Maternal Factors Contributing to Low Birth Weight Babies in an Urban Slum Community of Greater Mumbai

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Abstract

Research Question : What are the various maternal factors associated with low birth weight?

Objective : 1) To find out the percentage of low birth weight in an urban slum community. 2) To study the maternal factors associated with low birth weight.

Study design : Prospective, Observational, Community based study.

Setting : An urban slum community Sahaji Nagar, situated in the outskirts of Mumbai.

Study Population : 282 pregnant women selected from the community and followed up to delivery.

Study variable : ANC visits, time of ANC registration, age of the mother, socio-economic status, spacing between two consecutive pregnancy, height, iron supplementation, rest in afternoon, bad obstetric history, education, religion, birth order and body mass index.

Outcome variable : Low birth weight (LBW) babies.

Statistical analysis : chi square test, multivariate analysis.

Results : The percentage of LBW is 45.2%. The % of LBW is more in less no of ANC visits i.e. 1 to 4 (56.8%), late ANC registration i.e. 3rd trimester of pregnancy (50.7%), teenage pregnancy (67%), low socio-economic class i.e. class III and above (57.4%), spacing between two pregnancies less than 2 years (76.5%), increasing parity (67% of 5th order), height of mother less than 145 cms (60.6%), body mass index less than or equal to 18.6 (60.7%), incomplete treatment of iron and folic acid supplements (78.9%) and bad obstetric history (57.6%). The above factors are statistically significant on applying the chi-square test. On multivariate analysis, ranking of all the above factors is made and it is seen that the 1st four factors i.e. less ANC visits, late ANC registration, teenage pregnancy and low socio-economic class exercise a maximum impact on the outcome of pregnancy in ascending order i.e. 1 to 4.

Introduction

A child has only one chance to develop normally, and the protection of that one chance therefore demands the kind of commitment that will not be superceded by other priorities.[1] The quality, character and health of the child depends upon the mother that bears the child. A multifactorial relationship exists between the environment, health, nutritional status, social status of a woman and the growth of the foetus.[2] All woman, whether their pregnancies are complicated or not, need good quality maternal health services during pregnancy, delivery and in the post partum period to ensure their health and that of their infants. While risk cannot be totally eliminated once pregnancy has begun but they can be reduced

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through effective, affordable, accessible and acceptable maternity care. In India, only 40-50% of pregnant women receive antenatal care.[3] The birth weight of the newborn is the single most important determinant of the chances of the newborn to survive and to experience healthy growth and development.[4] According to UNICEF the proportion of low birth weight was 30% in 1991,[5] increased to 33% in 1995,[1] from 1995 to 2000 it has decreased to 26%.[6] The percentage of low birth weight must be regarded as an index of our status of public health in general and of maternal health and nutrition in particular. The identification of factors that underlay the continuing high percentage of low birth weight and institution of remedial measures to combat it must be perceived as a major challenge in the field of public health The present study was therefore undertaken to identify the percentage of low birth weight in an urban slum community and study the various epidemiological factors associated with it.

Material and Method

The study was carried out at Shahaji Nagar, an urban slum community situated in the outskirts of Mumbai which is a catchment area of Shahaji Nagar urban health centre. The sample of 282 pregnant women was selected from the community by employing simple random sampling method over a period of 3 months, These women were selected from all the 11 sectors of the community in proportion of approximately 20-30 from each sector, who were not registered for ANC at any place. The study group subjects were directed to the Municipal Maternity Hospital which was in close vicinity of the community for ANC registration and motivated to attend their visits regularly. At each ANC visit, detailed clinical and obstetric examination, anthropometric measurement and laboratory

investigation were done. The study subjects were followed till delivery. The study continued for a period of 10 months. All babies were weighed within 1 hour after birth[7] on a standard baby weighing scale, to the nearest 100 grams and were assessed for any complications. The birth weight was compared with the various maternal variables to identify the risk factors for low birth weight. As per the guidelines of CSSM programme,[8] infants with birth weight < 2500 grams were considered as low birth weight and with birth weight ≥ 2500 grams as normal. The birth weight was recorded from child's birth record. Out of 282 study sample 252 women were analyzed at the end of the study. Out of the remaining 30 women, 19 were lost to follow up, home deliveries in 2, abortion in 5, still birth in 3 and 1 delivered twins. As the birth weight in case of home deliveries were not recorded, they were not included in the study. In the study only singleton pregnancy was considered for analysis, therefore twin delivery was not included. Four women had preterm deliveries. They are not divided into term and preterm low birth weight infants, due to very small number. Essential data was collected on preformed structured proforma containing relevant information. Every attempt was made to collect the information accurately and the results were then compiled and analyzed. The data was statistically analyzed by SPSS package on computer and was presented by employing descriptive epidemiological study method.

Results

According to CSSM classification, ≤ 2499 grams are low birth weight newborns and ≥ 2500 grams are normal birth weight newborns. Taking into account the above criteria, in the recent study, 114 women delivered low birth weight newborns, while 138 women delivered normal birth weight

newborns. Hence the percentage of low birth weight newborns in the present study was found out to be 45.2%.The average birth weight of the newborns is found to be 2.61± 2 (0.48), hence the range of newborns birth weight is from 1.65 grams to 3.57 grams, however in the present study group, lowest birth weight is 1.8 grams and the highest is 3.9 grams (Table 1).

It is seen from the Table 2 that, as the mother's age increases, the percentage of low birth weight decreases significantly. 67% of the total women who belong to < 20 years age group gave birth to low birth weight babies.

In the present study, it is observed that, out of the 136 Muslim mothers, 72(52.9%) gave birth to normal weight newborns, while 64(47.1%) gave to low birth weight newborns.

Among the 114 Hindu women, 64(64.9%) and 50(35.1%) gave birth to normal weight and low birth weight newborns respectively. Both the Christain mothers gave birth to normal weight newborns, however the difference was not statistically significant.

It is observed from the Table 3 that, 38.5% of the women of socio-economic class I, gave birth to low birth weight newborns, as against 57.4% of the women belonging to class III and below, which is significant statistically.

In the present study, 58 i.e. 23% of the women are primigravida, whereas 42.1%, 23%, 9.5% and 2.4% are of the 2nd , 3rd , 4th and 5th order respectively. 37.9% and 37.7% of the women of 1st and 2nd order, gave birth to low birth weight babies which is significantly less as compared to 51.7%, 75% and 67% of 3rd, 4th and 5th order respectively (Table 4).

In the present study 2.4%, 41.3% and 56.3% of the women registered for ANC care during 1st, 2nd and 3rd trimester respectively and the Table 5 shows that late registration also influences the outcome of pregnancy significantly.

The relationship between number of ANC visits and low birth weight is statistically highly significant i.e. increase in the number of ANC visits leads to decrease in the incidence of low birth weight. 34 women had

Table 1 : Distribution of newborns according to their birth weight

Birth weight (in gms)	No. of newborn	Percentage (%)
* ≤ 2000	28	11.1
* 2001-2499	86	34.1
≥ 2500	138	54.8
Total	252	100.0

*Data pooled together.

Table 2 : Mother's Age Vs the Birth weight of newborn

Mother's Age in years		Birth weight of new born		Total
		Within Normal limits	Low birth weight	
< 20	No.	4	8	12
	%	33.0	67.0	100.0
20-25	No.	102	94	196
	%	52.0	48.0	100.0
> 25	No.	32	12	44
	%	82.7	17.3	100.0
Total	No.	138	114	252
	%	54.8	45.2	100.0

X^2 = 8.54; p < 0.02 Significant

Table 3 : Relationship between socio-economic status and the birth weight of new born

Per Capita Income per month Rs. (socio-economic class)		Birth weight of new born		Total
		Within Normal limits	Low birth weight	
1215 and	No.	75	47	122
Above (I)	%	61.5	38.5	100.0
608-1214	No.	34	28	62
(II)	%	54.8	45.2	100.0
*284-607	No.	22	28	50
(III)	%	44.0	56.0	100.0
*121-283	No.	6	10	16
(IV)	%	37.5	62.5	100.0
* $\leq$ 120	No.	1	1	2
(V)	%	50.0	50.0	100.0
Total	No.	138	114	252
	%	54.8	45.2	100.0

X^2 = 6.24; $p < 0.05$ Significant

*Data pooled together to apply test of significance.

Table 4 : Co-relationship between Birth order and the birth weight of the newborn

Birth order		Birth weight of new born		Total
		Within Normal limits	Low birth weight	
1st	No.	36	22	58
	%	62.1	37.9	100.0
2nd	No.	66	40	106
	%	62.3	37.7	100.0
3rd	No.	28	30	58
	%	48.3	51.7	100.0
4th	No.	6	18	24
	%	25.0	75.0	100.0
5th	No.	2	4	6
	%	33.0	67.0	100.0
Total	No.	138	114	252
	%	54.8	45.2	100.0

$r = 0.95$; $p < 0.01$ Significant

only 1ANC visit, maximum number of women i.e.66 women had 5 ANC visits, while only 2 women had 10 ANC visits (Table 6).

In the study group, 1.6% of the women were having haemoglobin level between 6 and less than 8 gm%, 58.7% between 8 and less than 10 and 39.7% greater than equal to 10 gm% (Table 7).

None of the mothers had haemoglobin level less than 6 gm%. 51.2% of the women took complete treatment, while 48.8% took partial treatment, as prescribed. In the present study 78.9% of the mothers who took partial treatment gave birth to low birth weight babies which is significantly high, as compared to 13.2% who took complete

Table 5 : Time of ANC Registration Vs the birth weight of newborn

Time of ANC Registration in weeks	Trimester	Birth weight of new born		Total
		Within Normal limits	Low birth weight	
≤ 12	1st No.	4	2	6
	%	67.0	33.0	100.0
13-28	2nd No.	64	40	104
	%	61.5	38.5	100.0
≥ 29	3rd No.	70	72	142
	%	49.3	50.7	100.0
Total	No.	138	114	252
	%	54.8	45.2	100.0

X^2 = 3.86; $p < 0.05$ Significant

Table 6 : Number of ANC visits Vs the birth weight of newborn

No. of ANC visits		Birth weight of new born		Total
		Within Normal limits	Low birth weight	
1-4	No.	64	84	148
	%	43.2	56.8	100.0
5-10	No.	74	30	104
	%	71.2	28.8	100.0
Total	No.	138	114	252
	%	54.8	45.2	100.0

X^2 = 18.09; $p < 0.001$ Highly significant

Table 7 : Comparison of haemoglobin levels of mothers and treatment taken with the birth weight of newborn

Hb level in gm%		Treatment taken				Total
		Complete (n=129)		Partial (n=123)		
		WNL	LBW	WNL	LBW	
*$\geq 6 < 8$	No.	—	—	—	4	4
	%	—	—	—	100.0	100.0
$\geq 8 < 10$	No.	60	11	23	54	148
	%	40.5	7.5	15.5	36.5	100.0
≥ 10	No.	52	6	3	39	100
	%	52.0	6.0	3.0	39.0	100.0
Total	No.	112	17	26	97	252
	(%)	(86.8)	(13.2)	(21.1)	(78.9)	

X^2 = 107.02; $p < 0.001$ Highly significant. Data pooled to apply test of significance. (WNL – Within Normal Limits, LBW – Low Birth Weight)

treatment.

Table 8 indicates the birth spacing of the children among 194 multipara women included in the present study. It is seen, that those mothers with spacing less than 2 years, 76.5% gave birth to low birth weight babies,

Table 8 : Spacing between two consecutive pregnancy Vs the birth weight of newborn (primi gravida excluded)

Spacing between 2 consecutive pregnancy in years		Birth weight of new born		Total
		Within Normal limits	Low birth weight	
< 2	No.	8	26	34
	%	23.5	76.5	100.0
*2-4	No.	80	60	140
	%	57.1	42.9	100.0
*> 4	No.	14	6	20
	%	70.0	30.0	100.0
Total	No.	102	92	194
	%	52.6	47.4	100.0

$X^2 = 12.57$; $p < 0.001$ Highly significant. *Data pooled together to apply test of significance

Table 9 : Comparison of Time of ANC Registration and No. of ANC visits with weight gain during pregnancy

Time of ANC registration in weeks	Trimester	Average weight gain during pregnancy in kg No. of ANC visits	
		1-4 (n=148)	5-10 (n=104)
≤ 12 (n=06)	1st	4.9	5.2
13-28 (n=104)	2nd	4.67	4.89
≥ 29 (n=142)	3rd	4.26	—

F = 5.67; $p < 0.05$ Significant

which is more as compared to 41.3%, with spacing ≥ 2 years, and the difference is highly statistically significant.

7.5% of the mothers have spacing less than 2 years, 72.2% with spacing 2 to 4 years and 10.3% with greater than 4 years. Out of the total number of 252, 58 mothers are primigravida, which are not included in the Table 8.

Data from Table 9 reveals that, irrespective of the time of ANC registration, the average weight gain of the women during pregnancy is more, if the number of ANC visits are more. The difference is found to be statistically significant.

In the present study, 26.2% of the women have height less than 145 cms, while 73.8% have height ≥ 145 cms (Table 10).

60.6% of women having height less than 145 cms gave birth to low birth weight newborns, as compared to 39.8% of women with height ≥ 145 cms.

The difference is statistically significant.

Body Mass Index is calculated according to the Quetelet's Index as follows:

$$\text{Body Mass Index (BMI)} = \frac{\text{Weight (in kgs)}}{\text{Height}^2 \text{ (in metres)}}$$

Normal range of body mass index for adult women is from 18.7 to 23.8. 61.9% of the women studied are within this range. 22.2% are ≤ 18.6, while 15.9% are ≥ 23.9. It is seen from the Table 11 that as the Body Mass Index increases, the incidence of low birth weight decreases and the difference is statistically

Table 10 : Maternal Height Vs the birth weight of the newborn

Maternal Height in cms		Birth weight of new born		Total
		Within Normal limits	Low birth weight	
< 145	No.	26	40	66
	%	39.4	60.6	100.0
≥ 145	No.	112	74	186
	%	60.2	39.8	100.0
Tota	No.	138	114	252
	%	54.8	45.2	100.0

$X^2 = 7.70$; $p < 0.01$ Significant

Table 11 : Mother's Body Mass Index (BMI) Vs the birth weight of newborn

Body Mass Index		Birth weight of new born		Total
		Within Normal limits	Low birth weight	
< 18.6	No.	22	34	56
	%	39.3	60.7	100.0
18.7 – 23.8	No.	89	67	156
	%	57.1	42.9	100.0
> 23.9	No.	27	13	40
	%	67.5	32.5	100.0
Total	No.	138	114	252
	%	54.8	45.2	100.0

$X^2 = 8.36$; $p < 0.02$ Significant

significant.

In the present study, 36.5% of the women had previous bad obstetric history (BOH), while 63.5% did not. 57.6% of the women, with bad obstetric history in the past, gave birth to low birth weight babies in present pregnancy, is significantly more as compared to 38.1% who did not have any such history (Table 12).

An attempt is made to give the ranking to all the variables or factors, influencing their effect on the percentage of low birth weight, by using multivariate analysis, as detailed above. It is clearly evident from the Table 13 that, number of ANC visits, time of ANC registration, age of the mother and socio-economic status exercise maximum impact on the outcome of pregnancy.

Discussion

In the present study, out of the 252 women, 45.2% delivered low birth weight babies and 54.8% gave birth to babies within the normal limit i.e. equal to or more than 2500 grams (Table 1). It is seen that as the mother's age increases the percentage of low birth weight decreases significantly. 67% of the total women who belong to < 20 years age group gave birth to low birth weight babies, which is more as compared to 48% and 17.3% of the women in the age group 20-25 years and > 25 years respectively (Table 2). A study conducted in rural-urban area of Nagpur, by Gawade *et al*, showed that low birth weight babies to be more in teenage mother (41.9%), which is in compliance with the finding seen in the present study.[9] It is evident that, socio-economic status is significantly associated

Table 12 : Relation between previous bad obstetric history (BOH) and birth weight of newborn

Previous BOH		Birth weight of new born		Total
		Within Normal limits	Low birth weight	
Yes	No.	39	53	92
	%	42.4	57.6	100.0
No	No.	99	61	160
	%	61.9	38.1	100.0
Total	No.	138	114	252
	%	54.8	45.2	100.0

X^2=8.18; p < 0.01 Significant

Table 13 : Relationship of each parameter in the study group with the birth weight of newborn

Parameters	Rank No.		Significancy of P value
ANC visits	1	0.452	p < 0.0022
Time of ANC Registration	2	0.104	p < 0.0040
Age of mother	3	0.015	p < 0.0048
Socio-Economic Status	4	1.23×10^{-4}	p < 0.0447
Spacing between two consecutive pregnancy	5	0.0693	p > 0.118
Height	6	0.0138	p > 0.280
Iron supplementation	7	0.13	p > 0.290
Rest in afternoon	8	-0.186	p > 0.358
Bad Obstetric History	9	0.24	p > 0.420
Education	10	0.052	p > 0.490
Religion	11	-0.087	p > 0.505
Birth order	12	0.38	p > 0.580
Body Mass Index	13	0.196	p > 0.781

with low birth weight. 38.5% of class I and 45.2% of class II gave birth to low birth weight babies, which is significantly less than 57.4% of class III and below (Table 3). The study population was categorized according to Prasad's revised classification 1988. Similar findings were seen in a study by Iceberg *et al.*[10] It is observed that percentage of low birth weight increased with an increase in parity (37.9% - 1st order, 37.7% - 2nd order, 51.7% - 3rd order, 75% - 4th order and 67%-5th order) (Table 4). Similar findings are confirmed by various studies conducted in the past.[10-12] Spacing between 2 consecutive pregnancy had a highly significant influence on the percentage of low birth weight i.e. more the spacing between 2 consecutive pregnancy less is the incidence of low birth weight babies (76.5%- ≤ 2 years, 41.3%- ≥ 2 years) (Table 8). Similar findings confirmed by study conducted by Gawde *et al*[9] and Desmukh *et al.*[14] It is seen that time of ANC registration, influences the percentage of low birth weight significantly i.e. 33% of the women registered in 1st trimester gave birth to low birth weight babies, which is significantly less than 38.5% and 50.7% of the women registered in 2nd and 3rd trimester respectively (Table 5). It is also revealed from the study that less the number of ANC visits i.e.1 to 4 gave birth to low birth

weight infants i.e. 56.8%, which is significantly more as compared to only 28.8% with ANC visits 5 to 10 (Table 6). Similar findings were observed by various other studies.[12,15,16] 60.6% of the women having height < 145 cms gave birth to LBW babies as compared to only 39.8% with height ≥ 145 cms. The different is found to be statistically significant (Table 10). The above findings were confirmed by various studies conducted in the past.[17,18] It is also evident that as the Body Mass Index increases, the percentage of low birth weight decreases significantly i.e. 60.7% of the women with BMI ≤ 18.6 gave birth to LBW babies, while 42.9% with BMI 18.7 to 23.8 and 32.5% with BMI ≥ 23.9 (Table 11). Mother's Body Mass Index indirectly relates with the nutritional status of the women. It is calculated by the Quetelet's Index, in which the weight of the women at the time of 36 to 40 weeks is taken into account. The above findings are in compliance with the study conducted by Ferreria *et al*, of 105 births in Goa, in which a gain of about 40 gms in the birth weight of infant is seen, for every unit rise in the body mass index.[15] In the present study among the 252 women, 51.2% have taken complete treatment and 48.8% have taken partial treatment. It is also evident, in the present study that 13.2% of the mothers who have taken complete treatment, gave birth to LBW babies, which is significantly less than 78.9% of the mothers who have taken partial treatment (Table 7). The treatment prescribed is either in form of iron-folic acid tablets or imferon injections or combination of the two, on the basis of haemoglobin level of the mother at the time of ANC registration. On questioning whether the patient has taken the complete treatment as prescribed, could be biased, hence repeat haemoglobin estimation was done at 38-40 weeks of gestation. Similar results were seen in the study by Lobo *et al*, at Shirur.[19] In the

present study, it is seen that, irrespective of the time of ANC registration, the average weight gain during pregnancy of the women is more, if the number of ANC visits are more. The difference is found to be statistically significant (Table 9). This is seen also in a study conducted by Scholl *et al* in USA.[20] Previous Bad Obstetric History (BOH) is significantly related with LBW babies i.e. 57.6% of the women with BOH in past, gave birth to LBW newborns in the present pregnancy, which is significantly more as compared to 38.1% who did not have any such history (Table 12). This is in compliance with the study conducted by Silvia de Sanjose et al in Scotland.[13] It is seen that religion, education of the mother, rest in afternoon for a period of 2 hrs during pregnancy till delivery did not play a significant impact on the outcome i.e. low birth weight when compared as individual variables hence the data was not tabulated. 92.9% of the women were not working i.e. they were housewives and 7.1% of the remaining women were working as part-time maid servants or seamstress. As all women were doing moderate work, the variable was not studied further. Also it was observed that the protein and caloric intake was less than the ideal levels of pregnant women, hence though it was important variable it could not be studied further. An attempt is made to give the ranking to all the variables or factors, influencing their effect on the incidence of low birth weight, by using multivariate analysis. It is clearly evident that, number of ANC visits, time of ANC registration, age of the mother and socio-economic status has a highly significant impact on the incidence of low birth weight. The other factors i.e. spacing between two consecutive pregnancy, height of the mother, iron supplementation, rest in afternoon for 2 hours, bad obstetric history, education, religion, birth order and

body mass index, arranged in the descending order, exercise a definite influence on the pregnancy outcome, but does not have a significant impact (Table 13).

Conclusion

Hence we conclude that, it is advisable to undertake a similar type of study on a wider scale, to confirm the findings of the above study and to strengthen ANC services, by giving more emphasis on the factors identified in the present study in order to reduce the overall incidence of low birth weight in the community.

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