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A cross sectional study to identify factors determining low birth weight babies observed in a tribal district of Odisha, India

Bishnu Charan Majhi [1], Ramesh Kanbargi [1], Rout George Kerry [2] and Sanatan Majhi [2,*]

[1] *Padmashree School of Public Health, Kommaghatta, Sulikere Post, Kengeri Bangalore-560060, Karnataka, India*
[2] *Department of Biotechnology, Utkal University, Vanivihar, Bhubneswar-751004, Odisha, India*

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Abstract

Birth weight is one of the important determinants of the chance of new born babies to survive and experience healthy growth and development. So present study was done to find some risk factors associated with delivering low birth weight (LBW) babies by the tribal womens in Mayurbhanj district of Odisha, India. A cross sectional, institution-community based study was undertaken over a period of 3 months on mothers at various hospitals and community in Mayurbhanj district of Odisha. The study group consisted of 100 mothers who had LBW babies and compared with 100 mothers who had normal birth weight babies, as control group. Factors like age at marriage, education of mother, family income, weight before pregnancy, weight gain during pregnancy, number of parity, completed months of pregnancy, hemoglobin level, blood pressure, infection, chronic disease, physical work, intake of iron and folic acid, alcohol consumption, use of tobacco etc. were compared between the two groups. Among the mothers of LBW babies, 70 (86.41%) had married between 15-19 years of age, 36 (94.73%) attained education up to primary level, 21 (91.30%) had family income< Rs. 1000 per months, 25 (80.64%) had achieved last conception at the age of 19 years, 14 (66.66%) had birth spacing <19 months, 42 (73.68%) had height<150cm, 70 (75.26%) had hemoglobin level<11gm/dl, 64 (78.04%) had malaria during pregnancy, 30 (85.71%) had done hard physical work during pregnancy, 42 (73.68%) had inadequate ANC visits, 91(73.98%) had no additional diet during pregnancy, 59 (83.09%) had consumed alcohol and 56 (77.77%) were addicted with tobacco during and before pregnancy. In addition to these factors, various epidemiological factors, the maternal factors like antenatal care, parity, inter pregnancy interval and bad obstetric history are also found to influence birth weight. Hence, it is the need of the hour to strengthen the existing maternal services at the basic level of community.

Keywords: Low birth weight; Physical work; Antenatal care; Pregnancy; Tribal

1. Introduction

According to WHO definition, babies with birth weight less than 2,500 gm are termed as low birth weight babies. Annually, almost 23 million LBW babies, born worldwide of which high proportions are observed in developing countries. LBW is not only a sensitive indicator for predicting the chances of both baby survival and healthy growth and development, but is also a reflector of the present and past health status of the mother. Additionally, it has been established that LBW is a leading cause of prenatal and neonatal deaths, and as such it remains a worldwide issue and one of the most important public health problems, particularly in developing countries [1]. A reduction of at least one-third in the proportion of babies with LBW is one of the seven major goals for the current decade of "A World Fit for Children" programme of the UN. Monitoring improvements in LBW is thus being given high priority within the UN system, as well as by national governments [2, 3].

*Corresponding author: Sanatan Majhi
Department of Biotechnology, Utkal University, Vanivihar, Bhubneswar-751004, Odisha, India.

Despite such constant efforts to enhance mother and child health, more than twenty million LBW babies are born worldwide each year. Half of all prenatal and one third of all baby deaths are directly or indirectly related to LBW [4, 5]. Therefore multifactorial relationship exists between the environment, health and nutritional status, social status of a woman and the growth of the fetus. All women, 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 babies [6, 7]. Risk cannot be totally eliminated once pregnancy has begun but they can be reduced through effective, affordable, accessible and acceptable maternity care [3]. The identification of factors that underlay the continuing high percentage of LBW and institution of remedial measures to combat it must be perceived as a major challenge in the field of public health [3, 8, 9].

South Asia has the highest prevalence of LBW in comparison to developed countries [10]. In fact, the latest projection indicates that more than half of the world's LBW babies are born in South Asia [11, 12]. Further, approximately 40% of LBW neonates are from India [13] with states like Odisha, accounting for 71%, which is much higher than the national average and other states. It has been observed that Manipur, Sikkim, Rajasthan, Karnataka, Andhra Pradesh, Himachal Pradesh and Tamil Nadu have reported less than 10% LBW rates, while the states of Maharashtra and Odisha have reported LBW rates as high as 39.2% and 71.3% respectively [14]. The LBW rates are closely linked with high utilization of quality ANC services. However, there are a few instances like in Odisha, where both the LBW rate (71.3%) and the percentage of women receiving 3 antenatal checkups (86.6%) are high as reported in HMIS. In the state of Maharashtra, the LBW rate is 39.2%, while the percentage of women receiving 3 antenatal checkups in the state is high at 69.3% [12, 15, 16].

Additionally, out of 30 districts in the state of Odisha, Mayurbhanj is the largest and thickly populated tribal district, having total geographical area of 10,418.6 Sq. kms, situated in the northern boundary of the state with district headquarters at Baripada. The district is divided into 4 administrative sub-divisions and has 3,945 villages. The IMR, nutritional level of both mother and child, endemicity of diseases and so on also reflect the health status in a region. The IMR for the district, which was 97/1000 in 1997 declined to 45.44/1000 in 2008 and MMR stood at 320/100000 and prevalence of LBW is high in comparison to other district of Odisha. Malnutrition and under-nutrition among women and children are rampant in this district [13, 17].

Thus, understanding the roots of LBW has been a difficult public health challenge. It can be speculated that there is correlation between birth weight and a variety of factors, including smoking, low maternal pre-pregnancy weight, low maternal weight gain, teenage pregnancy, single motherhood, socioeconomic status and race. However, the meaning of these associations remains murky and it is unclear whether these factors influence birth weight directly or indirectly. Therefore, the current study focuses on finding specific risk factors associated with delivering LBW babies by the tribal womens in various hospitals in Mayurbhanj district of Odisha, India.

2. Material and methods

2.1. Study design

A cross sectional, institution-community based study was undertaken over a period of 3 months on mothers at various hospitals and community in Mayurbhanj district of Odisha. The study group consisted of 100 mothers who had LBW babies and compared with 100 mothers who had normal birth weight babies as control group. In this study, both qualitative and quantitative data were included.

2.2. Study area

The study was carried out in Mayurbhanj district of Odisha, a state of India, during the period of April to July, 2012. Two hundred pregnant women were selected employing simple random sampling method from various hospitals. The study was done by listing out 100 mothers who gave birth to LBW babies and 100 of those who gave birth to normal weight babies during last six month from birth records of various hospitals and new born care unit. With the structured questionnaires, the mothers were interviewed by home visit. A pre-tested schedule was used to record the information regarding identification of mothers, their relevant bio-social variables, past obstetrical history, complications of pregnancy, illness during pregnancy, utilization of antenatal care, history of dietary intake and nature of physical activity during pregnancy, along with the birth weight and sex of new born babies.

2.3. Sampling Method

The sampling was conducted from these mothers who delivered LBW babies and normal weight babies in various health centres during last six months. The variables taken into consideration includes, age of mother at the time of conception,

age of mother at the time of marriage, sex of newborn, educational background of mother, family income of mother, parity, duration of pregnancy in completed month, birth spacing between this delivery and previous delivery, additional food during pregnancy, content of regular food, food frequency, height of mother, weight of mother before pregnancy, weight gain during pregnancy, ANC visit of mother, number of ANC visit, Iron and folic acid intake during pregnancy, hemoglobin level during pregnancy, blood pressure during pregnancy, infection during pregnancy, chronic disease of mother, physical work during pregnancy, alcohol consumption during pregnancy and tobacco intake during pregnancy.

Details of operational definition of the variables, data collection methods and tools, interview (face to face), data processing and analysis (editing, coding), classification and tabulation, analysis, inclusion and exclusion criteria, reliability were carried out using SPSS statistical analysis software and Graphpad Prism.

3. Results

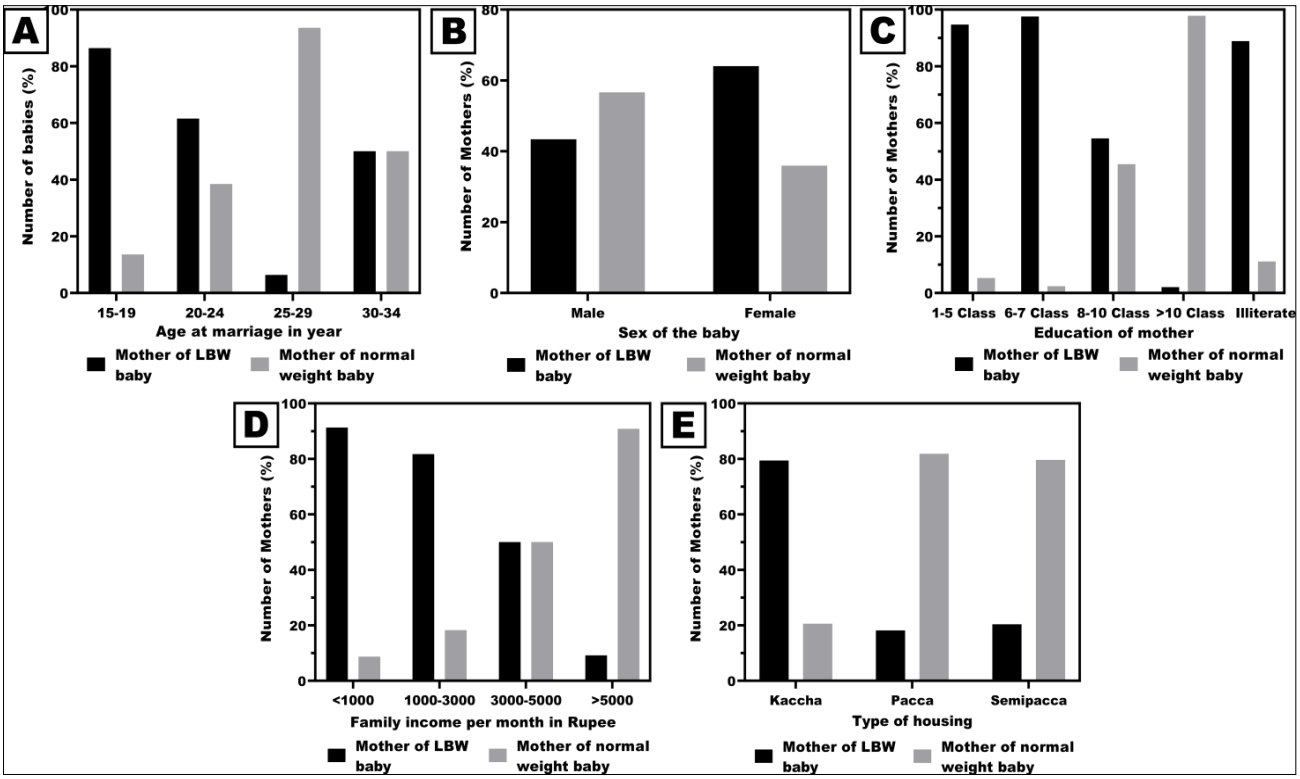

Figure 1 Frequency and percentage distribution on the basis of socio-economic and demographic characteristics of mothers and babies. Age at marriage in year (A), Sex of baby (B), Education of mother (C), Family income per month in Rupee (D), Type of housing (E)

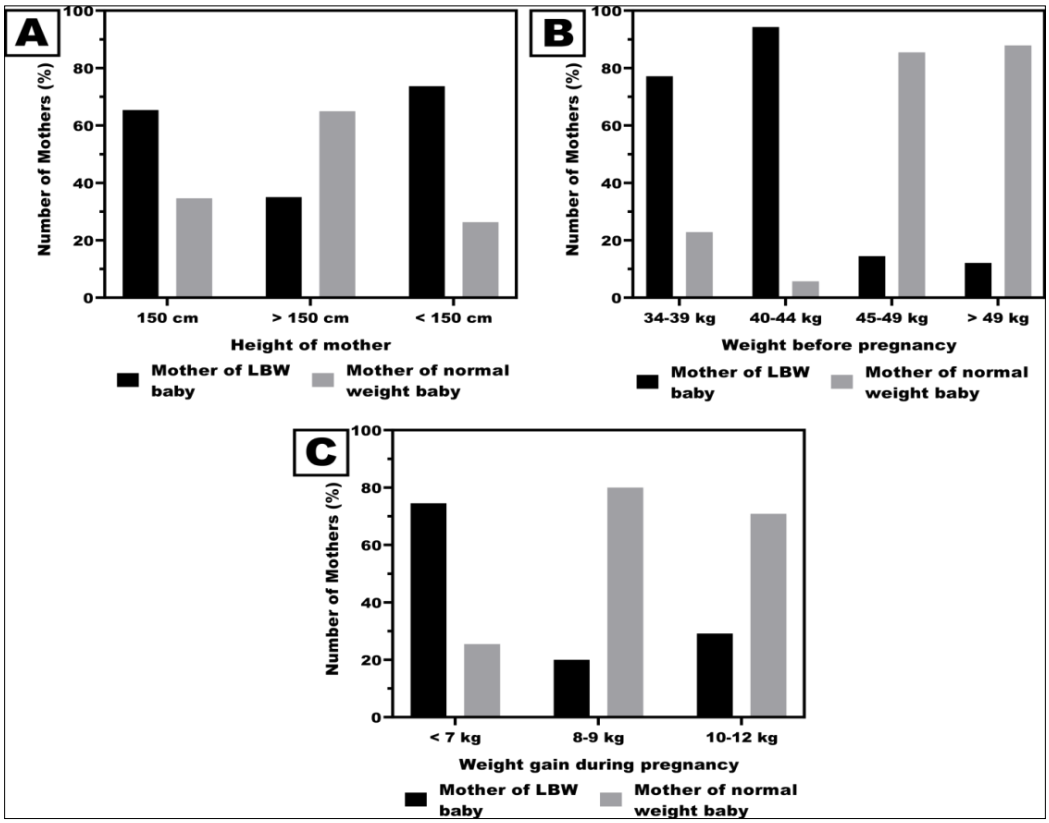

Figure 2 Frequency and percentage distribution of mothers on the basis of anthropometric measure. Height of mother (A), Weight before pregnancy (B), Weight gain during pregnancy (C)

Survey results describing the socio-economic and demographic characteristics of mothers as well as their frequency and percentage distribution were given in Table 1 and are graphically represented in figure 1. Further, frequency and percentage distribution of mothers on the basis of anthropometric measure are represented in table 2. Here it was found that 80.64% (25) of mothers of LBW baby had conceived at the age of 19 year. On the other hand 81.81% (9) of mothers of normal weight babies were at the age of 22 year (Fig. 2). First parity occupies 72% (72), among the mother who gave birth to LBW baby, where as 80% (12) of mothers who gave birth to normal weight babies were in their third parity. It was further found that among the mothers of LBW babies, only 42.97% (52) of mother completed full term pregnancy of 9 months, while 57.02% (69) of mothers of normal weight babies had completed their full term pregnancy. Birth spacing was found to be below 19 month in 66.66% (14) of mothers of LBW baby, while, 93.33% (28) mothers with normal weight babies had birth spacing between 25-29 months. 88% (22) of mothers of LBW baby had a blood pressures more than 120/80 mm of Hg whereas, blood pressure of mothers with normal weight babies were normal. Maternal infection specifically malaria during pregnancy for mothers with LBW baby was about 78.04% (64) while 72.22% (78) of mother with normal birth weight baby had no other infections except mild cold during pregnancy. The survey also reviled that 85.71% (30) of mothers with LBW baby were carrying out heavy strenuous work during pregnancy, and 81.52% (75) of mother with normal weight babies were performing sedentary practice and had taken more rest during pregnancy (Fig. 3; Table-3). It was also found that there is strong relationship between malaria during pregnancy and depletion of hemoglobin level. Among the women who had LBW babies, 78.04% (64) had malaria during their pregnancy, while only 22.5 % mother had hemoglobin level below 11 gm/dl. Strenuous physical work during pregnancy affects adversely upon outcome of birth weight. From the study it can be understood that the distribution of variables in such mothers varies from one group to another group. It is also understood that the cause of LBW is multifactoral, so not a single cause can be attributed for this type of outcome.

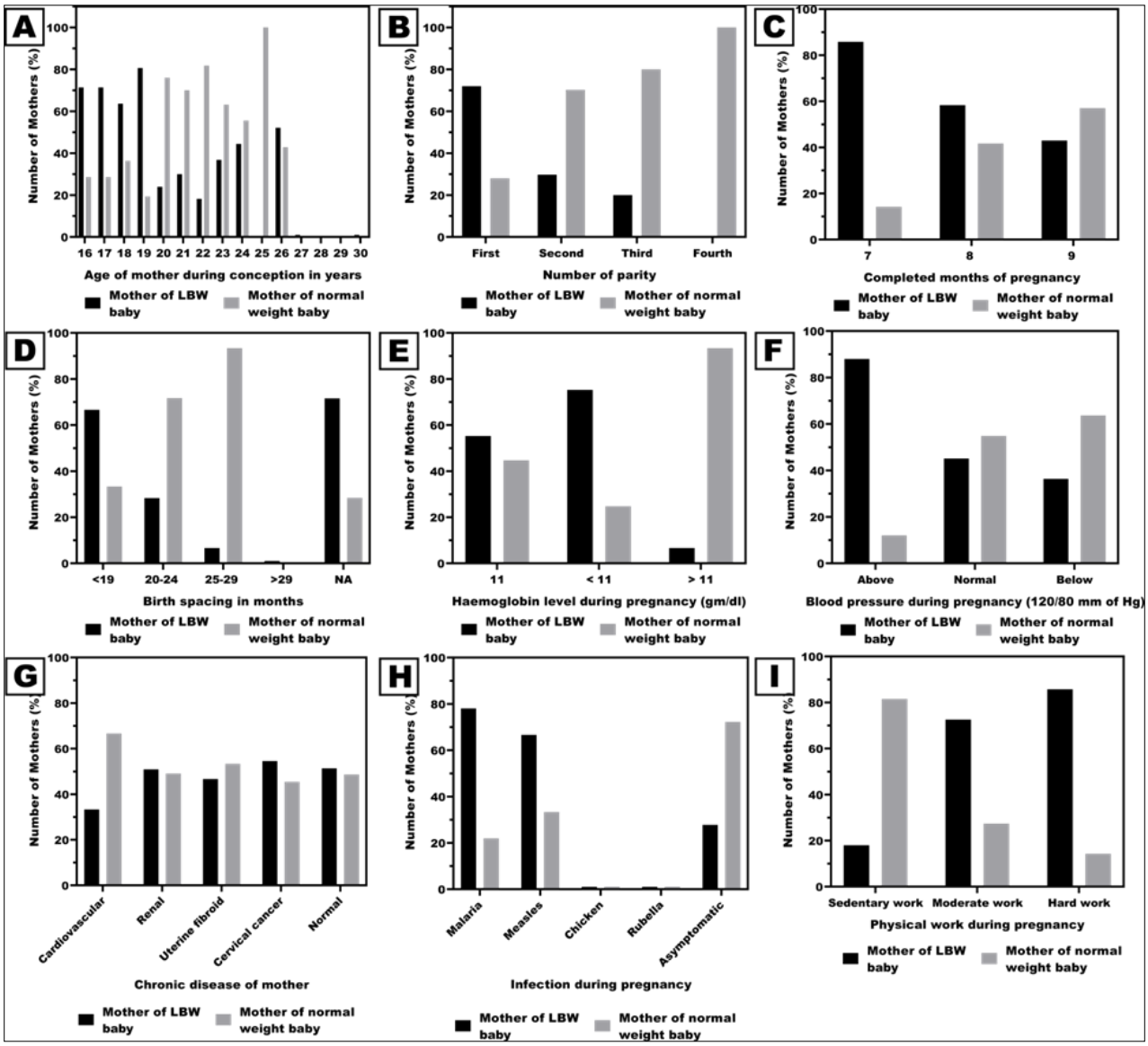

Figure 3 Frequency and percentage distribution of mothers on the basis of medical history. Age of mother during conception in year (A), Number of parity (B), Completed months of pregnancy (C), Birth spacing in months (D), Hemoglobin level during pregnancy (gm/dl) (E), Blood pressure during pregnancy (120/80mm of Hg) (F), Infection during pregnancy (G), Chronic disease of mother (H), Physical work during pregnancy (I)

Antenatal care including frequency of ANC visit and intake of iron and folic acid during pregnancy, are also some of the important aspects for a healthy pregnancy. During pregnancy, mothers of LBW babies who had ANC visit were only about 40.55% (58), while 59.44% (85) of mothers of normal weight babies had ANC visit during their pregnancy. It is further noticed that among the 89.18% (33) of the mothers of LBW who had their first ANC visit, only 13.04% (9) had third visit. On the other hand 86.95% (60) of mother of normal weight babies had completed their third ANC visit. During pregnancy, about 72.5 % (58) of mothers with LBW kids did not take iron folic acid supplements; whereas 65% (78) of mothers who took iron folic acid supplements during pregnancy had normal birth weight babies (Fig. 4, Table-4).

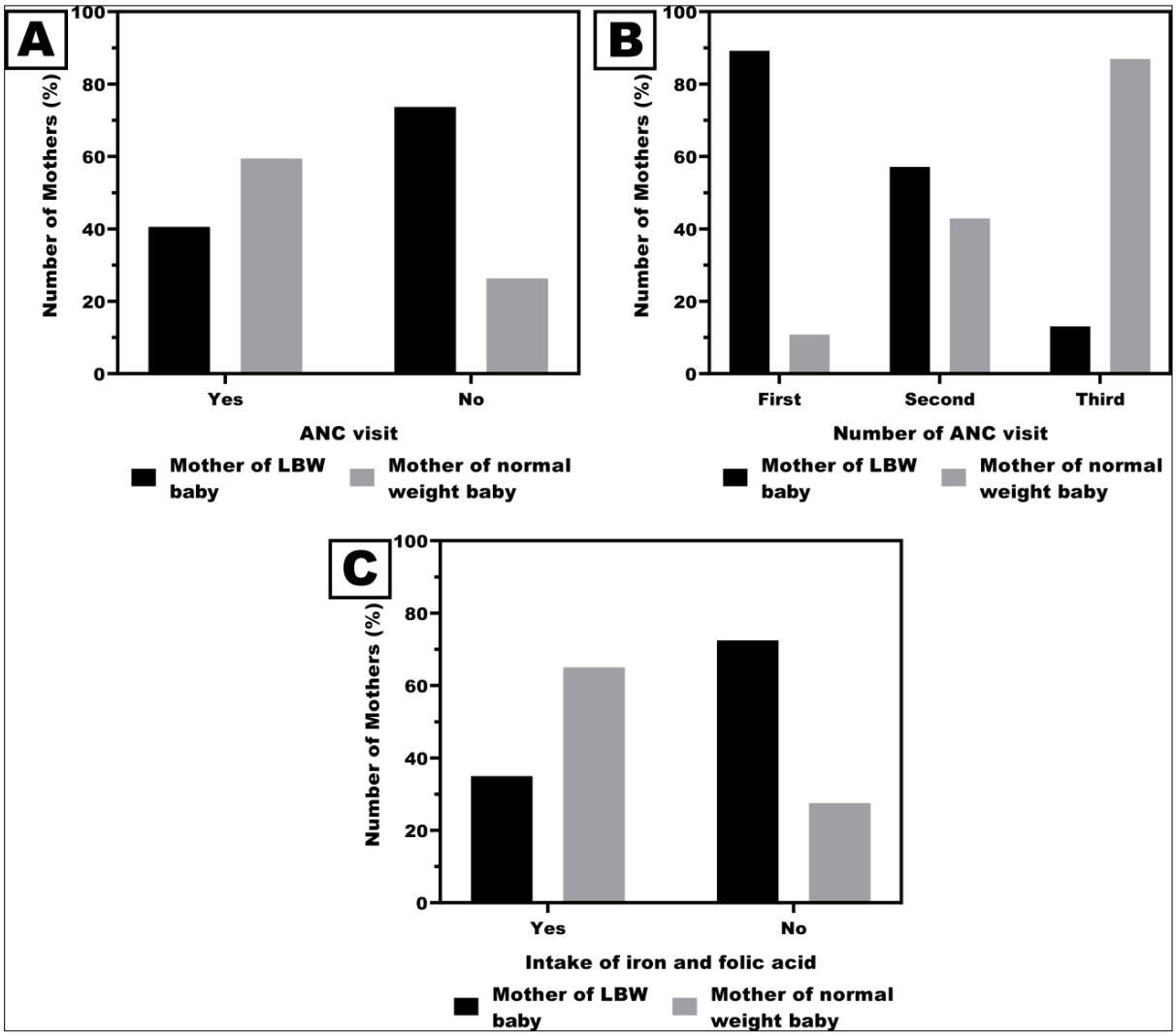

Figure 4 Percentage distribution of mothers on the basis of Antenatal care. ANC visit (A), Number of ANC visit (B), Intake of iron and folic acid (C)

From current survey, it was found that 73.98% (91) mothers of LBW baby had not taken additional food during pregnancy, while 88.31% (68) of mother of normal weight birth weight baby had additional food during pregnancy. Among mothers of LBW baby, 83 % (83) had regular diet (rice, green leafy vegetables, potato), only 17 % (17) had only atkins diet with fruits, dal etc. in their diet. As a traditional practice, 83.09 % (59) of mothers who had taken alcohol during pregnancy had LBW baby. Consequently the nutritional status of mother was found to be below substandard. With regular intake of only rice and green leafy vegetables leads to deficiency of vitamin B. It is noticed that regular intake of green leafy vegetables, provide most of the nutrients including vitamin C and iron and folic acid. Additionally, 77.77 % (56) of mothers who used tobacco before and throughout pregnancy also had LBW babies, whereas 65.62 % (84) of mothers who had normal weight babies did not use tobacco and alcohol (Fig.5, Table-5). Out of total malaria infected mothers during pregnancy, 22 % (45) had hemoglobin levels less than 11gm/dl and only 7.5 % (15) had hemoglobin levels greater than 11gm/dl. So the Chi-square value computed for selected variables with mothers who had malaria in the time of pregnancy were statistically insignificant ($p<.05$), that means there is statistical association between hemoglobin level with malaria (Table 6). It was found that there is no statistical significant ($p>0.05$) between birth spacing and rate of preterm delivery. It is noticed that as the month of birth space is maximum, 17.5% (35) of mother who completed 9 months, had birth spacing of 20-24 months (Table 7). Our study identifies that the prevalence of anemia was significantly more in the age group of 15-19 years *i.e.* (66.7%). Similarly the prevalence of anemia was significantly more ($p<0.001$) among these mothers who had not taken additional food during pregnancy (55.3%) as well as who had taken less amount of proteinous food like meat, egg, milk etc. Consequently there is also statistical significance between content of regular diet and hemoglobin level of mothers ($p<0.001$).

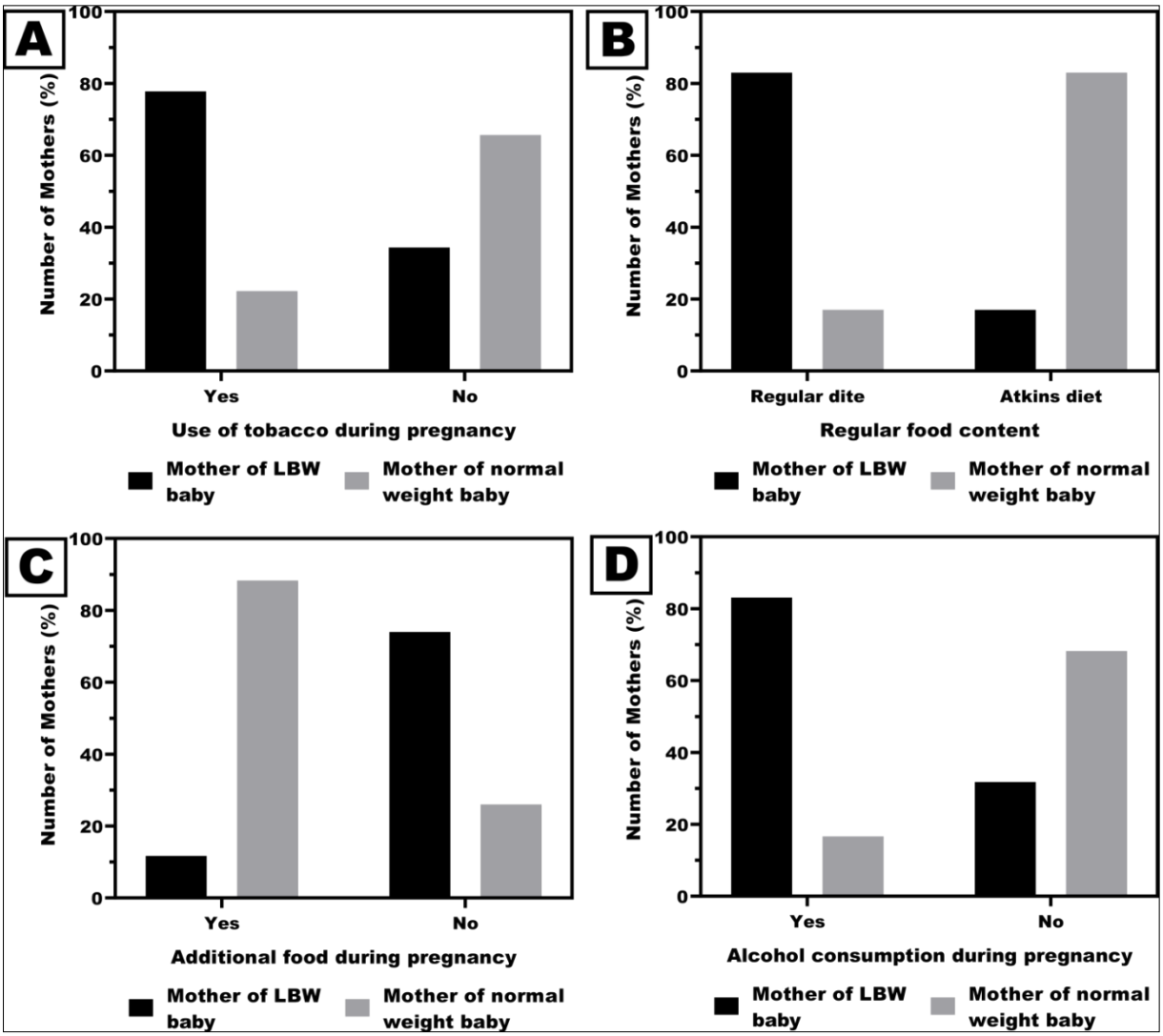

Figure 5 Frequency and percentage distribution of mothers on the basis of foods and other habit during and before pregnancy. Additional food during pregnancy (A), Regular food content (B), Alcohol consumption during pregnancy (C), Use of tobacco during pregnancy (D)

Table 1 Frequency and percentage distribution on the basis of socio-economic and demographic characteristics of mothers and babies

Age at marriage in year	**Mother of LBW baby N (%)**	**Mother of normal weight baby N (%)**	**Total**
15 -19	70(86.41)	11(13.58)	81
20-24	24(61.53)	15(38.46)	39
25-29	5(6.41)	73(93.58)	78
30-34	1(50)	1(50)	2
Total	100	100	200
Sex of baby			**Total**
Male	59(43.38)	77(56.61)	136
Female	41(64.01)	23(35.93)	64
Total	100	100	200

Education of mother			**Total**
Primary (1-5 class)	36(94.73)	2(5.26)	38
Upper primary (6-7 class)	40(97.56)	1(2.4)	41
Higher secondary (8-10 class)	6(54.54)	5(45.45)	11
More than secondary (>10 class)	2(2.1)	90(97.82)	92
Illiterate	16(88.88)	2(11.11)	18
Total	100	100	200
Family income per month in Rupee			**Total**
Less than 1000	21(91.30)	2(8.69)	23
1000-3000	67(81.71)	15(18.29)	82
3000-5000	4(50)	4(50)	8
>5000	8(9.19)	79(90.80)	87
Total	100	100	200
Type of housing			**Total**
Kaccha	81(79.41)	21(20.58)	102
Pacca	8(18.18)	36(81.81)	44
Semipacca	11(20.37)	43(79.62)	54
Total	100	100	200

Table 2 Frequency and percentage distribution of mothers on the basis of anthropometric measure

Height of mother	**Mother of low birth weight baby (%)**	**Mother of normal weight baby (%)**	**Total**
150 cm	17(65.38)	9(34.61)	26
More than 150 cm	41(35.04)	76(64.95)	117
Less than 150 cm	42(73.68)	15(26.31)	57
Total	100	100	200
Weight before pregnancy			Total
34-39 kg	54(77.14)	16(22.85)	70
40-44kg	33(94.28)	2(5.71)	35
45-49 kg	9(14.51)	53(85.48)	62
More than 49kg	4(12.12)	29(87.87)	33
Total	100	100	200
Weight gain during pregnancy			Total
< 7kg	79(74.52)	27(25.47)	106
8-9 kg	14(20)	56(80)	70
10-12kg	7(29.16)	17(70.83)	24
Total	100	100	200

Table 3 Frequency and percentage distribution of mothers on the basis of medical history

Age of mother during conception in year	**Mother of LBW baby (%)**	**Mother of normal weight baby (%)**	**Total (%)**
16	5(71.42)	2(28.57)	7
17	15(71.42)	6(28.57)	21
18	21(63.63)	12(36.36)	33
19	25(80.64)	6(19.35)	31
20	6(24)	19(76)	25
21	9(30)	21(70)	30
22	2(18.18)	9(81.81)	11
23	7(36.84)	12(63.15)	19
24	4(44.44)	5(55.55)	9
25	0	5(100)	5
26	4(52.14)	3(42.85)	7
27	1(100)	0	1
28	0	0	0
29	0	0	0
30	1(100)	0	1
Total	100	100	200
Number of parity			Total
First	72(72)	28(28)	100
Second	25(29.76)	59(70.23)	84
Third	3(20)	12(80)	15
Fourth	0	1(100)	1
Total	100	100	200
Completed months of pregnancy			Total
7	6(85.76)	1(14.28)	7
8	42(58.33)	30(41.66)	72
9	52(42.97)	69(57.02)	121
Total	100	100	200
Birth spacing in months			Total
<19	14(66.66)	7(33.33)	21
20-24	15(28.30)	38(71.69)	53
25-29	2(6.66)	28(93.33)	30
>29	1(100)	0	1
NA	68(71.57)	27(28.42)	95
Total	100	100	200
Hemoglobin level during pregnancy (gm/dl)			Total
11	26(55.31)	21(44.68)	47
< 11	70(75.26)	23(24.73)	93

> 11	4(6.66)	56(93.33)	60
Total	100	100	200
Blood pressure during pregnancy (120/80 mm of Hg)			Total
Above	22(88)	3(12)	25
Normal	74(45.12)	90(54.87)	164
Below	4(36.36)	7(63.63)	11
Total	100	100	200
Infection during pregnancy			Total
Malaria	64(78.04)	18(21.95)	82
Measles	4(66.66)	2(33.3)	6
Chicken pox	1(50)	1(50)	2
Rubella	1(50)	1(50)	2
Asymptomatic	30(27.77)	78(72.22)	108
Total	100	100	200
Chronic disease of mother			Total
Cardiovascular	2(33.33)	4(66.66)	6
Renal	28(50.90)	27(49.09)	55
Uterine fibroid	7(46.66)	8(53.33)	15
Cervical cancer	6(54.54)	5(45.45)	11
None	57(51.35)	54(48.64)	111
Total	100	100	200
Physical work during pregnancy			Total
Sedentary work	17(18)	75(81.52)	92
Moderate work	53(72.60)	20(27.39)	73
Hard work	30(85.71)	5(14.28)	35
Total	100	100	200

Table 4 Percentage distribution of mothers on the basis of Antenatal care

ANC visit	**Mother of low birth weight baby N (%)**	**Mother of normal weight baby N (%)**	**Total**
yes	58(40.55)	85(59.44)	143
no	42(73.68)	15(26.31)	57
Total	100	100	200
Number of ANC visit			Total
First	33(89.18)	4(10.81)	37
Second	24(57.14)	18(42.85)	42
Third	9(13.04)	60(86.95)	69
None	34(65.38)	18(34.61)	52
Total	100	100	200
Intake of iron and folic acid			Total
Yes	42(35)	78(65)	120

No	58(72.5)	22(27.5)	80
Total	100	100	200

Table 5 Frequency and percentage distribution of mothers on the basis of foods and other habit during and before pregnancy

Additional food during pregnancy	**Mother of low birth weight babyN (%)**	**Mother of normal weight baby N (%)**	**Total**
Yes	9(11.68)	68(88.31)	77
No	91(73.98)	32(26.01)	123
Total	100	100	200
Regular food content			Total
Regular diet (Rice, green leafy vegetable, potato)	83(83)	17(17)	100
Atkins diet (Meat, fruits, dal, etc.)	17(17)	83(83)	100
Total	100	100	200
Alcohol consumption during pregnancy			Total
Yes	59(83.09)	12(16.66)	71
No	41(31.78)	88(68.21)	129
Total	100	100	200
Use of tobacco during pregnancy			Total
Yes	56(77.77)	16(22.22)	72
No	44(34.37)	84(65.62)	128
Total	100	100	200

Table 6 Association between maternal infection during pregnancy and hemoglobin level

Infection	**Hemoglobin level during pregnancy (gm/dl)**						**Total**	
	11		**< 11**		**> 11**			
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Malaria	23	11.5	45	22.5	15	7.5	83	41.5
Measles	1	0.5	5	2.5	0	0.0	6	3.0
Chicken pox	0	0.0	0	0.0	1	0.5	1	0.5
Rubella	0	0.0	1	0.5	1	0.5	2	1.0
NA	23	11.5	42	21.0	43	21.5	108	54.0
Total	47	23.5	93	46.5	60	30.0	200	100.0

Table 7 Association between birth spacing and completed month of pregnancy at delivery

Birth Spacing (Months)	Completed months of pregnancy						Total	
	7		8		9			
	N	%	N	%	N	%	N	%
<19	2	1	6	3	13	6.5	21	10.5
20-24	1	0.5	17	8.5	35	17.5	53	26.5
25-29	0	0	7	3.5	23	11.5	30	15
>29	0	0	0	0	1	0.5	1	0.5
NA	4	2	42	21	49	24.5	95	47.5
Total	7	3.5	72	36	121	60.5	200	100

4. Discussion

Among the various epidemiological factors, the maternal factors like antenatal care, parity, inter pregnancy interval and bad obstetric history are found to influence birth weight of the baby. One of the important points noticed in our study is early marriage of girls specifically in adolescent period, which leads to educational ignorance and poverty. Pregnancy in young women is generally considered to be a high risk event because teenage girls are physically and psychologically immature for reproduction. In addition, there are some extrinsic factors such as inadequate prenatal care, illiteracy and poor socio-economic conditions that affect the outcome of pregnancy in teenage girls [13, 18, 19]. Anthropometric factors like maternal height, normal body weight and weight gain during pregnancy etc. were also found to be involved in birth of LBW babies. Height of mother is an important factor for birth of LBW baby. From the medical history, it was observed that, the age during conception, number of parity, complete month of pregnancy, birth spacing, hemoglobin level during pregnancy, blood pressure, infection during pregnancy, chronic disease and physical work during pregnancy etc. also plays a major role in conception of LBW babies. Majority of the mothers had not received full ANC services. Majority of mothers had malaria during pregnancy, which resulted in reduction of hemoglobin level in babies. So, proper preventive measure should be taken for malaria. Besides the content of food, additional food during pregnancy, food frequency needs to be advised to them by the health workers. Simultaneously, alcohol and tobacco addiction during pregnancy should be prohibited during pregnancy. It is recommended for the pregnant women to have extra calorie food during pregnancy. Strenuous work during pregnancy leads to consumption of more calories, consequently inadequacy of additional food leads to LBW baby delivery. Hence, the current study gives base label survey data, indicating the social and health status of the tribal communities in the state, which can be used further to strengthen the Maternal and Child Health programmes in the state.

4.1. Abbreviations

ANC: Antenantal care; HMIS: Health management information system; IMR: Infant mortality rate; LBW: Low birth weight; MMR: Maternal mortality ratio; NBW: Normal weight baby; UN: United Nations; WHO: World health organization; NA: Not applicable

5. Conclusion

Our study identified many factors involved in LBW baby birth in tribal communities. Among the various factors as mentioned in the manuscript, bad obstetric history is also found to influence birth weight. Strainful physical work should be avoided and enough rest should be recommended for pregnant women. Preventive measure should be taken for malaria and other communicable disease during and before pregnancy. Regular health educational programmes on nutrition and regular ANC visit should be encouraged to every pregnant woman. Beside, the education level of girl should be promoted, which is a main factor for a better and healthy society, above all. The age of marriage should also

be extended. Intake of tobacco and alcohol should be avoided during pregnancy for better and healthy baby delivery. Hence, it is the need of the hour to strengthen the existing maternal services at the door steps of the community by all possible means supported by the government and non-government agencies.

Compliance with ethical standards

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Authors' contributions

All authors contributed to this study. Conceptualization and design of study: RK, BCM. Data collection: BCM, SM. Statistical analysis and interpretation of data: BCM, RGK. Manuscript drafting: BCM, RK, RGK, SM. All authors approved the final manuscript.

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Availability of data and materials

The research data will be available upon request to the corresponding author.

Disclosure of conflict of interest

The authors declare no conflict of interest.

Statement of ethical approval

Ethical approval was obtained from Padmashree School of Public Health, Bangalore, Karnataka, India.

Statement of informed consent

The written consent of the respondents was taken by explaining the objectives of the study before starting the interview/discussion. Their right of refusal to participate in the study was respected. Privacy and confidentiality was maintained for the information provided by the respondents. They were not compelled to give answers.

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