. The p-value is $0.00001 < 0.05$ statistically significant.

Table 9 Comparison between the duration of diabetes and fasting gallbladder volume

DURATION OF DIABETES	FASTING GALLBLADDER VOLUME (ml)	
	MEAN	SD
<5 YEARS	25.87	3.94
5-10 YEARS	26.65	4.63
10-15 YEARS	25.24	5.16
15-20 YEARS	33.12	3.98
f VALUE	12.483	
P VALUE	0.00001	

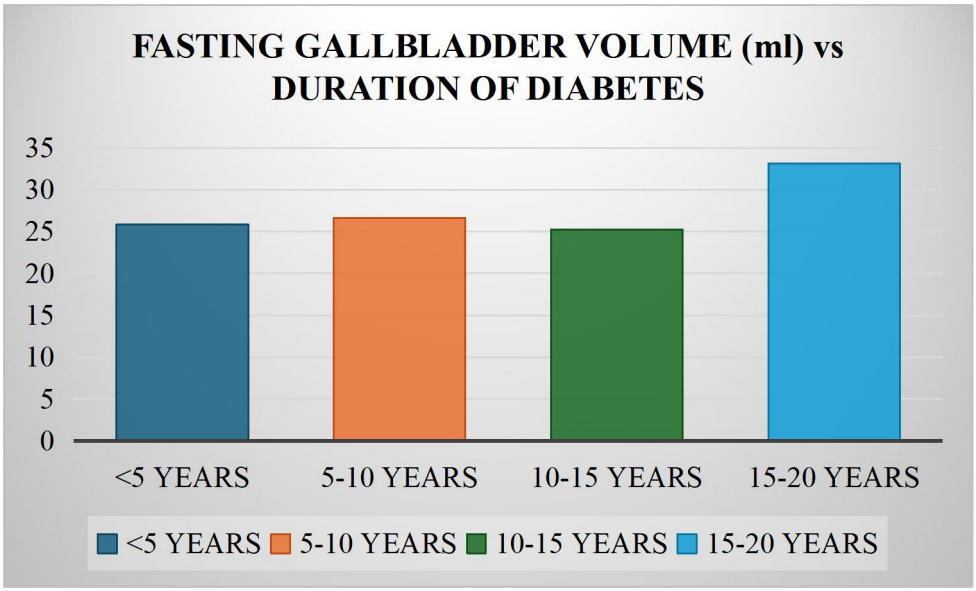
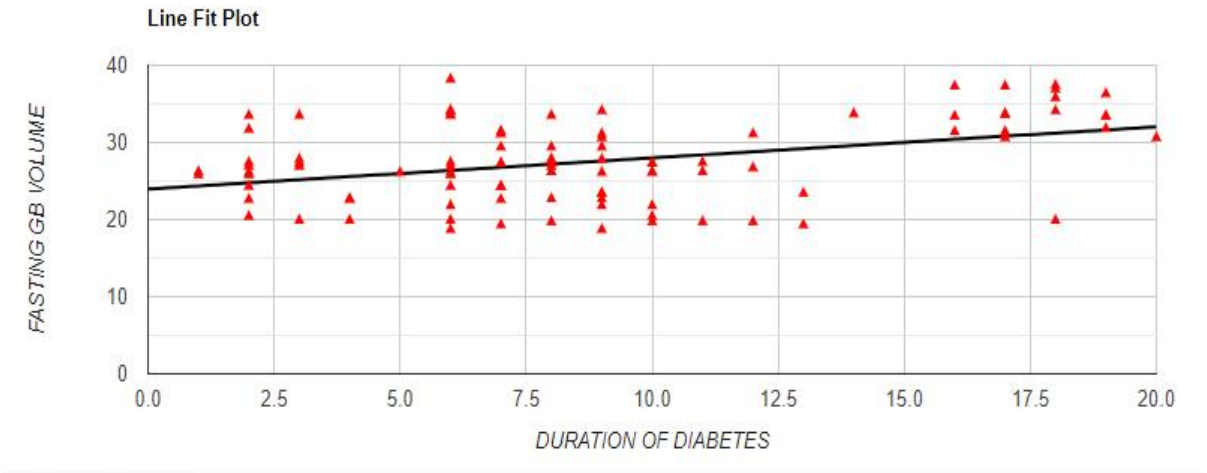


Figure 9 Comparison between the duration of diabetes and fasting gallbladder volume



Results of the pearson correlation indicated that there is a significant medium positive relationship between duration of diabetes and fasting gb volume, p value = 0.000395 (r(98) = .399, p < .001).

The comparison between the duration of diabetes and postprandial gallbladder volume were calculated and given in Table 10. The higher mean postprandial gallbladder volume were observed in 5-10 years and <5 years of patients shown in Figure 10. The p-value is 0.00058 < 0.05 statistically significant.

Table 10 Comparison between the duration of diabetes and postprandial gallbladder volume

DURATION OF DIABETES	POSTPRANDIAL GALLBLADDER VOLUME (ml)	
	MEAN	SD
<5 YEARS	18.07	3.94
5-10 YEARS	18.85	4.63
10-15 YEARS	17.44	5.16
15-20 YEARS	14.06	1.37
f VALUE	6.317	
P VALUE	0.00058	

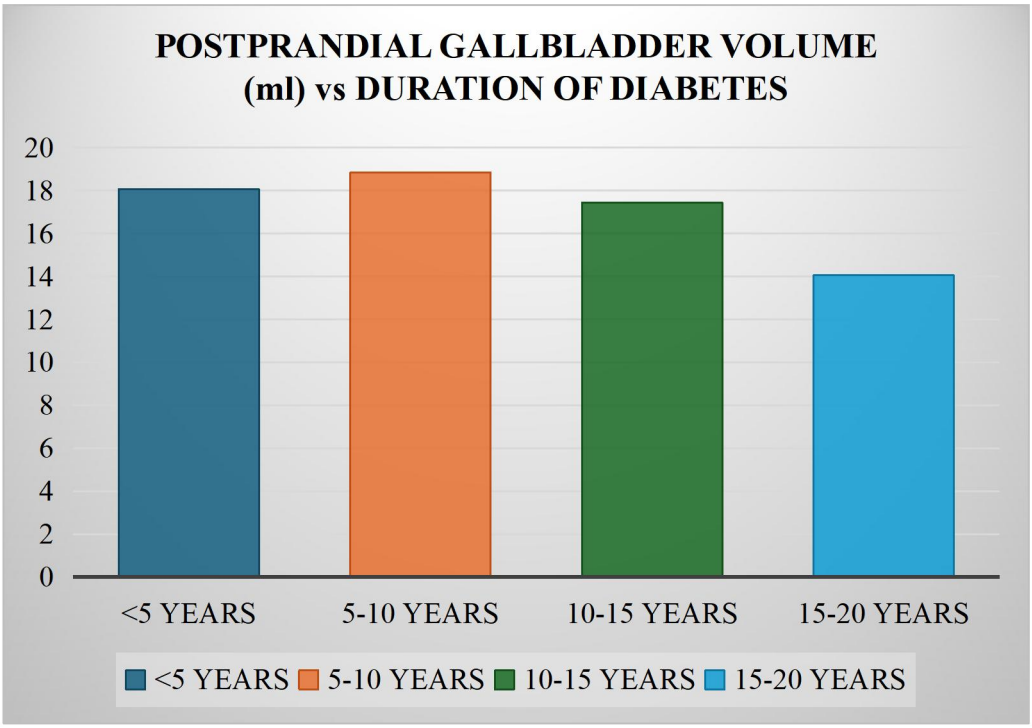
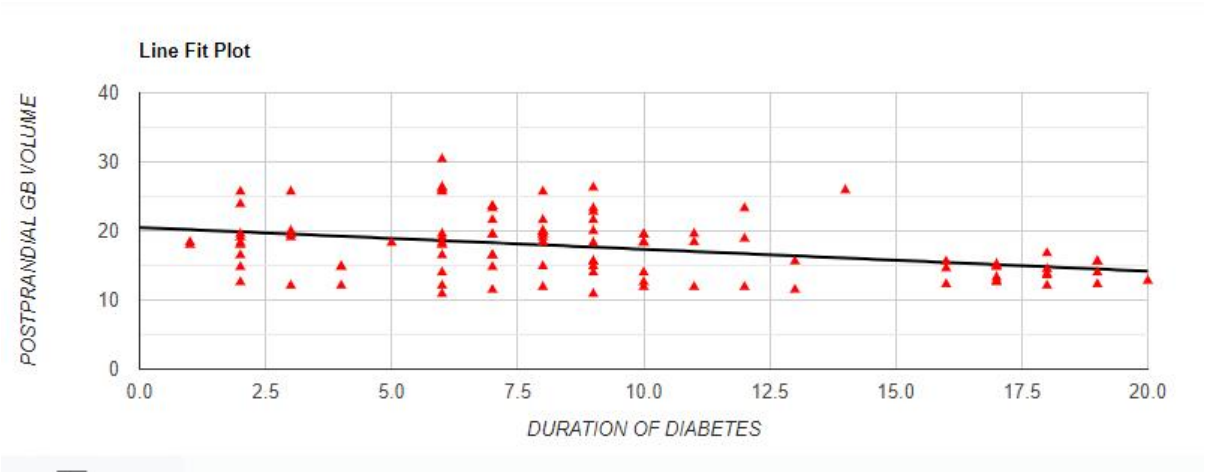


Figure 10 Comparison between the duration of diabetes and postprandial gallbladder volume



Results of the pearson correlation indicated that there is a significant medium negative relationship between DURATION OF DIABETES and POSTPRANDIAL GB VOLUME, p value= 0.00021 (r(98) = .362, p < .001).

The comparison between the duration of diabetes and gallbladder contractility were calculated and given in Table 6.11. The higher mean gallbladder contractility were observed in 15-20 years (53.24±4.53) shown in Figure 6.11. The p-value is 0.00001 < 0.05 statistically significant.

Table 11 Comparison between the duration of diabetes and gallbladder contractility

DURATION OF DIABETES	GALLBLADDER CONTRACTILITY	
	MEAN	SD
<5 YEARS	44.96	3.94
5-10 YEARS	45.74	4.63
10-15 YEARS	44.33	5.16
15-20 YEARS	53.24	4.53
f VALUE	15.703	
P VALUE	0.00001	

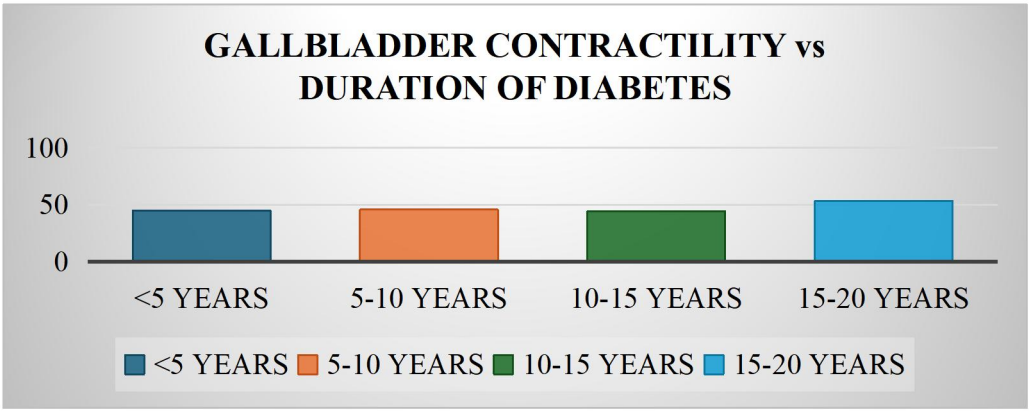
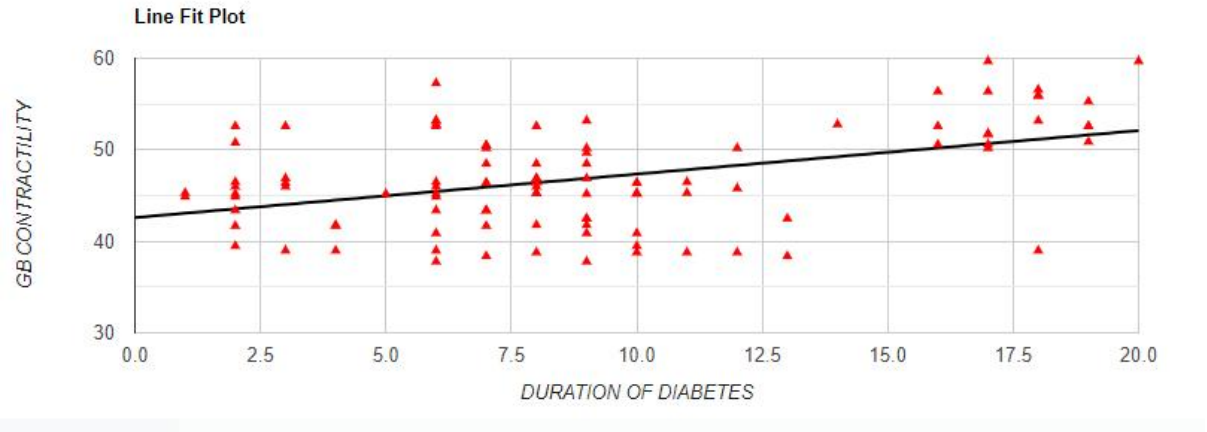


Figure 11 Comparison between the duration of diabetes and gallbladder contractility



Conclusion

Results of the pearson correlation indicated that there is a significant medium positive relationship between DURATION OF DIABETES and GB CONTRACTILITY, p value= 0.0000035 (r(98) = .445, p < .001).

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