

Comparative Analysis of Birth Weight in a Hospital Over a Decade: Low Birth Weight Still a Major Problem

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Introduction

Considerable progress has been made in last three decades resulting in overall development which inter-alia paved way in reducing childhood morbidity and mortality across the globe, yet 8.8 million children die every year before their fifth birthday¹. Nearly 49% (4.29 million) of children death occurred in five countries-India, Nigeria, Democratic Republic of the Congo, Pakistan, and China². Of the various putative causative factors, malnutrition still remains one of the major concerns, challenge and issue especially in developing countries to be overcome. Low birth weight (LBW) has been aptly identified as a major determinant of child health with immediate consequence during infancy and long-term impact on health outcomes in adult life. LBW is an outcome of either preterm birth or intrauterine growth restriction (IUGR) and is known to be an underlying factor in 60-80% of neonatal deaths.

According to the latest available international estimates 15% of all newborns were born with low birth weight (<2500g) in the world and selected countries like China (2%), Australia (7%), Japan (8%), UK (8%), USA (8%), Gambia (20%), Nepal (21%) & Bangladesh accounted with 22% respectively. The picture with respect to LBW in India was 28% this decade (2011) with slight improvement from 33% during last decade (2000), accounting a reduction of 5 units³. With this background a cross-sectional comparative descriptive study was undertaken to determine magnitude of newborn weight in a government hospital and to explore association of low birth weight with selected variables.

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Abstract

Introduction: The objective of this study was to compare the magnitude of birth weight and proportion of low birth weight in a hospital over a decade. **Materials and Methods:** A descriptive study was undertaken in a public funded hospital catering to rural and urban population of northern India. Pertinent information was collected for all intramural singleton births using structured proforma for a sample period in a calendar year. For comparison purpose birth data was extracted from log books for the corresponding period of previous decade also. Data management was done using MS excel sheet and analysis carried out by computing descriptive statistics using software statistical package. **Results:** The mean (2568 ± 596.7 gm) & median (2600 gm) birth-weight recorded for 2011 was low in-comparison to 2657 ± 581.7 gm (2750 gm) for 2001. The prevalence of low birth weight (LBW) was 36.1% (2011) in comparison to 30.5% (2001) and the state of deterioration was found to be statistically significant ($p < 0.001$). Higher proportion of LBW birth was observed amongst un-booked ANC, pre-term, anemic mothers and whose residence was from outside the district of location of study institute (< 0.001). Statistically significant (< 0.001) and higher perinatal mortality was noticed in LBW neonates. Rising level of maternal education was protective against LBW. Mothers with their first pregnancy gave higher proportion of LBW births in comparison to mothers with higher gravida status (< 0.001).

Key words: Antenatal, Anemia, Education, Delivery, Nutrition, Poverty.

Materials and Methods

State of Haryana is one of the financially advance state of India (per capita income of Rupees 94,680 during 2010-11) with a population of 2.53 crores residing in 21 districts with life expectancy and literacy rate of 69

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years and 76.6% respectively. Important latest statistics in comparison to country are: Birth rate, 21.8 (India: 21.8); Death rate, 6.5 (India: 7.1); Infant Mortality rate, 44 (India: 44); Sex ratio, 877 (India: 940); Child (0-6 years) sex ratio, 830 (India: 914); Maternal Mortality ratio, 153 (India: 212); Institutional deliveries, 77.3% (India: 62%); Complete immunization, 71.7% (India: 61%) and 3 ante natal check up, 75% (India: 73.1%) with total proportion of citizens (30%) in country falling below national poverty line.

The study was conducted in one of the publically funded teaching institution of northern India which provides specialist's tertiary care services to patients largely belonging to lower/ middle socio-economic strata of the society with rural and urban background serving 4-5 adjoining districts. It caters to an avg. daily out-patient (OPD) attendance of 5000 patients and more than 80,000 annual admissions supported by 1750 in-patient beds. Birth weight of all new born was recorded using weighting scale immediately after birth upto one-hour. All standard operating procedure of labor room were undertaken e.g. calibration of weighing instrument before recording weight of newborn, adequate lightening etc. to name a few.

The maternal and newborn variables included in the study were age, occupation & education of mother, usual place of residence, booked/un-booked ante-natal (ANC) status, estimated period of gestation, gravida, hemoglobin, birth weight, sex and outcome (live/mortality). Considering feasibility it was envisaged to collect pertinent information of all singleton intramural births occurring during randomly selected four months of the year 2011. Similarly log books of labor room were retrieved and reviewed for the corresponding time-frame of 2001 to record birth weight and other variables. Atleast one of the investigators was present during both the study time frame. During this period, weighing machine was replaced atleast four times because of maintenance issues but of the same company and make. The machine was placed at the same location/site in the labor room during both the time frame.

Data collection was carried out by resident on duty after orientation training under the supervision of investigators using structured proforma after taking clearance from authority and verbal consent of mothers in a non-judgmental and confidential manner. The staff nurses involved in labor room activities was also given re-orientation training. All mothers were provided case-based advise regarding breast feeding, immunization, post natal care, family planning, nutrition, follow up

etc. Detail information of all intramural births was then entered into MS excel spread sheet and analysis carried out using software statistical package (SPSS ver. 16). Some of the information was not available (8.0%) and such case entries were excluded from final analysis. Standard definition as relevant to birth weight considered in the present study was LBW (<2500g), Very LBW (<1500g), Extremely LBW (<1000g); Anemia according to hemoglobin (Hb) level as mild (10-10.99gm/dl), moderate (7-9.99gm/dl), severe (less than 7gm/dl) and no anemia (atleast 11gm/dl).

Results

There were a total of 2812 & 1577 births recorded for the sampled period during 2011 and 2001. Majority (34.7%) of mothers (2011) did not attend to school while majority (37.9%) had atleast 9-year of schooling during 2001 while age-structure & gravida status of mothers for both periods was similar. Higher proportion of mother (72%) was resident of district of location of study institution (2001) in comparison to 59% (2011). Majority of women were home-maker, 90.2% (2011) and 85.1% in 2001.

The mean (2568±596.7 gm) & median (2600 gm) birth-weight recorded for 2011 was low in-comparison to 2657±581.7gm & 2750 gm as recorded for 2001. The birth weight of male, female and live neonate was 2.61 kg, 2.50 kg, and 2.61 kg respectively during 2011. The prevalence of low birth weight (LBW) was 36.1% (2011) in comparison to 30.5% (2001) and this deterioration was found to be statistically significant ($p < 0.001$). Further analysis amongst LBW newborn showed that Very LBW constituted 22.8% (2011) & 14.4% (2001) and Extremely LBW constituted 4.3% & 4.4% for the corresponding period (Table-1).

Association of LBW with selective variables: Details are shown in Table-2. Rising level of education was protective against LBW. Majority of LBW occurred to mother in age group of 20-29 years followed by 30/ above and less than 19 years but this observation was statistically non-significant. Mothers with their first pregnancy gave birth to higher proportion of LBW births in comparison to higher gravida mothers in the recent year [< 0.001]. For both time frame, higher proportion of LBW birth was observed amongst un-booked, pre-term mothers and whose residence was from outside the district of location of study institute (< 0.001). Statistically significant (< 0.001) and higher perinatal mortality was noticed in LBW neonates. Higher proportion of females were born with LBW during 2011 (< 0.001).

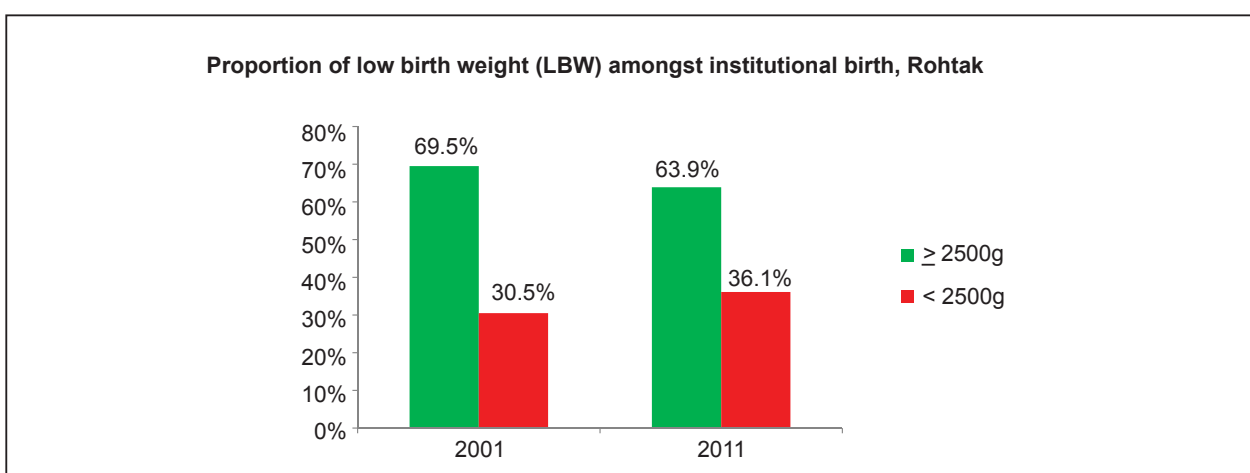
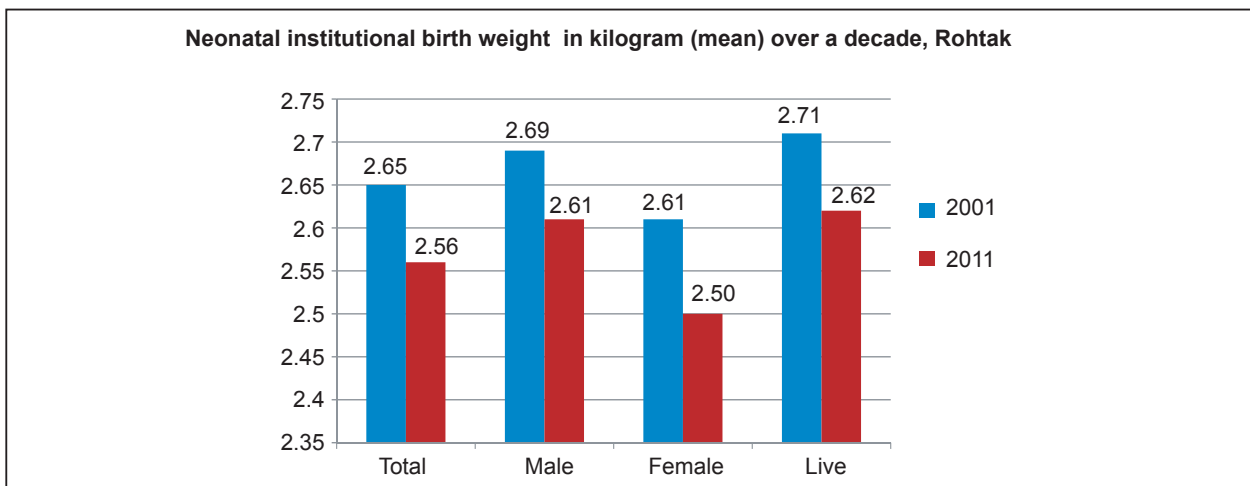
Table 1: Distribution of neonatal birth weight in the government hospital, Rohtak

Item	2001	2011	Total
Birth weight (kg.)			
<i>mean ± S.D.</i>	2.65 (± 0.58)	2.56 (± 0.59)	2.59 (± 0.59)
Male	2.69 (± 0.61)	2.61 (± 0.58)	2.64 (± 0.59)
Female	2.61 (± 0.53)	2.50 (± 0.60)	2.54 (± 0.58)
Live	2.71 (± 0.52)	2.62 (± 0.54)	2.65 (± 0.53)
Median	2.75	2.60	2.70
Proportion (%) of Low Birth Weight (LBW)			
≥ 2500 g	69.5%	63.9%	65.8%
<2500 g (LBW)	30.5%	36.1%	34.1%
Distribution of birth weight amongst LBW neonates			
< 1000g	04.4%	04.3%	04.4%
1000-1499g	10.0%	18.5%	15.8%
1500-1999g	19.6%	23.6%	22.3%
2000-2499g	66.0%	53.6%	57.4%

Table 2: Association of Low Birth Weight (LBW) according to selected variables

Item	2001 (%)		2011 (%)	
	LBW (<2.5 kg)	NORMAL (≥2.5 kg)	LBW (<2.5 kg)	NORMAL (≥2.5 kg)
Education of mother*				
No schooling	23.8	16.5	44.1	32.5
1-8 th class	25.8	20.7	22.5	22.8
9 th class/above	50.3	62.8	33.4	44.6
Age of mother (years)				
Upto 19	6.5	4.8	3.5	2.8
20-29	82.2	85.9	87.9	89.1
30 or above	11.2	9.3	8.6	8.1
Residence*				
Within district	69.0	77.9	53.2	62.4
Outside district	31.0	22.1	46.8	37.6
ANC status*				
Un-booked	30.55	22.2	68.8	51.6
Booked	69.5	77.8	31.2	48.4
Gravida				
First	43.0	40.9	45.3	39.3
Second	28.2	29.6	27.5	33.6
Third or more	28.8	29.6	27.1	27.0
Period of gestation*				
28- 36 weeks	46.7	7.6	50.0	8.2
37 weeks/more	53.3	92.4	50.0	91.8
h/o Abortion				
None	85.6	86.9	83.6	82.9
Present	14.4	13.1	16.4	17.1
Maternal anaemia*				
Severe	16.2	8.8	6.7	3.1
Moderate	55.7	54.8	55.0	56.1
Mild	22.7	25.2	30.1	33.3
No anaemia	5.4	11.2	8.2	7.5

*p<0.001



Discussion

A descriptive study was undertaken to document birth weight over a decade in a government hospital in the state of Haryana. The study revealed that median birth weight in 2011 (2.6 kg) was lower than 2001 (2.75 kg) with proportion of LBW as 36.1% (2011) and 30.5% (2001). India, the largest democracy & second most populous country in the world is striving strongly on all fronts of human development especially economic value yet lagging on social issues. Over the years there has been intense promotion for institutional deliveries in the country with concomitant increased program funding, infrastructure development, easy access to communication and free transport facilities for pregnant and poor patients. However, nation-wide data on birth is still not available since most of these occur at home i.e. 52.3% (61.3% in rural and 29% in urban areas)⁴ with latest figure of 60% (Sample Registration System, 2010).

In spite of certain inherent limitations as hospital usually attracts high risk mothers with non-generalizability of study findings still it reflects a grim situation with respect to neonatal birth weight. Another

trend being observed in this region especially in the light of large scale migration of labor due to infrastructure and agriculture development with issues like poverty, social security, manual physical labor and poor nutrition with profound influence on birth weight could also add on to listed limitations.

Data based on nationally representative Demographic Health Survey (DHS) of 1993 & 1999 in India after adjustment of birth-size for heaping, LBW was reported to the tune of 31.7% and 30.4% respectively⁵. A community based study in rural areas of West Bengal, urban re-settlement of Delhi and Pune documented the magnitude of LBW as 31.3%, 39.1% and 29% respectively⁶⁻⁸. National Neonatal-Perinatal Database (NNPD) from secondary & tertiary care network (n=15) reported LBW as 31.3% (2002-03)⁹ while isolated Indian hospital based studies at Orissa, Shimla, Bhillai and Amritsar, reported LBW as 39.8%, 27.8%, 23% and 16.3%, respectively^{10, 11, 12, 13}.

The multi-factorial complex inter-linked factors leading to LBW could be grouped into biological (maternal, placental, fetal etc), social-economic determinants-poverty, demography, education, cultural & nutritional

practices, infections (e.g. malaria etc), health system (availability, access, quality & compliance), tobacco exposure, or environmental related issues^{14,15,16,17,18,19,20}. Much has been deliberated & documented on enlisted parameters. In the back-drop of various factors enlisted and variables examined in present study, authors would broaden the discussion to cover environmental issues in particular.

Carbon monoxide (CO) in particular and nicotine are regarded as the agents most likely to be responsible for detrimental effects on intrauterine growth²¹. CO results from incomplete combustion of bio-fuels (wood, dung, and fiber residues) as well as fossil fuels such as coal and gas that is used for cooking and heating biomass and also tobacco. Studies have shown that exposure to bio-fuels is associated with carboxy-hemoglobin (COHb) levels of 2.5–13%^{22,23}. This compound does not readily give up oxygen to peripheral organs and tissue including foetus thus leading to growth restriction. A study carried out Guatemala confirmed that children born to mothers habitually cooking on open fires had the lowest mean birth weight of 2,819 g; those using a chimney stove had an intermediate mean of 2,863 g; and those using the cleanest fuels (electricity or gas) had the highest mean of 2,948 g ($p < 0.0001$). The proportion of low birth weights in these three groups was 19.9% (open fire), 16.8% (chimney stove), and 16.0% (electricity/gas)²⁴. A study carried out in south India, reported that exposure to bio-mass fuel was associated with an adjusted 49% increased risk of LBW²⁵.

It may not be un-reasonable to interpret that bio-fuels used by Indian women for cooking or heating may be one of the likely causes of LBW in addition to studied co-variables. Considering environmental issues, nearly 65.4% of rural & 26.5% of urban households in India used fire wood for cooking. In Haryana, nearly 61.8% [76.6% (rural) and 22% (urban)] used fuel other than (LPG, electricity, or kerosene) suggesting dung/crop/fiber residue etc. while 11% of household used woods for cooking. On the health front, more than 50% mothers are anaemic while mothers who consumed IFA supplements were only 29.0% (urban, 31.7%-28.1%, rural)²⁶. Similarly, adult prevalence of tobacco use at national level among males is 48% and that among females is 20% while prevalence of smoking among males is 24% and 3% among females including 1% each of pregnant and breastfeeding women (NFHS-3, Haryana)²⁷. Similarly higher proportion of rural (58%) than urban (39%) adults were exposed to second hand smoke in their homes.

Considering background discussion it may not be surprising to visualize the interface that substantial gain on newborn birth weight will be achieved in conjunction

with development of related sectors (e.g. energy/tobacco control/poverty alleviation), tuberculosis/malaria control, modification of cultural practices, improving health compliance and time-frame needed to do so etc. India, accounts for one of the highest magnitude of LBW newborn, a surrogate indicator for prevailing malnutrition & inequity in the society leading to inter-generational effect especially among women. Directly and/or in-directly country is bearing & draining huge resources when the consequences are translated from the perspective of health, loss of productivity and psycho-social cost into financial terms. Maternal and child health is considered as one of the major thrust areas in country with many concentrated interventions underway by government of India still a lot needs to be done in this direction.

Conclusion

To conclude, with a pinch of salt, we have faltered in achieving health & family welfare goals as envisaged in Health-for-All (e.g. to bring down LBW to 10% by the year 2000), National Population Policy (2000) and National Health Policy (2002) etc. High aspirations, hopes & targets, which are though necessary for guiding path & raising moral of health team, have resulted in modest progress only. But to reiterate, integrated strategies, actions & will is the hallmark required to bring down the scale of malnutrition and improvement in related sectors so as to achieve at least some of the Millennium Development Goals (MDG, 2015) or else it would still remain just one of the many fancy dreams and charter of wish-lists to be achieved by, to be realistically saying, at least not before year 2030.

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Permission from IRB: Yes

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