Complete Blood Count-Derived Indices as Predictive Markers for Significant Fibrosis in **Metabolic Dysfunction-Associated Steatotic Liver Disease** (MASLD): Findings from NHANES 2021–2023

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Introduction

- **Metabolic dysfunction-associated steatotic liver disease (MASLD)** is an increasingly prevalent condition with progression to significant fibrosis (≥ F2) in 11.3% of patients (1).
- **Gap in knowledge:** CBC-derived indices have shown potential in predicting liver disease outcomes, but their utility in identifying significant fibrosis among MASLD patients has not been thoroughly evaluated.
- **Study objective:** To assess the predictive value of these indices using data from NHANES 2021–2023.

Study Methods

- **Study design:** Cross-sectional analysis using NHANES 2021–2023 data.
- **Population:** Adults (≥18 years) with MASLD criteria:
  - Hepatic steatosis: (CAP) ≥ 288 dB/m via elastography
  - ≥1 cardiometabolic risk factor
- **Exclusions:** Hepatitis B infection, excessive alcohol use (≥20 g/day women; ≥30 g/day men), missing elastography or CBC index data.
- **Fibrosis was assessed via Liver stiffness measurement (LSM) :** from F0-F1 (non-significant), F2-F4 (significant)
- **CBC-derived indices analyzed:** NLR (Neutrophil–Lymphocyte Ratio), PLR (Platelet–Lymphocyte Ratio), MHR (Monocyte–HDL Ratio), RDW (Red Cell Distribution Width)
- **Statistical analysis:**
  - Univariate logistic regression to assess the association between CBC-derived indices and liver fibrosis.
  - Statistically significant ($p < 0.05$) or nearly significant variables ($0.05 < p > 0.1$) included in multivariate logistic regression.

Results

Study Population Characteristics

- **Final sample:** 379 adults (mean age: 58.8 +/- 14.3 years)
- **Sex distribution:** 60% male
- **Race/ethnicity:**
  - 71% Non-Hispanic White
  - 12% Hispanic
  - 9% Non-Hispanic Black
  - 8% Other races/ethnicities
- **Mean Anthropometrics:**
  - Mean BMI: 33.7 +/- 6.3 kg/m²
  - Mean Waist circumference: 112.8 +/- 14 cm
- **Liver stiffness measurement (LSM):**
  - Mean: 7.93 +/- 5.83 kPa
  - Fibrosis stages: 75% F0–F1, 25% F2–F4
- **Comorbidities:**
  - Diabetes mellitus: 37.2%
  - Hypertension: 65.2%
  - Dyslipidemia: 71.5%
- **Mean CBC-derived indices:**
  - NLR: 2.35 +/- 1.3
  - PLR: 130.21 +/- 46
  - MHR: 0.46 +/- 0.2
  - RDW: 13.81 +/- 0.96

Univariate Logistic Regression

Univariate analysis showed no statistically significant association between NLR, MHR, or RDW and liver fibrosis. PLR demonstrated near statistical significance, as shown in Table 1, and was therefore included in the multivariate model.

Table 1. Univariate logistic regression

Characteristic	Odds Ratio (OR)	95% Confidence Interval	p-value
NLR	0.92	(0.75-1.12)	0.4089
PLR	1.00	(0.99-1)	0.0817
MHR	1.40	(0.44-4.43)	0.5647
RDW	0.98	(0.77-1.25)	0.8842

Multivariate Analysis

PLR was included in the multivariate regression model, adjusting for age, sex, race/ethnicity, and BMI, and remained nearly significant. Additionally, male sex was associated with lower odds of fibrosis ($p = 0.02$), and higher BMI remained a significant risk factor ($p < 0.01$), as shown in Table 2.

Table 2. Multivariate Regression Results

Characteristic	Adjusted OR	95% CI	p-value
PLR	0.99	(0.99 - 1.00)	0.0653
Age	1.02	(1.00 - 1.04)	0.0544
Sex (Male)	0.55	(0.32 - 0.93)	0.026
Race: Hispanic	0.93	(0.21 - 4.15)	0.9225
Race: Non-Hispanic White	1.18	(0.35 - 3.97)	0.7861
Race: Non-Hispanic Black	1.00	(0.24 - 4.23)	0.9984
Race: Asian	4.79	(0.96 - 24.05)	0.0569
Race: Other	0.39	(0.06 - 2.66)	0.3334
BMI	1.12	(1.07 - 1.16)	<0.001

Discussion

Univariate analysis and adjusted multivariate analysis

- PLR was nearly statistically significant in predicting liver fibrosis in both the univariate analysis and in the multivariate analysis adjusted for demographic and metabolic factors.
- PLR can be influenced by undiagnosed conditions unrelated to liver disease or by MASLD cases overlapping with autoimmune disorders.

Comparison with prior studies

- NLR has demonstrated strong predictive value for fibrosis in MASLD (2), RDW has been reported to predict advanced stages of fibrosis (3), and MHR has been reported to reflect systemic inflammation, a core mechanism driving fibrogenesis (4); however, these associations were not reproduced in our analysis.

Conclusion

- While CBC-derived indices have shown value in predicting fibrosis, among patients with moderate fibrosis, **PLR appears to be the only index with potential predictive utility.**
- **Higher BMI** is independently associated with an **increased risk of fibrosis**.
- Although CBC-derived indices may hold **promise as noninvasive markers** of fibrosis in MASLD, their **inconsistent performance across studies** suggests they should **not be incorporated into models predicting moderate fibrosis**.

References

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