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Clinical Evaluation of APRI as a Non-Invasive Screening Tool for Liver Fibrosis and Cirrhosis in Faisalabad, Punjab, Pakistan

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Abstract

The Aspartate Transaminase-to-Platelet Ratio Index (APRI) has emerged as a simple, inexpensive, non-invasive alternative based on laboratory parameters that are routinely available. The objective of the present study was to assess the feasibility of APRI as an inexpensive screening test for liver cirrhosis in adult population of Faisalabad, Punjab, Pakistan. A total of 275 persons were screened, out of which 247 participants (128 females and 119 males) aged 18-70 years were included and the subjects were selected by non-probability purposive sampling technique. Patients who had a history of dengue fever, malaria, blood transfusion, non-alcoholic fatty liver disease (NAFLD), hepatic malignancies, or liver transplantation were excluded from the study. The formula for APRI scores was: (AST ÷ Upper Limit of Normal AST) ÷ Platelet Count ($\times 10^9$/L) × 100. Data were analyzed statistically using IBM SPSS software including the Spearman's rho correlation and receiver operating characteristic (ROC) curve analysis. The most prevalent age groups were 31–45 years (37.7%) and 46–60 years (32.8%). The distribution of APRI scores showed that 15.0% (37) of the participants had APRI scores ≥2.0, representing severe cirrhosis and 29.6% (73) of participants had APRI scores >1.5, indicating significant fibrosis. Moreover, 137 of the participants (55.5%) had APRI values lesser than 0.5. Spearman's rho analysis showed a significant negative correlation between the platelet count and AST level ($r = -0.817$, $p < 0.01$). APRI had a very strong positive correlation with AST levels ($r = 0.951$, $p < 0.01$), a strong negative correlation with platelet count ($r = -0.930$, $p < 0.01$). The area under the receiver operating characteristics curve (AUC) was 1.000 (95% CI: 1.000–1.000; $p < 0.001$), signifying good discriminatory capacity of APRI for liver cirrhosis.

The results prove that the APRI is a very accurate, reliable and cost-effective non-invasive screening test for liver fibrosis and cirrhosis. It is simple, easily accessible, and can be especially beneficial in resource-limited healthcare environments in Pakistan, where it can aid in the timely diagnosis, timely clinical interventions, and better health outcomes for patients.

INTRODUCTION

Liver cirrhosis is defined as a chronic and progressive liver disease where there is a widespread fibrosis, regeneration of liver nodules, loss of normal hepatic architecture followed by reduced liver function and portal hypertension. It is the end result of different chronic liver diseases and is responsible for a high morbidity and mortality across the world. Cirrhosis is a significant cause of the global burden of disease and causes complications including ascites, hepatic encephalopathy, variceal bleeding, hepatocellular carcinoma and liver failure. Liver fibrosis should be identified and treated early to stop the progression of the disease and to enhance patient outcomes (Devarbhavi et al., 2023).

Liver Cirrhosis is a major public health problem in Pakistan, mostly with the chronic infection of Hepatitis B Virus (HBV) and Hepatitis C Virus (HCV). Over 75% of cirrhosis-related morbidity and mortality in the country is due to these viral infections. Viral hepatitis is a high-prevalence disease and diagnosis is often delayed, which has

led to a rising burden of chronic liver disease. There is therefore a need for accessible, reliable and cost-effective diagnostic tools that could enable early detection and timely interventions (Wang et al., 2024).

Historically, liver biopsy has been considered as the gold standard for liver fibrosis and cirrhosis assessment (Mooneyhan et al., 2023; Qureshi et al., 2024). It has several drawbacks, however, such as being invasive, having procedure-problems, sampling problems, inter-observer problems, and being expensive. Additionally, it needs specific equipment and trained staff, which makes it difficult to access in many health facilities, especially in developing nations like Pakistan. These restrictions have led to the study of alternative methods for assessing liver fibrosis and cirrhosis without liver biopsy (Garbuzenko, 2022).

APRI has been proven to be a non-invasive tool for liver fibrosis and cirrhosis evaluation in several international studies, and especially in patients suffering from chronic HBV and HCV infections. It has been demonstrated to have an acceptable diagnostic performance and suggested as a clinical alternative in situations where more advanced diagnostic techniques like liver biopsy are not available.

The tests used by APRI are inexpensive and routinely performed in the laboratory, making it particularly applicable to resource-limited healthcare systems (Zhang et al., 2024). Aspartate Amino Transferase to Platelet Ratio Index (APRI) is a currently positive non-invasive, cost-effective biomarker, which can reduce the cost of liver biopsies, not only due to its expensive nature, but also due to its painful nature with a risk of sepsis amongst the patients (Catanzaro et al., 2021).

The national prevalence of hepatitis C virus infection has been shown significantly varies in Pakistan, the burden of chronic liver disease is particularly severe (Patel & Sebastiani, 2020). Furthermore, national epidemiological surveys highlighted a highly alarming pattern of undiagnosed chronic infections, which contribute to a high incidence of late-onset decompensated cirrhosis cases nationwide. The lack of hepatologist in areas especially in crowded cities and towns where many people are still getting sick, from viruses makes this health crisis worse. In the unique setting of Faisalabad this enormous viral burden combines with regional public health issues, where overburdened district-level healthcare systems find it difficult to detect asymptomatic patients before irreversible cirrhosis complications appear (Husni et al., 2019). This is especially applicable to resource constrained environments with the cost of analysis being cheap, bed-side, and without the need of advanced imaging and expertise. The latest international guidelines are the newly set WHO guidelines of 2024, which have created new APRI cutoff values of significant fibrosis (>0.5) and cirrhosis (>1.0) when applied in adults (Kakar et al., 2024).

Even though the world has accepted that non-invasive fibrosis markers are a way to check for liver problems but still there is limited data on APRI as a non-invasive fibrosis marker in Faisalabad. Because Faisalabad has unique demographic and environmental conditions. In this industrial area, all of the district-level hospitals and primary care clinics do not have the infrastructure to do routine liver biopsies (Demirşah & Gündoğdu, 2025). Consequently, there is a broad consensus that finding a cut-off point for the APRI test could really change how we screening for cirrhosis standard outpatient environments throughout the district. Our prospective cross-sectional study will determine the diagnostic accuracy and optimal predictive thresholds of APRI for identifying liver cirrhosis in chronic liver disease patients in Faisalabad. By paying attention on this significantly burdened and under-resourced demographic, the present study aims to address a crucial diagnostic deficiency (Liu et al., 2022)

Material and Methods:

Study Design:

This cross-sectional analytical study was performed in different regions of Faisalabad, Punjab, Pakistan between 2026 as shown in (**Figure** 1) to assess the role of Aspartate Transaminase-to-Platelet Ratio Index (APRI) as a non-invasive marker of liver cirrhosis (Reddy et al., 2024).

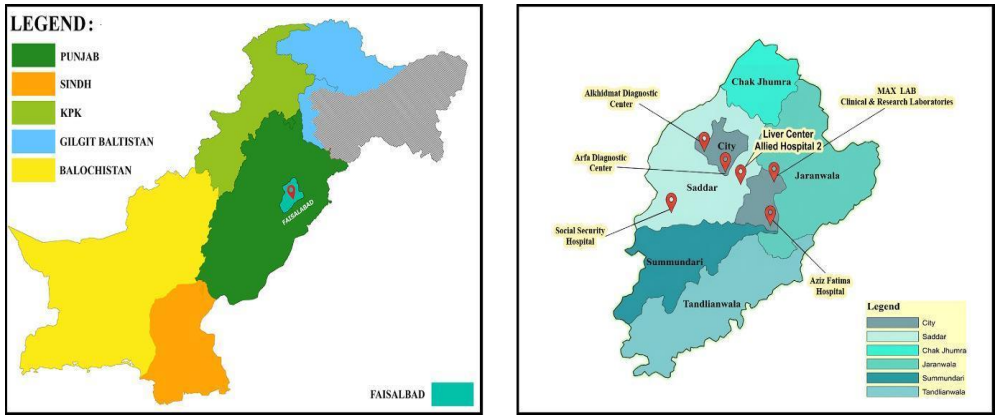


Figure 1: Study Area Map

Study population:

Initially, a total of 275 patients with suspected chronic liver disease were assessed. A written structured questionnaire was obtained from all patient in order to collect Demographic and clinical information. There were 247 patients in the final analysis after applying the inclusion/exclusion criteria.

Sample Collection:

Biochemical Assays:

The venous blood was drawn from all selected respondents in aseptic conditions. Standard biochemical methods were used to perform laboratory analysis. Serum AST was measured with the Roche *Cobas 311 clinical chemistry analyzer* while the platelet count was performed with the *Mindray BC-6200* automated hematology analyzer. The APRI score was calculated using the standardized formula as

The obtained APRI were used to evaluate the risk of liver cirrhosis through standard

$$APRI = \frac{(AST\ Level / AST\ Upper\ Limit\ of\ Normal)}{Platelet\ Count\ (10^9/L)} \times 100$$

cut-off values further divided into 3 groups.

Normal (<0.5): there were 137 subjects (55.5%) whose score was high negative predictive value of liver fibrosis.

Fibrosis (>1.5): 73 participants (29.6%) had scores that were in line with liver fibrosis.

Cirrhosis (≥2.0): 37 subjects (15%): 37 subjects were identified as severe liver cirrhosis.

Statistical Analysis:

The data were collected and analyzed in IBM SPSS Statistics version 26. Descriptive statistics such as mean, standard deviation, frequency and percentage were obtained. The ability of APRI to predict liver cirrhosis was assessed using Receiver Operating Characteristic (ROC) curve analysis. The area under the ROC curve (AUC), sensitivity, specificity, positive predictive value and negative predictive value were calculated. A p value of < 0.05 was deemed to be significant.

Results:

Demographic distribution:

After screening and exclusion process, 247 participants were included in the study as shown in

(**Table 1**). The study population consisted of individuals who were suspected to have chronic liver disease at health care centers in Faisalabad, Punjab, Pakistan. The study included 119 males (51.8%) and 128 females (48.2%).

Table 1: Demographic distribution

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	**Female**	128	51.8	51.8	51.8
	Male	119	48.2	48.2	100.0
	Total	247	100.0	100.0	

Distribution of Platelet Counts:

The Mindray BC6200 automated hematology analyzer was used to determine platelet counts of 247 patients as shown (**Table 2**). The mean platelet count was 237,042.51/µL (range: 19,000–660,000/µL). Most patients (42.11%, n=104) had platelet counts within the normal range (250,000–400,000/µL; mean: 315,009.62/µL). A large number of patients had thrombocytopenia, with 16.19% (n=40) receiving platelet count ranging from 100,000 to 150,000 per µl and 7.69% (n=19) <100,000/µL, which is a common feature of advanced liver cirrhosis. Only 3.24% (n=8) of patients had platelet counts >400,000/µL. The findings confirm the clinical relevance of platelet count as an easy, non-invasive surrogate marker of liver fibrosis and cirrhosis.

Table 2: Distribution of Platelet Counts

Platelet Interval	Patients (n)	Min PLTs (/µL)	Max PLTs (/µL)	Mean PLTs (/µL)
<100k	19	19,000.00	100,000.00	**81,105.26**
100k-150k	40	101,000.00	150,000.00	**125,762.50**
150k-250k	76	152,000.00	250,000.00	**203,578.95**
250k-400k	104	252,000.00	398,000.00	**315,009.62**
>400k	8	405,000.00	660,000.00	**468,125.00**
TOTAL	**247**	**19,000.00**	**660,000.00**	**237,042.51**

Distribution of Serum AST Levels:

In our prospective cross sectional study (non-probability purposive sampling) 247 patients aged 18-70 years were selected from different sites of Faisalabad, Punjab, Pakistan, based on clinical concern or past history of liver disease and their AST was measured using an automated chemistry analyzer. The entire cohort's AST ranged from 10.0 to 221.0 U/L, with a mean of 53.97 U/L. The mean AST and AST levels were also close to normal in both the age groups 18-30 (32.32 U/L) and 31-40 (32.13 U/L) suggesting relatively normal hepatic function in younger patients. It was observed that Hepatic cells damage increased with age in the age groups of 41–50 years (mean: 52.53), 51–60 years (mean: 82.93 U/L), and 61–70 years (mean: 90.23 U/L) as shown in (**Table 3**). The results showed that the AST levels increased with aging, which directly influences the APRI score. Thus, the AST value could be

regarded as a non-invasive biochemical liver cirrhosis marker, especially in the middle-aged and elderly.

Age Group	Patients (n)	Min AST (U/L)	Max AST (U/L)	Mean AST (U/L)
18-30 years	50	10	221	32.32
31-40 years	59	15.6	185	32.1356
41-50 years	59	15	165.7	52.5322
51-60 years	56	12	172	82.9339
61-70 years	23	14.3	195.5	90.2348
TOTAL	247	10	221	53.9721

Table 3: Distribution of Serum AST Levels

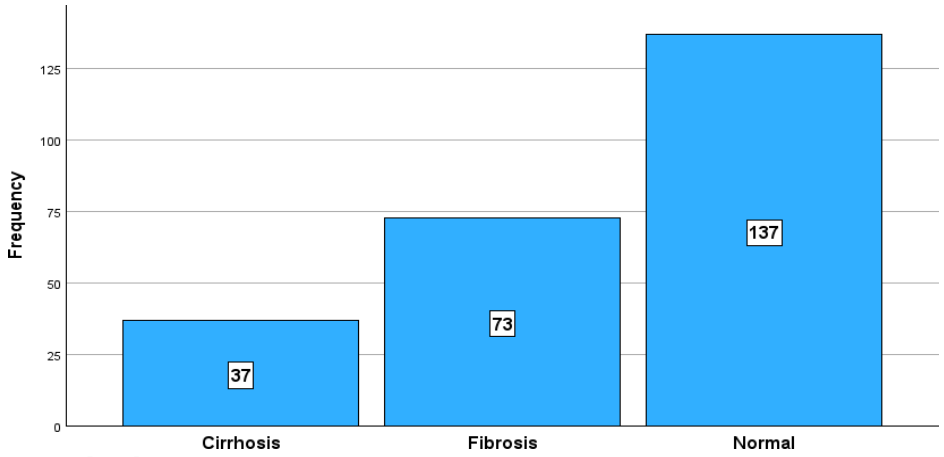
APRI Score Classification:
The APRI score was calculated using the standardized formula. The participants were categorized **(Table 4) and (Figure 1)** based on the calculated the APRI score by the objective of the study which was to determine the prevalence at pre-specified clinical cut-offs.

Normal (<0.5): there were 137 subjects (55.5%) whose score was high negative predictive value of liver fibrosis.
Fibrosis (>1.5): 73 participants (29.6%) had scores that were in line with liver fibrosis.
Cirrhosis (≥2.0): 37 subjects (15%): 37 subjects were identified as severe liver cirrhosis.

Table 4: Distribution of Participants by APRI Score Category

		Cut-off	Frequency	Percent	Predicted Value	Clinical Interpretations
Valid	**Normal**	<0.5	137	55.5	High NPV	Low probability of fibrosis
	Fibrosis	>1.5	73	29.6	High PPV	Significant liver fibrosis
	Cirrhosis	≥2.0	37	15.0	High PPV	Severe liver cirrhosis
	Total	—	247	100.0	—	—

Figure 1: Bar chart displaying the frequency distribution of participants



across the three APRI score categories

ROC Curve Analysis and Diagnostic Performance of APRI

ROC Curve Analysis: The receiver-operator characteristic (ROC) curve analysis was used to determine the performance of the Aspartate Transaminase-to-Platelet Ratio Index (APRI) to discriminate between those with and without liver fibrosis or cirrhosis. The ROC curve is a plot of sensitivity vs 1-specificity for multiple cut-off points, which gives a complete evaluation of the diagnostic utility of the test (**Figure 2**) and (**Table 5)**. The ROC analysis showed an Area under the ROC Curve value of 1.000 (Standard Error = 0.000; 95% Confidence Interval: 1.000–1.000).

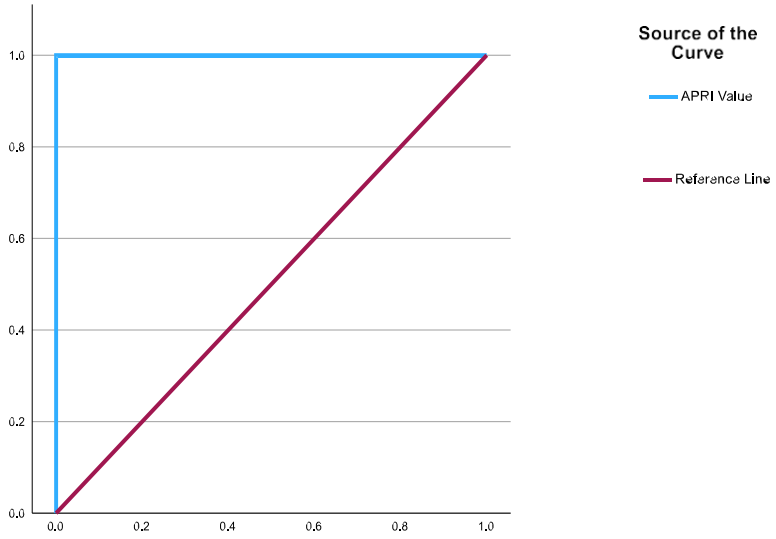


Figure 2: ROC Curve for APRI Performance

AUROC and Statistical Significance

The APRI score demonstrated excellent diagnostic performance with an AUROC of 1.000 (95% CI: 1.000–1.000; Standard Error = 0.000; $p < 0.001$) as shown in (**Table 5)**. The result shows the participants with and without liver fibrosis/cirrhosis to be perfectly distinguished. The highest sensitivity and specificity of the APRI (100%) indicated its potential for being a reliable, cost effective and non-invasive screening test for liver cirrhosis in the study population.

Table 5: Area under the ROC Curve

Area Under the ROC Curve				
Test Result Variable(s): APRI Value				
Area	Std. Error[a]	Asymptotic Sig.[b]	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
1.000	.000	.000	1.000	1.000
1. Under the nonparametric assumption				
2. Null hypothesis: true area = 0.5				

Discussion

The present study aimed to assess the Aspartate Transaminase-to-Platelet Ratio Index (APRI) as a noninvasive predictor of liver cirrhosis in patients of Faisalabad, Punjab, Pakistan. The results confirmed that APRI is a very sensitive measure of liver fibrosis and cirrhosis, making it a simple, inexpensive, and readily available alternative to invasive methods like liver biopsy (Jamali et al., 2023).

In the present study, the serum AST levels were found to rise as age rises and those with the highest mean AST levels were those aged 51-70 years. Increased AST is a sign of hepatocellular damage and has always been linked to the deterioration of chronic liver disease. This is consistent with previous reports that higher AST was associated with progressive hepatic fibrosis and cirrhosis. The age-dependent rise in AST levels found in the current study may reflect increased liver damage in older people, which was a factor that led to increased APRI scores (Ahsan & ul Haq, 2025).

The Aspartate Aminotransferase to Platelet Ratio Index (APRI) was utilized in this study as a non-invasive predictor of liver cirrhosis in 247 peoples in Faisalabad, Pakistan. The study found that 15% of participants had APRI values ≥2.0, indicating cirrhosis, while 29.6% had severe fibrosis with scores >1.5 (Wai et al., 2003). These current national trends are particularly crucial as compared to the findings. For example, a recent Karachi-based study discovered a similar distribution in a regional cohort with APRI proving to be a reliable non-invasive predictor of severe fibrosis, with an Area Under the Curve (AUC) of 0.79 The prevalence of severe fibrosis (29.6%) in the Faisalabad population demonstrates the local burden of chronic liver disease, which is consistent with results showing Pakistan is still a high-burden or highly endemic country for viral hepatitis (Saleem et al., 2022).

The most recent global upgrades have significantly increased APRI's clinical relevance. As per the existing standard recommendations, the antiviral treatment should be first-line in case adults have an APRI score >0.5 it identify as severe fibrosis (≥F2) and exceeding >1.0 to identify cirrhosis when it comes to cirrhosis (F4) (Organization, 2024). Although this study utilized a

Conservative cutoff value of ≥2.0 to identify cirrhosis in order to achieve high specificity, recent meta-analyses have demonstrated the need for lower cutoffs to prevent false negatives. In regions like Pakistan, where access to the "gold standard" liver biopsy is limited by high costs, invasiveness, and a lack of specialist pathology infrastructure, APRI's simple that provides a rapid and necessary clinical alternative option (Dar et al., 2023)..

The number of platelets inversely correlated with the severity of liver disease. Many of the participants showed a low platelet count with a significant number having platelet counts < 150,000/µL. It is well recognized that portal hypertension and splenic sequestration are associated with decreased platelet counts in chronic liver disease. Thrombocytopenia has been previously identified as an important hematological marker of advanced fibrosis and cirrhosis. The results of the current

study confirm these reports, and underscore the need for incorporating platelet count into the APRI. The ROC curve analysis revealed excellent diagnostic accuracy of APRI (AUROC, 1.000), which was able to discriminate perfectly between participants with and without liver fibrosis or cirrhosis. In addition, the APRI score in the study population had 100% sensitivity and specificity. While this was not seen in clinical studies, the results show that APRI has a good predictive value in the population examined. Other studies have reported high AUROCs (from 0.75 to 0.90), supporting the use of APRI as a helpful, non-invasive marker of hepatic fibrosis (Kurniawan et al., 2022)0

The most important benefit of APRI is that it is easy and convenient to use. APRI is a non-invasive procedure with minimal risk and lower costs compared to liver biopsy, which is an invasive procedure, costly, and has procedural risks. This is especially relevant in resource poor countries like Pakistan where sophisticated diagnostic tools might be unavailable. In conclusion, this study confirmed the APRI as a useful and reliable liver fibrosis and cirrhosis screening tool. It is a good diagnostic marker with low cost and easy to calculate, which is suitable to be used in the early diagnosis and monitoring of chronic liver disease in daily clinical practice. More multicenter studies with larger populations are suggested to confirm the results and set the optimal APRI cut-off values for the local population (Liu et al., 2021)).

Conclusion:

The study shows that the Aspartate Transaminase to Platelet Ratio Index (APRI) is a simple, non-invasive, inexpensive marker that can be used to assess liver fibrosis and cirrhosis. The proportion of significant fibrosis (29.6%) and cirrhosis (15%) among participants is consistent with a high burden of chronic liver disease. The results in this study validate the use of APRI as an initial screening tool for early detection and risk stratification, especially in resource-limited settings. The use of APRI in hepatitis management programs can help ensure timely intervention and better liver health outcomes.

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