

## Assessment of Foetal Malnutrition by CANSORE and comparison with anthropometric attributes – A tertiary care centre experience

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### Abstract:

**Background:** Neonatal deaths account for 56% of under-5 deaths in India which is much higher than the global average of 44%. Unless looked for in the neonate, foetal malnutrition is missed.

**Method:** The present study is undertaken at Niloufer Hospital for Children, Osmania Medical College, a tertiary paediatric care centre, to assess the nutritional status of new born at birth. A total of 125 new born babies with gestational age of 38 weeks and with no major congenital malformations are included in this study. Eight Anthropometric parameters are recorded. CAN Score are calculated for all the babies.

**Results:** Babies are divided into Appropriate For Dates (AFD) & Small For Dates (SFD) and foetal malnutrition among AFD & SFD babies are checked. The total Incidence of foetal malnutrition in this study came as 49.6% with 32.98% of foetal malnutrition among AFD babies and 100% of foetal malnutrition among SFD babies with CANSORE cut off as  $\leq 4$ . Whereas, using the cut off score of  $\leq 1$  the total incidence of FM came down to 19.15% with 55% among SFD babies.

**Conclusion:** CAN Score is a simple, accurate bedside assessment tool requiring no sophisticated equipment and can be easily performed with minimal training at Primary Care Level. Hence early intervention can be advised which would prevent long term morbidity.

**Key Words:** Anthropometry, Appropriate for Dates, CAN Score, Foetal Malnourishment, neonatal mortality, Small for Dates

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### I. Introduction

The term FOETAL MALNOURISHMENT (FM) is not synonymous to SMALL FOR GESTATIONAL AGE (SGA) since, the mortality and morbidity of many SGA babies is attributed to FM<sup>1</sup>. Foetal Malnutrition (FM) is a common and potentially serious problem during the perinatal period and for the later growth and development of the child. FM or malnutrition in a neonate and the terms Small for Gestational Age (SGA) and Intrauterine growth Retardation (IUGR) are not synonymous and one may occur without the other. FM indicates a clinical state that may be present at almost any birth weight. Small for Gestational Age (SGA) is weight for gestational age based on population norms and some predetermined weight cut off (-2SD, 5%, 10%). IUGR refers to multiplicity of adverse effects limiting the foetal growth potential. An infant who is classified as IUGR may or may not also be classified as SGA. Likewise an infant who is IUGR and/or SGA may not have FM.<sup>(1,2,3,4)</sup>

FM affects body composition and impairs brain development and behaviour development and clinically it is characterised by obvious intrauterine loss of, or failure to acquire normal amount of subcutaneous fat and muscle.

FM is the term first coined by SCOTT and USHER in 1966 that can be identified on the basis of typical clinical features.<sup>5</sup> Till recent times there was no single methodology to identify the nutritional status of the new born at bed side. CAN SCORE (Clinical Assessment of Nutritional Status) is simple, rapid and quantifiable examination to differentiate SGA and FM babies.

**Aim:** The aim of this study is to assess the nutritional status of the new born and score them using nine superficial, readily detectable signs of malnutrition and test its significance. CAN Scores of the babies have also been compared to individual anthropometric attributes.

## Experimental Section/Material And Methods

The new born babies are selected from Niloufer Hospital for Children, Red Hills and Modern Government Maternity Hospital, Petlaburz which are allied Hospitals of Osmania Medical college located in Hyderabad. Both the Institutes are tertiary referral centres who get patients from all socio economic groups. A total of One Hundred and Twenty Five (125) new born babies are included in the study. Firstly all the babies are examined for their health status. Only those babies who clinically free from disease and congenital malformations are included in the study. These babies are then subjected to gestational age assessment by applying an Expanded Ballard Scoring system, the sensitivity of which is  $\pm 1$  week within 24 hours of life.<sup>6</sup>

Babies who are found to be full term i.e., 38 weeks and more with the above scoring system only are selected for the study. All the babies are examined systematically as per a protocol within 48 hours of the birth. The protocol contained data regarding the anthropometry of the baby, all the parameters of CANSCORE as described by Metcoff and maternal data. All the babies are examined by the author alone to avoid subjective variations and bias. Tools used are standardized digital weighing machine, infantometer and fibre glass tape.

Anthropometric data for the following attributes has been recorded: Weight (Wt), Length (L), Chest Circumference (CC), Head circumference (HC), Right Arm Circumference (RAC), Right Thigh Circumference (RTC), Right Calf Circumference (LC), Foot Length (FL).

### CANSCORE

Nine superficially readily detected signs of malnutrition are checked in the CAN SCORE.<sup>1</sup> They are Hair, Cheeks, Chin & Neck, Skin of fore arm, Skin of thighs and legs, Back in the scapular and interscapular region, buttocks, chest and abdomen. Each of the sign is rated from 4 (best, no evidence of malnutrition) to 1 (worst, definite evidence of foetal Malnutrition). The total ratings ranges from 36 which is highest to 9 as the lowest.<sup>7</sup>

**Table 1** The Nine Signs For Canscore In The Newborn

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).
Cheeks	Progression from full buccal pads and round face (4); to significantly reduced buccal fat with narrow, flat face (1)
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).
Arms	Full, round, cannot elicit 'accordion' folds or lift folds of skin from elbow or triceps area (4); to a 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 examiners 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.
Legs	Like arms
Back	Difficult to grasp and lift skin in the interscapular are (4); to skin loose, easily lifted in a thin fold from the interscapular area (1).
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).
Chest	Full, round, ribs not seen (4); to progressively prominence of the ribs with obvious loss of intercostal tissues (1).
Abdomen	Full, round, no loose skin (4); to distended or scaphoid, but with very loose skin, easily lifted, wrinkled and 'accordion' folds demonstrable.

CANSCORE is applied on all babies and a score is given to each baby. The babies are classified under FM if their score is less than or equal to 24 ( $\leq 24$ ).<sup>1</sup>

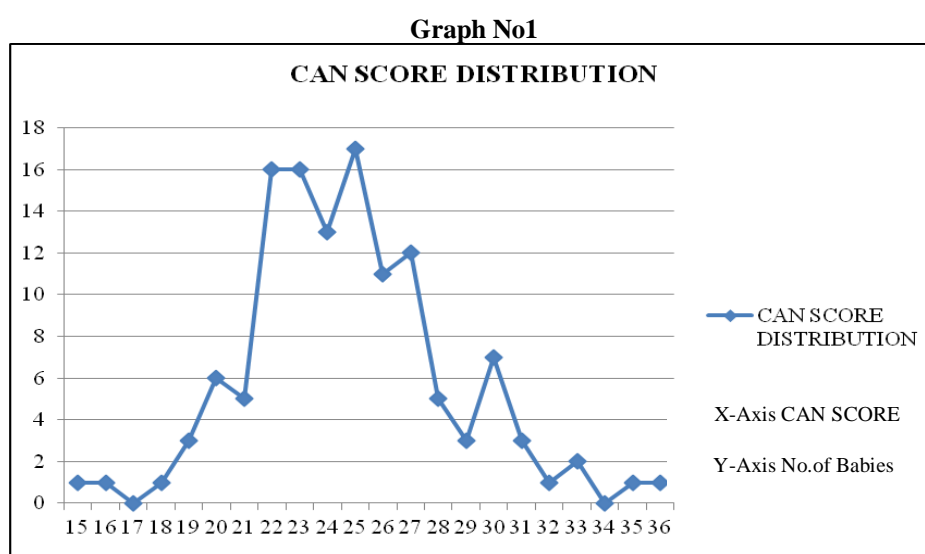
All the babies are divided into AFD and SFD by using growth percentile charts. All the babies who have scored less than or equal to 24 and 21 on CANSCORE are rechecked by the author to confirm to scoring. Then statistical analysis is done on every result. Significance test (Chi-square) is applied to know whether it is statistically significant or not.

For studying the relationship of anthropometric attributes of the new born babies with CANSCORE, statistical techniques like computation of percentages and performing significances tests are adopted. Each attribute is divided into 2 groups by using the value mean minus 1 SD as a cut off point and the percentage distribution of FM in each group is calculated. All these are represented in the tables and statistical significance is checked for each anthropometric data versus CANSCORE.

The frequency distribution of CANSCORE of all the babies are plotted in graph to see the distribution of babies and to get a cutoff point to divide well and malnourished babies for this data which represents our community.

## II. Results

First, frequency distribution curve is prepared as shown below and then pattern of distribution is observed. There is an upward slope in the initial part of the curve starting from 17 upto 20 followed by a short fall upto score 21 and from this point there is a steep rise in the curve upto score 23 with a fall again upto score 24. This indicates that more number of babies are clustered between 21 and 24, and because in a community large proportion cannot be called as abnormal, CANSCORE  $\leq 21$  can be taken as cutoff for our community.



All the babies are divided into AFD & SFD depending on the growth percentile charts and foetal malnutrition among AFD & SFD babies at CAN SCORE cut off  $\leq 24$  and  $\leq 21$  are checked and represented in Table No. 2A & 2B.

**Table 2a** Foetal Malnutrition With Canscore Cut Off  $\leq 24$

	No.Of babies	(%)
Total No. of AFD babies	94	75.2%
Total No. of SFD babies	31	24.8%
Total No. of FM babies	62	49.6%
Total No. of FM among AFD babies	31	32.98%
Total No. of FM among SFD babies	31	100%

**Table 2b** Foetal Malnutrition With Canscore Cut Off  $\leq 21$

	No.Of babies	(%)
Total No. of AFD babies	94	75.2%
Total No. of SFD babies	31	24.8%
Total No. of FM babies	18	19.15%
Total No. of FM among AFD babies	1	1.1%
Total No. of FM among SFD babies	17	55%

The total Incidence of foetal malnutrition in this study came as 49.6% with 32.98% of foetal malnutrition among AFD babies and 100% foetal malnutrition among SFD babies with CANSCORE cutoff as  $\leq 24$  (as shown in Table 2A). Whereas, using the cutoff score of  $\leq 21$  the total incidence of FM came down to 19.15% with just 1.1% of FM among AFD babies and 55% of FM among SFD babies (as shown in Table 2B).

The association between anthropometric attributes and nutritional status of new born are checked. The results are represented in Table-3. The study revealed that all the attributes are having strong association with nutritional status of the new born with both CANSCORE cutoff of  $\leq 24$  and  $\leq 21$ .

**TABLE 3** Contingency table of anthropometry with CANSCORE cutoff of  $\leq 21$  and  $\leq 24$

Sl no	Attribute	CANSCORE 21						CANSCORE 24				
		Sub Grp	FM <21	WN >21	Total	%	P	FM <24	WN >24	Total	%	P
1	Wt. 2.69kg	1	18	47	65	27.69	<0.05 (S)	51	14	65	78.46	<0.05 (S)
		2	0	60	60	0		11	49	60	18.33	
2	L 48.41cm	1	12	35	47	25.53	<0.05 (S)	29	18	47	61.7	<0.05 (S)
		2	6	72	78	7.69		33	45	78	42.31	
3	HC 32.31cm	1	13	39	52	25	<0.05 (S)	38	14	52	73.08	<0.05 (S)
		2	5	68	73	6.85		24	49	73	32.88	
4	CC 30.11cm	1	16	48	64	25	<0.05 (S)	43	21	64	67.19	<0.05 (S)
		2	2	59	61	3.28		19	42	61	31.15	
5	RAC 8.4cm	1	15	47	62	24.19	<0.05 (S)	42	20	62	67.74	<0.05 (S)
		2	3	60	63	4.76		20	43	63	31.75	
6	RTC 13.23cm	1	16	48	64	25	<0.05 (S)	46	18	64	71.88	<0.05 (S)
		2	2	59	61	3.28		16	45	61	26.23	
7	LC 8.78cm	1	17	45	62	27.44	<0.05 (S)	44	18	62	70.97	<0.05 (S)
		2	1	62	63	1.59		18	45	63	26.98	
8	FL 7.72cm	1	17	45	62	27.44	<0.05 (S)	41	21	62	66.13	<0.05 (S)
		2	1	62	63	1.59		21	42	63	33.33	

1 - Less than or equal to  
2 - More than  
FM - Foetal Malnourished  
WN - Well Nourished  
% - Percentage

As each anthropometric attribute is having strong association with nutritional status, a trial is made statistically to check which single anthropometric attribute is more sensitive in relation to nutritional status. For this all chi-square values with cutoff  $\leq 21$  and  $\leq 24$  are arrange in descending order and first three values in each group are taken and these are given in Table 4.

**Table 4** Chisquare Values In Descending Order

Canscore cutoff	Attribute	Chisquare value
24	Weight	19.4
	FL	16.91
	LC	16.75
21	Weight	45.13
	RTC	26.05
	LC	22.48

The table reveals that weight is more sensitive and significant attribute with both cutoff of canscore  $\leq 24$  and  $\leq 21$ . If we take only this single attribute to compare the nutritional status, there is nil chance of missing the babies which are malnourished.

To be more sensitive in assessing nutritional status based on anthropometry a combination of anthropometric attributes is checked in the following way. First the chi-square values are calculated for the combinations like 1.Wt + RTC, 2.Wt + FL, 3.Wt + RTC + FL, 4.Wt + RTC + LC . The Table -5 shows significant association of combination of anthropometric attributes with the nutritional status of new born.

**Table 5** Contingency Table For Combination Of Anthropometry

Slno	Attribute	CANSCORE 21						CANSCORE 24				
		Sub Grp	FM <21	WN >21	Total	%	P	FM <24	WN >24	Total	%	P
1	Wt.+RTC 2.69+13.23	1	16	33	49	32.65	<0.05 (S)	41	08	49	83.67	<0.05 (S)
		2	02	74	76	2.63		21	55	76	27.63	
2	Wt+FL 2.69+7.72	1	17	27	44	38.64	<0.05 (S)	35	09	44	79.55	<0.05 (S)
		2	01	80	81	1.23		27	54	81	33.33	
3	Wt+RTC+FL 2.69+13.2+7.7	1	15	20	35	42.86	<0.05 (S)	29	06	35	82.86	<0.05 (S)
		2	03	87	90	3.33		33	57	90	36.67	
4	Wt+RTC+LC 2.69+13.2+8.7	1	15	22	37	40.54	<0.05 (S)	32	05	37	86.49	<0.05 (S)
		2	03	85	88	3.41		30	58	88	34.10	

1 - Less than or equal to  
2 - More than  
FM - Foetal Malnourished  
WN - Well Nourished  
% - Percentage

Then the percentages of anthropometric combinations are calculated for CANSCORE cutoff 21 and 24 as shown in Table-6

**Table 6** Comparison Of Percentages Of Anthropometric Combinations

Sl.No	Attribute	CANSCORE CUTOFF 21		CANSCORE CUTOFF 24	
		% of Attributes		% of Attributes	
		1	2	1	2
1	Wt (2.69)	27.69	0	78.46	18.33
2	Wt + RTC (2.69)(13.23)	32.65	2.63	83.67	27.63
3	Wt + FL (2.69)(7.72)	38.64	<b>1.23</b>	79.55	33.33
4	Wt + RTC + FL (2.69)(13.23)(7.72)	42.86	3.33	82.86	36.67
5	Wt + RTC + LC (2.69)(13.23)(8.78)	40.54	3.14	86.49	34.1

Note: 1. Less than or equal to Anthropometric Cutoff                      2. More than Anthropometric Cutoff

Results in Table-6 are revealing that out of all combinations a combination of Wt+FL is sensitive i.e.98.77% (100 -1.23) .This means if any baby is having an anthropometric reading of weight more than 2.69kg and foot length more than 7.72cms the probability of that baby to be misclassified as well nourished is only 1.23%.

**In the same way**

1. If Wt + RTC combination is taken the chance of missing the malnourished baby is 2.63%, if the baby is having measurements above respective cutoff i.e., Wt > 2.69kg and RTC > 13.23cms.
2. If Wt + RTC + FL combination is taken the chance of missing the malnourished baby is 3.33%.
3. If Wt +RTC + LC combination is taken the chance of missing the malnourished baby is 3.41%.

The ratios of the percentages distribution of anthropometric data with CANSCORE cutoff of  $\leq 21$  and  $\leq 24$  for Below Mean -1SD and Above Mean -1SD are show in tables 7A and 7B respectively.

**Table 7a** Percentage Distribution Of Anthropometric Data For Below Mean -1sd

Attributes	$\leq 21$	$\leq 24$	Ratio
Wt	27.69%	78.46%	1:2.83
Length	25.53%	61.7%	1:2.42
H.C	25%	73.08%	1:2.92
C.C	25%	67.19%	1:2.69
RAC	24.19%	67.74%	1:2.8
RTC	25%	71.88%	1:2.88
LC	27.42%	70.97%	1:2.59
FL	27.42%	66.13%	1:2.41

**Table7b** Percentage Distribution Of Anthropometric Data For Above Mean -1sd

Attributes	$\leq 21$	$\leq 24$	Ratio
Wt	0	18.33%	
Length	7.69%	42.31%	1:5.5
H.C	6.85%	32.88%	1:4.8
C.C	3.28%	31.15%	1:9.5
RAC	4.76%	31.75%	1:6.67
RTC	3.28%	26.23%	1:7.99
LC	1.59%	26.98%	1:16.97
FL	1.59%	33.33%	1:20.96

The Table 7A (for anthropometric reading of below mean - 1SD value) is revealing that the ratio of percentage of FM between CANSCORE cut off  $\leq 21$  and  $\leq 24$  is ranging from 1:2.4 to 1:2.8. Similarly Table 7B (for anthropometric reading of above mean - 1SD value) is revealing the ratios of percentages of FM between CANSCORE  $\leq 21$  and  $\leq 24$  ranging from 1:4.8 to 1:20.

### III. Discussion

The total incidence of FM is 49.6% and 19.15% with CANSCORE cutoff of  $\leq 24$  and  $\leq 21$  respectively. The present study shows no significant association of sex with nutritional status of new born. The study done by USHER and SCOTT in 1966 also revealed no significant relationship between sex and nutritional status, whereas report from Indian Paediatrics – 94 revealed low birth weight is lower in males.<sup>10</sup>

The cutoff derived from CANSCORE is based on the proportion of FM babies when compared with the nutritional status of that population and this may differ from developed countries to developing countries. If we follow the cutoff of 24, 49.6% are falling within the cutoff and 37% are falling in between scores of 21 and 24, but there should not be any compromise in the nutritional status of new born. So it may be said that those babies scoring  $\leq 21$  as definitely foetally malnourished babies and those scoring between 21 and 24 as borderline foetally malnourished babies. The incidence of FM in AFD babies is 32.98% in the present study which is comparable to the study conducted by Hill etal which is 45% whereas in the study conducted by Dr. J. Metcoff it is 5.5%. The incidence of FM in SFD babies is 100% in our study which is again comparable to the study by Hill etal. In our community all the SGA babies can be treated as FM babies.

**Table.8** Comparison Of Results With Other Studies

	J. Metcoff study	Scott and Usher	Hill etal	Present Study
Total incidence of FM	10.9%	10%	54.5%	49.6%
Incidence of FM in AFD	5.5%	--	45%	32.98%
Incidence of FM in SFD	54%	--	100%	100%

Any baby having an anthropometric reading of weight more than 2.69kg and foot length more than 7.72cms the probability of that baby to be misclassified as well nourished is only 1.23%.

Thus to use a single attribute to relate with the nutritional status the weight(Wt) is best and to use a combination of anthropometry Wt + FL is best.

Tables 7A and 7B indicate that more number of babies with anthropometric reading above mean – 1SD are clustered between CANSCORE 21 and 24. So if we take CANSCORE cut-off 24 many babies will be grouped as FM. It would be ideal to consider CANSCORE cut-off of 21 as appropriate to differentiate between foetal malnourishment and well nourished babies. Thus any baby scoring  $\leq 21$  can be grouped under definite FM and those scoring between 21 and 24 as borderline malnourished and those scoring above 24 as well nourished.

### IV. Conclusion

India is one among the many countries where Foetal malnutrition (FM) is severe and also malnutrition is a major underlying cause of neonatal mortality. It has been observed that early intervention with nutritional supplementation might decrease the long term morbidity and mortality. CANSCORE is an inexpensive and effective tool to identify the foetal malnourishment. A CANSCORE cutoff of  $\leq 21$  is appropriate for our community. All the anthropometric parameters are having strong association and direct relationship with nutritional status of newborn and weight is the most sensitive attribute when taken singly. Studies on much larger samples would further authenticate these findings

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