Health Assessment of Newborns - A Community Based Study in Jharsuguda District of Odisha, India

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Abstract

Newborns of today are tomorrow's citizens; thus, it is crucial to ensure good health for newborns. Today child's health ponders the health of the future generation, and it assist in forecasting future public health problems for families, communities as well as the healthcare system of the nation. The objective of the present research is to assess the nutritional and health status of the newborns with the help of Birth weight BMI, PI CAN score. Lakhanpur and Jharsuguda Block of Jharsuguda district of Odisha, India was selected as study area and purposive sampling method was followed. 300 women in the third trimester of pregnancy till their delivery were selected from the total population. The research concluded that, assessment of health status of newborns by birth weight, PI, BMI and CAN score revealed that more percentage of malnourished newborns identify by CAN score i.e. 44.67% followed by birth weight i.e. 40.66% whereas by BMI it was 29% by PI it was 15.33%. Thus it can be concluded that CAN score is the best tool to identify malnourished neonates who may be identified as well-nourished neonates by other tools.

Keyword: Newborn's health, Birth weight, BMI, PI, CAN score

1. Introduction

Newborns of today are tomorrow's citizens; thus, it is crucial to ensure good health for newborns. The health of newborns plays a significant role in the development of a nation. The first 28 days of life constitutes the most critical stage of life. In this period of life, the foundation stone is laid for physical, mental and social development. Today child's health ponders the health of the future generation, and it assist in forecasting future public health problems for families, communities as well as the healthcare system of the nation [1]. As newborns are descendents of next generation, thus making them sound and healthy is call of the hour. Healthy newborns ensure healthy adults who are key to healthy economic growth and reinforcement of the nation.

According to the UNICEF report, every year, 20 lacs babies die globally within the neonatal period. The neonatal mortality rate is 25.4 in India, India has 12th ranked among 52 lower-middle-income nation in newborn mortality [2]. This report also said that India is the only one major nation in the world, which has the higher mortality among girls than boys. While Kerala and Goa have 10% of neonatal mortality, whereas Bihar, Uttarakhand has 44%. Uttar Pradesh, Madhya Pradesh, Rajasthan stands at 57%. It was globally estimated that 15%

to 20% of newborns were born with low birth weight, and it represented more than 20 million births in a year. The WHO goal is to achieve a 30% reduction in low birth weight among newborns by 2025. The reduction of infant mortality is an area concern for governments across the globe [3].

According to SRS report 2017, 160% of the infant death occurs during the first 28 days of life, while about 9 percent died within the first 24 hours (1 day) of birth due to asphyxia (insufficient oxygen supply), prematurity, low birth weight, respiratory infection, diarrhoea and malnutrition [4]. It was also found that the infant mortality rate is higher in low socioeconomic groups who live in backward tribal districts [5]. According to the “Annual Health Survey (2012-13)”, the Child Mortality Rate of Jharsuguda district was 42, and the Maternal Mortality Rate was 234 whereas NMR is 34. The district average of Institutional delivery in percentage is 99, and the immunization status of children below five years is 83.2 % [6].

2. Objective

The objective of the study is to assess the nutritional and health status of the newborns with the help of Birth weight BMI, PI CAN score.

3. Literature review

Singhal *et al.*, (2012) conducted an examination CAN score to the detection of fetal malnutrition by at birth and its association with different methods of determining prenatal growth and found that to CAN score recognized 17.5% (n = 35) malnourished babies and 82.5% (n = 165) of children also fed by keeping the cut-off estimation of <25. 8% of AGA children and 76.8% of SGA babies were seen as very much supported on contrasting weight for growth age and CAN score. 8% of babies were found to have FM utilizing PI yet by applying CAN score just 10 children were found to have FM [10].

Soundarya *et al.*, (2012) made an examination on comparative analysis of fetal malnutrition by anthropometry and CAN score and found that the incidence of FM was 24%. Infants recognized malnourished by PI, BMI, MAC/HC were assessed by CAN score and the noteworthy number of them 31/78 in PI, 60/121 in BMI, 51/81 in MAC/HC were discovered all around sustained [9].

4. Methodology

For the present study, Lakhanpur and Jharsuguda Block of Jharsuguda district of Odisha was selected as a study area. 957 Anganwadi centers at Jharsuguda district out of the 16 numbers of Anganwadi centers of Lakanpur block and 12 Anganwadi centers of Jharsuguda Block were selected randomly for the present study. Considering the different literature and keeping objectives in the mind exploratory cum descriptive research was most adopted for the present study. For the present study, the purposive sampling method was followed. 300 women in the third trimester of pregnancy till their delivery and their babies were selected from the total population.

Study criteria:

Inclusion Criteria:	Exclusion criteria
1. Permanent resident of the study area	1. Went to the maternal house for delivery.
2. Live birth babies	2. Stillbirths
3. Singleton babies	3. Twin gestation
4. Hospital delivery	4. Home delivery

Anthropometric measurements of newborns:

For the assessment of the nutritional status of the newborn's weight, crown heel length, head, chest, and mid-arm circumference were taken with standard instruments like weighing machine, measuring tape, and infantometer. Weight and height were measured to nearest 0.1 kg and 0.1 cm respectively with minimal cloth and shoes.

- **Weight:** Weight of the newborn was recorded immediately after delivery.
- **Height or Length:** Length is recorded in cm after delivery with the help of an infantometer.
- **Chest Circumference:** The chest circumference of the newborn was measured by putting the measuring tape horizontally around the chest just across the nipple. The lowest measurement recorded during the normal breathing process.
- **Head Circumference:** The head circumference of the newborn was measured in cm with the help of a flexible metal measuring tape. Then the tape was wrapped snugly around the widest possible circumference from the most prominent part of the forehead (often 1-2 finger above the eyebrow) around to the widest part of the back of the head and it was remeasured three times and took the largest number.
- **Mid arm circumference:** The Mid arm circumference of the newborn was measured in cm with the help of measuring tape. MUAC is the circumference of the left upper arm and is measured at the mid-point between the tips of the shoulder and elbow. To measure MUAC: bend the left arm, find and mark with a pen the olecranon process and chromium, then mark the mid-point between these two marks. With the arm hanging straight down, wrap a MUAC tape around the arm at the mid-point mark. At last, measure to the nearest 1mm.

Ponderal Index (PI):

Ponderal Index (PI) is a measure of the leanness of a person calculated as a relationship between mass and height. It was first proposed in 1921 by Swiss Physician Fritz Rohrer so it is also known as Rohrer's index. The PI formula is given below-

$$\text{Ponderal Index (PI)} = \text{Weight (Gms)} \times 100 / \text{length (Cms)}^3$$

Ponderal Index (PI) of less than 2.2 gm/cm³ was considered as an index of malnutrition.

Body Mass Index (BMI) of newborns:

Body mass index (BMI) is a calculation used to assess the body weight according to height. The BMI formula is given below-

$$\text{Body mass index (BMI)} = \text{weight (Kg)} / \text{length (m)}^2$$

A cut off value of 11.20 kg/m² was considered as malnutrition.

Clinical assessment of newborns by "CAN score":

The clinical assessment of newborns was assessed by clinical assessment of nutrition score popularly termed a “CAN Score” devised by Metcoff J (1994) [7]. The score was used from the examination of clinical signs on nine regions of the body viz. hair, cheeks, neck, arms, chest, skin of the abdominal wall, back, buttocks and leg. Depending upon the grade of development of clinical sign CAN Score was awarded for each region ranging from a minimum of 1 to a maximum of 4 as suggested by Metcoff. A score of 4 denotes “well-nourished” and a score of 1 denotes evidence of malnutrition. A score of 2 or 3 indicates a degree of improvement in the nutritional status compared to the score of one. The highest possible rating of CAN Score is 36 and the lowest possible is 9 for the nine regions of the body collectively.

5. Result and Discussion

Birth weight of newborns

Table 1. Distribution of newborns on the basis of birth weight

Birth weight	Number	Percentages
Below 1.5 kg (VLBW)	3	1.00
1.5 to 2 kg (LBW)	16	5.33
2 to 2.5 kg (LBW)	103	34.33
2.5 to 3 kg (NBW)	97	32.33
3 to 3.5 kg (NBW)	70	23.33
Above 3.5 kg (NBW)	11	3.68
Total	300	100

Table 1 reveals that the distribution of newborns according to their birth weight and the prevalence of low birth weight among newborns was 40.66%. On further analysis, it was observed that the majority (59.34%) newborns had normal birth weight (NBW) followed by 39.66% newborns belonged to low birth weight (LBW) category whereas only 1% newborns found under very low birth weight (VLBW) category. According to NFHS-3 prevalence of low birth weight in rural India is 22.1% but in the present research, the percentage of LBW was found to be more by 17.56% which is a matter of concern. Agrawal and Sharma (2017) investigated the incidence of LBW and found that the majority of 41% newborns had 2.5 to 3.49 kg birth weight [8].

I.2. Health status of newborns according to CAN Score

Table 2. Distribution of newborns on the basis of CAN score

Can score	Number	Percentages
Malnourished	134	44.67
Well-nourished	166	55.33
Total	300	100

Table 2 indicates that the prevalence of malnutrition among newborns according to CAN score. It was observed that 44.67% of newborns were malnourished whereas 55.33%

were well-nourished. The incidence of malnutrition was found to be 24 % by Soundarya *et al.*, (2012) [9]. Singhal *et al.*, (2012) also identified 17.5% malnourished neonates and 82.5% of babies as well-nourished with the help of CAN Score in their studies [10].

Health status of newborns according to Ponderal index

Table 3. Distribution of newborns on the basis of the ponderal index

Ponderal index	Number	Percentages
Malnourished	46	15.33
Well-nourished	254	84.67
Total	300	100

Table 3 indicates that the prevalence of malnutrition among newborns according to PI. It was observed that 15.33% of newborns were malnourished whereas 84.67% were well-nourished. Singhal *et al.*, (2012) also identified 8% malnourished neonates as per PI [10] whereas Soundarya *et al.*, (2012) also identified 26% malnourished neonates and 74% babies well-nourished with the help of PI in their studies [9].

Health status of newborns according to BMI

Table 4. Distribution of newborns on the basis of BMI

BMI of newborn	Number	Percentages
Underweight	87	29
Normal weight	213	71
Total	300	100

Table 4 shows that the prevalence of underweight was 29% among newborns according to BMI whereas 71% of newborns were normal at birth. Incidence of malnutrition was found to be 24 % by Soundarya, *et al.*, (2012) and also identified 40.33% underweight neonates and 59.66% well-nourished with the help of BMI of newborns in their studies [9].

Comparative Statement of Nutritional status of newborns

Table 5. Nutritional status of newborns in comparison to ICMR value

Variable	Normal Body measurement value (ICMR)	Actual Mean $\pm$ S.D.	Kurtosis	Skewness	Range	Minimum	Maximum
Birth Weight (Kg)	2.5 – 4.3	2.71 $\pm$ 0.49	- 0.15	- 0.01	2.87	1.125	4

Crown Heel Length (cms)	46.3 – 53.4	48.05 ± 2.93	- 0.84	0.38	12.9	42.8	55.7
Chest Circumference(cms)	30.5-33	32.12 ± 1.54	- 0.78	0.46	6.5	29.4	35.9
Head Circumference (cms)	33.9-34.3	34.16 ± 1.49	- 0.96	0.33	6.5	31.5	38
Arm Circumference (cms)	9- 10.76	9.67 ± 0.46	- 0.40	- 0.32	2	8.5	10.5

Table 5 indicates nutritional status of newborns. The mean birth weight, crown heel length, chest circumference, head circumference, and arm circumference was found to be 2.71 ± 0.49 , 48.05 ± 2.93 , 32.12 ± 1.54 , 34.16 ± 1.49 and 9.67 ± 0.46 respectively. The minimum weight of newborns was 1.125 kg. and the maximum was 4k.g. with 2.87 range, -0.15 kurtosis, and -0.01 skewness. The minimum crown heel length of newborns was 42.8 cm. and the maximum was 55.7 cm with 12.9, -0.84 and 0.38 of range, kurtosis, and skewness respectively. The minimum chest circumference of newborns was 29.4 cm and the maximum was 35.9 cm. with 6.5 range, -0.78 kurtosis, and 0.46 skewness. The minimum head Circumference of newborns was 31.5 cm and the maximum was 38 cm. with 6.5 range, -0.96 kurtosis, and 0.33 skewness. The minimum arm circumference of newborns was 8.5 cm. and maximum 10.5 cm with 2, -0.40 and -0.32 range, kurtosis, and skewness respectively. Similar findings was also obtained by Kabir *et al.*, (2014) that, the mean weight, length, MUAC, head circumference, and chest circumference was found to be 2.44(0.42), 46.43(2.41), 9.31(0.84), 32.36(1.63) and 30.40(2.09) respectively [13]. The mean birth weight, crown heel length, chest circumference, head circumference, and arm circumference of newborns was found to be normal in comparison to ICMR value.

Correlation between birth weight and other body measurements of newborns

Table 6. Correlation between birth weight and other body measurements of newborns

Model	R	R Square	F	Sig.
1	.942 ^a	.887	576.856	.000 ^b

a. Dependent Variable: birth weight

b. Predictors: (Constant), arm circumference, chest circumference, Crown heel length, head circumference

From Table .6, it was observed that R² (coefficient of determination) is 0.887. It indicates that 88.7% of the variation in the birth weight of new-borns can be explained by four independent variables *i.e.* other body measurements of new-borns. However, with F= 576.856 and value is 0.000 this indicates that the regression model is statistically significant. So the result of the present model explains that the birth weight of new-borns is affected by 85.5% by other body measurements of new-borns.

Birth weight and body measurement of newborns

Table 7. Regression output of birth weight and body measurement of newborns

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	-8.393	.413		-20.344	.000
	Crown heel length	-.059	.018	-.348	-3.202	.002
	Chest circumference	.059	.028	.184	2.130	.034
	Head circumference	.126	.052	.382	2.444	.015
	Arm Circumference	.799	.039	.748	20.663	.000
a. Dependent Variable: birth weight						

From Table 7 it was observed that birth weight and other body measurements of newborns were statistically significant such as crown heel length, chest circumference, head circumference, and arm circumference with values of 0.002, 0.034, 0.015 and 0.000 respectively, which are less than 0.05 (significant). From the regression model can be written as follow:

Birth weight of newborns = -8.393 (Birth weight of newborns)+ -.059 (Crown heel length)+ 0.059 (Chest circumference) + 0.126 (Head circumference) + 0.799 (Arm Circumference)

Thus, there was a strong correlation between birth weight and arm circumference, chest circumference, crown heel length, head circumference of newborns were highly significant. It was clear from the above Table that when the birth weight of newborns increases, the other body measurement also increases.

Health condition of newborns

Table 8. Distribution of newborns according to their health condition

Health Condition	No	Percentage
Normal	281	93.66
Abnormal	19	6.33

Table 8 indicate the health condition of the newborns. Most of the babies (93.66%) were born healthy whereas 6.33% of newborns had some health complications.

Health complication of newborns found during birth

Table 9. Distribution of newborns on the basis of health complication found during birth

Complications found among newborns	No	Percentage
Jaundice	8	42.11
Infection	3	15.79
NICU experience	8	42.11

*19 numbers of respondents suffering from the health complication

Several unexpected medical issues can arise during labour or after birth with newborns. Table 9 indicates the distribution of respondents based on their health complications found during birth. In this study out of 19 numbers of newborns 42.11% were suffering from jaundice, 36.84% were suffering from infection whereas the majority of newborns had NICU experience. According to WHO, more number (75%) of all newborns mortality occur during the first 7 days of life, and about 1 million neonates die within the first days of life. Intrapartum-related complications *i.e.* lack of breathing at birth or birth asphyxia, Preterm birth, and birth defects infections are found significant causes neonatal mortality in year 2017. Sankar *et al.*, (2016) found in their study 20.8% newborns were suffering from severe infection [11] whereas Sharma *et al.*, (2016) found in their study severe infection (22%) major causes of neonatal death [12].

6. Conclusion

There was a significant statistical correlation found between birth weight and crown heel length, chest, arm, head circumference of newborns. The linear regression model also proves that the other body measurement parameters affected with the increase and decrease of birth weight of newborns such as crown heel length, chest, arm, head circumference of newborns and it was statistically highly significant. Information on the health condition of newborns shows that most of the babies (93.66%) were born healthy whereas 6.33% had some complications and out of 19 numbers of newborns, more newborns *i.e.* 42.11% suffering from jaundice. Assessment of health status of newborns by birth weight, PI, BMI and CAN score revealed that more percentage of malnourished newborns identify by CAN score *i.e.* 44.67% followed by birth weight *i.e.* 40.66% whereas by BMI it was 29% by PI it was 15.33%. Thus it can be concluded that CAN score is the best tool to identify malnourished neonates who may be identified as well-nourished neonates by other tools.

Short term training programmes, workshops, and training programmes should be organized by the government and voluntary organization for the women as well as family members for adequate antenatal care, maternal nutrition and effective management of health complications of mothers and newborns.

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REFERENCES

- [1]. *Maternal-infant-and-child-health*. 2020. Retrieved from the website (<https://www.healthypeople.gov>) on June 03th , 2020.
- [2]. UNICEF. *Newborn and child health (2017)* Retrieved from the website (<https://www.unicef.org/india/what-we-do/newborn-and-child-health>) on January 28th 2019.
- [3]. World health organization. 2014. Retrieved from website (<https://www.euro.who.int/en/health-topics/disease-prevention/nutrition/a-healthy-lifestyle/body-mass-index-bmi>) on September 28th 2019.
- [4]. *Indian's infant mortality. SRS. 2017*. Retrieved from the website the website (www.indianspend.com) on September 25th 2018.
- [5]. Government of Odisha. 2019. *Infant mortality rate mission- 2017*. Retrieved from the website (www.health.odisha.gov.in/imr-mission.asp) on November 6th, 2019.
- [6]. *Maternal health programme (Annual Report 2013-14)* Retrieved from the website <https://main.mohfw.gov.in/sites/default/files/Chapter415.pdf>) on April 1st 2019.
- [7]. Metcalf, J. (1994). *Clinical assessment of health nutritional status at birth: fetal malnutrition*.
- [8] Agarwal A, Sharma V. (2017). *To Study the maternal factors which determine the low birth weight babies. Pediatric Review. International Journal of Pediatric Research*, 4(01), pp. 8-13.
- [9]. Soundarya, M., Basavaprabhu, A., Raghuvveera, K., Baliga, B., & Shivanagaraja, B. (2012). *Comparative Assessment of Fetal Malnutrition by Anthropometry and CAN Score. Iranian Journal of Pediatrics*, 22(1), pp. 70-76.
- [10]. Singhal, V., Agal, P., & Kamath, N. (2012). *Detection of Fetal Malnutrition by CAN Score at Birth and its Comparison with other Methods of Determining Intrauterine Growth. Indian Journal of Clinical Practice*. 22(11) pp. 576-582.
- [11]. Sankar, M. J., Neogi, S. B., Sharma, J., Chauhan, M., Srivastava, R., Prabhakar, P. K., Paul, V. K. (2016). *State of newborn health in India. Journal of Perinatology*, 36(S3), pp. S3–S8. <https://doi.org/10.1038/jp.2016.183>.
- [12]. Sharma, M., & Mishra, S., (2015). *Maternal risk factors for low birth weight infants: a hospital based study in lucknow. Journal of medical science and clinical research*, 03(03), pp. 4761-4769.
- [13]. Kabir, A., Merrill, R. D., Shamim A.A., Klemn, R. W., Labrique, A.B., Christian P, West Jr K.P., Nasser, M., (2014). *Canonical Correlation Analysis of Infant's Size at Birth and Maternal Factors: A Study in Rural Northwest Bangladesh. PLoS ONE*. 9(4), e94243. doi:10.1371/journal.pone.0094243.