Section: Pediatrics

Original Research Article

CLINICAL ASSESSMENT OF NUTRITION SCORE (CAN SCORE) VERSUS PONDERAL INDEX IN NEONATAL NUTRITIONAL STATUS

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ABSTRACT

Background: Fetal malnutrition reflects inadequate intrauterine fat and muscle accretion and may be present in term neonates with apparently normal birth weight. Clinical tools such as the Clinical Assessment of Nutrition (CAN) score may identify malnutrition more effectively than proportionality-based indices like the Ponderal Index (PI). The objective is to estimate the prevalence of fetal malnutrition in term neonates and compare the effectiveness of CAN score and PI in assessing neonatal nutritional status. **Materials and Methods:** A cross-sectional study was conducted on 198 singleton term neonates admitted to the postnatal ward. Fetal malnutrition was defined as CAN score <25 and PI <2.2 g/cm³. Data were analyzed using SPSS v23, with $p<0.05$ considered significant. **Result:** Fetal malnutrition was detected in 29.8% of neonates by CAN score and 27.8% by PI ($p = 0.001$), with a strong association between the two methods ($p = 0.001$). The CAN score showed higher diagnostic accuracy, with sensitivity 88.0%, specificity 84.2%, positive predictive value 76.0%, and negative predictive value 91.8%, compared with lower sensitivity for PI (69.1%). Malnourished neonates had significantly lower birth weight, length, head circumference, and mid-arm circumference (all $p \leq 0.002$). **Conclusion:** Fetal malnutrition is common among term neonates, and the CAN score demonstrates superior diagnostic performance and clinical validity compared to the Ponderal Index, supporting its routine use in neonatal nutritional assessment.

INTRODUCTION

Adequate fetal nutrition determines neonatal survival and growth. Many appropriate-for-gestational-age neonates still show malnutrition signs undetected by birth weight alone, necessitating assessment beyond anthropometry.[1] The CAN score clinically assesses fat and muscle loss across body regions, enabling simple bedside detection of fetal malnutrition in term neonates beyond anthropometric size measures.[2] Comparative studies show CAN score detects more fetal malnutrition than anthropometry; normal-weight neonates often exhibit fat and muscle loss, supporting structured clinical examination in neonatal nutritional assessment.[3] Ponderal Index relates weight to length for neonatal growth assessment, but may miss soft tissue wasting when linear growth persists, especially in asymmetric fetal growth restriction.[4] Proportionality indices underestimate fetal malnutrition; CAN score identifies compromised neonates with normal Ponderal Index, supporting complementary clinical assessment in neonatal care.[5] Early detection of fetal malnutrition is crucial amid the double burden; prenatal insults program chronic disease risk, enabling timely intervention.[6] Low birth weight and fetal undernutrition predispose to adult obesity, diabetes, and cardiovascular disease, highlighting neonatal nutritional assessment for immediate and lifelong prevention.[7] Maternal nutrition and intrauterine environment epigenetically shape fetal growth and metabolism; prenatal imbalance alters programming, making subtle malnutrition undetectable by anthropometry alone.[8] Advances in neonatal nutrition stress early identification of at-risk newborns; individualized assessment improves outcomes, especially in resource-limited settings, supporting simple tools like CAN score.[9] Growth assessment varies due to anthropometric measurement differences, reducing proportionality

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index sensitivity; population-specific references further limit universal cut-offs, supporting integration of clinical assessment.[10,11]

Comparative studies consistently show that the CAN score detects fetal malnutrition more effectively than anthropometric indices, including the Ponderal Index.[12] Maternal and neonatal factors influencing energy metabolism further contribute to variations in neonatal body composition that are not adequately captured by proportionality measures.[13] Validation studies confirm the reliability and reproducibility of the CAN score across clinical settings.[14] While correlations exist between the CAN score and proportionality indices, they are not interchangeable, as clinical assessment frequently identifies nutritional compromise in neonates with normal Ponderal Index values.[15] Combined use of clinical and anthropometric methods therefore offers a more comprehensive approach to neonatal nutritional assessment.[16]

MATERIALS AND METHODS

Study Design: A cross-sectional study

Inclusion Criterion:

1. Singleton term neonates.
2. Neonates who were admitted to the postnatal ward of Rohilkhand Medical College and Hospital for more than 24 hours.

Exclusion Criterion:

1. All preterm neonates, i.e., neonates with gestational age less than 37 weeks.
2. Neonates born with congenital malformations.
3. Twins and other multiple gestations.
4. Neonates with cephalhematoma or subgaleal bleed.
5. Neonates requiring admission to Neonatal Intensive Care Unit (NICU).
6. Neonates born to mothers diagnosed with Gestational Diabetes Mellitus (GDM).

Sample size: 198

The study was conducted after obtaining formal approval from the Institutional Ethics Committee of Rohilkhand Medical College and Hospital, Bareilly (U.P.), and all ethical guidelines were strictly adhered to throughout the study period. Written informed consent was obtained from the parents or legal guardians of each neonate prior to enrollment; the consent was explained in a language understandable to them, confidentiality was assured, anonymity was optional, participation was voluntary, and parents were informed of their right to withdraw at any stage without affecting the standard care of the neonate.

Measurement Tools and Procedures:

- Birth weight: Measured using a Sahyog Wellness Digital Weighing Scale (accuracy ±10 g), with the neonate weighed unclothed.
- Length: Measured immediately after birth using an IS IndoSurgicals Infantometer (accuracy ±2 cm) with the neonate in a supine position, head touching the fixed board, legs fully extended, and the movable board placed against the soles.
- Mid-arm circumference (MAC): Measured midway between the acromion and olecranon processes using a non-stretchable plastic measuring tape placed snugly without compressing soft tissues.
- Head circumference: Measured using a non-stretchable plastic tape encircling the most prominent part of the forehead and occiput, employing the cross-tape method for accuracy.

Ponderal Index (PI):

- Calculated using the formula: Weight (g) × 100 / Length (cm)^3.
- PI < 2.2 g/cm^3 was considered indicative of fetal malnutrition and useful in identifying asymmetric intrauterine growth restriction.

CAN Score Assessment:

- Assessed within 24–48 hours of birth.
- Based on nine clinical parameters: hair, cheeks, neck, arms, chest, abdomen, back, buttocks, and legs.
- Total score ranged from 9 to 36.
- Score < 25: fetal malnutrition; score ≥ 25: well nourished.

Maternal and Obstetric Data Collected:

- Maternal age.
- Gravida, para, live births, and abortions.
- Consanguinity status.
- Number of antenatal visits.
- Maternal illnesses or pregnancy-related complications.
- Gestational age at delivery.
- Mode of delivery (normal vaginal delivery or lower segment cesarean section).
- Neonatal birth details including immediate cry, need for resuscitation, Apgar scores at 1 and 5 minutes, presence of congenital anomalies, external birth injuries, and meconium-stained liquor.

Data Analysis: Data were entered in Excel and analyzed with SPSS v23 using appropriate tests. Results were expressed as percentages and presented in tables and graphs; $p<0.05$ indicated significance for interpretation clarity.

RESULTS

The study population shows a nearly equal gender distribution, with 52.5% males (n = 104) and 47.5% females (n = 94), and no statistically significant difference (p = 0.62). Most mothers belong to the 22–27 years age group (48.5%, n = 96), followed by those aged <22 years (22.7%, n = 45), with maternal age showing a significant association (p = 0.032). Regarding education, 32.8% (n = 65) of mothers have primary education, 28.3% (n = 56) secondary education, while 24.2% (n = 48) are illiterate and 14.7% (n = 29) are graduates or above, demonstrating a significant difference (p = 0.03). Socioeconomic assessment reveals that the majority belong to the lower middle class (34.3%, n = 68) and upper middle class (29.8%, n = 59), with a statistically significant

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distribution across socioeconomic categories (p = 0.019).

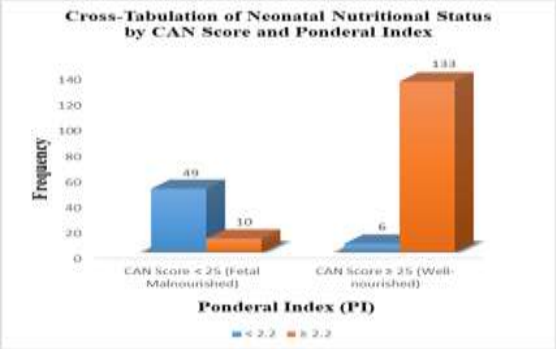

Figure 1: Cross-Tabulation of Neonatal Nutritional Status by CAN Score and Ponderal Index (n = 198)

[Figure 1] shows a significant association between Ponderal Index (PI) and CAN score classification (p = 0.001). Among 55 neonates with PI < 2.2, 49 (89.1%) were classified as malnourished by CAN score, while only 6 (10.9%) were well-nourished. Conversely, among 143 neonates with PI ≥ 2.2, the majority 133 (93.0%) were well-nourished and only 10 (7.0%) were malnourished. These findings demonstrate strong concordance between PI and CAN score in identifying fetal malnutrition, supporting the validity of PI as an anthropometric correlate of clinical nutritional assessment.

Table 1: Diagnostic Performance of CAN Score vs Ponderal Index for Neonatal Nutritional Status (n = 198)

Parameter	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
CAN Score (< 25)	88	84.2	76	91.8
PI (< 2.2)	69.1	82.1	67.3	83.2

[Table 1] compares the diagnostic performance of CAN score and Ponderal Index (PI) for detecting fetal malnutrition. The CAN score (<25) demonstrated higher sensitivity (88%) and specificity (84.2%) compared to PI <2.2 (69.1% and 82.1%, respectively). Positive predictive value and negative predictive value were also superior for CAN score (76% and 91.8%) than PI (67.3% and 83.2%). These findings indicate that the clinical CAN score has better overall diagnostic accuracy than the anthropometric Ponderal Index for identifying neonatal fetal malnutrition.

Table 2: Pearson Correlation between CAN Score and Ponderal Index in Neonatal Nutritional Status Assessment (n = 198)

Variables	Pearson r	p-value
CAN Score & Ponderal Index (PI)	0.73	0.001

[Table 2] shows a strong positive Pearson correlation between CAN score and Ponderal Index (r = 0.73, p = 0.001) in neonatal nutritional status assessment. This indicates that higher Ponderal Index values are significantly associated with higher CAN scores, reflecting better nutritional status. The statistically significant correlation confirms that the anthropometric Ponderal Index closely aligns with the clinical CAN score in detecting fetal malnutrition among neonates.

Table 3: Ponderal Index vs CAN Score in Neonatal Nutritional Status Assessment (n = 198)

CAN Category	PI < 2.2	PI ≥ 2.2	Total	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
< 25	49	10	59	86.9	76.1	18.2	98.9
≥ 25	6	133	139				
Total	55	143	198				

[Table 3] shows the comparison of fetal malnutrition detection by Ponderal Index (PI) against CAN score. Among 59 neonates classified as malnourished by CAN score (<25), 49 had PI <2.2 while 10 had PI ≥2.2. Among 139 well-nourished neonates (CAN ≥25), 6 had PI <2.2 and 133 had PI ≥2.2. The Ponderal Index demonstrated a sensitivity of 86.9%, specificity of 76.1%, positive predictive value of 18.2%, and negative predictive value of 98.9% for detecting fetal malnutrition. These findings indicate that PI shows good sensitivity and high NPV but lower PPV compared with the clinical CAN score, suggesting that while PI is useful for screening, CAN score remains the more reliable method for neonatal nutritional assessment.

DISCUSSION

The present study demonstrates a nearly equal gender distribution (52.5% males, 47.5% females; p = 0.62) with maternal age predominantly 22–27 years (48.5%) and significant associations with maternal age (p = 0.032), education (p = 0.03), and socioeconomic status (p = 0.019). Similar sociodemographic influence on neonatal nutritional status has been emphasized by Yadav et al. (2023),[17] who reported significantly lower anthropometric parameters among malnourished neonates (p < 0.001), indicating maternal–environmental determinants of fetal nutrition. The strong concordance observed between PI and CAN score in the present study (p = 0.001), with 89.1% of PI < 2.2 neonates classified as malnourished and 93.0% of PI ≥ 2.2 neonates well nourished, aligns with Almarzoki Jasim and Jasim (2015),[2] who reported a significant

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positive correlation between CAN score and PI. Diagnostic evaluation further shows higher sensitivity and specificity of CAN score (88%, 84.2%) compared with PI (69.1%, 82.1%), consistent with Felix et al. (2025),[18] who identified CAN score as having superior sensitivity and specificity over anthropometric indices. In contrast, Thomas et al. (2022),[19] reported BMI as more reliable than CAN score, highlighting methodological variability across populations. a strong positive correlation between CAN score and Ponderal Index ($r = 0.73$, $p = 0.001$), indicating close agreement between clinical and anthropometric assessment of neonatal nutrition. Similar concordance between CAN score and PI has been reported by Almarzoki Jasim and Jasim (2015),[2] who observed a significant positive correlation between these indices in identifying fetal malnutrition. The diagnostic comparison further shows that PI has good sensitivity (86.9%) and very high negative predictive value (98.9%) but low positive predictive value (18.2%) against CAN score, supporting its screening utility. This aligns with Martínez-Nadal et al,[14] (2016) who also noted discordance with PI missing some clinically malnourished infants. In contrast, Kapoor et al,[20] (2021) emphasized CAN score as more reliable than anthropometry alone.

CONCLUSION

The present study entitled "Clinical Assessment of Nutrition Score (CAN score) Versus Ponderal Index in Neonatal Nutritional Status" was conducted as a cross-sectional observational investigation in the postnatal wards of Rohilkhand Medical College and Hospital, Bareilly, among term singleton neonates fulfilling predefined eligibility criteria. The study was undertaken to compare the Clinical Assessment of Nutrition (CAN) score with the Ponderal Index (PI) in evaluating neonatal nutritional status at birth. It further sought to determine the prevalence of fetal malnutrition among term newborns, examine the effectiveness of both clinical and anthropometric indices in identifying nutritional deficits, compute CAN score and PI using standardized measurement protocols, and analyze the agreement between these methods in classifying fetal nutritional status. By integrating structured neonatal anthropometry with systematic clinical assessment within the early postnatal period, the investigation intended to clarify the relative diagnostic utility and concordance of these commonly employed tools in routine neonatal nutritional evaluation.

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