



## Assessment of Fetal Malnutrition and its proportion among AGA and SGA using CAN Score

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### Abstract

**Objectives:** Use of clinical assessment of nutritional status (CAN) score to assess the prevalence of fetal malnutrition and its proportion among Appropriate for gestational age(AGA)& small for gestational age(SGA).

**Study Design:** Prospective observational hospital based study

**Setting:** Tertiary care hospital, Kamla Nehru Hospital, an associated hospital of Indira Gandhi Medical College Shimla.

**Methods:** Out of one thousand twelve live births during the study period 529 newborns which were fulfilling the required criteria were enrolled in the study. All the enrolled newborns were assessed for weight, length, OFC, MAC, MAC/OFC and Ponderal index. The data also comprised of demographic and social factors viz. maternal age, socioeconomic status, dietary habits, maternal education, occupation, parity, residence, altitude and antenatal care. Clinical assessment of nutritional status using CAN score suggested by Metcoffand its proportion was assessed in AGA and SGA using appropriate statistics.

**Results:** The study population had mean birth weight of  $2822.80 \pm 447.64$ , mean length  $48.0319 \pm 2.1963$ , mean OFC  $33.6866 \pm 1.3510$ , mean MAC  $8.8866 \pm 0.8349$ , MAC/OFC  $0.2636 \pm 2.039 E-02$  and mean CANSCORE  $25.8110 \pm 4.2299$ . The study showed 29% LBW babies. Fetal malnutrition was seen in both small for gestational age (SGA) and appropriate for gestational age (AGA).

**Conclusion:** Fetal malnutrition was much more in small for gestational age but present in both groups i.e. AGA and SGA.

**Keywords:** Newborn, SGA, AGA, Neonatal anthropometry, CAN Score, Fetal malnutrition.

### Introduction

Fetal malnutrition is a clinical state characterized by obvious intrauterine loss or failure to acquire normal amounts of subcutaneous fat and muscles. "Fetal Malnutrition", is a term coined by Scott and

Usher<sup>1</sup> can be identified on the basis of typical clinical features. This state may be presents at almost all birth weights irrespective of the classification of birth weight in to AGA or SGA. Fetal malnutrition (FM) and the term small for

gestational age (SGA) and Intra uterine growth retardation (IUGR) are not synonymous, one may occur without the other. FM is a clinical diagnosis and is independent of birth weight for gestational age<sup>2</sup>. SGA is the weight for gestational age based on population norms and some predetermined weight cutoff (-2SD, 5%, 10%). IUGR refers to a multiplicity of adverse effects limiting the fetal growth potential. An infant who is classified IUGR may, or may not, also be classified SGA. Likewise, an infant who is IUGR and/or SGA may, or may not, have FM. Lower IQ scores, higher needs for special education, neurologic handicaps, mental retardation, learning disorders and seizures later in childhood are more closely linked to fetal malnutrition (FM) rather than weight for gestational age.<sup>2</sup> In FM, the subcutaneous tissue and underlying muscles are diminished and the skin of arms, legs, elbows, knees and interscapular regions is very loose. Fetal malnutrition can be clinically assessed by using the "Clinical Assessment of Nutritional Status (CAN) Score"<sup>3</sup>. CAN score consist of nine superficial readily detectable signs of nutritional status to differentiate between well nourished and malnourished neonates. This study is undertaken with an objective, to study the prevalence of fetal malnutrition among term neonates using a clinical score and to determine its proportion among AGA and SGA.

### Material and Methods

Out of one thousand twelve consecutive live births at Kamla Nehru Hospital, Shimla, Himachal Pradesh an associated hospital of Indira Gandhi Medical college Shimla, 529 term healthy term newborns who were meeting the requisite criteria were enrolled.

### Inclusion Criteria

- Maternal age 20-30 years
- Parity <4
- Complete maternal data available
- Singleton term baby (POG ≥ 37 weeks)
- Newborn with hospital stay > 24 hours

- Mother registered antenatally during first trimester
- Parents consenting to take part in the study.

### Exclusion criteria

- Chronic maternal illness (diabetes mellitus, hypertension, pulmonary tuberculosis, renal, heart diseases etc.)
- Handicapped or mentally retarded mothers.
- Major neonatal congenital anomalies.
- Intrauterine infections.

After obtaining an informed consent from parents, anthropometric evaluation was carried out between 24-48 hours by single observer in a warm well lighted room. Gestational age assessment was based on accurate recollection of date of the last menstrual period by the mother, when doubt existed, assessment of newborn using Expanded New Ballard score were used to assign gestational age in completed weeks<sup>4</sup>. Weight was obtained one hour after feeding using a digital scale with a capacity of 10 kgs and sensitivity of ±5gm without any clothing on and 2500gm is taken as normal weight. A cut off value of tenth centile was used to define SGA<sup>5</sup>.

Length was measured to the nearest of 0.1cm using an infantometer. The baby was placed on the infantometer with head towards the fixed end of the infantometer and feet towards the sliding end of infantometer. A slight pressure was applied at the newborn's knees to ensure full extension of lower extremities. A value below 3rd centile was taken as abnormal (CDC2000).<sup>6</sup>

HC was measured with a non stretchable measuring tape just above the supraorbital prominence and over the maximum occipital prominence excluding ears. Midarm circumference was taken on left arm midway between the tip of acromion and olecranon process with non stretchable measuring tape and a value below 8.6 was taken as abnormal. Ponderal index was calculated as weight (grams)/Length<sup>3</sup> (cm) × 100 and values below 2.2 were taken as indicative of

growth retardation, while a MAC/HC ratio below 0.27 was taken as abnormal<sup>7</sup>.

Socioeconomic status was categorized by modified Prasad's Classification updated by P. Kumar and classified as low, middle and high socioeconomic group<sup>8</sup>.

Pearson chi square, likelihood ratio, linear by linear association has been run at p 0.05 values at 95% confidence interval (CI), nutritional status of mother and anthropometry by applying ANOVA, Mean and SD for all the parameters has been calculated and Frequency wherever applicable is generated.

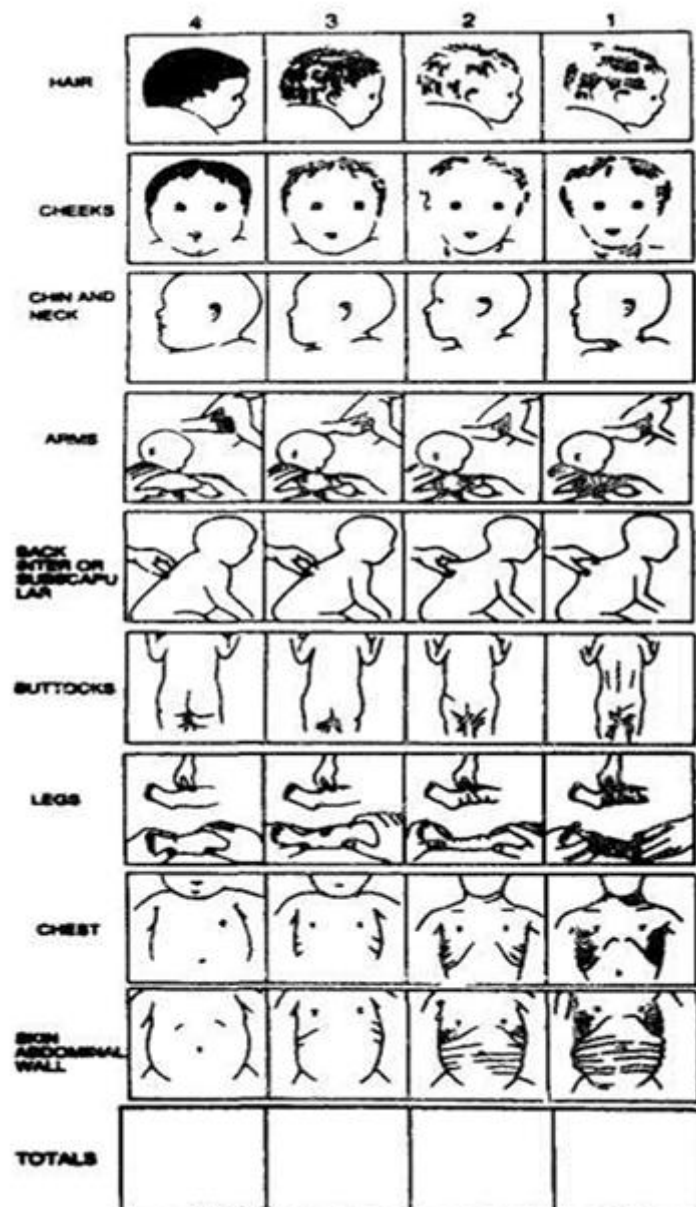
The clinical assessment of nutrition was done within 24-48 hours on the basis of superficial readily detectable signs of malnutrition in the newborn described by Metcoff<sup>3</sup>.

Nine clinical signs for clinical assessment of nutrition were taken in to account viz. hair, cheeks, neck and chin, arms, legs, back, buttocks, chest and abdomen. Each clinical signs of CANSCORE was scored from 1 to 4.

Each sign rated from 4 (best or no evidence of malnutrition) to 1 (worst, definite evidence of malnutrition in utero)

### Signs for Clinical Assessment of Nutritional (CAN) Status in the Newborn

S.No.	Physical Sign	Scoring
1.	Hair	Large amount, smooth, silky, easily groomed (4). Thinner, some straight, "staring" hair (3). Still thinner, more straight, "staring" hair which does not respond to brushing (2). Straight "staring" hair with depigmented strip (flag sign) (1).
2.	Cheeks	Progression from full buccal pads and round face (4), To significantly reduce buccal fat with narrow, flat face (1).
3.	Neck and Chin	Double or triple chin fat fold, neck not evident (4); to thin chin. No fat fold, neck with loose, wrinkled skin, very evident (1).
4.	Arms	Full, round, cannot elicit "accordion" folds or lift folds of skin from elbow or tricep area (4); to striking "accordion" folding of lower arm, elicited when examiner's thumb and fingers of the left hand grasps the arm just below the elbow of the baby and thumb and fingers of the examiner's right hand circling the wrist of the baby are moved towards each other; skin is loose and easily grasped and pulled away from the elbow.
5.	Legs	Like arms.
6.	Back	Difficult to grasp and lift skin in inter-scapular area to skin loose, easily lifted in a thin fold from inter-scapular area (1).
7.	Buttocks	Full round gluteal fat pads (4); to virtually no evident gluteal fat and skin of the buttocks and upper posterior high loose and deeply wrinkled (1).
8.	Chest	Full, round, ribs not seen (4); to progressively prominence of the ribs with obvious loss of intercostal tissues (1).
9.	Abdomen	Full, round, no loose skin (4); to distended or scaphoid, but with very loose skin, easily lifted, wrinkled and "accordion" folds demonstrable (1).



CANSORE Ratings

36 (Highest Possible)

9 (lowest)

Clinical assessment of nutrition status scores

Maximum-36

<25- Fetal Malnutrition

>25- Well Nourished.

2500meters. 53.7% belongs to middle income group, 96.6% of mothers were literate, 91.5% were house wives, and 87.5% received optimal care. 59% of mothers had gained equal to or more than 9 kg weight during pregnancy.

**Results**

The data was collected from mothers between 20-30 years (25.03±3.35) and their newborns.

The demographic and social attributes of study population was recorded Table 1. Majority of population (72.4%) was from rural background with a place of residence at an altitude of 2000-

**Table 1:** Demographic and social attributes of study population (n- 529)

Variable	Category	Frequency	Percentage (%)
Altitude	<1000mts	46	8.69
	1000-1500mts	100	18.90
	1500-2000mts	99	18.71
	2000-2500mts	284	57.70
Rural/urban	Rural	383	72.40
	Urban	146	27.60
Parity	Primi	335	63.3
	2 <sup>nd</sup> Para	149	28.2
	Multigravida	45	8.5
Socioeconomic Status	Low income group	165	31.2
	Middle income group	284	53.7
	High income group	80	15.5
Maternal education	Illiterate	12	2.3
	Primary	36	6.8
	Middle	122	23.1
	High School	130	24.3
	Higher Sec/+2	138	26.1
	Graduates	73	13.8
	Postgraduates		
Personal History	Vegetarian	298	56.00
	Non-vegetarian	231	44.00
Occupation	Non-working(House wives)	484	91.5
	Working(Employed in Public/private Sec	45	8.5
Antenatal care	Booked	463	87.5
	Unbooked	66	12.5
Weight gain during pregnancy	<3kg	1	0.2
	3-9kg	216	40.8
	>9kg	312	59

Newborns anthropometric measurements showed the mean birth weight 2822.80±447.64, length 48.0319±2.1963, mean occipitofrontal circumference 33.68±1.35, mean mid arm circumference 8.88±0.83, MAC/OFC was 0.2636±2.039 Table2.

**Table 2.** Various anthropometric measurements of neonate in the study population

Variable	Mean	Standard Deviation
Birth weight	28.22	±447.64
Length	48.0319	±2.1963
Occipito-Frontal circumference	33.6866	±1.3510
Mid-arm circumference	8.8868	±0.8349
Mid-arm circumference/occipito- frontal circumference	0.2636	±2.039 E-02
Ponderal index	2.5361	±0.2580
CANSCORE	25.8110	±4.2299

**Fetal Malnutrition**

**Table 3** Weight for gestational age classification and proportion fetal malnutrition

Weight for age classification	Frequency/percent	No FM*	FM*
SGA	69(13%)	22(32%)	47(68%)
AGA	426(80.6%)	339(60%)	87(20%)
LGA	34(6.4%)	34(100%)	0(0%)

\*Fetal malnutrition based upon CANSCORE.

\*FM Score<25      \*No FM Score>25

Of the total 529 neonates evaluated 144 (27.2%) were detected to have malnutrition based on CAN Score<25. Out of 69(13%) SGA babies 22(32%) had no fetal malnutrition whereas 47(68%) babies

had fetal malnutrition. Similarly in 426(80.6%) AGA babies 87 (20%) have fetal malnutrition and 426(80%) have no fetal malnutrition.

Fetal malnutrition was seen in both small for gestational age (SGA) and appropriate for gestational age (AGA) neonates, however the proportion of fetal malnutrition was more in SGA (68%) as compared to AGA (20%). No FM was detected in LGA group.

### Discussion

Fetal malnutrition presumably is the result of a limitation of nutrition supply to the fetus in utero, thereby preventing the attainment of full growth potential. Long term, low grade nutritional deprivation may provide calories sufficient for maintenance, but insufficient for growth, resulting in an infant under weight for gestational age without soft tissue wasting. A more acute and severe nutritional deprivation superimposed on the long term milder process, would produce soft tissue wasting at birth. Large number of small for gestational age babies (68%) have features of malnutrition. However 20% of the babies in the appropriate for gestational age group were detected to have fetal malnutrition. J. Metcuff 1994 found that 5.5% of AGA and 54% of SGA babies had fetal malnutrition. Whereas Dheodhar J. et al<sup>9</sup> in the year (1999) showed that fetal malnutrition was present in 84.2% of the SGA babies and 12.9% of AGA babies which is comparable to present study and same findings were observed by Mehta. et al<sup>10</sup>. The CAN score is much simpler to learn and easy to do, particularly with the aid of simple illustrations of the signs and scores on the paper as described by Metcuff<sup>3</sup>. Several studies<sup>3,9,10</sup> Including the present study indicate that CAN score is a simple and best clinical method for assessment of fetal malnutrition in newborn.

### Conclusion

CAN Score may be a simple clinical index for identifying fetal malnutrition and for prediction of neonatal morbidity associated with it, without the aid of sophisticated equipments.

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