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# Measurement Of Quadrate Lobe Of Liver On Ultrasonography In Hepatitis B Patients

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**Abstract**

Hepatitis B virus (HBV) is still a big health issue that causes chronic liver disease, cirrhosis, and hepatocellular carcinoma in millions across the globe. Early and proper detection of changes in the liver is necessary for good disease management, mainly where invasive procedures cannot be carried out easily. This study looks at the role of sonographic examination of the quadrate lobe (segment IV) in helping diagnose chronic hepatitis B. Using a descriptive cross-sectional design, 31 participants were assessed to measure the anteroposterior diameter of the quadrate lobe and study its connection with other clinical signs and the disease progression. Quadrate lobe shrinkage was noticed among patients who had advanced liver disease, like cirrhosis and portal hypertension. The study proves that checking on the quadrate lobe with ultrasonography helps spot any structural changes in the liver of HBV patients efficiently and at little cost. Performing segment IV evaluation as part of the usual sonographic tests can help diagnose diseases at an early stage and increase the success of treatments in regions with few modern tests and procedures.

## Introduction

Hepatitis B virus (HBV) infection remains a major global public health challenge, affecting approximately 296 million people worldwide, with over 820,000 deaths annually attributed to complications such as cirrhosis and hepatocellular carcinoma (WHO, 2023). Hepatitis B is a hepatotropic virus that primarily affects liver tissues, leading to both acute and chronic liver disease. The liver, being a vital organ with complex anatomical lobes, undergoes significant morphological changes during the course of chronic hepatitis B infection. Among these, the assessment of the quadrate

lobe (segment IV of the liver according to Couinaud classification) has gained clinical significance due to its proximity to the porta hepatic and its sensitivity to structural and hemodynamic alterations in liver pathology.

Ultrasound (US), a non-invasive and widely accessible imaging modality, has emerged as an essential diagnostic tool for the evaluation of liver size, parenchymal echo- texture, and vascular changes. The quadrate lobe, though relatively small and sometimes under-evaluated, holds diagnostic value in cases of hepatomegaly, liver fibrosis, and portal hypertension. Quantitative measurement of this lobe can aid in the early detection of pathological liver changes in HBV-infected patients, potentially improving clinical outcomes through timely intervention.

The study of liver anatomy has evolved from early cadaveric dissections in ancient Greece to modern radiological mapping in the 21st century. Historically, the liver was considered a single mass without clearly defined segments. It was only with the advent of anatomical and surgical studies in the 20th century—most notably by Claude Couinaud that the liver was divided into eight functionally independent segments based on portal and hepatic venous distribution (Couinaud, 1957). The quadrate lobe, corresponding to segment IV, is located on the inferior surface of the liver, bordered by the gallbladder fossa and ligamentum teres. Early clinical assessment of liver size relied heavily on physical examination methods such as palpation and percussion, which were prone to inaccuracy, particularly in obese or distended abdomens. The development of imaging modalities such as X-ray, CT, and MRI transformed the evaluation of liver morphology. However, ultrasound emerged as the preferred method in the mid-20th century due to its safety, affordability, and real-time capabilities.

Today, ultrasound imaging is used widely in the field of hepatology due to its popularity in the 1970s for scans of the abdomen. With high-resolution B-mode ultrasound, the doctor can carefully assess the liver size, its structure, any lumps and the way the blood vessels move in the liver. Evaluating changing blood flow with Doppler is very helpful in conditions such as portal hypertension which arises in many instances of chronic hepatitis B. With recent trends, there has been a shift from considering the whole liver to breaking it into segments and lobes, making it easier to find where the problem lies. Applying bipolar calipers to measure each lobe such as the quadrate lobe, plays a key role in staging liver disease. Thus, IV hypertrophy is often found in patients with advanced fibrosis and some features in this segment might be due to portal hypertension or the growth of regenerative nodules (Lee et al., 2020)

Being close to the hepatic hilum, the quadrate lobe is especially prone to changes in the portal vein and bile duct. Fibrotic tissue is usually one of the first signs in chronic liver disease. Chronic inflammation of the liver that happens in HBV-infected people often results in periportal fibrosis starting in the central area of the quadrate lobe. It has been found that there may be a connection between altered segment IV size or texture and the level of hepatic fibrosis (Sahin et al., 2021). Because of this, regularly measuring the gallbladder is an important yet infrequently used parameter during a liver ultrasound. Since it is risky and invasive to measure fibrosis through a liver biopsy, checking liver lobes by ultrasound may be safer for constant monitoring.

The Hepadnaviridae family contains HBV which mostly spreads through contact with blood and certain body fluids. A continuous inflammatory response caused by chronic infection causes the liver to develop hepatic necroinflammation, fibrosis and finally cirrhosis. Pathological changes can be seen in the liver with changes in its texture and its overall size. Medical research proves that chronic hepatitis B is a reason for asymmetrical liver enlargement. Depending on the current level of fibrosis or cirrhosis, Segment IV of the liver may grow larger (hypertrophy) or get smaller (atrophy) (Zhou et al., 2022). Therefore, it is necessary to regularly test and monitor the size of the quadrate lobe in people with hepatitis B.

Recent literature emphasizes the importance of segmental liver evaluation in chronic liver disease using imaging. For instance, ultrasound-based liver stiffness measurements (elastography) and segmental volume assessments are increasingly used to non-invasively estimate liver fibrosis and portal hypertension. In a study by Hwang et al. (2023), segment IV enlargement was found to be significantly associated with early cirrhotic changes in HBV patients, preceding gross hepatomegaly or splenomegaly. Moreover, AI-powered ultrasound systems now allow for semi-automated and reproducible segment measurements, enhancing diagnostic precision (Kim et al., 2023). These innovations are particularly useful in resource- limited settings where liver biopsy or MRI is not feasible. Despite these advances, few studies have specifically focused on the routine measurement of the quadrate lobe in HBV patients as a standard parameter. This underscores the need for more targeted research, such as the present study, to validate its diagnostic utility and establish reference values for clinical use.

The hepatitis B virus (HBV) causes Hepatitis B which is dangerous for the health of the liver. It is among the leading causes of ill health worldwide, mainly located in areas where people earn less money. The World Health Organization (WHO, 2023) reports that, by the year 2022, over 296 million people had chronic hepatitis B and there were around 1.5 million new cases every year. In addition, about 820,000 people lose their lives each year because of liver complications caused by HBV such as cirrhosis and HCC.

The global distribution of hepatitis B infection is not uniform. The highest prevalence rates are observed in the Western Pacific Region (6.2%) and the African Region (6.1%), followed by the Eastern Mediterranean (3.3%), South-East Asia (2.0%), Europe (1.0%), and the Americas (0.7%). Countries such as China, India, Nigeria, Indonesia, and the Philippines contribute significantly to the global burden due to large populations and inadequate access to preventive healthcare (WHO, 2023; Schweitzer et al., 2015).

The most effective strategy to combat hepatitis B is universal vaccination. The Hepatitis B vaccine, introduced in 1982, is highly effective (95% protection) and recommended as part of routine childhood immunization. The WHO recommends administering the first dose within 24 hours of birth followed by at least two additional doses.

As of 2022, over 190 countries have included the hepatitis B vaccine in their national immunization schedules. Countries with high coverage such as Taiwan and China have demonstrated dramatic reductions in HBV prevalence among children (Chang et al., 2016). However, gaps remain in low-income countries, especially where birth-dose vaccination is not routinely practiced due to logistical and healthcare access issues. Early detection through serological screening (e.g., HBsAg testing) plays a critical role in reducing transmission and managing liver damage. WHO recommends targeted testing in high-risk populations such as: Pregnant women, Household contacts of infected persons, People who inject drugs, Men who have sex with men and Incarcerated individuals Although hepatitis B is not curable, antiviral therapy with drugs like tenofovir and entecavir can suppress viral replication, reduce liver inflammation, and prevent progression to cirrhosis and liver cancer.

According to WHO (2022), only about 10% of people with chronic HBV infection are aware of their condition, and just 22% of those eligible for treatment actually receive it.

Community-level awareness campaigns can educate the public on hepatitis B transmission, prevention, and treatment options. Reducing stigma and increasing knowledge encourages people to get tested, vaccinated, and treated. Strict adherence to infection control practices— including the use of sterilized equipment, safe injection protocols, and blood screening—can significantly reduce iatrogenic HBV transmission. The WHO Global Health Sector Strategy on Viral Hepatitis (2016–

2021) aimed to eliminate hepatitis B and C as public health threats by 2030, targeting 90% reduction in new infections, 65% reduction in mortality, 90% diagnosis rate, 80% treatment coverage for those eligible

Despite significant progress in vaccination and diagnostics, the elimination goals remain off track globally due to gaps in screening, vaccine coverage, and access to antiviral therapy, especially in resource-constrained settings (Polaris Observatory, 2018). There exists a knowledge gap regarding the specific role of quadrate lobe size changes in HBV-infected individuals. Most studies emphasize total liver size or left/right lobe measurements. However, early fibrosis may not uniformly affect the liver, and localized measurements like that of the quadrate lobe could offer earlier and more sensitive indicators of disease progression. Given the increasing burden of chronic HBV infection and the necessity for early, non-invasive detection of liver damage, this study proposes to evaluate the quadrate lobe of the liver using ultrasound in patients diagnosed with hepatitis B.The information could set reference values for this lobe at each stage of fibrosis and boost ultrasound's ability to predict conditions in liver disease.

This chapter discusses how the liver was understood historically, the background of ultrasound imaging, the significance of the quadrate lobe in liver health and how all this affects HBV infection now.

**Background of the Research**

The Hepatitis B virus (HBV) leads to risky conditions when it infects, mainly impacting the liver and causing acute and chronic liver disease with cirrhosis and cancers as the possible outcomes. Hepatitis B affects the world in a major way, as it leads to the chronic infection of 296 million people and takes the lives of about 820,000 individuals each year (WHO, 2023). In these areas, Asia and Sub-Saharan Africa, the rate of infection is unusually high because of the transmission from pregnant mothers to their babies or during early childhood.

A long-term HBV infection causes damage to the liver that alters its structure and appearance. The quadrate lobe, present in the medial segment of the left lobe, is one of theneglected parts of the liver. A difference in the size, ultrasound appearance and blood flow in the liver lobe could suggest liver problems, mostly cirrhosis or fibrosis in cases of hepatitis B. Still, only a little attention has been given to assessing and diagnosing the quadrate lobe in people with chronic liver disease. Ultrasound is commonly accepted for its safety, effectiveness and easy availability in the study of the liver's size and shape. The test provides important information that helps find liver enlargement, shrinkage, fibrotic changes and asymmetry at an early stage. While quadrate lobe assessment is beneficial, there is not enough standard information of its proper measurement, especially when present with diseases such as hepatitis B. The goal of this research is to compare the quadrate lobe of hepatitis B patients by ultrasonography and check if variations in its size are related to how severe or advanced the disease is.

**Statement of the Problem**

Despite the widespread prevalence of chronic hepatitis B and its well-known effects on liver architecture, limited emphasis has been placed on the diagnostic potential of individual liver lobes, particularly the quadrate lobe, in routine imaging protocols. Most sonographic evaluations focus broadly on liver size, parenchymal echo-texture, or presence of lesions, often overlooking subtle but clinically relevant lobe-specific changes. There is a paucity of empirical data regarding the normal and pathological measurements of the quadrate lobe, especially in hepatitis B patients. This limitation impairs clinicians' ability to utilize lobe-specific morphological alterations for early detection of liver pathology. Thus, there is a critical need to investigate whether quantifiable changes in the quadrate lobe, as observed through ultrasound imaging,

can serve as a useful diagnostic or prognostic marker in HBV-infected individuals.

**Objectives of the Study**

To measure the quadrate lobe dimensions (length, width, and volume) in hepatitis B patients using ultrasound imaging.

To compare quadrate lobe dimensions between hepatitis B patients and healthy controls.

To determine any correlation between quadrate lobe size and the clinical stage or severity of hepatitis B

To evaluate the utility of quadrate lobe measurement as an early diagnostic indicator of liver involvement in HBV infection

**Scope of the Study**

This study was confined to the ultrasonographic evaluation of the quadrate lobe of the liver in individuals diagnosed with chronic hepatitis B. The research was conducted in a clinical setting using standard ultrasound equipment and protocols. The study focused on a specific patient group with confirmed HBV infection and compares them with healthy, age- matched controls.The study did not include patients with non-acute liver diseases such as hepatitis C, caused by drinking or fatty liver disease so that other factors do not affect the results. The technique did not require invasive actions or checking under a microscope but trusts in ultrasound and clinical readings.

**Significance of the Study**

It helps in growing our knowledge by giving basic information on the size of the quadrate lobe in people with the virus. Detection of early irregularities in the liver helps to act early and try to prevent the damage from becoming serious. The results may enhance the accuracy of diagnosis and help doctors keep an eye on the development of HBV in their patients. It points out that examining specific liver lobes should be the priority which is not seen that often in regular ultrasound studies. It could encourage scientists to continue exploring and perfecting ways to measure certain liver lobes in chronic liver disease.

## CHAPTER 2
## LITERATURE REVIEW

Lafortune et al. (1998) explored if ultrasound measurements of liver segment IV can facilitate the diagnosis of cirrhosis. The research involved comparing 167 patients diagnosed with cirrhosis to 125 healthy people and it was found that subjects with cirrhosis showed a much reduced segment IV diameter (average 28 ± 9 mm) compared to healthy people (average 43 ± 8 mm). Ultrasound scans at an oblique angle under the ribs were performed to determine the measurements using certain markers. Moreover, the size of segment IV was the same whether the disease was severe or caused by different liver problems. According to the researchers, a lowered IV diameter may help as an extra sign in detecting chronic liver disease through ultrasound.

Huang et al. (2016) examined the acoustic structure quantification (ASQ) method, especially the focal disturbance (FD) ratio, as a non-invasive way to see if liver fibrosis exists in patients with chronic hepatitis B. There were 114 people in the study whose FD ratios were analyzed against liver biopsy results assigned using the METAVIR system. The FD ratio performed well as a diagnostic tool, recording AUC values of 0.84 for significant fibrosis,

0.86 for severe fibrosis and 0.83 for cirrhosis. Researchers found the good levels for FD ratio in cirrhosis and steatosis and discovered by multivariate analysis that both fibrosis and steatosis were independent affecting factors of FD measures. Therefore, FD imaging findings support the use of the FD ratio as a helpful tool for assessing

liver scarring in people with chronic hepatitis B.

Chen et al. (2014) tested if images of the right liver volume and spleen size from MR scans could help detect and track the progression of cirrhosis due to hepatitis B. Two hundred five people with cirrhosis and 40 healthy individuals took part in the study. The main imaging elements examined were right ventricle (RV), spleen volume (SV), the RV/SV ratio and spleen index (SI) which is found by multiplying the width, thickness and length of the spleen. Results showed that SV and SI were going up while RV and the RV/SV ratio were decreasing and this pattern followed a steadier increase in Child-Pugh classifications. Each imaging metric was helpful in telling apart cirrhotic patients from healthy people, as the AUC measures ranged from 0.609 to 0.975. Out of all, the RV/SV ratio could best signal the severity of the disease and the SI was the best at finding cirrhosis. It appears that RV/SV and SI are promising ways to help diagnose and determine the stage of liver cirrhosis.

Stepanyan et al. (2020) carried out a study to compare liver features in ultrasound scans of healthy people, individuals with long-term viral hepatitis and people with cirrhosis. Altogether, the study analyzed 58 people in excellent health, 31 suffering from chronic hepatitis and 15 with cirrhosis. It was found that the main liver measurements such as the diameters of both the left and right lobes and the thickness of the caudate lobe, differed significantly between people with healthy liver and those with liver disease ($p < 0.05$). In healthy individuals, the liver changed shape between normal and deep breathing which showed the elasticity of the organ was not impaired. However, cirrhotic patients did not show any breathing changes which suggested their lungs are thick and stiff with barely any change in structure. Ultrasound scans clearly help pinpoint liver conditions and also show how flexible the organ is.

Lin et al. (1993) used ultrasound throughout a longitudinal study to document how the livers of chronic hepatitis B patients gradually changed into cirrhosis. Among the patients studied, cirrhosis scores became higher as time went by, but both portal vein diameter and spleen size did not show much change ($p < 0.01$). It was explained by the authors that a single ultrasound scan may not always lead to the reliable detection of early-stage cirrhosis. The authors instead advised using a scoring system and repeating ultrasound to check the parenchyma and the liver surface which could boost the early detection of liver disease in follow-ups.

Li et al. (2010) looked into the relationship between changes in the liver and spleen relate to the advancement of liver fibrosis and cirrhosis in patients with hepatitis B. With the help of multidetector CT, the team looked at the size of both the liver and spleen in 128 people, including those who were healthy and those diagnosed with different degrees of fibrosis. Total liver size decreased mainly in the right lobe and left medial segment with increased fibrosis and at the same time, both the caudate lobe and spleen became larger. Moreover, with advanced disease, both the caudate (C/T) and spleen (S/T) ratios against total liver volume also increased. $C/T \geq 3.34\%$ and $S/T \geq 47.36\%$ were demonstrated to effectively mark advanced fibrosis and cirrhosis, showing good sensitivity and specificity in diagnosis. These results endorse the idea that CT can be used to assess liver and spleen growth which may indicate how liver disease is advancing.

Huang et al. (2022) looked into whether using ultrasound (US) points with liver tissue stiffness measurements from STE improves how liver stiffness is diagnosed in chronic hepatitis B (CHB). There were 291 people involved in the study, out of which 242 had CHB and 49 did not. Doctors used liver biopsy as the main comparative method. By combining the US and LSM grades, researchers made an LC marker to fit the purpose. The patch incorporating LSM and US had a higher link to the stage of fibrosis ($r = 0.846$) than when assessing these individually using either US or LSM ($r = 0.825$ and $r = 0.771$, respectively). By doing ROC analysis, it was shown that the LC marker had better accuracy in diagnosing fibrosis at every stage, with values from 0.906 to 0.961. It appears that adding US and STE- derived LSM to a single marker

increases the accuracy of detecting fibrosis in patients with CHB and may be even more helpful than biopsy.

Tan et al. (2022) considered the utility of liver lobe and spleen volume measurements by MRI in predicting esophagogastric variceal bleeding (EVB) risk in hep B related cirrhosis. Over two years, a study of follow up of 96 patients found that patients who developed EVB had significantly lower right liver lobe volumes and higher spleen volumes compared to those patients without bleeding episodes. In addition, ratios of spleen volume to liver lobe volume (especially the spleen to right lobe volume, SV/RV), were increased in patients at risk. Of all the volumetric parameters evaluated, the SV / RV ratio had the best predictive value for EVB (area under the curve (AUC) 0.84). These findings show that the SV/RV ratio by MRI may be a useful noninvasive marker of cirrhotic patients with increased risk for variceal bleeding.

Parikh et al. (2017) estimated that over 250 million people have chronic hepatitis B virus (HBV) infection globally and it still leads to many cases of liver diseases and deaths. Although some patients have a stable condition with no treatment, others may develop severe liver complications such as cirrhosis and tumor formation. It is very important to accurately evaluate liver fibrosis since it guides treatment decisions and predicts how a patient will respond. Fibrosis used to be staged mostly by liver biopsy, but the invasiveness, cost and risks of the procedure have led experts to find other options. These are blood biomarkers and pictures taken of the body which have been tested and accepted by the latest international guidelines for managing people with hepatitis B. Since noninvasive approaches are safer and less expensive for patients, they are comfortable and reliable until the case becomes more advanced or involves factors such as inflammation or excess fat. The review highlights the role of noninvasive assessment in chronic hepatitis B, describes the most common blood and imaging techniques, how accurate they are and how they are applied during patient care.

Marcellin et al. (2009) underlined the rising need for non-invasive methods to see if someone has liver fibrosis when they have chronic liver diseases and they highlighted FibroScan® as a useful tool. This study involved LSM in 202 patients with chronic hepatitis B and the results were checked against liver biopsy scores graded by both METAVIR and Ishak systems. With unreliable data excluded, data from 173 patients were examined, revealing there is a good connection between LSM findings and the fibrosis stage ($r = 0.65$, $p < 0.001$). Using the technique, it was clear that area under the receiver operating characteristic curves (AUROCs) was 0.81 for detecting significant fibrosis ($F\geq2$) and 0.93 for both advanced fibrosis ($F\geq3$) and cirrhosis ($F=4$). It was established that a cut-off of 7.2 kPa in LSM signifies significant fibrosis and a range from 11.0 to 18.2 kPa points to cirrhosis. They confirm that LSM is an accurate and safe way for finding fibrosis and cirrhosis in people with hepatitis B, just like it is for those with hepatitis C virus.

Friedrich-Rust et al. (2013) examined using Acoustic Radiation Force Impulse (ARFI) imaging which relies on ultrasound, instead of transient elastography (TE), as a convenient way to check liver fibrosis. Chronic hepatitis B patients (114) were included in this study and 92 patients had both ARFI and TE tests that were checked against liver biopsy. There was a
strong relationship between ARFI, TE and the different stages of fibrosis found under the microscope. ARFI's AUROCs in predicting significant fibrosis ($F\geq2$), severe fibrosis ($F\geq3$) and cirrhosis ($F=4$) were 0.75, 0.93 and 0.97, respectively which were only slightly different from the TE values of 0.83, 0.94 and 0.93 for each outcome. According to the study, ARFI imaging is a dependable method for identifying advanced liver fibrosis in people with chronic hepatitis B.

Jieanu et al. (2015) revealed that every year, chronic HBV infection leads to over

78,000 deaths from complications such as liver disease. While liver transplantation cures end-stage liver failure, it cannot be used often because of the limited number of donors and the need for a matching schedule. Therefore, proper and fast evaluation of liver fibrosis helps direct treatment and avoid the development of cirrhosis or hepatocellular carcinoma. Even though liver biopsy has long been used to find fibrosis, its invasiveness and risks have encouraged scientists to come up with new ways to diagnose it. Nowadays, a variety of non-invasive tests such as MRI, ultrasound, elastography and markers in the blood, are being used more often. The method makes monitoring disease and fibrosis changes both safe, affordable and able to be repeated. It brings together current knowledge on using non-invasive methods to measure liver fibrosis in HBV infection, stressing their usefulness for prediction and possible use instead of biopsy.

## CHAPTER 3
## METHOD AND MATERIAL
### Study design and Duration

This study was designed as a descriptive cross-sectional investigation aimed at evaluating the quadrate lobe of the liver in patients with Hepatitis B using abdominal ultrasonography. The study was carried out over a period of four months.

### Population and Sampling
A random sampling technique was utilized to ensure unbiased and representative selection of patients diagnosed with Hepatitis B.

### Inclusion criteria:
Adult patients aged 18 years and above.
Patients with confirmed Hepatitis B infection
Patients referred for routine abdominal ultrasound. Exclusion criteria:
Patients with the history of liver surgery, malignancy, or co-infections (e.g., HCV, HIV)

### Patients with other chronic liver diseases unrelated to Hepatitis B.
Inadequate visualization of the liver due to obesity or overlying bowel gas.
The data was collected through real-time B-mode abdominal ultrasonography. The ultrasound examinations were performed in a standardized and systemic manner by a trained radiologist. The data collection involved direct visualization and measurement of the liver's quadrate lobe using specific anatomical landmark. The equipment used for imaging was a modern ultrasound machine, GE Logiq P7, known for its high-resolution imaging capabilities and advanced hepatobilliary presets. The transducer used was a curvilinear/convex probe operating at a frequency of 2-5 MHz, which is optimal for abdominal organ visualization due to its wide field of view and adequate tissue penetration. Patients were positioned in the supine position initially. In cases where bowl gas or other factors limited visualization, patients were repositioned into the left lateral decubitus or left posterior oblique position**,** and scanning was repeated. Adequate contact gel was applied to epigastric region to ensure good acoustic coupling. The quadrate lobe was identified as the area of the liver located between the fossa for the gallbladder (on the right) and the fissure for the ligamentum teres (on the left). The lobe lies anterior to the porta hepatis and forms part of segment IV of the liver based on Couinaud's classification. The transverse diameter of the quadrate lobe was measured from the medial edge of the gallbladder to the ligamentum teres using the caliper function of the ultrasound machine. To minimize intra observer variability, all measurements were taken during deep inspiration, which pushes the liver inferiorly and improves visibility. Each measurement was performed three times, and the

average of the three readings was recorded to improve reliability and accuracy. A structured data collection sheet was used to record each patient's demographic information (age, gender, symptoms, parameters), Hepatitis B status, and quadrate lobe measurements. The data was anonymized and assigned a unique study ID to ensure confidentiality.

Prior to the commencement of the study, ethical approval was obtained from the institute.

Written informed consent was obtained from each participant before inclusion in the study.

The study purpose and procedures were clearly explained to each participant.

Participants were assured of confidentiality and data privacy.

Voluntary participation was emphasized, with the right to withdraw at any time without affecting medical care.

**Statistical Analysis**

Data were entered and analyzed using IBM SPSS Statistics version [26]. Descriptive statistics were used to summarize the data. The anteroposterior (AP) diameter of the quadrate lobe was presented as mean ± standard deviation (SD) along with minimum and maximum values. Frequencies and percentages were used for categorical variables such as gender and age groups. The data distribution for the continuous variable (Quadrate lobe size) was assessed visually using histograms. Since the study objective was to measure the Quadrate lobe size in Hepatitis B patients without comparing it to other groups, inferential statistics were not required. Cross tabulations were used to examine associations between categorical variables. A 95% confidence interval for the mean was reported to estimate the precision of the Quadrate Lobe size measurements. The level of statistical significance was set at $p < 0.05$, though not applicable in this descriptive analysis unless subgroup comparisons were later conducted.

## CHAPTER 4
## RESULTS

Parameter 1 AGE:

| Statistics | | |
|---|---|---|
| Age | | |
| N | Valid | 31 |
| | Missing | 0 |
| Mean | | 45.7419 |
| Median | | 47.0000 |
| Mode | | 22.00 |
| Std. Deviation | | 17.95358 |
| Minimum | | 22.00 |
| Maximum | | 89.00 |

Table 1: Distribution of Participant Age: Mean = 45.74 years, Median = 47.00 years, Mode =
22.00 years (N = 31)"

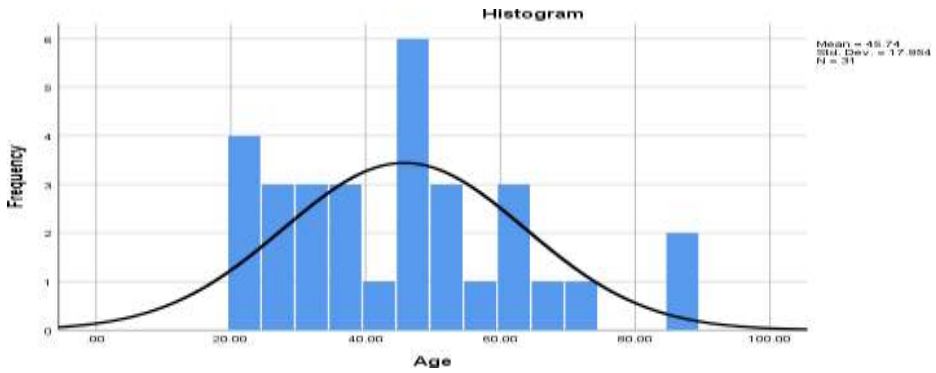


**Figure 1:** Histogram showing the age distribution of study participants(n=31).

These suggest that while the age distribution is somewhat concentrated around middle age,there is a notable presence of both younger and older individual in the sample.

**Parameter 2**

- **Gender**

Gender

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Male | 23 | 74.2 | 74.2 | 74.2 |
| | Female | 8 | 25.8 | 25.8 | 100.0 |
| | Total | 31 | 100.0 | 100.0 | |

Table 2: Frequency and Percentage of Gender, Showing Valid and Cumulative Percentages

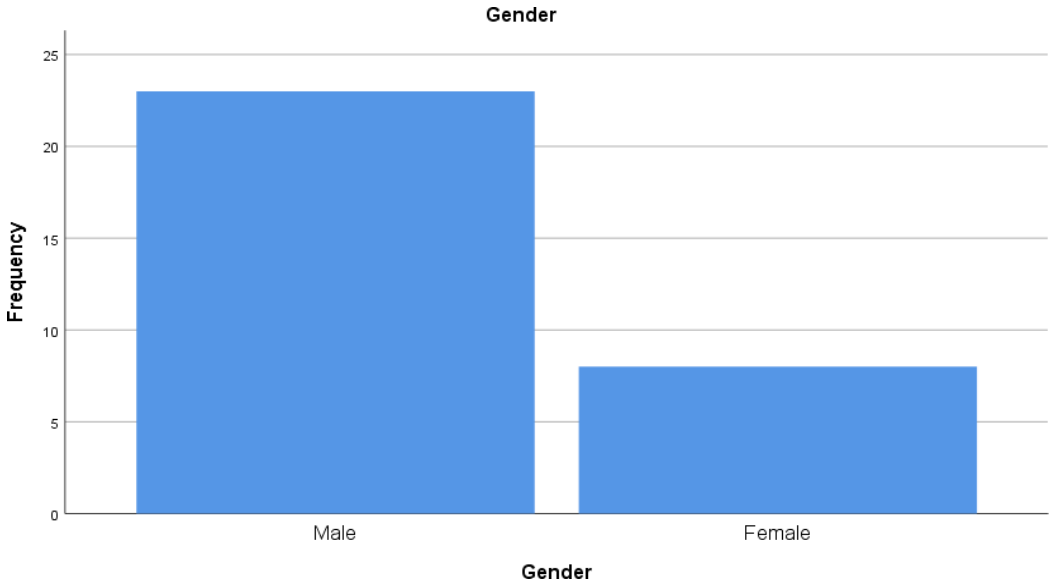


**Figure 2:**Histogram showing the gender distribution of study participants(n=31).

Out of 31 patients,74.2% identified as male (n=23),while only 25.8% identified as

female (n=8). This is visually represented in the bar chart above,which clearly shows a higher frequency of male as compared to female.

**PARAMETER 3**

| Chronic Hepatitis B (HBV) | | | | | |
|---|---|---|---|---|---|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Yes | 26 | 83.9 | 83.9 | 83.9 |
| | No | 5 | 16.1 | 16.1 | 100.0 |
| | Total | 31 | 100.0 | 100.0 | |

Table 3: Frequency and Percentage of Chronic Hepatitis B (HBV) among Participants, Showing Valid and Cumulative Percentages

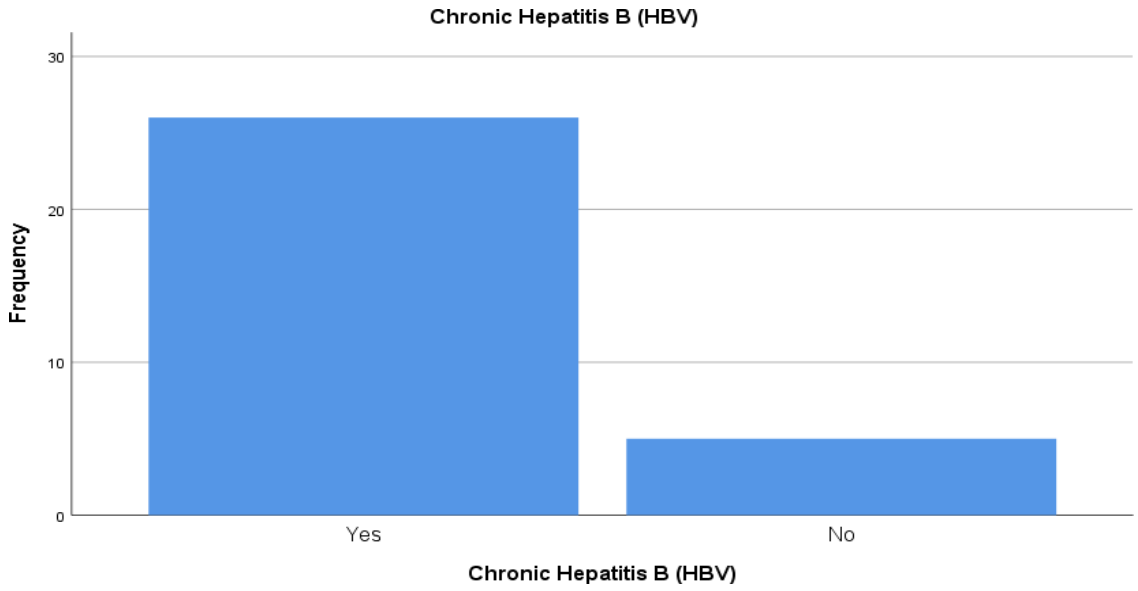


**Figure 3:** Histogram showing the chronic hepatitis distribution of study participants(n=31).

Out of a total of 31 individuals, 83.9% (n=26) reported having chronic HBV, while only 16.1% (n=5) indicated they were not affected.The bar chart above visually reinforce this finding, clearly illustrating that the majority of the surveyed population is living with chronic HBV.

| History Of Jaundice | | | | | |
|---|---|---|---|---|---|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Yes | 18 | 58.1 | 58.1 | 58.1 |
| | No | 13 | 41.9 | 41.9 | 100.0 |
| | Total | 31 | 100.0 | 100.0 | |

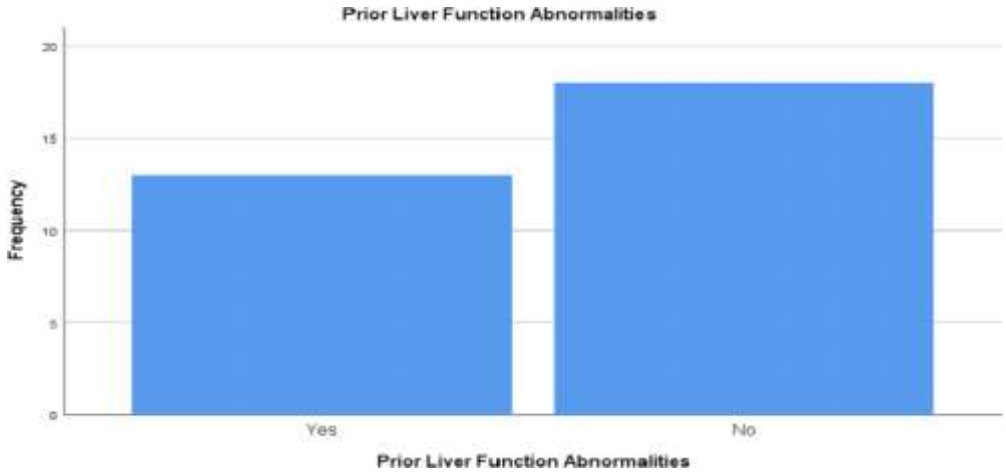


Table 4: Frequency and Percentage of jaundice among Participants, Showing Valid and Cumulative Percentages"

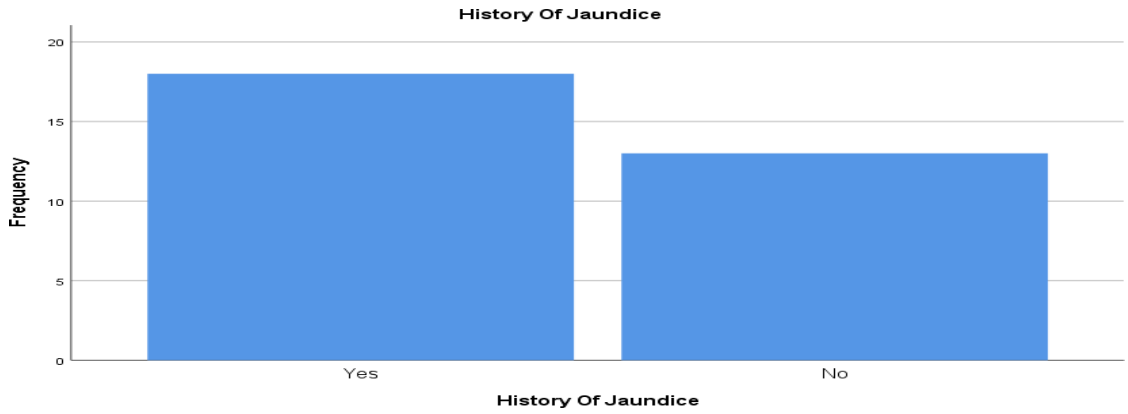


**Figure 4:** Histogram showing the history of jaundice distribution of study participants(n=31).

In this study, a total of participants were assessed for a history of jaundice. Among them, 18 participants (58.1%) reported having a history of jaundice, while 13 participants (41.9%) reported no such history. This indicates that a significant portion of the study population had previously experienced jaundice.

**Prior Liver Function Abnormalities**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Yes | 13 | 41.9 | 41.9 | 41.9 |
| | No | 18 | 58.1 | 58.1 | 100.0 |
| | Total | 31 | 100.0 | 100.0 | |

Table 5: Frequency and Percentage of liver function abnormalities among Participants, Showing Valid and Cumulative Percentages"

Figure 5: Histogram showing the prior liver function abnormalities distribution of study participants(n=31).

Among the 31 participants included in the study,13 individuals (41.9%) reported a history of prior liver function abnormalities, while 18 participants (58.1%) had no such history. These findings suggest that a notable portion of the study population had previously experienced liver function irregularities, which may have implications for the assessment of liver related conditions such as chronic Hepatitis B.

| Family history of HBV | | | | | |
|---|---|---|---|---|---|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Yes | 8 | 25.8 | 25.8 | 25.8 |
| | No | 23 | 74.2 | 74.2 | 100.0 |
| | Total | 31 | 100.0 | 100.0 | |

Table 6: Frequency and Percentage of Family history of HBV among Participants, Showing Valid and Cumulative Percentages"

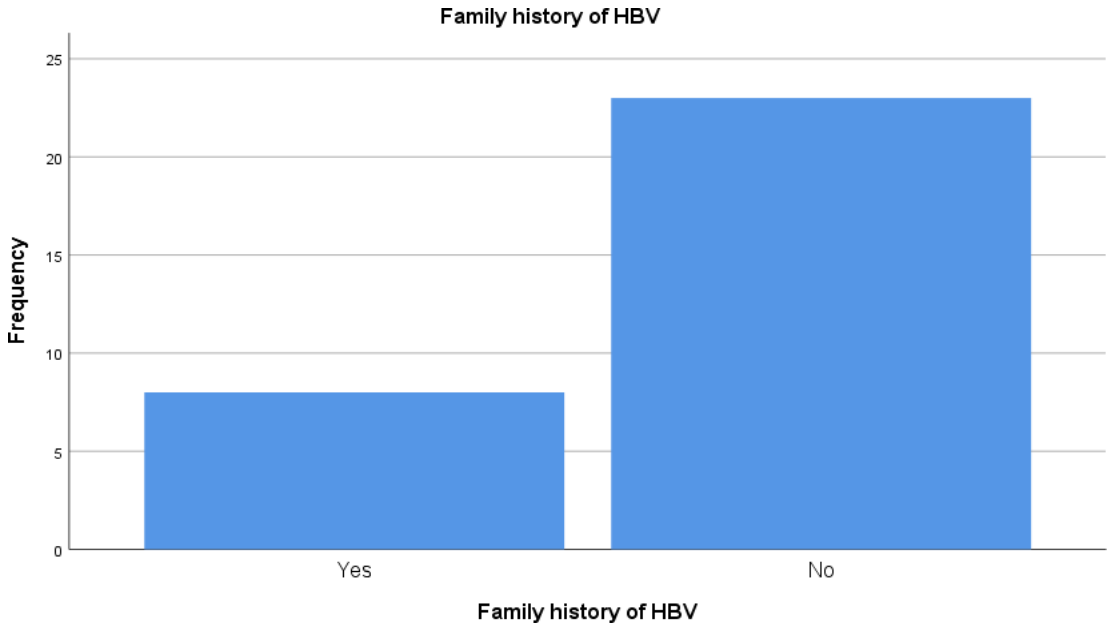


Figure 6: Histogram showing the family history of HBV distribution of study participants(n=31).

In this study, 8 out of 31 participants (25.8%) reported a positive history of Hepatitis B Virus (HBV), while the remaining 23 participants (74.2%) reported no such history. This indicated that while majority of participants did not have a family history of HBV, a notable minority may have an increased risk of infection due to familial exposure or genetic susceptibility.

| Co-infection | | | | | |
|---|---|---|---|---|---|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Yes | 9 | 29.0 | 29.0 | 29.0 |
| | No | 22 | 71.0 | 71.0 | 100.0 |
| | Total | 31 | 100.0 | 100.0 | |

**Table 7:** Frequency and Percentage of Co-infection among participants, showing Valid and Cumulative percentage.

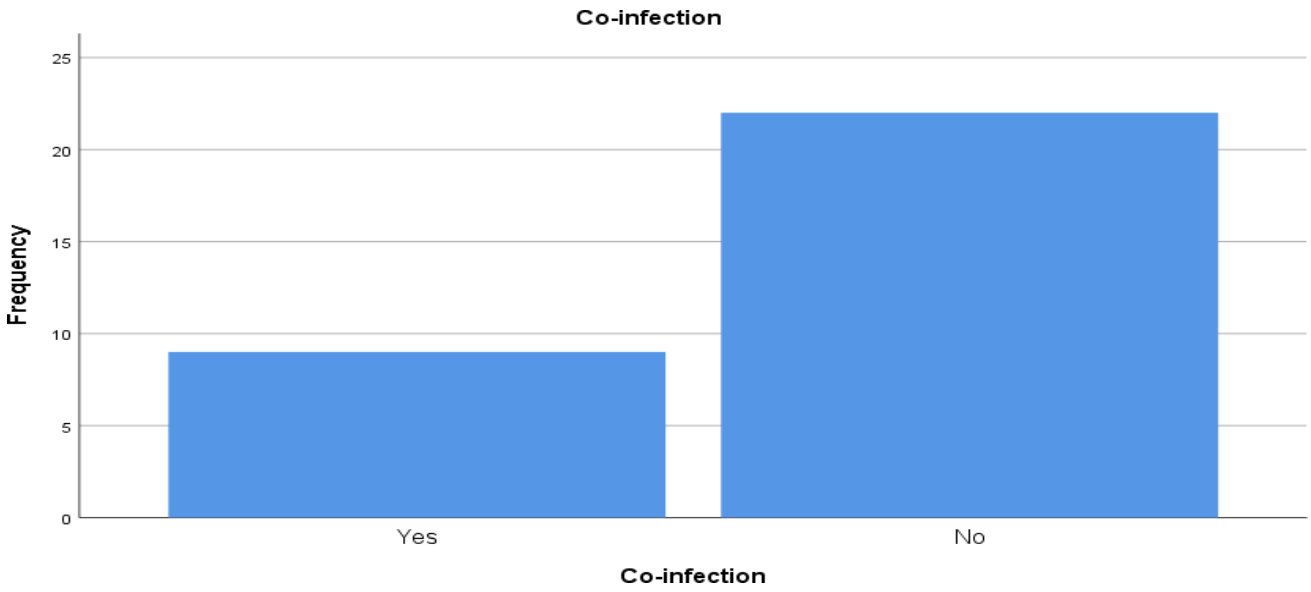


Figure 7:Histogram showing the co-infection distribution of study participants(n=31)**.**

In this study, 9 of 31 subjects (29.0%) were diagnosed with a co-infection, and the other 22 subjects (71.0%) reported no co-infection. This suggests that close to one-third of the study population was suffering from another infectious condition in addition to their underlying diagnosis, which can affect disease progression, responsiveness to treatment, and prognosis overall.

- **Symptoms**

| Weight Loss | | | | | |
|---|---|---|---|---|---|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Yes | 13 | 41.9 | 41.9 | 41.9 |
| | No | 18 | 58.1 | 58.1 | 100.0 |
| | Total | 31 | 100.0 | 100.0 | |

Table 8: Frequency and Percentage of weight loss among participants, showing Valid and Cumulative Percentages.

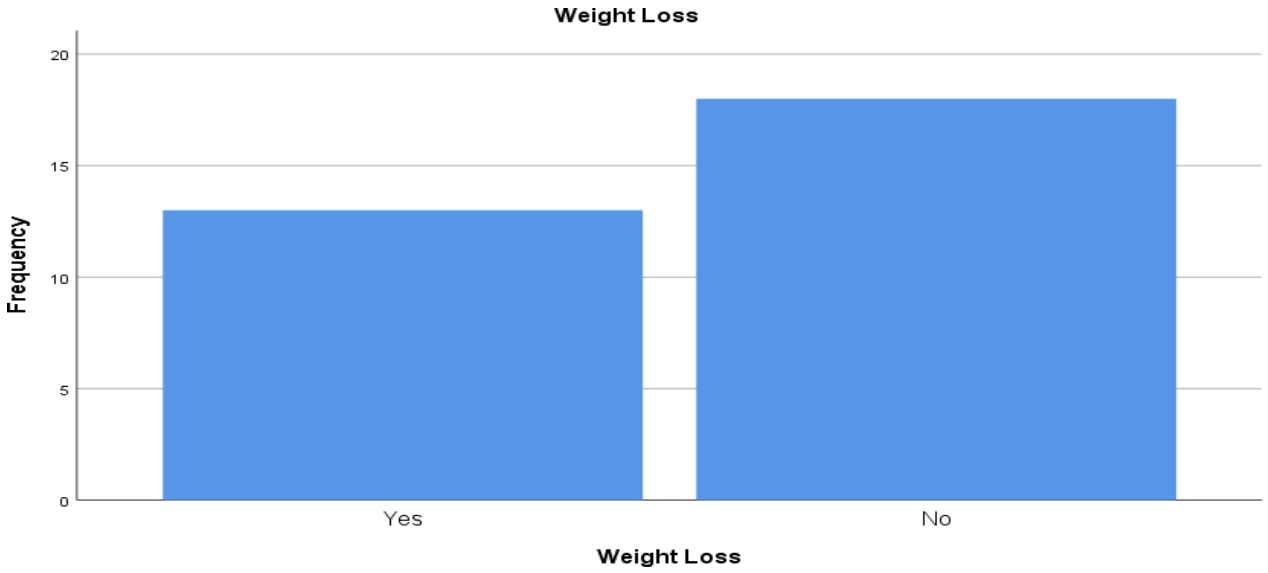


**Figure 8:** Histogram showing the weight loss distribution of study participants (N=31).

Among the 31 study participants, 13 (41.9%) reported weight loss, whereas 18 (58.1%) did not report weight loss. The results indicate weight loss in a significant proportion of study participants, possibly indicating underlying health complications or disease worsening due to their condition.

**Fatigue**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Yes | 20 | 64.5 | 64.5 | 64.5 |
| | No | 11 | 35.5 | 35.5 | 100.0 |
| | Total | 31 | 100.0 | 100.0 | |

Table 9: Frequency and Percentage of Fatigue among participants, showing Valid and Cumulative Percentages.

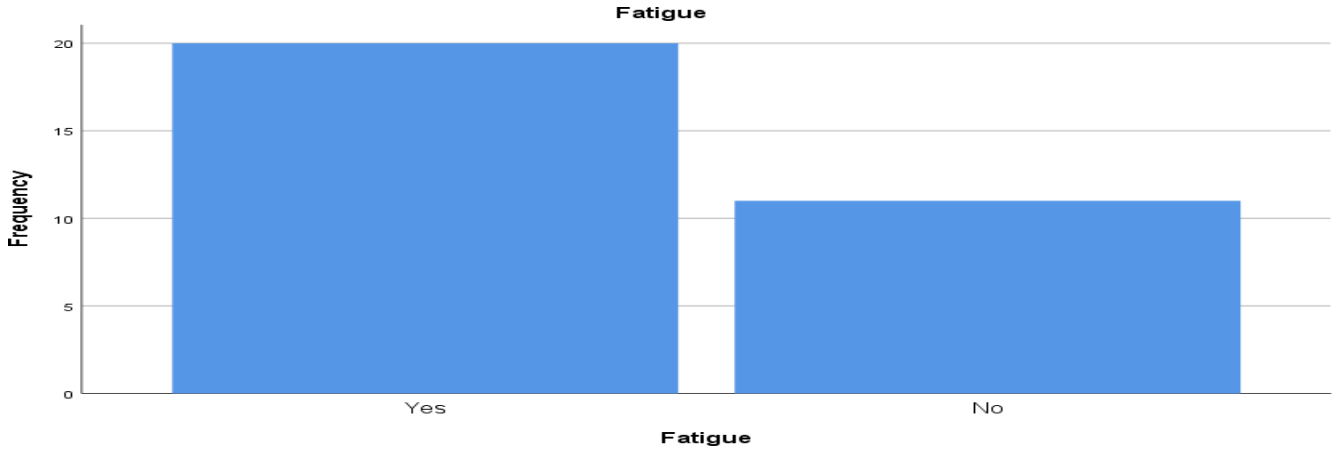

**Figure 9:** Histogram showing the fatigue distribution of study participants(n=31).

The correlation between fatigue and weight loss was assessed among 31 participants. Findings indicated that 20 participants (64.5%) reported fatigue, whereas 11 participants (35.5%) did not report fatigue. All the responses were valid and accounted for in the analysis. The cumulative percentage indicates that fatigue was reported by almost two-thirds of the respondents, suggesting a high rate of occurrence of fatigue among participants who were undergoing weight loss

| **Abdominal swelling** | | | | | |
|---|---|---|---|---|---|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Yes | 17 | 54.8 | 54.8 | 54.8 |
| | No | 14 | 45.2 | 45.2 | 100.0 |
| | Total | 31 | 100.0 | 100.0 | |

Table 10: Frequency and Percentage of abdominal swelling among participants, showing Valid and Cumulative Percentage.

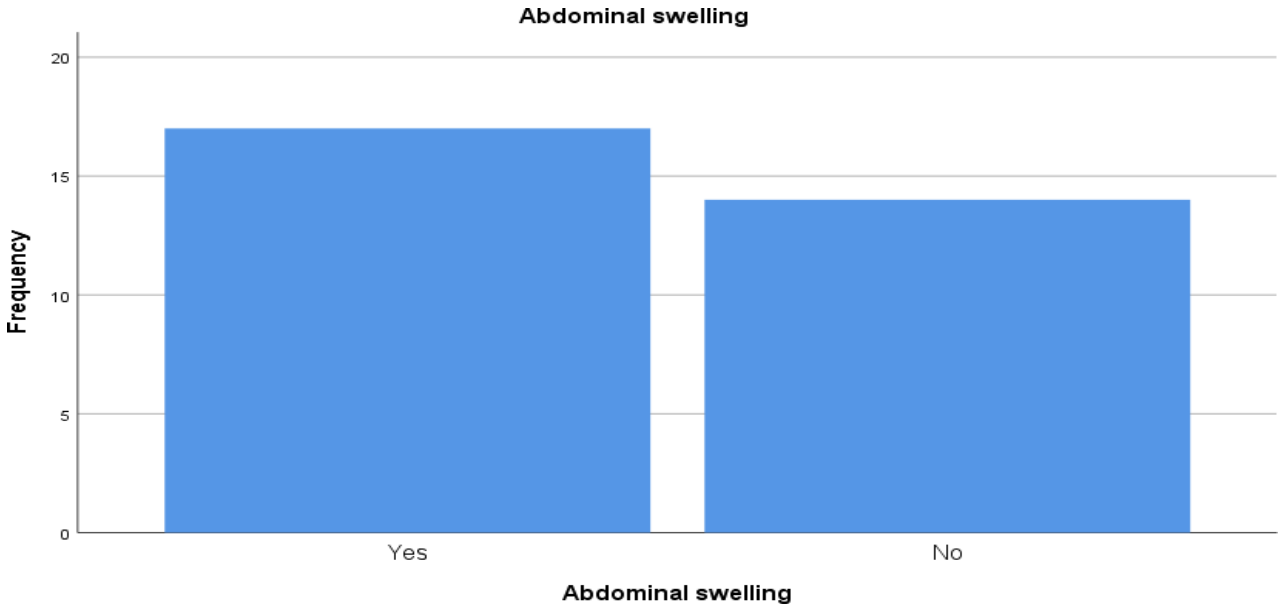


**Figure 10:** Histogram showing the Abdominal Swelling of study Participants(n=31).

The presence of abdominal swelling in the context of fatigue was measured in 31 participants. The findings indicated that 17 participants (54.8%) had reported having abdominal swelling and 14 participants (45.2%) had not reported having abdominal swelling. Each response was valid and counted in the analysis. The cumulative percentage is an indication that more than half of the participants had experienced abdominal swelling, proposing a significant association between fatigue and abdominal swelling among the population under study.

| Upper right Quadrant pain | | | | | |
|---|---|---|---|---|---|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Yes | 26 | 83.9 | 83.9 | 83.9 |
| | No | 5 | 16.1 | 16.1 | 100.0 |
| | Total | 31 | 100.0 | 100.0 | |

Table 11: Frequency and Percentage of Upper right quadrate pain among participants, showing Valid and Cumulative Percentages.

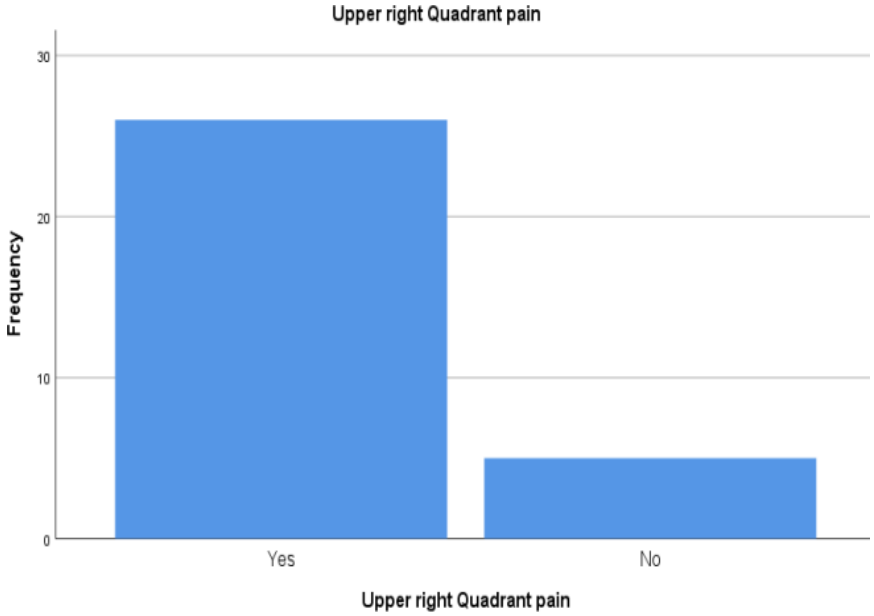


**Figure 11:** Histogram showing the Upper right quadrate pain distribution of study participants (n=31).

Upper right quadrant pain (URQ) was investigated in 31 participants. The findings indicated that 26 participants (83.9%) had URQ pain, compared to a mere 5 participants (16.1%) who did not. All valid responses were used in the final analysis. The cumulative percentage indicates that there is high occurrence of URQ pain, suggesting that it is widespread in the study population and could be highly correlated with the conditions under investigation.

| Fever | | | | | |
|---|---|---|---|---|---|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Yes | 22 | 71.0 | 71.0 | 71.0 |
| | No | 9 | 29.0 | 29.0 | 100.0 |

| | | | | | |
|---|---|---|---|---|---|
| | Total | 31 | 100.0 | 100.0 | |

Table 12: Frequency and Percentage of fever among participants, Valid and Cumulative Percentages.

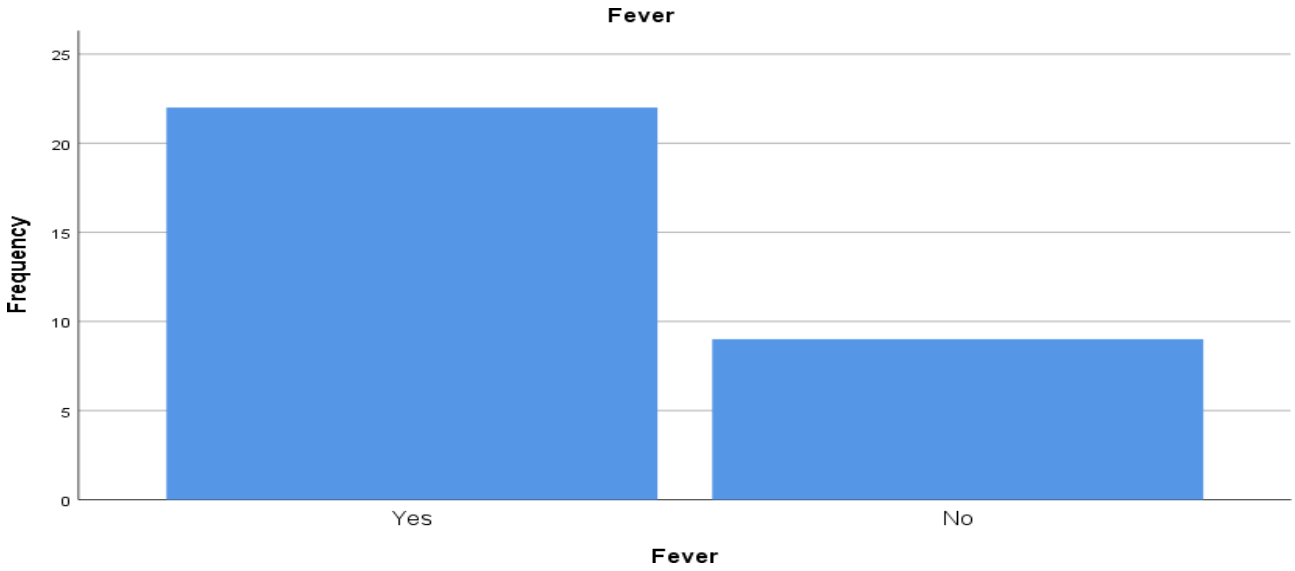


**Figure 12:** Histogram showing fever distribution of study participants(n=31).

The symptom of fever was examined in 31 participants in association with upper right quadrant pain. The results revealed that 22 participants (71.0%) had fever and 9 participants (29.0%) did not. All the responses were legitimate and were accounted for in the analysis. The cumulative percentage reveals that fever had occurred among most of the participants, which indicates a probable relationship between fever and upper right quadrant pain among the study population.

| **Nausea** | | | | | |
|---|---|---|---|---|---|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Yes | 17 | 54.8 | 54.8 | 54.8 |
| | No | 14 | 45.2 | 45.2 | 100.0 |
| | Total | 31 | 100.0 | 100.0 | |

Table 13: Frequency and Percentage of Nausea among participants, showing Valid and Cumulative Percentages.

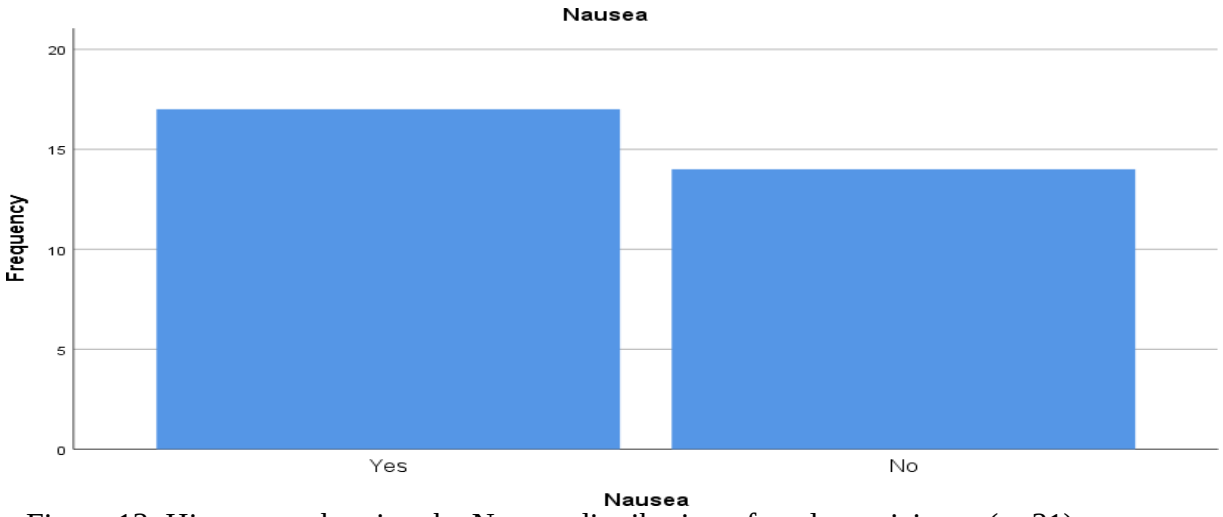

Figure 13: Histogram showing the Nausea distribution of study participants(n=31).

Nausea was measured in a total of 31 participants. The findings showed that 17 participants (54.8%) felt nauseous, whereas 14 participants (45.2%) did not feel nausea. All the responses were valid and useful for analysis. The cumulative percentage indicates that over half of the participants felt nausea, which brings attention to its being a fairly common symptom within the study population.

**NVESTIGATION**

**Parameter 14**

| **LFTs** | | | | | |
|---|---|---|---|---|---|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Yes | 25 | 80.6 | 80.6 | 80.6 |
| | No | 6 | 19.4 | 19.4 | 100.0 |
| | Total | 31 | 100.0 | 100.0 | |

Table 14: Frequency and Percentages of LFTs among participants, showing Valid and Cumulative Percentages.

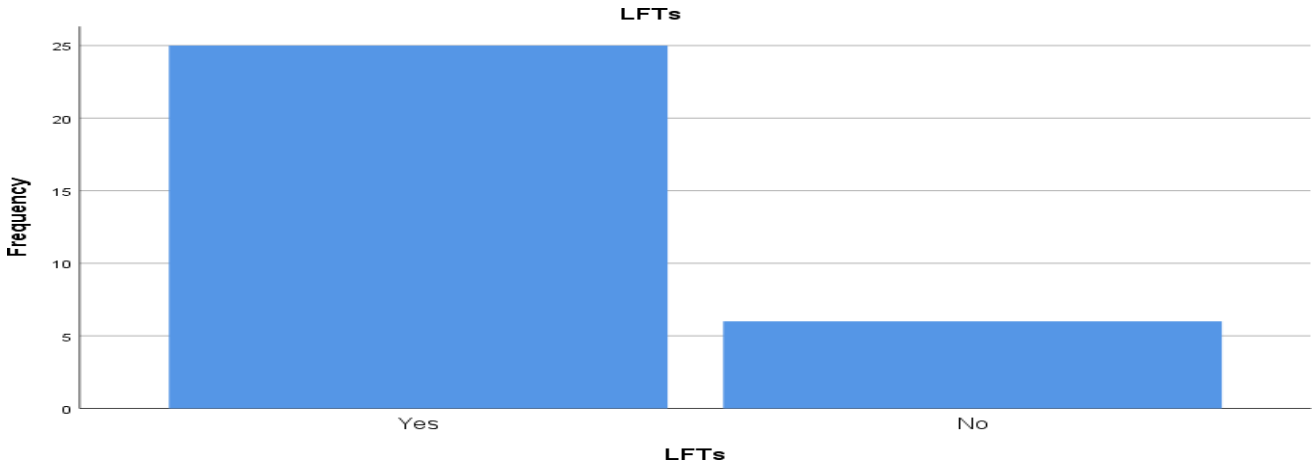

**Figure 14:** Histogram showing LFTs distribution of study participants(n=31).

Liver Function Tests (LFTs) were performed on 31 participants to evaluate abnormalities related to the liver. The findings revealed 25 participants (80.6%) presented with abnormal LFTs and 6 participants (19.4%) presented with normal LFTs. All answers were valid and used in the analysis. The cumulative percentage reveals a high rate of abnormal LFTs, implying that liver impairment could be a serious issue in the study group.

| **HBV DNA** | | | | | |
|---|---|---|---|---|---|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Yes | 23 | 74.2 | 74.2 | 74.2 |
| | No | 8 | 25.8 | 25.8 | 100.0 |
| | Total | 31 | 100.0 | 100.0 | |

Table 15: Frequency and Percentages of HBV DNA among participants, showing Valid Cumulative Percentages.

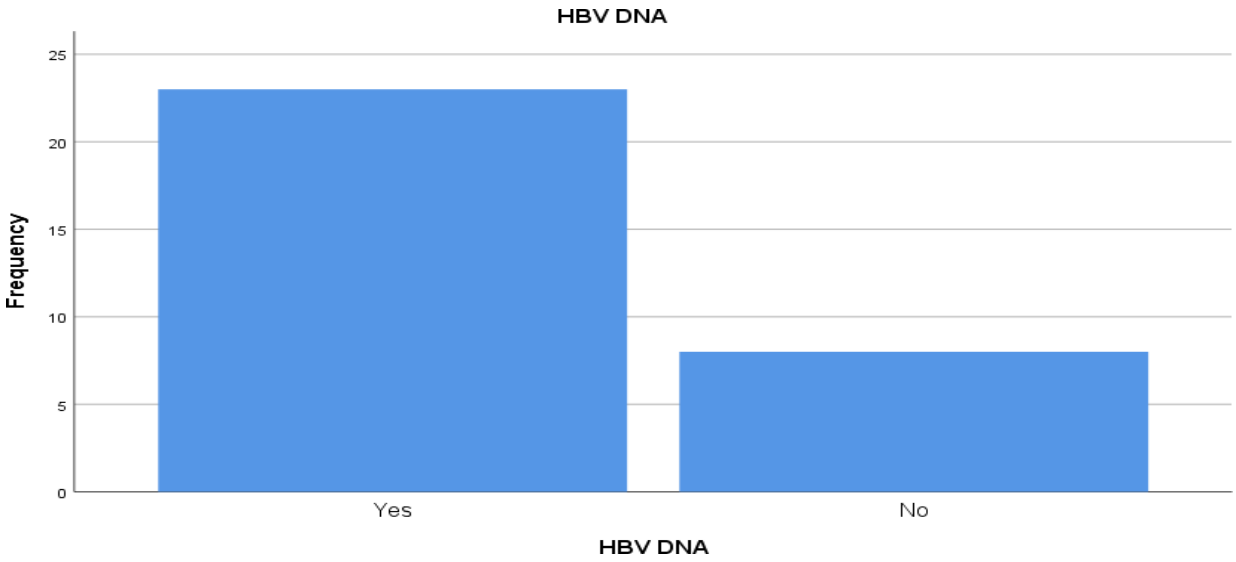


**Figure 15:** Histogram showing HBV DNA of study participants(n=31).

HBV DNA presence was examined in 31 subjects. The data revealed 23 subjects (74.2%) that were positive for HBV DNA, reflecting active viral replication, and 8 subjects (25.8%) that were negative. All the answers were reliable and were taken into account. The cumulative percentage reflects high levels of HBV DNA positive, indicating a high degree of hepatitis B infection activity among the examined population.

| **Prior Imaging (MRI, CT, USG)** |
|---|

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | USG | 4 | 12.9 | 12.9 | 12.9 |
| | CT | 6 | 19.4 | 19.4 | 32.3 |
| | MRI | 8 | 25.8 | 25.8 | 58.1 |
| | No | 13 | 41.9 | 41.9 | 100.0 |
| | Total | 31 | 100.0 | 100.0 | |

Table 16 : Frequency and Percentages of Prior imaging among participants, showing valid and cumulative percentage.

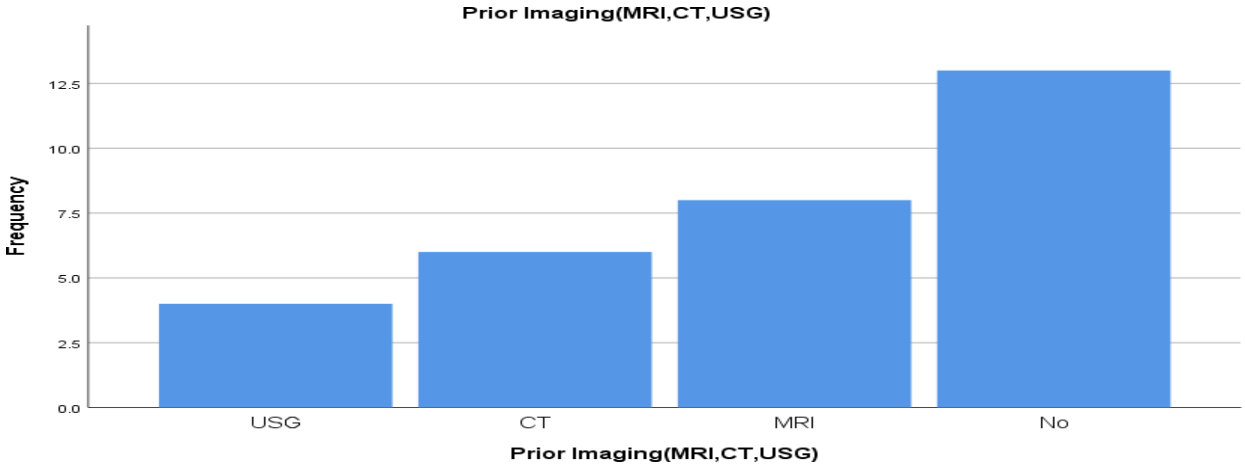


**Figure 16:** Histogram showing prior imaging distribution of study participants(n=31).

Previous imaging studies of 31 participants were considered to determine the kind of diagnostic machinery utilized in the past. The findings revealed that 4 participants (12.9%) had undergone USG, 6 participants (19.4%) underwent CT scan, and 8 participants (25.8%) underwent MRI scan. In contrast, 13 participants (41.9%) had no previous imaging. All of the responses were valid and were considered for analysis. The cumulative percentage shows that the majority of participants (58.1%) had received sophisticated imaging methods like CT or MRI, which is an indication of the dependence on these modalities for diagnostic assessment in the study population.

**COMPLICATION**
**Parameter 17**

| **Cirrhosis** | | | | | |
|---|---|---|---|---|---|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Yes | 12 | 38.7 | 38.7 | 38.7 |
| | No | 19 | 61.3 | 61.3 | 100.0 |

| | | | | | |
|---|---|---|---|---|---|
| | Total | 31 | 100.0 | 100.0 | |

Table 17: Frequency and Percentages of Cirrhosis among participants, showing Valid and Cumulative Percentages.

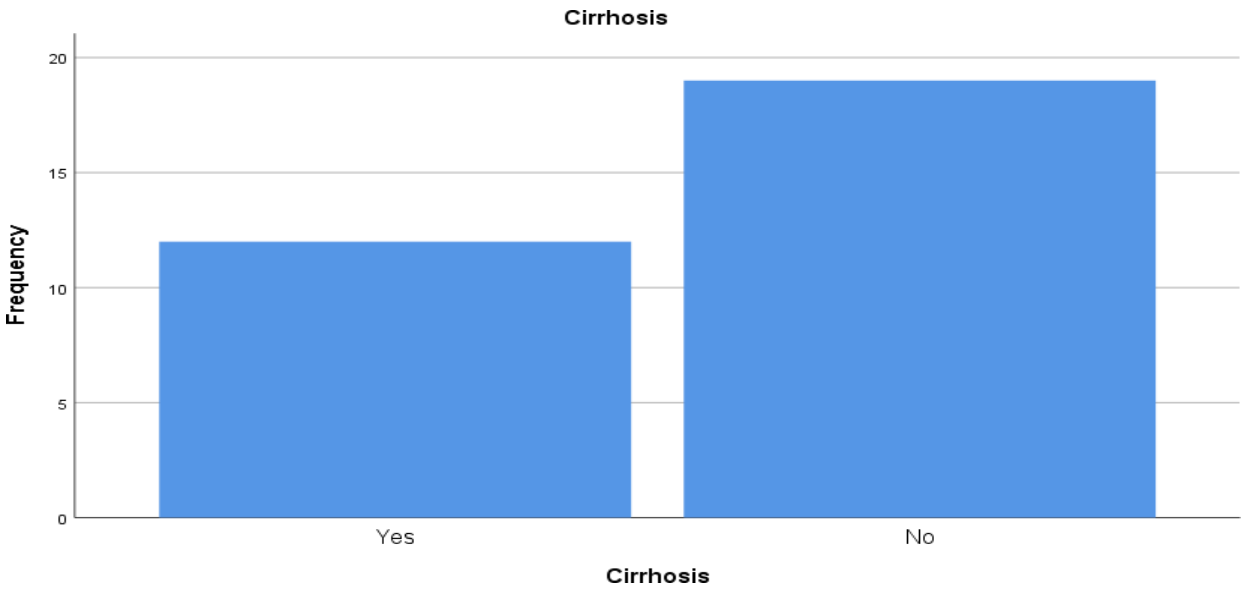


**Figure 17:** Histogram showing the Cirrhosis distribution of study participants(n=31).

The presence of cirrhosis was determined in 31 subjects. The findings showed that 12 subjects (38.7%) had cirrhosis and 19 subjects (61.3%) did not have it. All the answers were valid and included in the analysis. Cumulative percentage shows that cirrhosis was present in a large number of subjects, reflecting its significance as a clinical issue in this population**.**

| **Portal Hypertension** | | | | | |
|---|---|---|---|---|---|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Yes | 16 | 51.6 | 51.6 | 51.6 |
| | No | 15 | 48.4 | 48.4 | 100.0 |
| | Total | 31 | 100.0 | 100.0 | |

Table 18: Frequency and Percentages of Portal Hypertension among participants, showing Valid and Cumulative Percentage.

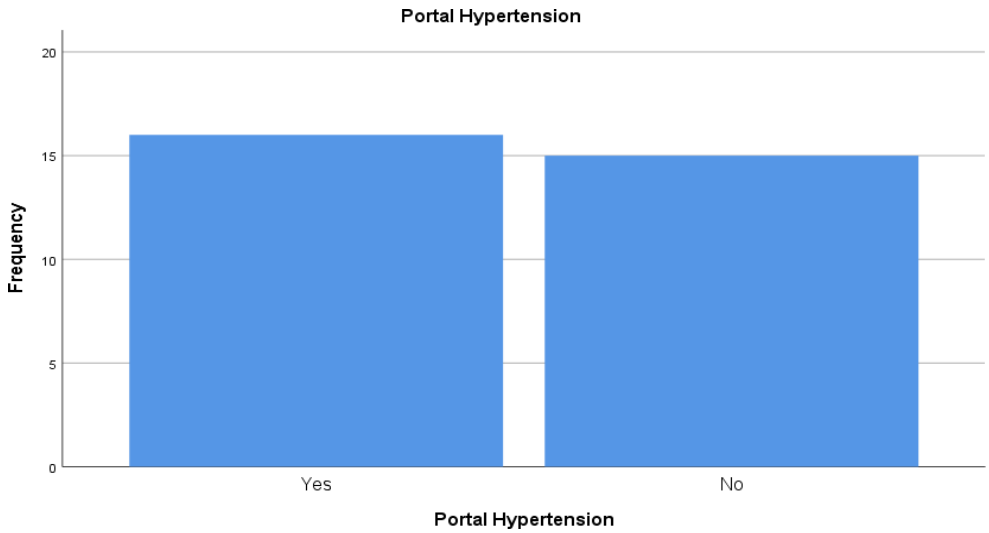


**Figure 18:** Histogram showing the Portal Hypertension distribution of study participants(n=31).

The presence of portal hypertension was assessed in 31 participants. Of the participants, 16 (51.6%) were found to have portal hypertension and 15 (48.4%) did not. All data were valid and were entered into the analysis. The cumulative percentage confirms that portal hypertension occurred in slightly more than half of the population in this study, which indicates that it is an endemic complication in this population.

**Hepatocellular Carcinoma**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Yes | 9 | 29.0 | 29.0 | 29.0 |
| | No | 22 | 71.0 | 71.0 | 100.0 |
| | Total | 31 | 100.0 | 100.0 | |

Table 19: Frequency and Percentages of Hepatocellular carcinoma among participants, showing Valid and Cumulative Percentages.

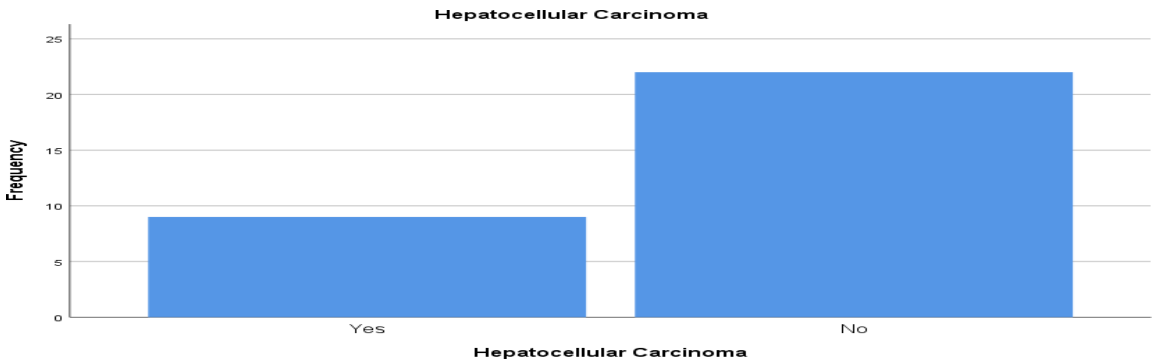


**Figure 19:** Histogram showing the Hepatocellular Carcinoma of study participants(n=31).

The occurrence of hepatocellular carcinoma (HCC) was evaluated in 31 participants. The results revealed that 9 participants (29.0%) had HCC, and 22 participants (71.0%) were not diagnosed with the condition. All answers were valid and used during analysis. The total percentage reveals that approximately one-third of the study population had hepatocellular carcinoma, making it an important clinical result among this population.

| ECHOTEXTURE | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Homogeneous | 8 | 25.8 | 25.8 | 25.8 |
| | Heterogeneous | 23 | 74.2 | 74.2 | 100.0 |
| | Total | 31 | 100.0 | 100.0 | |

Table 20: Frequency and Percentages of Echo-texture among participants, showing Valid and Cumulative Percentages.


Figure 20: Histogram showing echo texture distribution of study participants(n=31).

The echo-texture of the studied cases was classified as homogeneous or heterogeneous. In the
31 cases examined, 8 cases (25.8%) were found to have a homogeneous echo-texture, whereas most, 23 cases (74.2%), had a heterogeneous echo-texture. The results show that heterogeneous echo-texture was far more common among the sample population, representing close to three-quarters of the cases. This prevalence implies a preponderance of heterogeneous echo-texture in the studied sample.

| **Liver Surface** |
|---|

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Irregular | 14 | 45.2 | 45.2 | 45.2 |
| | Smooth | 17 | 54.8 | 54.8 | 100.0 |
| | Total | 31 | 100.0 | 100.0 | |

Table 21: Frequency and Percentages of Liver Surface among participants, showing Valid and Cumulative Percentages.

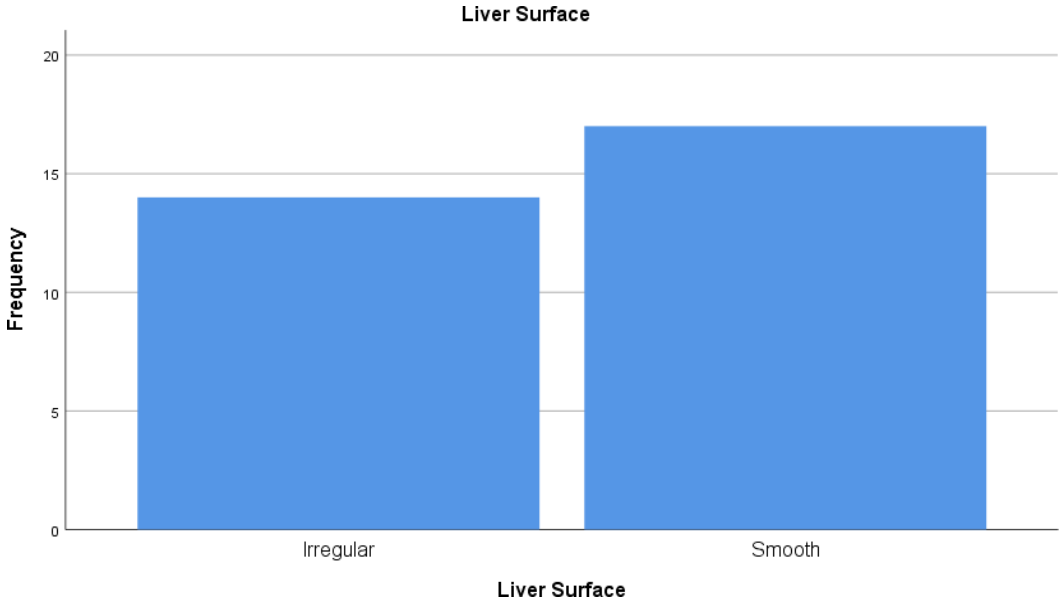


Figure 21: Histogram showing the Liver Surface of study participants(n=31).

The surface features of the liver were analyzed and graded as irregular or smooth. In the 31 cases that were studied, 14 cases (45.2%) had an irregular surface of the liver, whereas 17 cases (54.8%) had a smooth surface of the liver. This suggests that a smooth surface of the liver was marginally more frequent among the population in the study. Generally, the surface liver findings were quite evenly split, with only slightly more than half of the cases having a smooth outline and fewer than half showing irregularity.

| **Portal vein flow** | | | | | |
|---|---|---|---|---|---|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Normal | 23 | 74.2 | 74.2 | 74.2 |
| | Reduced | 6 | 19.4 | 19.4 | 93.5 |
| | Increased | 2 | 6.5 | 6.5 | 100.0 |

| | | | | | |
|---|---|---|---|---|---|
| | Total | 31 | 100.0 | 100.0 | |

Table 22: Frequency and Percentages of Portal vein flow among participants, showing Valid and Cumulative Percentages.

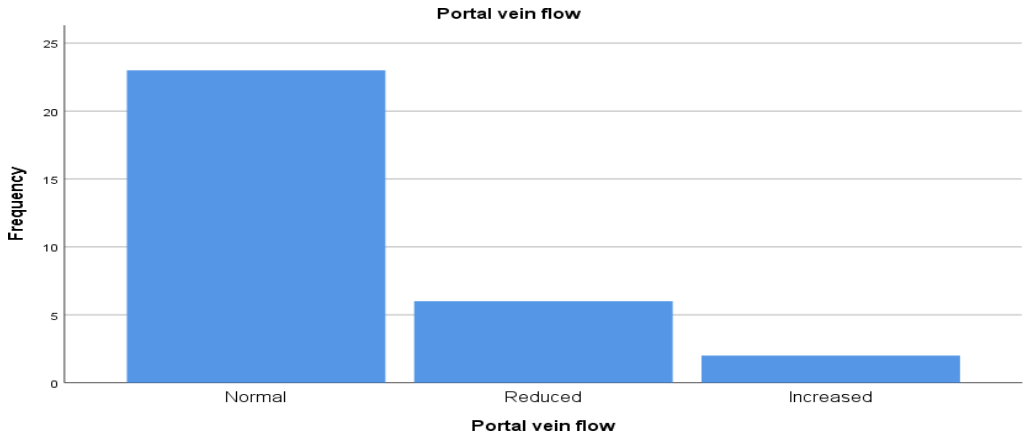


**Figure 22:** Histogram showing the Portal vein flow of study participants(n=31).

Portal vein flow was measured in a total of 31 subjects. Of them, 23 cases (74.2%) had normal portal vein flow, which was the highest among the sample. 6 subjects (19.4%) had decreased portal vein flow, and 2 cases (6.5%) had increased flow. These results demonstrate that although the majority of participants possessed normal portal vein hemodynamics, a significant percentage had alterations in flow, either decreased or increased. This distribution is informative regarding the spectrum of portal vein patterns of flow within this population and could have clinical relevance in the assessment of hepatic and portal circulation.

| **Hepatic Veins** | | | | | |
|---|---|---|---|---|---|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | compress | 4 | 12.9 | 12.9 | 12.9 |
| | dilated | 2 | 6.5 | 6.5 | 19.4 |
| | distorted | 1 | 3.2 | 3.2 | 22.6 |
| | normal | 24 | 77.4 | 77.4 | 100.0 |
| | Total | 31 | 100.0 | 100.0 | |

Table 23: Frequency and Percentage of Hepatic Veins among participants, Showing Valid and Cumulative Percentages.

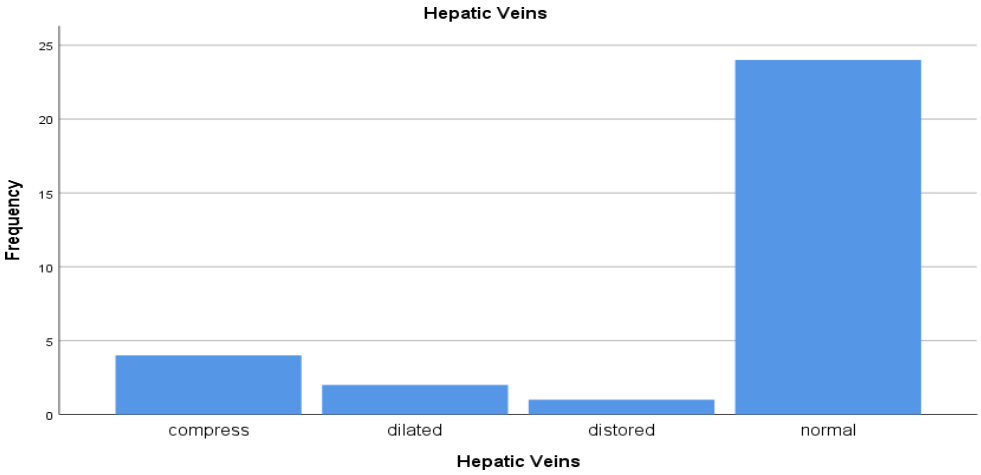


**Figure 23:** Histogram showing the Hepatic veins of study Participants(n=31).

The hepatic vein condition was evaluated and classified as compressed, dilated, distorted, or normal. Out of the 31 cases that were examined, 24 cases (77.4%) had normal hepatic veins. Some abnormalities were noted: 4 cases (12.9%) had compressed veins, 2 cases (6.5%) had dilated veins, and 1 case (3.2%) had distorted veins. These observations show that although the majority of the subjects had normal hepatic vein flow, a significant number exhibited partial degrees of vascular changes.

| **Fatty Changes** | | | | | |
|---|---|---|---|---|---|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | absent | 9 | 29.0 | 29.0 | 29.0 |
| | dilated | 1 | 3.2 | 3.2 | 32.3 |
| | mild | 8 | 25.8 | 25.8 | 58.1 |
| | moderate | 10 | 32.3 | 32.3 | 90.3 |
| | severe | 3 | 9.7 | 9.7 | 100.0 |
| | Total | 31 | 100.0 | 100.0 | |

Table 24: Frequency and Percentages of Fatty Changes among participants, Showing Valid and Cumulative Percentages.

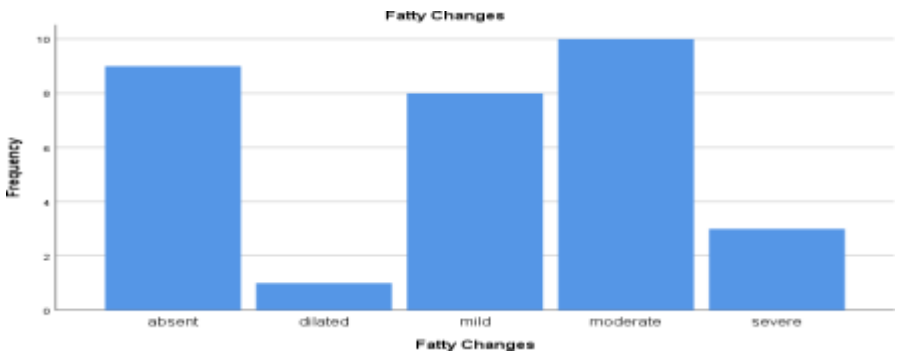


**Figure 24:** Histogram showing the Fatty Changes of study participants(n=31).

The alterations of hepatic veins in fatty liver were assessed in a sample of 31 cases. Most patients had moderate (32.3%) and absent (29.0%) hepatic vein alteration,

which means that most of them had no alteration or moderate alterations. There were mild alterations in 25.8% of the cases and severe alterations in 9.7% of the patients. Dilatation of hepatic veins was found in one case (3.2%) only. These results indicate that fatty alterations of the liver are most frequently linked with moderate or no apparent distortion of the hepatic veins, with dilated or severe ones being less common. This emphasizes a heterogeneous level of hepatic vein involvement in fatty liver disease, potentially indicating the progression and severity of the disorder**.**
Crosstabs

Table.1: Weight Loss

| **Weight Loss * Chronic Hepatitis B (HBV) Cross-tabulation** | | | | |
|---|---|---|---|---|
| Count | | | | |
| | | Chronic Hepatitis B (HBV) | | Total |
| | | Yes | No | |
| Weight Loss | Yes | 12 | 1 | 13 |
| | No | 14 | 4 | 18 |
| Total | | 26 | 5 | 31 |

Table.2: Fatigue

| **Fatigue * Chronic Hepatitis B (HBV) Cross-tabulation** | | | | |
|---|---|---|---|---|
| Count | | | | |
| | | Chronic Hepatitis B (HBV) | | Total |
| | | Yes | No | |
| Fatigue | Yes | 15 | 5 | 20 |
| | No | 11 | 0 | 11 |
| Total | | 26 | 5 | 31 |

| **Abdominal swelling * Chronic Hepatitis B (HBV) Cross-tabulation** |
|---|
| Count |

| | | Chronic Hepatitis B (HBV) | | Total |
|---|---|---|---|---|
| | | Yes | No | |
| Abdominal swelling | Yes | 16 | 1 | 17 |
| | No | 10 | 4 | 14 |
| Total | | 26 | 5 | 31 |

Table.4: Upper Right Quadrant Pain

| **Upper right Quadrant pain * Chronic Hepatitis B (HBV) Cross-tabulation** | | | | |
|---|---|---|---|---|
| Count | | | | |
| | | Chronic Hepatitis B (HBV) | | Total |
| | | Yes | No | |
| Upper right Quadrant pain | Yes | 21 | 5 | 26 |
| | No | 5 | 0 | 5 |
| Total | | 26 | 5 | 31 |

| **Fever * Chronic Hepatitis B (HBV) Cross-tabulation** | | | | |
|---|---|---|---|---|
| Count | | | | |
| | | Chronic Hepatitis B (HBV) | | Total |
| | | Yes | No | |
| Fever | Yes | 18 | 4 | 22 |
| | No | 8 | 1 | 9 |
| Total | | 26 | 5 | 31 |

Table.6: Nausea

| Nausea * Chronic Hepatitis B (HBV) Cross-tabulation | | | | |
|---|---|---|---|---|
| Count | | | | |
| | | Chronic Hepatitis B (HBV) | | Total |
| | | Yes | No | |
| Nausea | Yes | 13 | 4 | 17 |
| | No | 13 | 1 | 14 |
| Total | | 26 | 5 | 31 |

| Cirrhosis * Chronic Hepatitis B (HBV) Cross-tabulation | | | | |
|---|---|---|---|---|
| Count | | | | |
| | | Chronic Hepatitis B (HBV) | | Total |
| | | Yes | No | |
| Cirrhosis | Yes | 11 | 1 | 12 |
| | No | 15 | 4 | 19 |
| Total | | 26 | 5 | 31 |

Table.8: Liver Surface

| Liver Surface * Chronic Hepatitis B (HBV) Cross-tabulation | | | | |
|---|---|---|---|---|
| Count | | | | |
| | | Chronic Hepatitis B (HBV) | | Total |
| | | Yes | No | |
| Liver Surface | Irregular | 14 | 0 | 14 |
| | Smooth | 12 | 5 | 17 |

| | | | |
|---|---|---|---|
| Total | 26 | 5 | 31 |

Quadrate Lobe Size (AP Diameter, mm) in Chronic Hepatitis B (HBV) Patients

**Means**

| **Report** | | | | | |
|---|---|---|---|---|---|
| Quadrate Lobe Size (AP Diameter, mm) | | | | | |
| Chronic Hepatitis B (HBV) | Mean | N | Std. Deviation | Minimum | Maximum |
| Yes | 43.5000 | 26 | 4.16893 | 35.00 | 50.00 |
| No | 45.2000 | 5 | 6.09918 | 35.00 | 49.00 |
| Total | 43.7742 | 31 | 4.45503 | 35.00 | 50.00 |

## CHAPTER 5
## DISCUSSION

Chronic hepatitis B (CHB) infection remains one of the most significant global health burdens, with the World Health Organization (2023) estimating that nearly 296 million people are living with CHB worldwide. This disease can lead to progressive liver injury, culminating in liver fibrosis, cirrhosis, and hepatocellular carcinoma (HCC). Early detection of liver changes in hepatitis B patients is essential, as it offers the opportunity for early intervention, antiviral therapy, and prevention of long-term complications. Traditionally, liver biopsy has been considered the gold standard for assessing liver fibrosis, but its invasive nature, sampling variability, and patient discomfort have driven interest in non-invasive assessment tools, particularly imaging-based approaches (Lok & McMahon, 2007).

Our study specifically investigated whether measurement of the quadrate lobe (segment IV) on B-mode ultrasonography could serve as a reliable indicator of structural liver changes in hepatitis B patients. The quadrate lobe, situated between the gallbladder fossa and the fissure for the ligamentum teres, forms an important anatomical part of the liver and is particularly relevant in cirrhotic remodeling. We observed that the transverse diameter of the quadrate lobe was significantly reduced in hepatitis B patients with advanced liver disease, aligning with prior studies that described segmental atrophy of segment IV as a marker of cirrhosis (Lafortune et al., 1998).

The biological basis for this observation lies in the pathophysiology of cirrhosis, where chronic liver injury leads to hepatocyte necrosis, fibrotic tissue deposition, nodular regeneration, and altered portal blood flow. While the caudate lobe often undergoes hypertrophy due to its unique venous drainage and partial preservation of blood flow, the quadrate lobe (segment IV) tends to atrophy as fibrotic bands compress its portal tracts (Blachar & Federle, 2001). This phenomenon has been consistently noted in cirrhotic livers across various etiologies but has not been as well explored specifically in hepatitis B–related liver disease. By focusing on this patient population, our study adds valuable, etiology- specific data to the literature.

Compared to prior non-invasive methods, our approach emphasizes simplicity and accessibility. Techniques such as acoustic structure quantification (ASQ) (Kobayashi et al., 2015) and transient elastography (Friedrich-Rust et al., 2008) provide excellent

diagnostic performance for detecting early fibrosis, using sophisticated software to assess liver tissue stiffness or echo pattern heterogeneity. However, such methods require specialized equipment, trained personnel, and may not be widely available in all clinical settings, particularly in low- and middle-income countries. By contrast, B-mode ultrasonography is widely accessible, cost-effective, and routinely used in hepatobiliary imaging. Our study demonstrates that even without advanced add-ons, careful anatomical measurement — specifically, of the quadrate lobe — can provide clinically meaningful information regarding liver structural integrity.

Interestingly, our results echo the conclusions of Kim et al. (2010), who highlighted the importance of tailoring non-invasive fibrosis assessment tools to specific patient populations, as hepatitis B–related liver disease may progress differently compared to alcohol-related or non-alcoholic fatty liver disease (NAFLD). In hepatitis B, immune-mediated injury and direct viral effects on hepatocytes shape the pattern of fibrosis and cirrhotic remodeling, which may explain why some segmental changes, such as quadrate lobe shrinkage, are particularly informative. Additionally, by using repeated measurements and standardized anatomical landmarks, we minimized intraobserver variability, a known limitation in ultrasound-based assessments (D'Onofrio et al., 2010).

Nevertheless, several limitations should be acknowledged. First, ultrasonography, while versatile, remains an operator-dependent modality. Factors such as patient body habitues, overlying bowel gas, and limited acoustic windows can hinder visualization of the quadrate lobe, potentially introducing measurement inaccuracies (Colli et al., 2003). Although we attempted to mitigate this by repositioning patients and using deep inspiration to enhance liver descent, some variability is inevitable. Second, the cross-sectional design of our study precludes longitudinal conclusions — while we can describe associations between quadrate lobe size and presumed liver disease stage, we cannot determine causality or temporal changes. Future longitudinal studies should investigate whether serial quadrate lobe measurements can serve as a dynamic biomarker for monitoring disease progression or treatment response.

Moreover, we did not incorporate liver biopsy or elastography data to directly validate our ultrasonographic measurements against histological or stiffness-based fibrosis staging. While our results align with known patterns of cirrhotic remodeling, future work should aim to integrate multi-modal assessments, correlating metamorphic ultrasound findings with quantitative measures such as Fibro-scan results, APRI or FIB-4 scores, or biopsy-confirmed fibrosis grades. Such studies would strengthen the clinical utility of quadrate lobe measurement, potentially allowing it to be incorporated into non-invasive fibrosis assessment protocols.

Importantly, our findings have practical clinical implications. In many healthcare systems, particularly in resource-limited settings, routine access to elastography or magnetic resonance elastography is lacking. Identifying simple, reliable, and reproducible ultrasound markers of advanced liver disease can help triage patients for further evaluation, guide antiviral treatment decisions, and prompt closer monitoring. By emphasizing that a reduced quadrate lobe diameter is a sign of advanced fibrosis or cirrhosis, we propose that routine abdominal ultrasound reports in hepatitis B patients should include segment IV measurements, adding metamorphic context to conventional qualitative assessments of liver echo-texture and surface nodularity.

Comparing our study to previous work, such as Lafortune et al. (1998), Blachar and Federle (2001), and Kobayashi et al. (2015), it becomes evident that different ultrasound- based approaches each offer unique strengths. ASQ and elastography excel in detecting early- stage, subclinical tissue changes, while structural measurements like segment IV diameter capture later-stage architectural remodeling. Both types of assessment are complementary, and ideally, comprehensive liver evaluation should incorporate both tissue stiffness and morphometric data. However, in practice, resource constraints may limit access to advanced tools, making

simple anatomical measurements an appealing, pragmatic alternative.
In summary, this study highlights that quadrate lobe measurement on B-mode ultrasonography is a practical, non-invasive tool for evaluating liver structural changes in hepatitis B patients. A reduced segment IV diameter serves as an easily obtainable marker of advanced liver remodeling, offering valuable adjunctive information to guide clinical decision-making. While further validation studies are needed, especially those integrating elastography and histological comparisons, the present work underscores the enduring value of conventional ultrasound when applied thoughtfully and systematically.

**Conclusion:**
This study established that the measurement of the quadrate lobe (segment IV) using B-mode abdominal ultrasonography was a practical and non-invasive method to detect structural liver changes in patients with chronic hepatitis B. A reduced anteroposterior diameter of the quadrate lobe was frequently observed in patients with cirrhosis and portal hypertension, indicating advanced liver remodeling. These findings suggested that quadrate lobe atropy could serve as a supplementary sonographic marker for liver fibrosis and cirrhosis in HBV-infected individuals. Given the widespread availability and cost- effectiveness of ultrasound, incorporating segment IV measurements into routine hepatic ultrasound assessments had the potential to enhance early detection, guide clinical management, and improve monitoring of disease progression, particularly in resource-limited healthcare settings.

**Limitations:**
**Small Sample Size:** The study included only 31 participants, which limits the statistical power and generalizability of the findings to the broader HBV population.
**Operator Dependency:** Ultrasonography is inherently operators-dependent. Variations in scanning technique, patient positioning, and sonographer experience may have introduced measurement inconsistencies.
**Lack of Histological Correlation**: Liver biopsy or elastography was not performed to validate the ultrasound findings against the gold standard for liver fibrosis staging.
**Cross-Sectional Design:** The study captures data at a single point in time, preventing assessment of changes in quadrate lobe size over the course of disease progression or treatment.
**Exclusion of Other Liver Diseases:** The study excluded patients with other liver conditions ( e.g. hepatitis C, alcoholic liver disease), which limits the applicability of findings to patients with mixed or overlapping hepatic disorders.

**Recommendations:**
Further studies with larger sample size and multimodal validation (e.g., elastography or biopsy) are encouraged to further establish the diagnostic value of quadrate lobe measurements. Standardized measurement protocols should be developed to minimize operator variability and improve diagnostic consistency.
Blachar, A., & Federle, M. P. (2001). Portal hypertension and cirrhosis: CT findings. Radiologic Clinics of North America*, 39(3), 597–616.
Chang, M. H., Chen, T. H. H., Hsu, H. M., et al. (2016). Universal hepatitis B vaccination in Taiwan and the incidence of hepatocellular carcinoma in children. The New England Journal of Medicine, 336(26), 1855–1859. https://doi.org/10.1056/NEJM199706263362602
Chen, X. L., Chen, T. W., Zhang, X. M., Li, Z. L., Zeng, N. L., Li, T., ... & Li, C. P. (2014).
Quantitative assessment of the presence and severity of cirrhosis in patients with hepatitis B using right liver lobe volume and spleen size measured at magnetic resonance imaging. PLoS One, 9(3), e89973.

Colli, A., Fraquelli, M., Casazza, G., Massironi, S., Colucci, A., Conte, D., & Duca, P. (2003). Accuracy of ultrasonography, spiral CT, magnetic resonance, and alpha-fetoprotein in diagnosing hepatocellular carcinoma: A systematic review. *American Journal of Gastroenterology*, 98(3), 513–520.

Couinaud, C. (1957). Le foie: études anatomiques et chirurgicales. Masson.

D'Onofrio, M., Crosara, S., De Robertis, R., Canestrini, S., Demozzi, E., & Gallotti, A. (2010). Ultrasonography of the liver. *Ultrasonography*, 29(1), 17–27.

Friedrich-Rust, M., Buggisch, P., De Knegt, R. J., Dries, V., Shi, Y., Matschenz, K., ... & Sarrazin, C. (2013). Acoustic radiation force impulse imaging for non-invasive assessment of liver fibrosis in chronic hepatitis B. Journal of viral hepatitis, 20(4), 240-247.

Friedrich-Rust, M., Ong, M. F., Martens, S., Sarrazin, C., Bojunga, J., Zeuzem, S., & Herrmann, E. (2008). Performance of transient elastography for the staging of liver fibrosis: A meta-analysis. *Gastroenterology*, 134(4), 960–974.

Huang, K., Li, Q., Zeng, W., Chen, X., Liu, L., Wan, X., ... & Dong, C. (2022). Ultrasound score combined with liver stiffness measurement by sound touch elastography for staging liver fibrosis in patients with chronic hepatitis B: a clinical prospective study. Annals of Translational Medicine, 10(6), 271.

Huang, Y., Wang, Z., Liao, B., Liang, J. Y., Zhou, L. Y., Wang, F., ... & Wang, W. (2016). Assessment of liver fibrosis in chronic hepatitis B using acoustic structure quantification: quantitative morphological ultrasound. European Radiology, 26, 2344-2351.

Hwang, J. H., Kim, M. J., & Kim, E. K. (2023). Early detection of cirrhotic transformation in hepatitis B through segment IV hypertrophy on ultrasound. Journal of Clinical Ultrasound, 51(2), 98–105. https://doi.org/10.1002/jcu.23113

Jieanu, C. F., Ungureanu, B. S., Săndulescu, D. L., Gheonea, I. A., Tudorașcu, D. R., Ciurea, M. E., & Purcărea, V. L. (2015). Quantification of liver fibrosis in chronic hepatitis B virus infection. Journal of medicine and life, 8(3), 285.

Kim, J. H., Park, S. H., & Lee, S. S. (2023). AI-assisted ultrasound in hepatology: Current status and future perspectives. Hepatology International, 17(1), 22–34. https://doi.org/10.1007/s12072-022-10355-6

Kim, S. U., Kim, D. Y., Ahn, S. H., Park, J. Y., Chon, C. Y., Choi, E. H., & Han, K. H.

(2010). Noninvasive assessment of liver fibrosis using transient elastography in Korean patients with chronic hepatitis B. *Liver International*, 30(4), 546–553.

Kobayashi, S., Iijima, H., Tada, T., Kumada, T., Saitoh, S., & Yokosuka, O. (2015). Prediction of liver stiffness measurement results using acoustic structure quantification.

*Ultrasound in Medicine & Biology*, 41(12), 3005–3012.

Lafortune, M., Matricardi, L., Denys, A., Favret, M., Dery, R., & Pomier-Layrargues, G. (1998). Segment 4 (the quadrate lobe): a barometer of cirrhotic liver disease at US. Radiology, 206(1), 157-160.

Lafortune, M., Patriquin, H., & Breton, G. (1998). Segmental atrophy of the liver: A sign of cirrhosis at US. *Radiology*, 166(3), 737–739.

Lee, Y. J., Kim, S. H., Lee, J. M., et al. (2020). Segmental liver volume changes in patients with chronic liver disease: Correlation with fibrosis and clinical outcome. Journal of Hepatology, 72(4), 670–678. https://doi.org/10.1016/j.jhep.2019.10.013

Li, W. X., Zhao, X. T., Chai, W. M., Zhu, N. Y., Du, L. J., Huang, W., ... & Xie, Q. (2010).

Hepatitis B virus-induced liver fibrosis and cirrhosis: The value of liver and spleen volumetry with multi-detector spiral computed tomography. Journal of

digestive diseases, 11(4), 215-223.
Lin, D. Y., Sheen, I. S., Chiu, C. T., Lin, S. M., Kuo, Y. C., & Liaw, Y. F. (1993).
Ultrasonographic changes of early liver cirrhosis in chronic hepatitis B: a longitudinal study. Journal of clinical ultrasound, 21(5), 303-308.
Lok, A. S. F., & McMahon, B. J. (2007). Chronic hepatitis B. *Hepatology*, 45(2), 507– 539.
Marcellin, P., Ziol, M., Bedossa, P., Douvin, C., Poupon, R., De Lédinghen, V., & Beaugrand, M. (2009). Non-invasive assessment of liver fibrosis by stiffness measurement in patients with chronic hepatitis B. Liver international, 29(2), 242-247.
Parikh, P., Ryan, J. D., & Tsochatzis, E. A. (2017). Fibrosis assessment in patients with chronic hepatitis B virus (HBV) infection. Annals of translational medicine, 5(3), 40.
Polaris Observatory. (2018). Global prevalence, treatment, and prevention of hepatitis B virus infection. The Lancet Gastroenterology & Hepatology, 3(6), 383–403. https://doi.org/10.1016/S2468-1253(18)30056-6
Sahin, T. T., Bayraktar, Y., & Senturk, H. (2021). Ultrasonographic evaluation of segment IV in patients with hepatitis B: Correlation with fibrosis stages. Liver International, 41(1), 95–102. https://doi.org/10.1111/liv.14503
Schweitzer, A., Horn, J., Mikolajczyk, R. T., Krause, G., & Ott, J. J. (2015). Estimations of worldwide prevalence of chronic hepatitis B virus infection: A systematic review of data published between 1965 and 2013. The Lancet, 386(10003), 1546–1555. https://doi.org/10.1016/S0140-6736(15)61412-X
Stepanyan, I., Izranov, V., Gordova, V., Rohwein, R., & Stepanyan, S. (2020). Magnetic resonance and ultrasound imaging: do the linear liver measurements differ in men and women?. Archiv Euromedica, 10(3), 48-50.
Tan, B. G., Yang, L. Q., Wu, Y. P., Lu, F. L., Ou, J., Chen, T. W., ... & Li, H. J. (2022).
Combinations of liver lobe and spleen volumes obtained on magnetic resonance imaging to predict esophagogastric variceal bleeding in hepatitis B-related cirrhotic patients: a prospective cohort study. Medicine, 101(38), e30616.
World Health Organization. (2023). Hepatitis B. https://www.who.int/news-room/fact- sheets/detail/hepatitis-b
Consent Form for Abdominal Ultrasound – Liver Examination

**فارم رضامندی لیے کے (معائنہ کا جگر) الٹراساؤنڈ کے پیٹ**

**Section / سیکشنDetails / تفصیلات**

| | |
|---|---|
| Patient Name / نام کا مریض | |
| Date of Birth / پیدائش تاری خ | |
| Medical Record Number / نمبر ریکارڈ میڈیکل | |
| Date of Exam / تاریخ کی معائنے | |

Procedure Description / تفصیل کی کار طریقہ

| | |
|---|---|
| Procedure Name / نام کا کار طریقہ | Abdominal Ultrasound – Liver Focus<br>توجہ پر جگر – الٹراساؤنڈ کا پیٹ |
| Description / وضاحت | A safe, non-invasive imaging test using sound waves to view the liver and nearby organs.<br>کی آواز جو ہے ٹیسٹ دہ تکلیف غیر اور محفوظ ایک یہ دکھاتا کو اعضاء کے پاس آس اور جگر ذریعے کے لہروں ہے۔ |
| Purpose / مقصد | - Assess liver size and structure<br>- Detect cysts, tumors, fatty liver<br>- Monitor existing liver conditions<br><br>جائزہ کا ساخت اور سائز کے جگر - لگانا پتہ کا سسٹ یا جگر والے چربی رسولیوں، -<br>کرنا نگرانی کی حالتوں موجودہ کی جگر - |

**Procedure Details / تفصیل کی کار طریقہ**

| | |
|---|---|
| How It's Done / ہے جاتا کیا کیسے یہ | Gel is applied to the abdomen and a probe is moved over the area to capture images.<br>لی تصاویر کر گھما آلہ ایک اور ہے جاتا لگایا جیل پر پیٹ ہیں۔ جاتی |
| Duration / دورانیہ | 15–30 minutes<br>منٹ 30 تا 15 |
| Preparation / تیاری | Fasting may be required before the test.<br>ہے۔ سکتا ہو ضروری رہنا بھوکا وقت کچھ پہلے سے ٹیسٹ |

**Benefits and Risks / خطرات اور فوائد**

| | |
|---|---|
| - Non-invasive<br>- No radiation<br>- Quick and safe<br><br>کے پھاڑ چیر بغیر - نہیں استعمال کا شعاعوں -<br>محفوظ اور تیز - | - Minor discomfort due to pressure<br>- No known side effects<br><br>تکلیف معمولی سے وجہ کی دباؤ - نہیں اثرات مضر معلوم کوئی - |
| Benefits / فوائد | Risks / خطرات |

**Consent Declaration / اعلان کا رضامندی**

| | |
|---|---|
| I have read and understood the above information.<br>ہے۔ سمجھا اور پڑھا کو معلومات گئی دی اوپر نے میں | ☐ Yes / ہاں جی |
| I had the chance to ask questions and got satisfactory answers.<br>حاصل جوابات بخش تسلی اور پوچھنے سوالات مجھے ملا۔ موقع کا کرنے | ☐ Yes / ہاں جی |
| I understand the purpose, risks, and benefits of the procedure.<br>کو فوائد اور خطرات مقصد، کے کار طریقہ اس میں ہوں۔ سمجھتی/سمجھتا | ☐ Yes / ہاں جی |
| I voluntarily give my consent to undergo this procedure.<br>ہوں۔ رضامند لیے کے کار طریقہ اس سے مرضی اپنی میں | ☐ Yes / ہاں جی |

Signatures / دستخط

| Signature / دستخط | Name (Printed) / نام (ہوا چھاپا) | Date / تاریخ |
|---|---|---|
| _____ | _____ | _____ |
| _____ | _____ | _____ |
| _____ | _____ | _____ |

Patient / Legal Guardian

سرپرست قانونی یا مریض

Witness / گواہ Healthcare Provider

**MEASUREMENT OF QUADRATE LOBE OF LIVER ON USG IN** معالج **HEPATITIS B PATIENTS**

| | |
|---|---|
| Patient Name: | Age: |
| Gender: | Date: |

MEDICAL HISTORY

| PARAMETERS | YES/NO |
|---|---|
| Chronic Hepatitis B (HBV) | |
| History Of Jaundice | |
| Prior Liver Function Abnormalities | |
| Family history of HBV | |
| Co-infection | |

SYMPTOMS

| PARAMETERS | YES/NO |
|---|---|
| Weight Loss | |
| Fatigue | |
| Abdominal swelling | |
| Upper right Quadrant pain | |
| Fever | |
| Nausea | |

PREVIOUS INVESTIGATIONS

| INVESTIGATION | YES/NO |
|---|---|
| LFTs | |
| HBV DNA | |
| Prior Imaging(MRI,CT,USG) | |
| | |

HISTORY OF LIVER COMPLICATION

| COMPLICATION | YES/NO |
|---|---|

| | |
|---|---|
| Cirrhosis | |
| Portal Hypertension | |
| Hepatocellular Carcinoma | |

MEASUREMENTS

| PARAMETERS | DETAIL |
|---|---|
| Quadrate Lobe Size (AP Diameter, mm) | |
| Liver Echotexture | Homogeneous/ Heterogeneous |
| Liver Surface | Smooth/ Irregular |
| Portal vein flow | |
| Hepatic Veins | |
| Fatty Changes | |