**Journal of Research in Medical and Dental Science**
**2021, Volume 9, Issue 8, Page No: 400-404**
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Available Online at: www.jrmds.in
eISSN No.2347-2367: pISSN No.2347-2545

# Assessment of Fetal Malnutrition by Clinical Assessment of Malnutrition Score (Can Score)-A Cross Sectional Study

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## ABSTRACT

*Background: Fetal malnutrition is defined as failure to acquire adequate amount of fat and muscle during intrauterine life. It is not synonymous with the terms small for gestational age (SGA) and intrauterine growth retardation (IUGR) one may occur without the other irrespective of the specific etiology and is independent of birth weight and gestational age. A simple, practical, clinically applicable scoring system CAN SCORE was developed by Metcoff to differentiate malnutrition from appropriately nourished babies, irrespective of birth weight or AGA/SGA.*

*Material and methods: This is cross sectional study conducted in 225 neonates in Adichunchanagiri institute of medical sciences, B.G.Nagara, from 01.04.2020 to 01.11.2020. Birth weight was recorded using electronic weighing scale, Crown to heel length was measured using infantometer. Weight was plotted on Growth charts and classified as AGA, SGA and LGA.Clinical assessment of nutritional status was done between 24-48 hours on the basis of CAN score.Proportionality indices like Ponderal Index calculated and compared with CANSCORE.Statistical analysis was carried out using software SPSS version 20. Pearson's chi-square test (X2) was used to find the association between the categorical variables. Pearson's correlation coefficient was used to find the correlation between two continuous variables. P-value of < 0.05 was considered as significant.*

*Results: Out of 225 babies, who fulfilled the inclusion criteria, 29 babies were low birth weight, 34 were small for gestational age, ponderal index identified 25 babies as malnourished while CAN score identified 75 babies as malnourished. By Fischer's exact test CAN score and ponderal index are statistically significantly associated with p<0.001. By Chi-square test Weight for age and CAN score are statistically significantly associated with p<0.001.*

*Conclusion: CAN score is a simple, robust and accurate method of identifying fetal malnutrition.*

**Key words:** CAN score, Fetal malnutrition, Small for gestational age, Intrauterine growth retardation

**HOW TO CITE THIS ARTICLE:** Madhunandan K, Archana T. P., Chandan N., Pavan Kumar D.*, Assessment of Fetal Malnutrition by Clinical Assessment of Malnutrition Score (Can Score)-A Cross Sectional Study, J Res Med Dent Sci, 2021, 9(8): 400-410. Assessment of Fetal Malnutrition by Clinical Assessment of Malnutrition Score (Can Score)-A Cross Sectional Study, J Res Med Dent Sci, 2021, 9(8): 400-404

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**Received: 05/11/2021**
**Accepted: 19/11/2021**

## INTRODUCTION

A good nutritional status in a fetus is important for good neonatal outcome. Gestational age and birth weight are predictors of immediate survivaland long term outcome. But, these factors do not indicate the actualnutritional status of the newborn. Fetal malnutrition is not synonymous with the terms small for gestational age (SGA) and intrauterine growth retardation (IUGR) one may occur without the other irrespective of the specific etiology and is independent of birth weight and gestational age. The termfetal malnutrition (FM) is coined by Scott and Usher in 1966 to describe babies who showed evidence of soft tissue wasting at birth irrespective of the specific etiology [1]. It is defined as failure to acquire adequate amount of fat and muscle during intrauterine life. In fetal malnutrition, subcutaneous fat and underlying muscles are diminished and the skin of arms, legs, elbows, knees and inter-scapular region is flabby. In severe fetal malnutrition, the neonate may look marasmic as the skin appears too large for the baby. Ponderal index is used to identify growth retardation. Ponderal index relieson the principle that during acute malnutrition weight affected sparing the length. However, there is proportionate change in length and weight in babies with chronic malnutrition. Therefore, infants with chronic malnutrition may not be identifiedby Ponderal index [2].

Since neonatal outcome is more closely related to nutritional status of newborn at birth than to the birth weight for gestational age, a simple,practical, clinically applicable scoring system Clinical Assessment of Nutritional Status (CAN SCORE) was developed by Metcoff

to differentiate malnutrition from appropriately nourished babies, irrespective of birth weight or AGA/ SGA. The score contains nine clinical signs namely hair, cheeks, neck, arms, chest, skin of abdominal wall, back, buttocks and legs. The score assess nutritional status of the fetus at birth. Features of fetal malnutrition are searched for using nine readily detectable clinical signs. Highest score of 4 is given to each parameter with no features of malnutrition and lowest of 1 is awarded to parameter with the worse feature of malnutrition. The CAN SCORE varies between 9 (lowest) and 36 (highest). A baby with CAN SCORE below 25 is regarded as having fetal malnutrition. CAN SCORE is a purely clinical assessment similar to Ballard score. It is simple to carry out bedside. It identifies babies with fetal malnutrition irrespective of it being small, appropriate or large for gestational age (SGA, AGA or LGA).

## METHODOLOGY

### Aims and objectives

- To assess fetal malnutrition by CAN score.
- To compare fetal malnutrition with CAN score and ponderal index.

### Study design

This is across sectional study conducted in Adichunchanagiri Institute of Medical Sciences AIMS, Mandya, which is a tertiary care teaching hospital, situated in rural area of Mandya district, Karnataka from 01.04.2020 to 01.11.2020

**Data:** A study subjects included 225 neonates who were born between April 2020 to November 2020 and who fulfilled the inclusion criteria were included in study.

### Inclusion criteria

Live born, singleton, term normal and stable newborn.

### Exclusion criteria

- Babies with major congenital malformation.
- Preterm newborns.
- Newborns requiring NICU care.

Birth weight was recorded using electronic weighing scale,Crown to heel length was measured using infantometer. Weight was plotted on Growth charts and classified as AGA, SGA and LGA. Proportionality indices like Ponderal Index calculated and compared with clinical assessment of Nutrition Score (CANSCORE).Ponderal index less than 2.2 gm/cm3 was considered as malnutrition. Clinical assessment of nutritional status was done between 24-48 hours on the basis of CAN score which is based on the superficial readily detectable signs of malnutrition in the newborn as described by Metcoff J (Table 1).

**Table1: can score.**

| Project | Canscore | | | |
|---|---|---|---|---|
| | 4 | 3 | 2 | 1 |
| Hair | Thick, dense, smooth, satin-like, easy to comb | Thick, Scarce, there is little hair straight. | Hair thin, straight and put up with more hair. | Sparse, straight and erect hair, the hair bundle associated with reduced pigmentation. |
| Cheek | Plump, round face | Slightly reduced fat | Significantly reduced | Fat is almost gone, narrow face |
| Neck chin | Fat overlap into double or triple chin, neck cover | Slightly reduced fat chin, the neck can be seen | Fat pad thin chin, neck revealed | Chin fat disappears, the neck is clear, loose skin, wrinkle |
| Arm | Fullness, cannot lift the skin | Arm a little thin, check on the pressure of hands, the accordion-like folds can be formed | Small arms, to form accordion-like folds | Very little fat, loose skin, accordion-like folds significantly |
| Back | Inter-scapular area of skin cannot be picked. | Little to lift the skin | Easy to lift and skin | Loose skin, easy to lift, wrinkles can form |
| Buttock | Fat pad thickness | Slightly reduced fat | Significantly reduced fat, hips tip, wrinkle | Fat disappears, fight wrinkles, loose skin and a very, kind of hip, such as pipe |
| Leg | Described with the same arm | Described with the same arm | Described with the same arm | Described with the same arm |
| Chest | Full intercostal space | Intercostal space slightly visible | Intercostal space revealed. | Intercostal space very clear, obvious loss of subcutaneous tissue. |
| Abdomen | Fullness, thickness of subcutaneous fat. | Slightly reduced fat. | Abdominal wall thinning, can form the accordion-like folds. | Abdominal bulging or boatshaped abdomen, loose skin, can form the accordion-like folds. |

Statistical analysis was carried out using software SPSS version 20. Categorical variables were presented as frequencies and percentages. Continuous variables were presented as (Means ± SD). Pearson's chi-square test($X^2$) was used to find the association between the categorical variables. Pearson's correlation coefficient was used to find the correlation between two continuous variables. P-value of <0.05 was considered as significant.

## RESULTS

There were 225 babies who fulfilled the inclusion criteria. Among them, 116 (51.6%) were males and 109 (48.4%) were females. Out of which 29 (12.9%) were low

birth weight and 196 (87.1%) had normal weight. Small for gestation age (SGA) babies were 34 (15.1 %), Appropriate for gestation age (AGA) babies were 188 (83.6%), large for gestation age (LGA) babies were 3 (1.3%) (Table 2).

**Table2: Weight for age category.**

| | Frequency | Percent | Valid percent | Cumulative percent |
|---|---|---|---|---|
| Valid SGA | 34 | 15.1 | 15.1 | 15.1 |
| AGA | 188 | 83.6 | 83.6 | 98.7 |
| LGA | 3 | 1.3 | 1.3 | 100 |
| Total | 225 | 100 | 100 | |

Out of 225 babies Ponderal index has identified 25 babies as malnourished and 200 babies as well nourished (Table 3) while CAN score has identified 75 babies as malnourished and 150 babies as well nourished (Table 4). Of the 25 malnourished babies by Ponderal Index, CAN SCORE identified 24 (96.0%) babies as malnourished and 1 (4.0 %) as well-nourished. Of 200 normal babies by Ponderal Index, CAN SCORE identified 46 (23.0%) babies as malnourished and 154 (77.0 %) babies as well-nourished. Thus sensitivity and specificity of Ponderal Index as compared to CAN score were 34.29% and 99.35% respectively. Positive predictive value and negative predictive value being 96% and 77% (Table 5). By Fischer's exact test CAN score and ponderal index are statistically significantly associated with $p<0.001$ (Table 6).

**Table3: Ponderal index category.**

| | Frequency | Percent | Valid percent | Cumulative percent |
|---|---|---|---|---|
| Valid malnourished | 25 | 11.1 | 11.1 | 11.1 |
| Normal | 200 | 88.9 | 88.9 | 100 |
| Total | 225 | 100 | 100 | |

**Table 4: CAN score category.**

| | Frequency | Percent | Valid percent | Cumulative percent |
|---|---|---|---|---|
| Valid Malnourished | 70 | 31.1 | 31.1 | 31.1 |
| Normal | 155 | 68.9 | 68.9 | 100 |
| Total | 225 | 100 | 100 | |

**Table5: Cross tab of ponderal index and CAN scores.**

| | | CANSCORE categories | | Total |
|---|---|---|---|---|
| | | Malnourished | Normal | |
| Ponderal category Malnourished | Count | 24 | 1 | 25 |
| | % within Ponderal category | 96.00% | 4.00% | 100.00% |
| Normal | Count | 46 | 154 | 200 |
| | % within Ponderal category | 23.00% | 77.00% | 100.00% |
| Total | Count | 70 | 155 | 225 |
| | % within Ponderal category | 31.10% | 68.90% | 100.00% |

**Table6: Chi-square test for ponderal index and CAN score.**

| | Value | df | Asymp. Sig. (2-sided) | Exact Sig. (2-sided) | Exact Sig. (1-sided) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Pearson chi-square | 55.255 | 1 | 0 |
| Continuity correction | 51.901 | 1 | 0 | | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Likelihood ratio | 54.886 | 1 | 0 | | |
| Fisher's exact test | | | | 0 | 0 |
| Linear-by-linear association | 55.009 | 1 | 0 | | |
| No. of valid cases | 225 | | | | |

**Table7: Cross tab of weight for age and CAN scores.**

| | | | CAN score categories | | Total |
|---|---|---|---|---|---|
| | | | Malnourished | Normal | |
| Weight for age | SGA | Count | 31 | 3 | 34 |
| | | % Within weight for age | 91.20% | 8.80% | 100.00% |
| | AGA | Count | 39 | 149 | 188 |
| | | % Within weight for age | 20.70% | 79.30% | 100.00% |
| | LGA | Count | 0 | 3 | 3 |
| | | % Within weight for age | 0.00% | 100.00% | 100.00% |
| Total | | Count | 70 | 155 | 225 |
| | | % Within weight for age | 31.10% | 68.90% | 100.00% |

Of the 34 SGA babies by weight for age, CAN scorehas identified 31 (91.2%) babies as malnourished and 3 (8.8%) as well-nourished. Of 188 AGA babies by weight for age, CAN score identified 39 (20.7%) babies as malnourished and 149 (79.3%) babies as well-nourished. malnourished (Table 7). By Chi-square test Weight for Of 3 LGA babies none of the babies were identified as age and CAN score are statistically significantly associated with p<0.001 (Table 8). CAN score is better index of measurement compared to ponderal index and weight for age assessment [3].

**Table8: Chi-square test for weight for age and CAN score.**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson chi-square | 68.016 | 2 | 0 |
| Likelihood ratio | 66.732 | 2 | 0 |
| Linear-by-linear association | 64.728 | 1 | 0 |
| N of valid cases | 225 | | |

## DISCUSSION

Assessment of malnutrition in newborn is important for clinicians because nutrition is one of the important factor determining outcome of a newborn. Malnutrition has a potentially serious squeal on multiple organ system. Various methods have been used to identify malnourished babies as early as possible. The clinical manifestation of fetal malnutrition depends on when it began during gestation [4]. Babies whose length, head circumference and weight are significantly reduced probably were exposed to malnutrition beginning early in the second trimester. Those whose length and head circumference are less affected but are small and underweight with some loss of subcutaneous tissues and muscle probably became malnourished beginning early in the third trimester. For babies who are significantly underweight for gestational age with obvious loss of subcutaneous tissues, but with length and head circumference within the normal range, an insufficient or unbalanced nutrient supply most likely occurred in the late third trimester. In our study 11.1% of the babies were identified to be malnourished by ponderal index, weight for height identified 15.1% of babies as malnourished and CAN score identified 31.1% as malnourished. Similarly other studies like Amarendra et al9, Soundarya et al10, Vikramsinghal et al11, have found that CAN score has identified more number of malnourished babies compared to Ponderal Index and Weight for height [5].

In our study, we have identified that 91.2% of SGA babies as malnourished and 20.9% of AGA babies as malnourished with a significant p value. Similar results

were found in other studies. Amarendra et al9 andZaheer et al identified 83% and 86.8% babies as malnourished among SGA group respectively and 58.6 % and 33.7% among AGA babies as malnourished respectively. Other studies like identified 23.2% and 23% babies as malnourished among SGA group respectively and 8% and 8.2% among AGA babies as malnourished respectively. In our study CAN score has identified 96% of babies as malnourished, which were identified by ponderal index as malnourished and 23% as malnourished which were identified by ponderal index as normal babies with a significant p value. Other studies like have identified 77.2%, 39.7% and 62.5% as malnourished respectively, which were identified by ponderal index as malnourished, 54.2%, 11.2% and 13.58% as malnourished respectively which were identified by ponderal index normal babies.

## CONCLUSION

If we consider weight as the only criteria for assessing nutritional status, there is more probability of missing malnourished babies in AGA category and well-nourished babies in SGA category. CAN score is a simple, robust and accurate method of identifying fetal malnutrition.

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