Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Association of second-trimester APRI and FIB-4 scores with intrahepatic cholestasis of pregnancy: a retrospective case–control study

Ceren Özceyran

cerenozceyran@gmail.com

Ankara Bilkent City Hospital

Nevda Ceren Sonu

Ankara Bilkent City Hospital

Fatma Doğa Öcal

Ankara Bilkent City Hospital

Dilek Şahin

Ankara Bilkent City Hospital

Research Article

Keywords: Intrahepatic cholestasis, pregnancy, APRI, FIB-4

Posted Date: June 19th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-9702763/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

Abstract

Background:

To evaluate whether second-trimester aspartate aminotransferase-to-platelet ratio index (APRI) and Fibrosis-4 (FIB-4) scores can predict subsequent development of intrahepatic cholestasis of pregnancy (ICP).

Methods:

This retrospective case–control study included 140 women diagnosed with ICP and 140 matched controls at a tertiary referral center between 2020 and 2025. Second-trimester (14–28 weeks) laboratory parameters were analyzed retrospectively. APRI and FIB-4 scores were calculated from routine biochemical data. Receiver operating characteristic (ROC) analysis was performed to assess the predictive performance of these scores.

Results:

Second-trimester AST, ALT, and total bilirubin levels were significantly higher and albumin levels were lower in women who later developed ICP ($p < 0.01$). APRI scores were significantly elevated in the ICP group ($p < 0.001$), whereas FIB-4 scores did not differ significantly. An APRI cut-off value of 0.215 predicted ICP with 69% sensitivity and 62% specificity (AUC:0.695). Gestational age at delivery and neonatal birth weight were significantly lower in the ICP group ($p < 0.001$).

Conclusion:

Second-trimester APRI demonstrates moderate predictive performance for subsequent ICP, whereas FIB-4 does not appear to provide additional value. APRI may represent a simple adjunctive tool for early risk assessment, although prospective validation is required.

BACKGROUND

Intrahepatic cholestasis of pregnancy (ICP) is the most common cholestatic liver disorder specific to pregnancy and represents an important obstetric condition with significant implications for both maternal and fetal outcomes. ICP typically manifests in the late second or third trimester and is characterized by intense pruritus, elevated serum bile acid levels, and abnormalities in liver function tests. Although the condition usually resolves spontaneously after delivery, it substantially impairs maternal quality of life and is associated with increased fetal morbidity and mortality [1].

Cholestasis is defined as a clinical syndrome resulting from impaired bile formation and secretion by hepatocytes or obstruction of bile flow at the intrahepatic level, leading to the accumulation of bile acids and bilirubin in hepatocytes and the systemic circulation. The accumulation of bile acids within hepatocytes results in hepatocellular injury and functional impairment, which is reflected biochemically by elevations in serum aminotransferases (AST and ALT) and a reduction in hepatic synthetic function markers such as serum albumin levels [2].

Early diagnosis and risk stratification of ICP are crucial for guiding fetal surveillance strategies and determining the optimal timing of delivery. However, bile acid measurement is not included in routine antenatal screening in many centers and may not be readily available, which limits early identification of high-risk patients.

The APRI and the FIB-4 score are noninvasive biochemical scores developed to reduce the need for liver biopsy in the assessment of hepatic fibrosis. The APRI combines serum AST levels with platelet counts, whereas the FIB-4 score incorporates age, AST, ALT, and platelet values to estimate liver fibrosis. Although these indices are widely used in chronic liver diseases, they have recently attracted attention as potential biomarkers reflecting early hepatocellular dysfunction during pregnancy [3].

The role of APRI and FIB-4 scores in predicting the development of ICP has been investigated in a limited number of studies, most of which involved small sample sizes and did not focus on second-trimester assessments [4] [5] [6] [7]. The second trimester represents a critical period in which biochemical alterations in ICP may begin before the onset of clinical symptoms [8].

Therefore, second-trimester alterations in routinely available biochemical parameters reflecting subclinical hepatocellular dysfunction may precede the clinical manifestation of ICP and provide an opportunity for early risk stratification and targeted obstetric surveillance.

The aim of this study was to evaluate the predictive value of second-trimester APRI and FIB-4 scores for the development of ICP before the onset of clinical symptoms and to investigate their association with maternal and fetal outcomes. The findings of this study may contribute to the development of risk-based obstetric surveillance strategies and help reduce maternal and fetal complications associated with ICP.

MATERIALS AND METHODS

This study was designed as a retrospective case–control study. Ethical approval was obtained from the Ankara Bilkent City Hospital No. 2 Clinical Research Ethics Committee on June 11, 2025, with the approval number TABED 2/1315/2025, prior to data collection. This study was conducted in accordance with the ethical principles of the Declaration of Helsinki.

Pregnant women aged 18–45 years who delivered at Ankara Bilkent City Hospital between May 2020 and May 2025 were included in the study. The case group consisted of 140 pregnant women diagnosed

with ICP, while the control group comprised 140 age-matched pregnant women who had an uncomplicated and healthy pregnancy and delivery.

Sample size calculation was performed using the G*Power 3.0.10 software. Based on a power of 95%, a significance level of 5%, and the predetermined effect size, a minimum total sample size of 128 participants (64 cases and 64 controls) was found to be sufficient. The final sample size exceeded this requirement.

In this study, women aged between 18 and 45 years with singleton pregnancies were included. All participants had their antenatal follow-up and delivery performed at Ankara Bilkent City Hospital and had undergone routine screening tests between 14 and 28 weeks of gestation. The diagnosis of ICP was established in patients presenting with pruritus, particularly affecting the palms and soles, and confirmed by fasting serum bile acid levels ≥ 10 μmol/L at or after 26 weeks of gestation, following exclusion of other hepatobiliary or systemic causes of liver dysfunction.

Participants were excluded in the presence of multiple pregnancy, chronic inflammatory diseases such as rheumatologic disorders, malignancy, or other systemic diseases. Cases with fetal genetic abnormalities or major structural anomalies were also excluded. Additional exclusion criteria included a history of smoking, alcohol consumption, or substance use; pregestational diabetes mellitus, chronic hypertension, placental abruption, or preeclampsia; and congenital infections during pregnancy. Patients with high-risk results in first-trimester screening tests, as well as those whose antenatal follow-up or delivery was not performed at our institution, were also excluded from the study.

The study evaluated demographic, obstetric, laboratory, and neonatal parameters. Demographic and obstetric data included maternal age, gravida, parity, and history of abortion. Laboratory tests obtained between 14 and 28 weeks of gestation comprised hemoglobin (g/dL), platelet count (×10⁹/L), aspartate aminotransferase (AST, U/L), alanine aminotransferase (ALT, U/L), fasting bile acid (FBA, μmol/L), glucose (mg/dL), albumin (g/dL), total bilirubin (mg/dL), and first-trimester combined screening test results.

Gestational age and neonatal outcomes were assessed using initial postnatal follow-up records, including first- and fifth-minute APGAR scores, admission to the neonatal intensive care unit (NICU), birth weight, and birth length.

In addition, noninvasive liver fibrosis indices were calculated. The APRI was derived using AST levels and platelet count according to the formula ([AST / upper limit of normal AST] × 100) / platelet count (10⁹/L). The FIB-4 index was calculated based on maternal age, AST, ALT, and platelet count using the formula (Age × AST) / (platelet count × √ALT). The upper limit of normal was accepted as 45 U/L for AST.

Pregnant women were diagnosed with ICP based on pruritus and fasting serum bile acid levels ≥ 10 μmol/L, following SMFM Consult Series recommendations, after excluding other hepatobiliary or systemic causes. Severity was classified as mild (10–40 μmol/L) or severe (> 40 μmol/L), with levels ≥

100 µmol/L associated with high fetal risk [9]. Additional laboratory parameters were collected during the second trimester prior to bile acid measurement.

Statistical Analysis

Statistical analyses were performed using IBM SPSS Statistics for Windows, version 27.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarize the data; categorical variables were expressed as frequencies and percentages, while continuous variables were presented as median (minimum–maximum) values due to non-normal distribution.

Normality of continuous variables was assessed using the Kolmogorov–Smirnov test. Since the data did not conform to normal distribution, non-parametric statistical methods were applied. Comparisons between two independent groups were performed using the Mann–Whitney U test. Categorical variables were compared using the chi-square test.

Factors associated with the risk of ICP were evaluated using binary logistic regression analysis with the backward likelihood ratio (Backward LR) method. The diagnostic performance of the APRI in discriminating cholestasis was assessed using receiver operating characteristic (ROC) curve analysis. The optimal cut-off value was determined based on the Youden index.

A p-value < 0.05 was considered statistically significant.

RESULTS

Baseline demographic characteristics were comparable between the cholestasis and control groups, with no significant differences observed in maternal age, gravida, parity, or history of abortion (Table 1).

Table 1
Demographic Characteristics of the Intrahepatic Cholestasis and Control Groups

Age (years)	**Cholestasis (n = 140)**	**Control (n = 140)**	***P* value**
	30 (19–44)	**29 (19–48)**	**0,486**
Gravida	2 (1–7)	2 (1–8)	0,435
Parity	1 (0–6)	1 (0–6)	0,452
History of Abortion	0 (0–4)	0 (0–5)	0,908
Data are presented as median (min-max). Continuous variables were compared using the Mann–Whitney U test.			

Gestational age at delivery and birth weight were significantly lower in the cholestasis group than in controls (p < 0.001 for both). Although 1-minute Apgar scores tended to be lower in the cholestasis group, the difference did not reach statistical significance. No significant differences were observed in 5-minute Apgar scores or neonatal intensive care unit admission rates between the groups (Table 2).

Table 2
Neonatal Outcomes of the Intrahepatic Cholestasis and Control Groups

Gestational age at delivery (weeks)	**Cholestasis (n = 140)**	**Control (n = 140)**	***p* value**
	37 (31–40)	**38 (25–41)**	**< 0,001**
Birth weight (g)	2970 (1500–4105)	3240 (800–4500)	**< 0,001**
1-minute APGAR score	7 (4–9)	7 (4–8)	0,051
5-minute APGAR score	9 (6–10)	9 (6–10)	0,069
NICU admission (%)	20 (14,3)	18 (13,4)	0,838
Data are presented as median (min -max) and number(%). Continuous variables were compared using the Mann–Whitney U test.The chi-square test was used to compare categorical variables.			

Second-trimester AST, ALT, fasting bile acid, and total bilirubin levels were significantly higher in the cholestasis group than in controls ($p < 0.001$ for all), whereas albumin levels were significantly lower ($p < 0.001$). The APRI score was also significantly elevated in the cholestasis group ($p < 0.001$). In contrast, FIB-4 scores did not differ significantly between groups (Table 3).

Table 3
Comparison of Laboratory Parameters Between the Intrahepatic Cholestasis and Control Groups

Hbg (gr/dL)	**Cholestasis (n = 140)**	**Control (n = 140)**	**P value**
	11,6 (8,1–14,5)	**11,6 (7,2–14,7)**	**0,504**
PLT (*10^9/L)	253 (106–579)	263 (98–682)	0,549
AST (U/L)	23 (2-942)	16 (6-324)	**< 0,001**
ALT (U/L)	30 (8-834)	15 (5-763)	**< 0,001**
Fasting Bile Acid (FBA) (µmol/L)	20 (10,2-114)	3,6 (1,72 – 9,4)	**< 0,001**
Albumine (gr/dL)	37 (30–44)	38 (9–50)	**< 0,001**
Total Bilirubine (mg/dL)	0,6 (0,1–6,2)	0,5 (0,1–1,7)	**< 0,001**
Glucose (mg/dL)	83 (47–153)	83 (60–138)	0,703
APRI	0,29 (0,03–13,19)	0,20 (0,06 – 3,92)	p < 0,001
FIB-4	0,52 (0,05 – 4,01)	0,47 (0,18 – 2,24)	0,063
Data are presented as median (min -max). Continuous variables were compared using the Mann–Whitney U test.			

Stratification by fasting bile acid levels revealed that severe ICP (> 40 μmol/L) was associated with earlier delivery and lower birth weight compared with mild disease (10–40 μmol/L) ($p < 0.05$) (Table 4).

Table 4
Distribution of Clinical and Laboratory Findings in Pregnant Women With Moderate (10–40 μmol/L) and Severe (> 40 μmol/L) Intrahepatic Cholestasis (n = 140)

Age (year)	**Moderate Intrahepatic Cholestasis (n = 117)**	**Severe Intrahepatic Cholestasis (n = 23)**	***p* value**
	30.0 (19.0–44.0)	**29.0 (22.0–40.0)**	**0,577**
Gravida	2.0 (1.0–7.0)	1.0 (1.0–7.0)	0,533
Parity	1.0 (0.0–4.0)	0.0 (0.0–4.0)	0,856
History of Abortion	0.0 (0.0–3.0)	0.0 (0.0–3.0)	0,394
Gestational age at delivery (weeks)	37.0 (31.0–40.0)	36.0 (34.0–39.0)	**0,012**
Birth weight (g)	3000.0 (1500.0–4010.0)	2840.0 (2190.0–4105.0)	**0,034**
1-minute APGAR score	7.0 (4.0–9.0)	7.0 (6.0–9.0)	0,793
5-minute APGAR score	9.0 (6.0–10.0)	9.0 (8.0–10.0)	0,611
NICU admission (%)	15 (12,8)	3 (14,3)	0,901
Hbg (gr/dL)	11.6 (8.1–15.4)	11.6 (8.6–14.5)	0,980
PLT (*10^9/L)	250.0 (106.0–579.0)	276.0 (175.00–442.0)	0,062
AST (U/L)	23.0 (2.0–942.0)	26.0 (10.0–283.0)	0,576
ALT (U/L)	30.0 (8.0–834.0)	33.0 (10.0–446.0)	0,431
Fasting Bile Acid (FBA) (μmol/L)	19.0 (10.2–30.2)	54.0 (44.7–114.0)	**< 0.001**
Albumine (gr/dL)	37.0 (30.0–44.0)	37.0 (30.0–44.0)	0,887
Total Bilirubine (mg/dL)	0.6 (0.1–3.9)	0.5 (0.1–2.30)	0,892
Glucose (mg/dL)	82.0 (56.0–153.0)	86.0 (47.0–109.0)	0,278
APRI	0.29 (0.03–13.59)	0.29 (0.07–2.30)	0,851
FIB-4	0.53 (0.05–4.41)	0.5 (0.13–1.30)	0,446

Data are presented as median (min -max) and number(%). Continuous variables were compared using the Mann–Whitney U test.The chi-square test was used to compare categorical variables.

ROC analysis demonstrated moderate discriminative performance of the APRI score for predicting ICP (AUC 0.695). An optimal cut-off value of 0.215 yielded 69% sensitivity and 62% specificity (Fig. 1).

ROC analysis demonstrated good discriminative ability for AST (AUC 0.774) and ALT (AUC 0.712), moderate performance for total bilirubin (AUC 0.646), and inverse discrimination for albumin (AUC 0.330) (Fig. 2).

DISCUSSION

In this study, second-trimester APRI scores were significantly higher in women who subsequently developed ICP, whereas FIB-4 scores did not differ significantly between groups. These findings suggest that APRI may reflect early biochemical alterations preceding the clinical onset of ICP, while FIB-4 appears to have limited predictive utility in this setting.

APRI was originally developed as a noninvasive marker of liver fibrosis in chronic hepatitis C. However, beyond fibrosis assessment, APRI reflects hepatocellular injury through its AST and platelet components [10]. Although ICP is not primarily a fibrotic disorder, it is characterized by cholestasis and hepatocellular stress. [11] The elevated APRI levels observed in our cohort may therefore represent early subclinical hepatic dysfunction rather than structural fibrosis. Our findings indicate that APRI may have potential clinical value in identifying pregnancies at increased risk for ICP.

Similarly, FIB-4 was developed by Sterling et al. in 2006 as a noninvasive fibrosis index incorporating age, AST, ALT, and platelet count [12]. The lack of statistical significance in our study may be explained by its stronger performance in chronic liver diseases characterized by progressive fibrosis. In addition, the relatively young age distribution of pregnant populations and the absence of underlying chronic liver pathology may limit the discriminative capacity of FIB-4 in ICP [13].

Previous studies evaluating APRI and FIB-4 in ICP are limited. Cemortan et al. reported elevations in both indices, although APRI was suggested to be more sensitive [3]. Differences between studies, including sample size, trimester distribution, and patient characteristics, may explain the variability in reported cut-off values. A first-trimester study identified an APRI cut-off of 0.55 [14], whereas another retrospective analysis including later gestational ages reported a cut-off of 0.092 [4]. In addition, a third-trimester study reported an APRI cut-off value of 0.295 [15]. In our second-trimester-focused cohort, the identified cut-off value of 0.215 suggests that physiological biochemical changes during pregnancy and gestational timing may substantially influence APRI levels. Moreover, compared with the third-trimester study, our cohort included a larger number of patients, and APRI was calculated using earlier second-trimester laboratory parameters, which may provide a more clinically useful assessment for earlier prediction of ICP.

In the study by Zhong-Hua Lin et al., which evaluated APRI in chronic hepatitis C–related fibrosis, higher cut-off values with moderate sensitivity and specificity were reported for predicting cirrhosis and advanced fibrosis [16]. APRI primarily reflects hepatic fibrosis in hepatitis C infection, whereas the pathophysiology of ICP is characterized by transient cholestasis and bile plugs rather than true fibrosis [13]. Therefore, the lower cut-off value observed in our study may be attributable to this difference in underlying pathophysiology.

The finding that studies involving similar patient profiles have reported cut-off values closer to our results supports this interpretation [4] [5] [6] [7].

The lack of statistical significance of the FIB-4 score in predicting ICP in our study is noteworthy when considered alongside the limited data in the literature. Although a retrospective study published in 2022 reported that first-trimester FIB-4 scores could predict the development of ICP in the third trimester, existing studies are small and mostly based on single-center cohorts [17]. External validation of proposed cut-off values across different populations has not yet been performed, and current guidelines do not recognize FIB-4 as a standard predictive biomarker for ICP. These findings indicate that the role of FIB-4 in pregnancy requires clarification through larger, prospective studies.

In our study, pregnancies complicated by ICP were associated with earlier delivery and lower birth weight, supporting the well-established association between ICP and adverse perinatal outcomes. However, despite these differences, neonatal intensive care unit admission rates and fifth-minute APGAR scores were comparable between groups. This discrepancy may reflect the heterogeneous clinical course of ICP and suggests that while ICP may influence the timing of delivery and fetal growth, its impact on immediate neonatal well-being may vary. Further studies are needed to clarify the relationship between biochemical markers and neonatal outcomes.

The presence of marked abnormalities in liver function tests (AST, ALT, albumine, total bilirubin) in the cholestasis group even during the second trimester suggests that ICP may be associated with earlier subclinical hepatocellular changes rather than being solely a condition that emerges in the third trimester. Nevertheless, the retrospective design of our study limits causal inferences. Prospective, multicenter studies are needed to validate the identified cut-off values in different populations. If APRI were to be used as a screening tool, it may allow the detection of ICP before the onset of clinical symptoms and potentially improve perinatal outcomes.

The relatively large sample size of our study, compared with previous publications, increases the statistical reliability of our findings and contributes to their generalizability. However, external validation in larger and more heterogeneous cohorts is required before biomarker-based cut-off values can be translated into clinical practice. This study provides a comprehensive dataset on the clinical value of APRI and FIB-4 in the context of ICP and introduces a new perspective to the existing literature through its specific focus on the second trimester.

CONCLUSION

This study demonstrates that the APRI calculated during the second trimester may help predict the development of ICP before the onset of clinical symptoms and may serve as an early warning biomarker rather than a standalone diagnostic test. In contrast, the FIB-4 score did not show predictive value in the same population, which may be related to the limited age variability in pregnant women and the non-fibrotic pathogenesis of ICP.

APRI can be easily derived from routine biochemical tests already used in antenatal care, it represents a practical and cost-effective candidate risk marker for clinical application. However, prospective, multicenter studies with larger cohorts are required to standardize cut-off values. If validated, early identification of pregnancies at risk for intrahepatic cholestasis may provide an important opportunity to improve perinatal outcomes.

Abbreviations

APRI
Aspartate Aminotransferase to Platelet Ratio Index
FIB-4
Fibrosis-4 Index
ICP
Intrahepatic Cholestasis of Pregnancy
AST
Aspartate Aminotransferase
ALT
Alanine Aminotransferase
ROC
Receiver Operating Characteristic
AUC
Area Under the Curve
NICU
Neonatal Intensive Care Unit
FBA
Fasting Bile Acid

Declarations

Ethics approval and consent to participate

This study was approved by the Ankara Bilkent City Hospital No. 2 Clinical Research Ethics Committee (approval number: TABED 2/1315/2025, date: June 11, 2025). As this was a retrospective study, informed consent was waived by the ethics committee.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

Funding

The authors received no specific funding for this work.

Author Contribution

Dilek Sahin (D.S.), Fatma Doğa Ocalan (F.D.O.) contributed to the conceptualization and methodology of the study. Ceren Ozceyran (C.O.) and Nevda Ceren Sonu (N.C.S.) were responsible for data curation and formal analysis. All authors contributed to the interpretation of the data. C.O. drafted the initial manuscript. All authors (C.O., N.C.S., F.D.O. and D.S.) critically reviewed and revised the manuscript for important intellectual content. All authors read and approved the final version of the manuscript.

Acknowledgements

Not applicable.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

References

1. Pillarisetty LS, Sharma A. Pregnancy intrahepatic cholestasis. 2019.
2. Odabaş RK, Sökmen Y, Dünder E, Taşpınar A. The Incidence of Intrahepatic Cholestasis of Pregnancy and its Maternal, Fetal, and Neonatal Adverse Outcomes: A Systematic Review and Meta-Analysis. J Midwifery Women's Health. 2024;69(3):370–82.
3. Cemortan M, Iliadi-Tulbure C, Sagaidac I, Cernetchi O. Assessment of aspartate aminotransferase to Platelet Ratio Index and Fibrosis-4 Index score on women with intrahepatic cholestasis of pregnancy. AJOG Global Rep. 2024;4(2):100337.
4. Sakcak B, Denizli R, Farisoğulları N, İpek G, Kara Ö, Tanacan A, Sahin D. Second-Third Trimester Aspartate Aminotransferase to Platelet Ratio Index in Predicting in Intrahepatic Cholestasis of Pregnancy and its Relationship with Neoanatal Intensive Care Unit Requirement: A Case Control Study From a Tertiary Hospital. Jinekoloji-Obstetrik ve Neonatoloji Tıp Dergisi. 2023;20(3):1863–6.
5. Bozbay N, Kılıç Ş, Yildirim O, Pekin AT, Örgül G. Role of aspartate aminotransferase to platelet ratioin prediction of intrahepatic cholestasis of pregnancy. Clin Experimental Hepatol 2024, 10(1).

6. Dinçgez B, Özgen G, Özgen L. Comparison of the predictive role of first trimester APRI score and de-Ritis ratio in intrahepatic cholestasis of pregnancy. J Contemp Med. 2024;14(5):222–7.
7. Konukcu B, Karabulut T, İLK TRİMESTER SERUM İNFLAMATUAR MARKERLARINI KULLANARAK GEBELİK KOLESTAZINI ÖNGÖREBİLİR MİYİZ?. Jinekoloji-Obstetrik ve Neonatoloji Tıp Dergisi. 2025;22(1):31–7.
8. Bicocca MJ, Sperling JD, Chauhan SP. Intrahepatic cholestasis of pregnancy: review of six national and regional guidelines. Eur J Obstet Gynecol Reproductive Biology. 2018;231:180–7.
9. Lee RH, Greenberg M, Metz TD, Pettker CM. Medicine SfM-F: Society for Maternal-Fetal Medicine Consult Series# 53: intrahepatic cholestasis of pregnancy: replaces consult# 13, April 2011. Am J Obstet Gynecol. 2021;224(2):B2–9.
10. Wai CT, Greenson JK, Fontana RJ, Kalbfleisch JD, Marrero JA, Conjeevaram HS, Lok ASF. A simple noninvasive index can predict both significant fibrosis and cirrhosis in patients with chronic hepatitis C. Hepatology. 2003;38(2):518–26.
11. Lammert F, Marschall H-U, Glantz A, Matern S. Intrahepatic cholestasis of pregnancy: molecular pathogenesis, diagnosis and management. J Hepatol. 2000;33(6):1012–21.
12. Sterling RK, Lissen E, Clumeck N, Sola R, Correa MC, Montaner J, Sulkowski S, Torriani M, Dieterich FJ, Thomas DT. Development of a simple noninvasive index to predict significant fibrosis in patients with HIV/HCV coinfection. Hepatology. 2006;43(6):1317–25.
13. Allen K, Jaeschke H, Copple BL. Bile acids induce inflammatory genes in hepatocytes: a novel mechanism of inflammation during obstructive cholestasis. Am J Pathol. 2011;178(1):175–86.
14. Tolunay HE, Kahraman NÇ, Varlı EN, Ergani SY, Obut M, Çelen Ş, Çağlar AT, Üstün YE. First-trimester aspartate aminotransferase to platelet ratio index in predicting intrahepatic cholestasis in pregnancy and its relationship with bile acids: A pilot study. Eur J Obstet Gynecol Reproductive Biology. 2021;256:114–7.
15. Yılmaz EBS, Sağlam E, Yalcin S, Özler MR. The diagnostic and prognostic value of APRI and de Ritis ratio in intrahepatic cholestasis of pregnancy. BMC Pregnancy Childbirth. 2025;25(1):892.
16. Lin ZH, Xin YN, Dong QJ, Wang Q, Jiang XJ, Zhan SH, Sun Y, Xuan SY. Performance of the aspartate aminotransferase-to-platelet ratio index for the staging of hepatitis C-related fibrosis: an updated meta-analysis. Hepatology. 2011;53(3):726–36.
17. Gök K, Takmaz T, Köse O, Tüten N, Bostancı MS, Özden S. Effectiveness of the fibrosis-4 score in predicting intrahepatic cholestasis of pregnancy. Eur Archives Med Res. 2022;38(4):299.

Figures

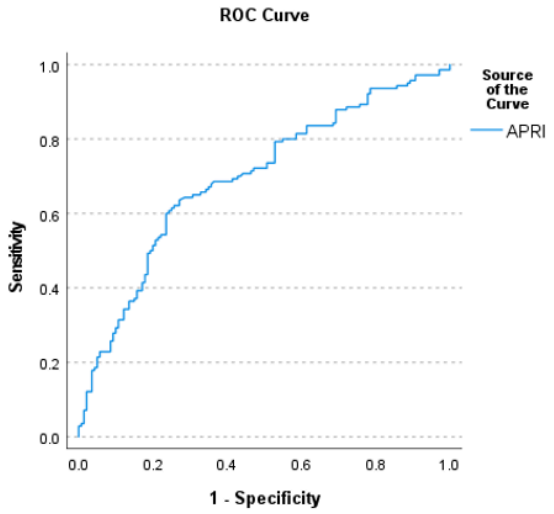


Figure 1. Receiver operating characteristic (ROC) curve of the APRI score in predicting intrahepatic cholestasis of pregnancy.

Figure 1

See image above for figure legend

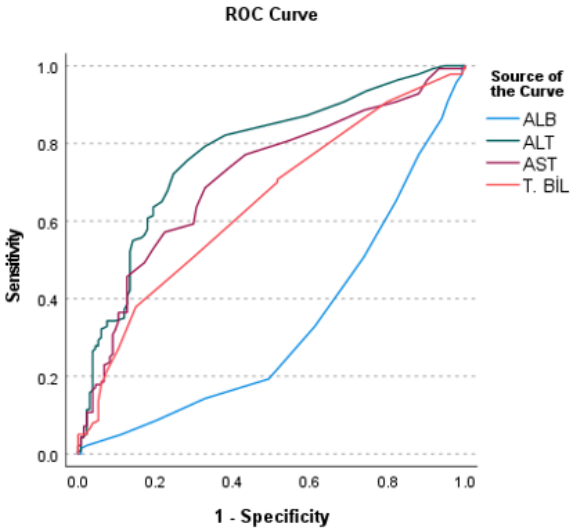


Figure 2. ROC curves of albumin, ALT, AST, and total bilirubin in predicting intrahepatic cholestasis of pregnancy

Figure 2

See image above for figure legend