

## Can Community-Based, Low-Cost Antenatal Care in the Third Trimester of Pregnancy Reduce the Incidence of Low Birth Weight Newborns?

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### Abstract

**Objective** To determine if community-based, low-cost interventions during third trimester of pregnancy can reduce the incidence of low birth weight babies.

**Methods** In a case control study, 290 pregnant women from a slum area were registered in the beginning of third trimester of pregnancy and provided full antenatal care comprising fortnightly check up, one IFA tablet daily, counseling for minimum one-and-a-half hour post-lunch rest in left lateral position, additional diet to ensure minimum 2,200 kcal per day, and management of clinical conditions, if any. An equal number of pregnant women belonging to the same slum area were registered as control who received routine antenatal services from the existing health care facilities. The birth weight of the babies in the two groups were recorded and compared. Test of significance and correlation coefficient were applied to the data.

**Results** Mean birth weight of the babies of the Subjects was 2.76 kg (SD 0.39) compared to mean birth weight of 2.57 kg (SD 0.36) of the babies in the Control group.

Incidence of low birth weight babies among subjects who consumed minimum 2,400 kcal per day, had one-and-a-half hour post-lunch rest in left lateral position and who consumed one tablet of IFA (100 mg iron and 5 mg folic acid) per day during the last trimester of pregnancy was lower (17.6 %) as compared with women in the Control group (36.2 %). The difference in the mean birth weight of newborns of the two groups was statistically significant ( $t = 2.52, p < 0.01$ ).

**Conclusions** Incidence of low birth weight babies can be significantly reduced by providing simple, low-cost care to pregnant women during the last trimester of pregnancy in the community setting.

**Keywords** Low birth weight ·  
Third trimester of pregnancy ·  
Community-based interventions

### Introduction

Infant mortality rate in India at 55 per thousand live births [1] is unacceptably high. Reduction of IMR is one of the goals of National Population Policy [2]. It is also an important goal of UN Millennium Development Goals [3]. Low birth weight (LBW) is an important cause of high infant mortality rate in the country. It accounts for almost half of perinatal deaths [4]. LBW is not the only cause of death during neonatal period, but it has several after effects also such as inhibited growth and cognitive development,

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chronic diseases like hypertension, diabetes mellitus, cardiovascular diseases, and birth of small babies when they become mothers [5].

Low birth weight is largely preventable if care comprising antenatal check ups, diet, rest, and management of existing morbidity among mothers is provided. The window of opportunity available to provide appropriate care extends from the first to the last month of pregnancy. Early registration of mothers and periodical follow up during pregnancy is, therefore, advocated. However, late registration of pregnancy is very common, particularly among women in rural as well as urban slums. Periodical follow up, thereafter, is also irregular. Social customs of mothers going to their parental homes during the last trimester for delivery is also practiced in many communities, particularly if the woman is primigravida. These factors pose serious challenge to the service providers in providing adequate, uninterrupted quality antenatal services to women during pregnancy.

Fetus gains maximum weight (up to 80 %) during the last trimester of pregnancy. The hypothesis arrived in this study is that low-cost, community-based intervention during this period will have positive impact on lowering the incidence of LBW newborns.

## Methodology

The study was conducted from March 2005 to October 2006 in pregnant women of Banganga urban slum area situated near J.P. Hospital, which is the district hospital of Bhopal. Most women in this area work as unskilled labor and have low level of literacy and poor income (family income of Rs. 1500–2500 per month). They live in makeshift houses with poor access to proper water supply and sanitation. The area is served by an ANM from urban family welfare center and Anganwadi Workers (AWW) of ICDS program. However, utilization of services is low because of a variety of factors including the fact that the timings of the clinics do not suit the women, majority of whom work as domestic help or as unskilled manual workers. Incidence of LBW is high as observed in women belonging to this area delivering at J.P. Hospital.

For the purpose of this study, pregnant women were identified using antenatal registers of local ANM and AWWs. At the beginning of 7th month of pregnancy (28 week), the women were registered in the study cohort and followed through the last trimester of pregnancy. A pre-designed schedule was used to record relevant data of the women.

The women were given complete obstetrical check up by an obstetrician from J.P. hospital. Height, weight, and blood pressure were recorded. Lab investigation included Hb% determination and urine examination. Dietary intake

of women was assessed by one-day diet survey by recall method. Dietary advice was given by ANM/AWW using a diet chart. Where indicated, nutritional supplement was arranged through local Anganwadi Centre so that minimum 2,200 kcal per day was consumed by the pregnant women. One tablet of IFA per day (100 mg iron and 5 mg folic acid) was administered from the day of registration till end of pregnancy irrespective of earlier intake of tablets. Two doses of TT immunization were also administered, if not received earlier. Twenty-four-hour activity pattern was recorded to assess the level of physical activity and rest. Women were counseled by ANM/AWW on the importance of rest and advised one-and-a-half hour to two hours post-lunch rest in left lateral position. Women with any morbidity detected, e.g., diabetes, urinary tract infection, hypertension, etc., were treated at J.P. hospital. All the registered pregnant women were followed up at weekly interval by local ANM/AWW to ensure that women are following the advice on diet and rest and are consuming one IFA tablet daily. Pregnant women—who failed to take diet and rest as per advice and where Hb level remained less than 8 g%, were not normotensive or where blood sugar could not be controlled even after management, and complicated deliveries (twins, hydramnios, congenital malformation, etc.)—were excluded from the study cohort.

The women in the Control group were also from the same slum area but were not included in the study cohort as they did not follow the advice on rest, diet, daily intake of IFA tablets, or they could not be followed up on weekly basis by the local ANM/AWW. They, however, remained registered with the ANM/AWW and were in receipt of routine antenatal services available from them and the specialist care when presenting at J.P. Hospital. Complicated deliveries, women with high blood pressure, uncontrolled diabetes, or with untreated UTI were excluded from the Control group also. However, the number of such women excluded was very small.

This study was not a case–control study in the strict sense of an epidemiologic enquiry because matching of women in the two groups was not done using different variables like age of woman, height, parity, income, education, occupation, etc. However, the common denominator of women of the two groups was that they belonged to the same urban slum where the study was conducted and they delivered at J.P. hospital.

During the period of the study, 290 women from the study cohort delivered at J.P. hospital. Birth weights of their newborns were recorded within 24 h of birth using a digital weighing machine. Another 290 consecutive women from the study areas who delivered in J.P. Hospital during the same period but were not part of study cohort were taken as control. Birth weights of their newborns were recorded following the same procedure.

## Results

WHO criteria of LBW i.e., less than 2,500 g was used to divide the newborns as LBW or normal weight. The mean birth weights of newborns of the study group women (designated as Subjects) and those of the Controls were 2.76 kg (SD  $\pm$  0.39) and 2.57 kg (SD  $\pm$  0.36), respectively. The difference in the mean birth weight among the newborns of the Subjects and the Controls was statistically significant ( $t = 2.52$ ;  $df = 578$ ;  $p < 0.01$ ).

Out of 290 Subjects, 51 (17.6 %) delivered LBW babies. On the other hand, among 290 Controls, 105 (36.2 %) had LBW babies (Table 1). Incidence of LBW newborns among Controls was more than twice than among the Subjects, and the difference was statistically significant ( $t = 2.52$ ;  $p < 0.01$ ).

Proportions of babies born with birth weight  $< 2,000$  g, between 2,000 and 2,500 g, and between 2,250 and 2,500 g were 2.8, 6.9, and 7.9 %, respectively, among the Subjects. The corresponding figures among the Controls were 3.1, 13.4, and 19.7 %, respectively, (Table 2). This shows that although there were LBW newborns among Subjects as well, their proportion was always lower than that among the Controls in different weight groups.

In this study, three interventions which were undertaken in the community setting and at low cost were provision of extra diet (minimum 2,200 kcal), one tablet IFA supplementation daily, and advice on 1–2-h post-lunch rest in left lateral position. The birth weight of the newborns in the Subjects and the Controls were analyzed to see if these interventions had any influence on lowering the incidence of LBW.

**Table 1** Incidence of low birth weight newborns among mothers in study and control groups

Group	Low birth weight (<2,500 g)		Normal birth weight ( $\geq$ 2,500 g)	
	No.	%	No.	%
Subjects	51	17.6	239	82.4
Controls	105	36.2	185	63.8
Total	156	26.9	424	73.1

**Table 2** Distribution of newborns according to birth weight

Weight (in g)	Subjects ( $n = 290$ )		Controls ( $n = 290$ )	
Less than 2,000	8	2.8	9	3.1
2,000–2,250	20	6.9	39	13.4
2,250–2,500	23	7.9	57	19.7
2,500–3,000	143	49.3	113	39.0
Above 3,000	96	33.1	72	24.8
	290		290	

**Table 3** Birth weight of newborns with reference to calorie intake by pregnant women

Daily calorie consumption	Subjects				Controls			
	Low birth weight		Normal birth weight		Low birth weight		Normal birth weight	
	No.	%	No.	%	No.	%	No.	%
2,000–2,200	–	–	–	–	44	91.7	4	8.3
2,200–2,400	38	50.0	38	50.0	38	62.3	23	37.7
>2,400	13	6.1	201	93.9	23	12.7	158	87.3
Total	51	17.6	239	82.4	105	36.2	185	63.8

In 48 Controls who had daily calorie consumption of 2,000–2,200 kcal, 44 (92 %) delivered LBW babies. The proportion of LBW babies sharply declined as the calorie consumption of women increased. Among the Controls consuming 2,200–2,400 kcal per day incidence of LBW was 62 %. The incidence dropped further to 13 % when calorie consumption increased to more than 2,400 kcal per day (Table 3). Among the Subjects, no one had daily calorie consumption less than 2,200 kcal which was due to counseling of women to increase their diet and, where required, arranging supplementary food through local Anganwadi Centres. Thirty eight (50 %) out of total 76 Subjects consuming 2,200–2,400 kcal per day had LBW newborns. The incidence dropped to 6.5 % when calorie consumption was increased to more than 2,400 kcal per day. Statistically significant positive correlation of 0.601 at 0.01 levels was observed between maternal calorie intake and birth weight.

Compliance of advice for post-lunch rest of at least one-and-a-half hour by women also showed positive influence on the incidence of LBW. Among the Controls who had less than 1 h post-lunch rest per day the incidence of LBW babies was 76.5 %. The incidence fell sharply to 21 % when the duration of rest increased up to one-and-a-half hour to two hours and to 7 % when duration of rest increased to 2 h (Table 4). There were no Subjects taking less than one-and-a-half hour post-lunch rest, and therefore, such women were deleted from the study cohort as per the eligibility criteria for inclusion adopted. Among the Subjects taking minimum one-and-a-half hour post-lunch rest, the incidence of LBW was 18 %. Statistically significant correlation, i.e., 0.312 at 0.01 level between duration of day-time rest during the last trimester of pregnancy and birth weight was observed.

All women, the Subjects and the Controls, who took post-lunch rest of more than 2 h per day during the last trimester of pregnancy, gave birth to normal weight babies.

Women were administered daily one tablet of IFA (100 mg iron and 15 mg folic acid) available from the

**Table 4** Birth weight of newborns with reference to rest taken by pregnant women

Post lunch rest in hours	Subjects				Controls			
	LBW		Normal weight		LBW		Normal weight	
	No.	%	No.	%	No.	%	No.	%
1/2–1	–	–	–	–	65	76.5	20	23.5
1–1½	–	–	–	–	39	21.4	143	78.6
1½–2	51	18.2	230	81.9	1	7.1	13	92.9
>2	–	–	9	100.0	–	–	9	100.0
Total	51		239		105		185	

**Table 5** Birth weight of newborns with reference to Hb% level of pregnant women

Hb% level (g)	Subjects				Controls			
	LBW		Normal weight		LBW		Normal weight	
	No.	%	No.	%	No.	%	No.	%
8–10	22	24.2	69	75.8	8	29.6	19	70.4
10–12	29	14.6	170	85.4	12	24.0	38	76.0
Total	51		239		20	26.0	57	

Note Hemoglobin records of 213 women in control group were not available, and hence they have been excluded from this analysis

government RCH/ICDS program. Women with less than ten grams Hb% in the last month of pregnancy were considered as anemic. Among the Controls, Hb% records were not available for 213 women, and therefore, were excluded from the analysis. Twenty-four percent of the Subjects with Hb% less than 10 g gave birth to LBW babies against 30 % Controls (Table 5). The difference in the incidence of LBW was slightly more marked in women with Hb% more than 10 g. The LBW incidence was 15 % in the Subjects and 24 % in the Controls with more than 10 g% Hb.

**Discussion**

A large number of data in the scientific literature are available showing that LBW is a multi-factorial phenomenon. Kramer [6] has reviewed the determinants of LBW in a meta-analysis. In spite of abundant knowledge available with medical profession, however, the incidence of LBW in developing countries, including India, has remained very high. LBW accounts for nearly one third of all neonatal deaths.

The objective of this study was to assess if community-based, low-cost interventions during the last trimester of pregnancy, which can be implemented through the available health delivery system, can effectively lower the incidence of LBW among newborns.

Three important variables examined in this study were post-lunch rest of one-and-a-half hour, and consumption of at least 2,200 kcal and one tablet of IFA (100 mg iron and 5 mg folic acid) per day during the last trimester of pregnancy.

In the present study, incidence of LBW was 50 % among the Subjects and 62 % in the Controls consuming 2,200–2,400 kcal per day. Slightly lower proportion of the Subjects with LBW newborns as compared with the Controls could be on account of other factors operating side by side along with calorie consumption. The incidence of LBW babies came down sharply to 6 and 13 %, respectively, among the Subjects and the Controls when calorie consumption increased to 2,400 kcal and more per day. Thus, calorie consumption of minimum of 2,400 kcal per day during the last trimester of pregnancy is observed to substantially reduce LBW among the newborns. It was possible to increase calorie consumption of mothers by nutritional counseling and providing supplementary nutrition through ICDS program. Both these initiatives could be achieved at the community level without any additional cost to the mothers or putting extra burden on the existing government services. Rao et al. [7] also observed that the mean calorific intake of women during third trimester of pregnancy, who delivered LBW babies, was significantly lower than those who delivered normal weight babies.

The present study showed that the day-time rest by women and incidence of LBW showed inverse correlation: longer the rest period, lower the incidence of LBW. In the Control group, LBW was very high, (i.e., 76 %) when day-time rest was less than 1 h per day, but the incidence fell sharply to 21 % when the period increased to minimum one hour to one-and-a-half hour. All the 18 women in both the groups who had more than 2 h post-lunch rest delivered normal weight babies. Biswas et al. [8], however, did not find duration of rest and sleep as a factor associated with LBW.

It was not always possible to ensure minimum one-and-a-half hour day-time rest by pregnant women in spite of counseling by ANM/AWW. Several such women had to be deleted from the study cohort. However, wherever it was possible to ensure post-lunch rest of one and half hour the effect was positive in lowering the incidence of LBW. Counseling to women by ANM/AWW for post-lunch rest is a no-cost, community-based intervention which is doable, although with varying degrees of success.

Ensuring consumption of one tablet of IFA daily was not possible in all the women. Such women were excluded from the study cohort. Among the 290 Subjects, who consumed one tablet IFA per day during the last trimester of pregnancy, 91 (31 %) had hemoglobin level less than 10 g%. This shows that consumption of one tablet IFA daily during the last trimester of pregnancy was not

sufficient to eliminate anemia. A better strategy, possibly, should have been to give two tablets IFA per day.

The incidence of LBW among the Subjects with hemoglobin level of 8–10 g% was 24 % which came down to 14 % when the hemoglobin level reached to 10–12 g%. The corresponding percentages were 30 and 24 %, respectively, in the Controls. Low birth weight babies were born both to the Subjects and the Controls (15 and 24 %, respectively), even when hemoglobin level was 10–12 g% showing that other factors operated side by side along with anemia as causal factors of LBW. Akoijam et al. [9] also observed that the proportion of LBW babies was lower among mothers with higher hemoglobin level.

### Conclusion

Incidence of LBW among newborns can be reduced substantially by simple, low-cost interventions, e.g., consumption of 2,200–2,400 kcal per day, 1–2 h post-lunch rest in left lateral position and one tablet of IFA daily (iron 100 mg and folic acid 5 mg) during the third trimester of pregnancy. Consumption of 2,400 or more kcal per day and two-hour post-lunch rest resulted into higher reduction in LBW incidence. One tablet of IFA per day had only limited effect on reduction of LBW incidence. The interventions examined in this study have several merits: they are simple

and of low cost. It is also feasible to implement these interventions through the existing service delivery system of the Department of Health and Family Welfare, and the Department of Women and Child Development, of which India has a large network reaching up to the lowest level, both in rural and urban areas.

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