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"Efficacy of Scoring System for Detection of Risk of Low Birth Weight Babies among Antenatal Women"

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Abstract
Background- The health of the mother might be reflected in the weight of her newborn. More over 20 million newborns, or 15.5% of all births, have a low weight at birth. 95.6 percent of these babies are born in nations that are developing. About 20% of births in India are affected by LBW. Aim and Objective- ObjectiveTo determine whether or if a scoring system can effectively recognise at-risk prenatal women who may go on to have kids with low birth weight. Material and Methods- The study included 339 pregnant women who went to an antenatal clinic at one of many different types of primary health care facilities. From a pool of eleven PHCs, four were randomly chosen. Women who were pregnant were enrolled in the research until the scoring system predicted 108 infants would be born at a low weight. Both descriptive and inferential statistics were used to examine the data. Results- Out of 339 antenatal women 108(31.86%) women had delivered LBW babies. Maternal risk factors such as number of meals per day, weight at 1st trimester and weight gain during pregnancy found significant associated with the mean birth weight ($P<0.05$). Newly developed scoring system was effective for detection of at risk mothers giving birth to low birth weight babies ($p < 0.0001$). Conclusion- The study concluded that newly developed scoring system was effective for the detection at risk mothers giving birth to low birth weight babies. The scoring system can be used in the different rural health setting where there is no possible resource for detection of at risk mothers giving birth to LBW babies.

1. Introduction:

More over 20 million babies, or 15.5% of all births, have a low birth weight. Of them, 95.6% are delivered to mothers living in developing nations. [1] The frequency of low birth weights was found to be 17.4% across the board in a research conducted in Gondar. [2] Low birth weight accounts for about 80% of the 2.5 million annual infant deaths worldwide. Babies born prematurely or with a low birth weight are more likely to suffer from stunting and other health problems later in life, placing a significant strain on the health care or social systems of developing nations.[3]

Nutritional needs vary throughout a woman's life, but are particularly critical in the years leading up to and after pregnancy and during nursing. Women require healthy and balanced diets prior to becoming pregnant in order to stock up on essential nutrients. Energy and nutritional requirements rise throughout pregnancy and lactation.

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Women's and children's health, both throughout pregnancy and in the early years of life, depend on these needs being met. Women have increased nutritional requirements during pregnancy, which are challenging to meet through diet alone, especially in low- and middle-income countries. In these settings, the absence of adequate nutrition before and during pregnancy is an underlying cause of increased maternal morbidity, mortality, and poor birth outcomes such as LBW and small for gestational age (SGA). [4]

Very few studies have focused on this aspect of primary prevention of LBW by identifying 'At Risk' mothers with a high probability of birth of a LBW in the Indian setting. This issue of LBW remains a challenge because of its burden (7.6 to 32.7%) in most of the Indian states, and it's not possible to the people living in the rural and remote area to go for any diagnostic test for the early detection of risk of low birth weight babies. So for early detection of risk of low birth weight babies newly develop scoring system was used to help decreasing the prevalence of LBW. [5]

The present study was undertaken to assess the efficacy of newly developed scoring system which is useful in the field of maternal and child health care and used as a health educational tool for pregnant women which will help to avoid the chance of having LBW babies.

Objectives-To identify the efficacy of scoring system among the antenatal women for detection of risk of giving birth to low birth weight babies.

2. Materials and Methods:

Study Design- A descriptive research design and quantitative research approach was adopted. The variables were birth weight and maternal risk factors i e Meal <4 times/day, hard work, <6hrs of sleep and illiteracy, Hb <11gm/dl, <40kg maternal weight at 1st trimester, <10kg weight gain during pregnancy, and antenatal morbidity. The study was conducted on antenatal women who were in 2nd trimester and attending antenatal clinic at selected PHCs in Karad Taluka, among 11 PHCs, four were selected by using simple random sampling technique (lottery method).

The sample size was calculated as per study by Salunkhe et al, [5] the predictive value for LBW was 42%, p = Percentage of actual LBW amongst predicted LBW by Scoring system = 42%, q = 100-p = 58, $L^2 = (10)^2 = 100$

$$n = 4pq = \frac{4 \times 42 \times 58}{L^2} = \frac{}{100} = 98$$

Minimum prediction of LBW was 98+10= 108. Thus study had been carried out till the scoring system predicts LBW's among 108 antenatal women and followed them until the delivery. High risk and who were diagnosed with twin and triplets were excluded from the study.

As per scoring system developed by Salunkhe et al, [5] score was given to the risk factors. Haemoglobin was assessed by the Sahli's haemoglobin meter. If the Hb level < 11gm% were scored one and those women having Hb level > 11gm% were given zero. 24-hours diet was assessed by recall method. Woman who were taking <4meal/day was given score 12 and those women taking ≥ 4 meals were given zero. The occupation was classified based on activity; Teacher, Tailor, Executives, Housewife, Nurses, etc. were in sedentary work. Servant-maid, Cooli, basket-maker, weaver, agricultural laborer, beedi-maker, etc. was in the moderate work. Stone-cutter was in the hard worker, [9] hard work women was given score 3 and sedentary and moderate work was given zero. Antenatal women who was taking less than 6 hrs of night sleep given score 3 and taking night sleep more than 6 hrs was given score zero. According to educational status, who were illiterate were given score 2 and literate was given zero. Weight at 1st trimester was taken,who had weight less than 40 kg was given score 1 and those having weight more than 40 kg given zero. Total weight gain during pregnancy was calculated, women who gain weight less than 10 kg was given score 1 and those women gain weight more than 10 kg was given zero. Women who were having antenatal morbidity during the pregnancy such as ante-partum hemorrhage, diabetes mellitus, pre-eclampsia, eclampsia and anemia was given score one and those who was not having any of the antenatal morbidity was given score zero.

The data was collected by using scoring scale.[5] The data was collected till the scoring system predicts LBW's among 108 antenatal women. After the data collection pregnant women were followed till delivery and the outcome was recorded within 24 hrs after delivery. Ethical clearance was obtained from ethical committee of KIMSDU, permission was taken from Taluka Medical officer and each selected PHC. Purpose of study was explained to participants and informed consent was

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obtained. Data analysis was done using the SPSS software v. 16.0 (SPSS Inc., Chicago, IL, USA). The obtained data was analyzed in the terms of the objectives of the study and by using descriptive (Frequency and percentage, Mean ± SD) and inferential statistics (Chi-square test and ANOVA test).

3. Results-

The study was conducted on 339 Antenatal women attending PHC's. Women were enrolled during 2nd trimester, till the desire samples were completed and followed them until the delivery.

There was significant association found between mean birth weight of babies and maternal risk factors i.e. number of meals per day **(χ^2 = 9.204, P = 0.027) ; [ANOVA F = 2.086; P = 0.102],** and there was no significant association found between type of work **(χ^2 = 1.125, P = 0.5699),** night sleep **(χ^2 = 2.822, P = 0.0930),** literacy **(χ^2 =0.9260 , P = 0.3359) [Table 1-A].**

Significant association found between mean birth weight of babies and maternal risk factors i.e. weight at 1st trimester **(χ^2 = 28.121, P <0.0001) ; [ANOVA F = 4.859 ; P <0.001],** weight gain during pregnancy **(χ^2 = 20.555, P = 0.0001) ; [ANOVA F = 9.755 ; P <0.001],** and there was no significant association found between Antenatal morbidity **(χ^2 = 2.671, P = 0.4452)** and Hb level **(χ^2 = 3.459, P= 0.0629) [TABLE 1-B].**

Table 1(A): At Risk Mothers Giving Birth to Low Birth Weight Babies According to Risk Factors N = 339

Risk Factors	**LBW <2500 g**		**NBW ≥ 2500 g**	
	No (%)	**Mean± SD**	**No (%)**	**Mean± SD**
Number of meals per day				
2 meal/day	31(35.63)	2.213±0.1887	56(64.37)	2.865±0.3032
3meal/day	58(32.77)	2.184±0.2274	119(67.23)	3.014±0.3454
4meal/day	15(39.47)	2.249±0.2259	23(60.53)	2.967±0.3217
>4meal/day	4(10.81)	2.275±0.0877	33(89.18)	2.907±0.2807
Type of work				
Sedentary work	100(32.57)	2.202±0.2108	207(67.43)	2.945±0.3315
Moderate work	6(28.57)	2.300±0.1453	15(71.43)	3.088±0.3395
Hard work	2(18.18)	0.062±0.4773	9(81.82)	3.027±0.1876
Night sleep				
< 6hours	53(36.81)	2.214±0.1825	91(63.19)	2.994±0.3044
> 6hours	55(28.21)	2.195±0.2391	140(71.79)	2.935±0.3428
Literacy				
Literate	105(31.53)	2.204±0.2135	228(68.46)	2.961±0.3298
Illiterate	3(50)	2.233±0.2083	3(50)	2.725±0.0250

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As per the scoring system 108 pregnant women was having score ≥ 12 and they were in high risk of giving birth to LBW babies among that, 94 (27.73%) delivered LBW and 39(11.50%) delivered NBW babies. And 206 pregnant women was having score Score < 12, among that 14(4.13%) was delivered LBW and 192(56.64%) was delivered NBW babies.

Table 2- Distribution of LBW and NBW Babies according to Scoring System.
N =339

Scoring Category	Birth Weight		Total
	LBW <2500 g	NBW ≥ 2500 g	
	No (%)	No (%)	
LBW (≥ 12)	94 (27.73)	39 (11.50)	133 (39.23)
NBW (< 12)	14 (4.13)	192 (56.64)	206 (60.77)
Total	108 (31.86)	231 (68.14)	339 (100%)

The validity parameters were: Sensitivity - 0.8704 with 95% Confidence interval 0.7921 to 0.9273. Specificity 0.8312 with 95% confidence interval 0.7768 to 0.8770, Positive (+) Predictive value 0.7068 with 95% Confidence Interval 0.6211 to 0.7829. Negative (-) Predictive value 0.9320 with 95% Confidence Interval- 0.8886 to 0.9624. Two sided P value was < 0.001.

Out of 339 pregnant women, 108(31.86%) given birth to low birth weight babies, among them 14 (12.96%) women was at low risk **(<12score)**, 30 (27.78%) was at Moderate risk **(score 12-14)** and 64 (59.26%) women was at High risk **(≥ 15 score)**. Mean ±SD birth weight of babies born to these women was 2.256±0.2224, 2.214±0.2427 and 2.189±0.1961 respectively

Among 206(60.76%) women with score of <12 delivered 14 (12.96%) low birth weight babies. 56(16.52%) women with score of between 12 to 14 was delivered 30(53.57%) of low birth weight and 77(22.71%) women with ≥15 score delivered 64(83.12%) low birth weight babies.

Table 3: Distribution of at Risk Mothers Giving Birth to Low Birth Weight Babies N = 339

Scoring category	LBW <2500 g		NBW ≥ 2500 g		Total
	No (%)	Mean± SD	No (%)	Mean± SD	No (%)
Low (< 12)	14 (12.96%)	2.256±0.2224	192 (83.12%)	3.021±0.3181	206 (60.76%)
Moderate (12-14)	30 (27.78%)	2.214±0.2427	26 (11.25%)	2.634±0.1355	56 (16.52%)
High (≥ 15)	64 (59.26)	2.189±0.1961	13 (5.63%)	2.676±0.2166	77 (22.71%)
Total	108 (31.86%)	-	231(68.14%)	-	339(100%)

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Note: Score<12 - mothers at Low risk, Score 12-14 - mothers at Moderate risk and Score ≥ 15 score indicate mothers at High risk of giving birth to low birth weight babies.

There was significant linear trend among the scoring categories and proportion of LBW's and NBW's (P<0.0001).

Table 4: Efficacy of Scoring System for Detection of at Risk Mothers Giving Birth to Low Birth Weight Babies. N= 339

Scoring category	F (%)	Birth Weight		Chi-squared test for trend (χ^2)	P- value
		LBW (%)	NBW (%)		
Low (< 12)	206 (60.76%)	14 (12.96%)	192 (93.20%)		
Moderate (12-14)	56 (16.52%)	30 (53.57%)	26 (46.43%)		
High (≥ 15)	77 (22.71%)	64 (83.12%)	13 (16.88%)		
Total-	339 (100%)	108 (31.86%)	231 (68.14%)	164.69	< 0.0001

4. Discussion-

Considering public health strategy for reducing the prevalence of low birth weight babies needs to focus attention on better maternal nutrition and education. Women need to be educated and encouraged for regular ANC checkups, which helps in the detection of risk factors at the earliest to improve the weight of a newborn. Good nutrition during pregnancy results in increased birth weight.

In the present study there was significant association found between mean birth weight of babies and number of meals per day **(P = 0.027),** weight at 1st trimester **(P <0.0001),** weight gain during pregnancy **(P < 0.0001)** number of meals per day (P=0.0267). A similar findings were noted by Salunkhe A. H. et al, [5] noted that association between < 4meal per day and birth of LBW babies.(P<0.05).

In our study those women 28(8.27%) gain weight < 5kg delivered 14(50%) of LBW babies. Similar findings were noted by S Rijvi et al, [6] he found significant association between maternal weight gain and mean birth weight. (P= 0.007).

In the present study 66(19.47%) women who was having weight <40kg at 1st trimester delivered 37(56.06%) percentage of LBW babies. Similar findings were noted by Salunkhe A. H. et. al, [5] in his study illiteracy, height of mother (<145 cm), number of ANC visits (<4), weight at first trimester (<40 kg), weight gain (<10 kg) during pregnancy, and presence of anemia (Hb < 11 gm%) at first trimester, and antenatal morbidity were found significantly associated with LBW by bivariate analysis of the study population of 1876 pregnant women. He also identified risk factors in his study were <4-meals per day, hard work, night sleep of <6 h. illiteracy, weight at first trimester <40 kg, anemia in first trimester (Hb < 11 g%), weight gain of <10 kg during pregnancy and antenatal morbidity, the sensitivity and specificity observed for the cutoff value of 12 was 98.6% and 46.1%, respectively. Another researchers also observed similar values.[7,8]

In our study out of 339 antenatal women 108 women delivered LBW babies among them 133(39.23%) were having score ≥ 12 and having high risk of birth of LBW babies among them 94 (27.73%) mothers were delivered LBW babies, and 206(60.77%) were having < 12 score

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among them 14(4.13%) women delivered LBW babies. In our study validity parameters were: Sensitivity - 0.8704 with 95% Confidence interval 0.7921 to 0.9273. Specificity 0.8312 with 95% confidence interval 0.7768 to 0.8770 and Positive (+) Predictive value 0.7068 with 95% Confidence Interval 0.6211 to 0.7829. Negative (-) Predictive value 0.9320 with 95% Confidence Interval-0.8886 to 0.9624. Two sided P value was < 0.001. Salunkhe A. H. et. al, [5] observed that at the score of 15 there was a sharp increase in the proportion of LBW to 96.3% which was identified as a higher cutoff point. Thus, the risk scale was refined as <12 indicating low risk, between 12 and 14 as moderate risk, and ≥15 as high risk. This higher cutoff value of ≥15 had a sensitivity of 74.6% and specificity of 99.4% and positive predictive value of LBW of 98.1%.

The current research found that LBW had a prevalence of 31.86 percent. Sarika M. et al. found a nearly same frequency of low birth weight, 26.9%. Thirty to three percent of births in India are to mothers who are pregnant for the whole term, yet their kids are born LBW.[10] Forty percent of all infants born in low-income countries as well than half of all babies born in Asia are born in India.[11] According to the NFHS-4 survey.About 17.5% of babies are born via LBW, according to one study [12]. Another study put the frequency of LBW at 18%, based on all surviving children in India less than 5 years old.[13] Nearly one-fifth (21.49%) of newborns were LBW in the research by Pal, A., Manna, S., Das, B. et al.[14], which analysed 2611 birth events from various districts in West Bengal. The eastern Indian state of Tripura has a very high rate of LBW, at 23.9%.[15] Dandekar et al.[16] found a similar incidence rate of LBW in Tamil Nadu, reporting 11.67 percent.

In the present study the maternal risk factors were assessed with help of scoring system for detection of LBW babies. There was significant linear trend among the scoring categories and proportion of LBW's and NBW's (P<0.0001). In various parts of India many researchers [7,17] developed scoring systems for identification of risk of LBW in the antenatal period. These researchers have identified risk factors based on bivariate analysis and multivariate analysis. They concluded that this scoring system is evidence based, with high sensitivity and specificity, easy to understand and easy to use for health-care workers. It is possible to incorporate this tool in routine antenatal care and give specific timely intervention. [7,17]

5. Conclusion

The study concluded that in the present study, the prevalence of the Low Birth Weight was 31.86%.There was significant linear trend among the scoring categories and proportion of LBW's and NBW's (P<0.0001). Newly developed scoring system was effective for detection of at risk mothers giving birth to low birth weight babies (p < 0.0001)

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