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Assessment of the Gold Standard Test for Fetal Malnutrition Using Statistical and Boolean Analyses

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ABSTRACT

Background: Fetal malnutrition (FM), defined by inadequate fat and muscle deposition in utero, poses serious risks to neonatal and long-term health. Early identification is vital for prompt intervention. This study aimed to compare the diagnostic accuracy of Body Mass Index (BMI), Ponderal Index (PI), and Mid-Upper Arm Circumference to Head Circumference ratio (MUAC/HC) against the Clinical Assessment of Nutritional Status Score (CANSCORE) for detecting FM.

Methods: A cross-sectional study was conducted at CMH Rawalakot, AJK, from December 2022 to July 2023. The study included 320 live singleton neonates between 28–42 weeks of gestation. Neonates with congenital anomalies, macrosomia from diabetic mothers, or multiple pregnancies were excluded. Within 48 hours of birth, each neonate underwent anthropometric measurements (weight, length, HC, MUAC) by a single observer. Derived indices included BMI, PI, and MUAC/HC. CANSCORE (<25 indicating FM) was also recorded. Statistical analyses, including sensitivity, specificity, PPV, and NPV of FM assessment tools, were performed using MATLAB, with significance set at $p < 0.05$.

Results: Using CANSCORE as the reference, BMI showed the highest sensitivity (92.9%) and NPV (95.1%), while PI demonstrated the highest specificity (81.6%) and PPV (70.9%). Error analysis revealed that BMI had the lowest total error and strongest consistency with other indices. A comparative literature review confirmed the superior diagnostic value of BMI and PI. All comparisons were statistically significant ($p < 0.05$)

Conclusion: BMI outperformed other measures in detecting FM, making it a practical and reliable tool for clinical screening. It offers a valuable alternative to CANSCORE, especially in resource-limited settings.

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Keywords: Fetal malnutrition, BMI, Neonates.

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INTRODUCTION

Fetal Malnutrition (FM), initially described by Scott and Usher in 1966, represents a clinical condition that is irrespective of birth weight at a given gestational age. FM is characterized by evident intrauterine weight loss or the inability to accrue Sufficient Subcutaneous (SC) fat and muscle. It's important to note that being determined to be small for gestational age (SGA) does not necessarily imply malnutrition. Perinatal issues primarily arise in malnourished infants, whether Appropriate for Gestational Age (AGA) or SGA, as opposed to those who are solely SGA without malnutrition [1].

Various assessment methods for FM have been proposed. Firstly, birth weight has traditionally served as a common indicator [2]. But FM has been observed at various birth weights, emphasizing that SGA is not synonymous with FM [3]. Anthropometric assessment tools, incorporating measurements such as body weight, length, and head circumference, offer a comprehensive evaluation of FM, but their sensitivity to FM varies. Proportionality indices, including the Mid Upper-Arm Circumference to Head Circumference Ratio (MUAC/HC) and Ponderal Index (PI), and Body Mass Index (BMI), have also been suggested in [4].

Given the closer relationship between neonatal morbidity/mortality and nutritional status rather than birth weight, a Clinical Assessment of Nutritional Status (CANS) score was developed [5]. This score involves a systematic inspection and estimation of loss of SC tissues and muscles based on nine physical parameters. Scores range from 1 (extreme FM) to 4 (healthy), with a total score of <25 indicating FM. The CANS score serves as a basic clinical measure that can be used to diagnose FM and forecast the related newborn morbidity without the requirement for complex machinery[6, 7].

While different anthropometric and proportionality indices measure diverse aspects of newborn well-being, the CANS score focuses on visible wasting in neonates undernourished, reflecting adverse intrauterine nutrition. The use of multiple FM determination methods increases the likelihood of identifying most FM cases [8, 9].

Children below 5 years mortality in Pakistan is still a major concern; there were 65.2 deaths for every 1000 live births, surpassing the global rate of 37 out of every 1000. Moreover, Pakistan's infant mortality rate (a subset of child mortality) significantly exceeds the global average IMR of 26.7 per 1,000 live births reported in 2022, standing at 56.9 per 1,000 live births[10]. Worrisomely, low birth weight babies were linked to problems in over 70% of these newborn deaths, which frequently resulted from inadequate prenatal care and inadequate nutrition for mothers[11]. The importance of maternal nutrition during pregnancy in influencing the outcomes of births in Pakistan. The nation urgently needs comprehensive maternal healthcare interventions and nutritional support because of

the association between poor maternal food intake and long-term detrimental impacts on both maternal and child health[12].

Regrettably, the CANS score is not routinely used in Pakistan. Incorporating the CANS score into routine newborn assessments could enhance newborn care, particularly in mitigating FM-related risks of neonatal morbidities and mortality rates. Additionally, the CANS score can streamline the identification of high-risk babies reducing the need for anticipatory care and follow-up [13,14,15,16].

Given the established association between FM and adverse neonatal outcomes, and the urgent need for accessible, reliable assessment methods in Pakistan's healthcare context, there is a compelling need to explore the utility of the CANS score in routine newborn evaluations. Implementing this tool could facilitate early detection of FM, enabling timely interventions, reducing neonatal morbidity and mortality, and improving long-term health trajectories. Therefore, this study is justified by the potential of the CANS score to enhance clinical decision-making, strengthen neonatal care practices, and address pressing gaps in maternal and newborn health outcomes in Pakistan.

METHODS

This cross-sectional study was conducted at the tertiary Combined Military Hospital (CMH) Rawalakot, Azad Jammu and Kashmir (AJK), where all live-born neonates delivered between December 2022 and July 2023 were included. A total of 320 neonates were enrolled in the study. Ethical approval was obtained from the institutional research committee under ERC #774/SKBZ/CMH/02/01/2024, and written permissions were secured from the heads of the Neonatology, Gynecology, and Obstetrics departments at Sheikh Khalifa Bin Zayed Al Nahyan Hospital/AK CMH Rawalakot before data collection. Informed consent was also taken from the legal guardians of each neonate before assessment. The study included both male and female neonates from singleton pregnancies with gestational ages between 28 and 40 weeks. Neonates with congenital anomalies involving disproportion, those born to diabetic mothers resulting in macrosomia, and infants from multiple pregnancies were excluded.

Standardized anthropometric techniques were applied within the first 48 hours after birth, and all assessments were performed by the same trained observer to minimize inter-observer bias. Weight was measured using a calibrated digital weighing scale with an accuracy of ±10 grams, while neonates were completely unclothed. Length was assessed using a rigid infant measuring board with the infant placed in a supine position, ensuring full leg extension, and readings were taken to an accuracy of ±0.5 cm. Head circumference was measured using a flexible, non-stretchable tape positioned over the most prominent part of the occiput and just above the supraorbital ridges. Mid-

upper-arm circumference (MUAC) was also recorded using the same type of tape, with measurements taken on the left arm midway between the acromion and olecranon, accurate to 0.1 cm.

Using these measurements, proportionality indices were calculated to assess fetal malnutrition (FM). The MUAC/HC ratio was computed, with values less than 0.27 considered malnourished. The Ponderal Index (PI) was derived using the formula: weight in grams divided by the cube of length in centimeters, multiplied by 100, where a PI <2.2 indicated FM. Body mass index (BMI) was calculated as weight in kilograms divided by the square of length in meters, with values below 11.2 kg/m² indicating FM.

In addition to anthropometric assessment, the Clinical Assessment of Nutritional Status (CANS) technique was used. This involved a detailed visual and tactile examination of nine superficial physical signs: the skin of the abdominal wall, arms, back, buttocks, legs, chin, cheeks, hair, and buccal fat pads. Each site was scored from 1 (severely malnourished appearance) to 4 (normal), generating a total score between 9 and 36. A score below 25 was considered clinical evidence of fetal malnutrition. To ensure consistency, all CANS evaluations were conducted by the same observer.

All collected data were entered into Microsoft Excel for organization, verification, and cleaning. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were calculated to summarize neonatal characteristics, gestational age, gender distribution, NICU admissions, and anthropometric measures. Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were calculated for BMI, PI, MUAC/HC, and CANS score using each measure as a reference standard in turn. Type I (false positive) and type II (false negative) errors, as well as total classification errors, were computed to evaluate the consistency and reliability of each test. All statistical analyses and graphical representations were performed using MATLAB, allowing precise calculations and effective visualization of anthropometric and clinical data. Comparative performance of the FM assessment tools was assessed numerically and visually, and statistical significance was considered at $p < 0.05$.

RESULTS

The study population included 320 live, singleton neonates, with a higher proportion of males (61.3%) compared to females (38.8%). This male predominance may reflect population-level birth

trends and is consistent with previous neonatal studies. The gender distribution provides important context for interpreting growth and nutritional assessments, as some anthropometric measures may vary by sex.

Table 1. Neonatal Distribution According to Gestational Age and NICU Admission

Gestational Age	Total (No., %)	NICU Admission Yes (No., %)	NICU Admission No (No., %)
Preterm (<37 wks)	82 (25.6)	66 (80)	16 (19.5)
Full-term (≥37 wks)	238 (74.4)	182 (76.5)	56 (23.5)

Among the neonates, 25.6% were preterm and 74.4% were full-term. NICU admission was observed in 80% of preterm neonates and 76.5% of full-term neonates, highlighting that preterm infants have slightly higher intensive care needs. These findings underscore the importance of gestational age in predicting neonatal morbidity and the necessity for careful nutritional and clinical monitoring in both preterm and full-term neonates.

Table 2. Sensitivity, Specificity, Positive Predictive Value (PPV), and Negative Predictive Value (NPV) of FM Measures Using Different Reference Standards

Reference	Parameter	Sensitivity	Specificity	PPV	NPV
CANS score	BMI	0.929	0.744	0.665	0.951
	PI	0.823	0.816	0.710	0.894
	MUAC/HC	0.664	0.729	0.573	0.799
BMI	CANS score	0.665	0.951	0.929	0.744
	PI	0.804	0.975	0.969	0.836
	MUAC/HC	0.557	0.735	0.672	0.630
PI	CANS score	0.710	0.894	0.823	0.816
	BMI	0.969	0.836	0.804	0.975

	MUAC/HC	0.504	0.657	0.504	0.656
MUAC/HC	CANS score	0.573	0.799	0.664	0.729
	BMI	0.672	0.630	0.557	0.735
	PI	0.504	0.656	0.504	0.656

Table 2 summarizes the performance of BMI, PI, MUAC/HC, and CANS score using each measure as the reference standard. BMI consistently demonstrates high sensitivity and NPV across multiple reference standards, indicating its reliability in correctly identifying neonates with FM and minimizing false negatives. PI exhibits the highest specificity and PPV when BMI is the reference, making it effective for confirming non-FM cases. CANS score provides moderate sensitivity and high specificity, supporting its complementary clinical use. MUAC/HC generally shows lower sensitivity and specificity, suggesting it is less reliable as a standalone measure for FM detection.

Table 3. FM Detection Errors (%) for All Pairings of FM Measures

Test	CANS Score	BMI	PI	MUAC/HC
CANS Score	0 / 16.6 / 16.6	2.5 / 0 / 2.5	6.3 / 19.1 / 18.1	11.8 / 21.9 / 21.9
BMI	2 / 0 / 2	0 / 0 / 0	1.25 / 10.9 / 11.9	13.4 / 20.3 / 25.0
PI	6.3 / 18.1 / 20.3	10.9 / 0 / 10.9	0 / 0 / 0	20.3 / 40.6 / 40.6
MUAC/HC	11.9 / 21.9 / 29.4	29.4 / 35.3 / 40.6	20.3 / 40.6 / 45.6	0 / 0 / 0

Note: Type I error / Type II error / Total error.

Analysis of FM detection errors revealed that BMI consistently exhibited the lowest type I, type II, and total errors across all pairings, highlighting its reliability and consistency compared to other measures. MUAC/HC showed the highest error rates, suggesting lower accuracy and agreement with other indices. The CANS score demonstrated intermediate error levels, supporting its role as a complementary clinical measure that can provide additional insight into FM status, especially when combined with direct anthropometric measures.

DISCUSSION

In the study, four assessment tables are used to evaluate FM assessment methods, rather than a single one, to circumvent the lack of a gold-standard test. In the four tables, the four measures of CANS score, BMI, PI, and MUAC/HC take turns for the role of a reference test that arbitrarily replaces the necessarily missing gold standard. The authors deliberately include in each table a line full of perfect (100%) parameters when it is used for comparing a measure to itself. We include such a line as a call for avoiding erroneous results reported in published papers in which such a line is entered with entries strictly less than 100% [17,18,19]. The use of each of the four measures to represent the gold standard enables us to compare results with any sort of results reported earlier in published papers. Moreover, this use also facilitates the comparison of our results to any kind of results reported in future papers.

Comparing results with similar results reported in the open literature where they use the CANS score as the gold standard for identifying FM [20]. They report the sensitivity and specificity of the Ponderal Index as 69.5% and 55.6%, respectively (compared to our corresponding results of 82.3% and 81.6%, respectively). Moreover, they declare the sensitivity and specificity of the MUAC/HC ratio to be 77.7% and 91.1%, respectively (compared to our corresponding results of 66.3% and 72.9%, respectively).

Instead of using the CANS score as a reference, BMI is also used as the gold standard for identifying FM [21]. They report the sensitivity, specificity, PPV and NPV of the Ponderal Index as 69.8%, 73.2%, 54%, and 85%, respectively (compared to our corresponding results of 80.4, 97.5%, 96.9% and 83.5% respectively). They also report the sensitivity, specificity, PPV and NPV of the CANS score as 39.6%, 59.8%, 33.9%, and 59.8%, respectively (compared to our corresponding results of 66.4%, 95.1%, 93% and 74.4% respectively).

The CANS score was used as the gold standard for identifying FM in [22]. They report the sensitivity, specificity, PPV and NPV of the MUAC/HC ratio as 34.9%, 75.0%, 38.6%, and 71.9%, respectively (compared to our corresponding results of 66.4%, 73%, 0.57.2% and 80%, respectively). They also report the sensitivity, specificity, PPV and NPV of the Ponderal Index as 31.7%, 83.6%, 46.5%, and 73.1%, respectively (compared to our corresponding results

of 82.3%, 81.7%, 71% and 89.4%, respectively). Moreover, they find the sensitivity, specificity, PPV and NPV of the BMI to be 69.8%, 72.1%, 53.1%, and 84.2%, respectively (compared to our corresponding results of 92.9%, 74.4%, 66.4% and 95.1%, respectively.

In clinical evaluation of diagnostic tests, sensitivity and specificity evaluate the accuracy of a test with respect to a gold standard, while PPV and NPV are the appropriate interpretations of the test results[22, 23]. Individually, each of these four indices expresses mutual agreement among pairs of the

four measures (MUAC/HC, PI, BMI, and the CANS score). By contrast, clinical diagnostics employ three measures of disagreement, namely the percentage error of the first kind (false positives), the percentage error of the second kind (false negatives) [24, 25], and their sum or the percentage total error among pairs of the CANS score, BMI, PI, and MUAC/HC measures.

It was noted that the BMI measure (and not the CANS score) has the best consistency with other measures. This result is somewhat surprising since the CANS score seems to be the de facto reference in FM studies [17, 20]. Despite the generally agreed-upon theoretical importance of different types of errors (false-positives, false-negatives, and their sum), the authors could not come across numerical results similar to ours in the various papers on diagnostic testing surveyed.

CONCLUSION

To overcome the absence of a definitive gold standard test, the research employs four assessment tables, rotating CANS score, BMI, PI, and MUAC/HC as reference tests. Each measure is intentionally represented as a gold standard in these tables, facilitating comparisons with previous and future research outcomes. A comparison with existing literature, including studies by Adebami, Korkmaz, Kamath, and Almarzoki, highlights variations in prevalence rates and diagnostic measures. BMI and CANS score consistently demonstrate strong consistency with other measures, challenging the prevalent reliance on the CANS score as the standard reference in FM studies. Further research is required to explore innovative methods for constructing gold standards or, alternatively, for processing data in unbiased and appropriate ways, even in the absence of a gold standard.

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CONFLICT OF INTEREST

None

ETHICAL APPROVAL

Ethical approval was obtained from the institutional research committee under approval **#774/SKBZ/CMH/02/01/2024**, and written permissions were secured from the heads of the Neonatology, Gynecology, and Obstetrics departments at Sheikh Khalifa Bin Zayed Al Nahyan Hospital/AK CMH Rawalakot, Pakistan.

AUTHORS' CONTRIBUTION

All authors contributed equally as per ICMJE.

REFERENCES

1. Fabre E, de Agüero RG, de Agustín JL, Ezquerra A. Intrauterine growth restriction: concept and epidemiology. In: Kurjak A, Chervenak FA, editors. Textbook of Perinatal Medicine. 2nd ed. Boca Raton: CRC Press; 2006 Sep 25. p. 1288–96.

2. Chelli SB, Surekha SM, Pulluru UR, Prithiviraj E, Sumathy G. A comparative study between CAN score and Ponderal Index in identifying nutritional status of the neonate. Int J Health Sci (Qassim). 2022;6(S6):3205–13. doi:10.53730/ijhs.v6nS6.11557.

3. Metcoff J. Clinical assessment of nutritional status at birth: fetal malnutrition and SGA are not synonymous. Pediatr Clin North Am. 1994 Aug;41(5):875–91. doi:10.1016/S0031-3955(16)38822-7.

4. Thomas TK, Kamath MK, Raj KH, Thomas T, Shetty HR. Clinical assessment of nutrition status score and body mass index in newborns: a comparative study. Int J Health Sci (Qassim). 2022;6(S6):10624–35. doi:10.53730/ijhs.v6nS6.14268.

5. Raza M, Imani B, Dordipour M, Pourbadakhshan N. Use of CAN score for clinical assessment of nutritional status of newborns at Ghaem Hospital, Mashhad, Iran: comparison with anthropometric criteria. J Pediatr Perspect. 2024 Apr;12(4):18712–20. doi:10.22038/ijp.2024.81405.5469.

6. Dhanorkar A, Bagdey P, Humne A, Ughade S, Yadav S, Khadse A. Comparison of fetal malnutrition by CANSCORE and other methods. Sch J Appl Med Sci. 2014 Jan;2(1B):209–12.

7. Dhanorkar A, Bagdey P, Humne A, Ughade S, Yadav S, Khadse A. Detection of fetal malnutrition at birth by clinical assessment of nutritional status score (CANSCORE). Int J Res Med Sci. 2014 Jan;4(1):1–5. doi:10.5455/2320-6012.ijrms20140201.

8. Ezenwa B, Iroha E, Ezeaka V, Egri-Okwaji M. Comparative study of Clinical Assessment of Nutritional Status Score and proportionality indices in the assessment of fetal malnutrition in term newborns. Niger Med J. 2016 Mar–Apr;57(2):124–8. doi:10.4103/0300-1652.182073.

9. Priyanka O, Sindgikar SP. Diagnostic utility of the CAN score and proportionality indices and variations in neutrophil- and platelet-lymphocyte ratios in fetal malnutrition. J Neonatol. 2024 Sep;38(3):433–8. doi:10.1177/09732179241262083.

10. Tharwani ZH, Bilal W, Khan HA, Kumar P, Butt MS, Hamdana AH, et al. Infant and child mortality in Pakistan and its determinants: a review. Inquiry. 2023 Apr;60:00469580231167024. doi:10.1177/00469580231167024.

11. Bhutta ZA, Das JK, Rizvi A, Gaffey MF, Walker N, Horton S, et al. Evidence-based interventions for improvement of maternal and child nutrition: what can be done and at what cost? Lancet. 2013 Aug 3;382(9890):452–77. doi:10.1016/S0140-6736(13)60996-4.

12. Jain S, Maheshwari A, Jain SK. Maternal nutrition and fetal/infant development. Clin Perinatol. 2022 Jun;49(2):313–30. doi:10.1016/j.clp.2022.02.004.

13. Rushdi RA. Fetal malnutrition: assessment by the CANS score versus anthropometry and impact on early neonatal morbidities [master's thesis]. Cairo: Department of Pediatrics, Kasr Al-Ainy Faculty of Medicine, Cairo University; 2017. Available from: https://www.researchgate.net/profile/Rufaidah_Rushdi/contributions

14. Sindgikar SP, Rao S. Fetal malnutrition: features and impact. In: Patel VB, Preedy VR, editors. Handbook of Public Health Nutrition: International, National, and Regional Perspectives. Cham: Springer Nature; 2025 Jul 17. p. 1–21. doi:10.1007/978-3-031-55066-4_51-1.

15. Felix ML, Basantes C, Nicola S, Hidalgo S, Guevara-Ramírez P, Cadena-Ullauri S, et al. Nutritional status assessment of newborns: comparison of the CAN score (Metcoff methodology), growth curves, anthropometry, and plicometry. Nutrients. 2025 May 12;17(10):1642. doi:10.3390/nu17101642.

16. Gul H, Ullah I, Khan MQ, Hayat AK, Khan A, Asma B. Comparison of the CAN (Clinical Assessment of Nutrition) score with other anthropometric parameters to determine the importance of the skin-fold thickness for fetal nutrition assessment. Pak J Health Sci. 2023 Jun 30:87–91.

17. Almarzoki M, Jasim R. Comparative study between Clinical Assessment of Nutritional Status score (CAN Score) and anthropometry in the assessment of fetal malnutrition. Int Res J Med Sci. 2015 Jul;3(7):8–12.

18. Sukulal K, Cherian R, Vasan MT, Elizabeth KE. Evaluation of newborn nutritional status using CANSCORE within 48 hours of birth. Res J Med Sci. 2024 Feb 25;18:433–7.

19. Attia Bari AA, Alvi MM, Javed R, Alvi MY. Relationship of mid-upper arm circumference and body mass index for assessing maternal nutritional status. Pak Pediatr J. 2021;45(2):186–91.

20. Amarendra M, Yoganand M. Comparison of Clinical Assessment of Nutritional Status (CAN) score with other methods in the assessment of fetal malnutrition. Int J Contemp Pediatr. 2017 May–Jun;4(3):713–8. doi:10.18203/2349-3291.ijcp20170917.

21. Ezenwa BN, Ezeaka VC. Is CAN Score a good indicator of fetal malnutrition in preterm newborns? Alexandria J Med. 2018 Mar;54(1):57–61. doi:10.1016/j.ajme.2016.12.005.

22. Lim CY. Methods for evaluating the accuracy of diagnostic tests. Cardiovasc Prev Pharmacol. 2021 Jan 31;3(1):15–20. doi:10.36011/cpp.2021.3.e5.

23. Mor Y. Diagnostic test evaluation. In: Chatterjee S, Gemmete JJ, editors. Translational Interventional Radiology. Cambridge: Academic Press; 2023 Jan 1. p. 221–4. doi:10.1016/B978-0-323-90760-8.00043-6.

24. CF CF. Laboratory diagnosis. In: McPherson RA, Pincus MR, editors. Henry's Clinical Diagnosis and Management by Laboratory Methods. 24th ed. South Asia ed. New Delhi: Elsevier; 2021 Jun 9. p. 331–6.

25. Herchline D, Rasooly IR, Bonafide C. Is that normal? A case of diagnostic error due to misinterpretation of laboratory findings. Hosp Pediatr. 2021 May;11(5):e78–81. doi:10.1542/hpeds.2020-001974.