ORIGINAL ARTICLE

PATTERNS OF BIRTH WEIGHT AT A COMMUNITY LEVEL IN SOUTHWEST ETHIOPIA

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ABSTRACT

BACKGROUND: ***Birth weight data are not routinely measured and recorded in Ethiopia and most of the analysis were based on births occurred in health institutions but such analysis lack representativeness as most deliveries are occurring at home. To fill this gap and issues related to representativeness a community based study that identified a one-year live birth cohort of 8,273 in Jimma, Illubabor and Keffa zones, South West Ethiopia was undertaken to determine patterns and identify independent factors contributing for birth weight.***
METHODS: ***This was a community-based longitudinal study, which attempts to record birth-weight by using existing net-work of community health workers.***
RESULTS: ***The results of the study found an estimated low birth weight rate of 10.0% that varied between residential areas, marital status, monthly family income, parity and mothers' experience of previous child deaths. In addition, number of antenatal clinic attendances, type of birth, sex of the foetus, season of birth, source of drinking water and type of latrine facility showed variation in low birth weight rates. These factors also showed independent and significant effect on birth weight patterns***.
CONCLUSION: ***Based on the findings of this study it is recommended that improving antenatal care visits of mother during pregnancy, delaying the age at first delivery, increasing access to safe water supply and access to pit latrine facility to families could improve birth weight patterns that could improve survival and subsequent growth of children.***

Key words: Birth weight, Community-based, Patterns, Factors

INTRODUCTION

Birth weight is an important factor which affects both neonatal and post-neonatal morbidity and mortality. Birth weight is mainly determined by gestational term and intrauterine growth rate. Low birth weight is caused by either short duration of pregnancy or retarded intrauterine growth or it could be a combination of both. In developing countries the common problem is intrauterine growth retardation (IUGR) (1-4). This has led to a greater clinical and epidemiological investigation to call for community intervention.

World Health Organization (WHO) estimated that 17% of all births in the world are low birth weight babies, with a contributing low birth weight rate of 19% for developing countries and 7% for developed countries (5).

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For Ethiopia, the 1995 World Health report, "Bridging The Gaps", the low birth weight rate estimate was 16%(6). Data from infants born in health care facilities in Addis Ababa, Ethiopia in 1982 estimated a low birth weight rate of 8.1% (7) and a study of infants born in Jimma between September 1985 to December 1988 in the regional hospital found a low birth weight rate of 13.1%(3) and the Lusaka, Zambia study found a rate of 11%(8).

Although the main factors contributing to low birth weight is due to poor intrauterine growth such as low caloric intake or weight gain, low pre-pregnancy weight, short stature, female sex of the foetus, malaria, cigarette smoking, primiparea, etc., are basically the same for both developed and developing countries, their proportional impact differs considerably(1).

Several, often interrelated, conditions are associated with low birth weight, including socioeconomic status, ethnicity, maternal nutrition, the environment and health status. Socio-economic indicators may contribute to low birth weight through poor nutrition, high incidence of sexually transmitted diseases, and increased physical stress during pregnancy. Birth weight distributions, a sensitive indicator of maternal nutrition, have been noted to vary with seasonal changes in food availability (9).

Birth weight data are routinely measured and recorded for infants born in institutions (hospitals, health centres, etc). Birth weight is often not recorded in countries where a substantial number of births occur at home. In order to improve our understanding of low birth weight and its preventable causes, population based data are therefore needed (10).

In this country there is no birth registration. Most birth weight studies were based on health facility records. According the Ministry of Health report of 2000, the proportion of health care delivery was 10%(11). Hence community based birth weight data is very scanty. This has prompted us to attempt to present data from a birth cohort using the local network of community health workers. The main objective of this study is to describe the pattern of birth weight and its influencing factors at a community level.

MATERIALS AND METHODS

This is part of a larger study, 'Infant Survival Project". The project was a longitudinal study which comprised of 46 urban and 65 rural 'kebeles', with an estimated population of over 300,200 in the administrative zones of Jimma, Illubabor and Keffa, Southwest Ethiopia. Data was collected by trained enumerators and traditional birth attendants (TBAs). In order to identify all live births, all the TBAs in the above mentioned kebeles were involved in the fieldwork. TBAs are women residents of the kebele they serve and by tradition they visit and assist women during pregnancy and delivery. The TBAs had easy access to women in the fertile age group, and were able to assess their pregnancy status. Each TBA was given responsibility for about 300 houses, and went house to house regularly to locate pregnant women at least in their second trimester. The TBA reported daily in person to the enumerator responsible for her kebele. The enumerator registered the address of the expectant mother. After registration both the TBA and the enumerator monitored the expectant mother so as to reach her on time soon after delivery. In each kebele all one-year live birth cohorts were recruited for this study and followed for one year from 1992 to 1994. Measurements on weight and length were taken using Salter scale balance and wooden length board with fitted tape meter to the nearest 100 gm and 0.1 cm. Data on

the household socio-demographic characteristics, mothers' obstetric history and health service use, seasonal and environmental factors were also collected.

Then regular follow-up was made bimonthly until their first birthday or to an earlier death. Information was also gathered from mothers, key informants on their views about multiple births. Two high school completed students were trained for computer data entry and two statisticians were responsible for data processing and analysis. Data were entered daily, so as to allow fast feedback for quality control procedures. Details of the study methods have been given elsewhere (12).

Enumerators were women who completed 12th grade schooling, speak the local language (Oromifa, Amharic and Keffecho) and were residents of the study areas. Supervisors were field experienced health and other workers. A 10 to 15 days training was given to enumerators and supervisors with classroom teaching, role model and practical field training at different health centres by the investigators. Relevant training was given to TBAs to their level. At filed level, on the average one enumerator was assigned for three kebeles, and one supervisor for three to five enumerators. Supervisors control and help data collectors during data collection, they met every week to assess their work and a person from the research team met them fortnightly.

The quality of the data was checked at three different stages. First, each data collector should have to check the collected data before leaving the house and submitting to her supervisor. Secondly, after receiving the data collectors, each supervisor had the responsibility to check for missed or inappropriate recorded data and if found he gave back the questionnaire to the data collector for re-checking and corrections. In addition, supervisors have the responsibility to re-interview at least 5 percent of the data collected in their areas. Thirdly the data were checked during data entry and if problems were found the forms were sent back to data collectors for further checking. The investigators also made random cross checking on the re-interviews made by supervisors and check data collectors on actual collection time at field level.

This data was entered into computer and analysed using SPSS package. Descriptive measures to characterize the study population and the logistic regression analysis to explore independent predictive variables for birth weight distribution were used.

RESULTS

Where there is no vital events registration, the attempt was to record all newborns of the one-year birth cohort soon after delivery using the network of community health workers. With this approach it was possible to contact 26.5% within the first 24 hours and 92.8% within seven days of birth. Of the total births recruited, 92.9% of them were followed to the age of one year or up to the death of the child and the rest 7.1% were lost to follow up at different ages. A total of 8,162 deliveries with 8,273 (8,050 singleton, 111 twins and 1 triplet) live births were registered in one-year period in the study sites. Of the total babies, 4,205 (50.8%) were males and the rest 4,068(49.2%) were females that gave a sex ratio at birth of 103.

The data revealed that 11.9 and 16.8% of the mothers were under the age of 20 and over 34 years at the time of the study and the mean age was 26.4 (SD=6.3) years. The majority (67.0%) of the mothers were Oromo by ethnicity and 68.9% were Muslims by religion. About 60% were illiterate; most of them (92.9%) were

married and housewife (90.7%) by occupation.

More than 62% of all households had family size greater than 4 persons and the average family size was 5.5 (SD=2.1). About 27% of the families had functional radio. Even though getting accurate data on income was difficult, rough estimation showed that 62.6% families earn below 100 birr per month. Of the total households 49.2% got their drinking water from unprotected sources (unprotected spring or well, river and pond), 63.4% had no latrine facility of any type.

Including the index child, 22.3% of the mothers had only one pregnancy and 33.1% of the mothers had experienced 5 or more pregnancies. Mean number of live births was calculated to be 3.6(SD=2.4). With respect to losses of children by death, or pregnancy by abortion or stillbirths, the data showed that 34.0, 7.7 and 2.1% of the mothers experienced at least one loss, respectively. Data on health service utilisation of mothers during pregnancy showed that 46.6% of the mothers never attended antenatal care during their pregnancy. With regard place and attendant of the index delivery, the data showed that 83.2% delivered at home and 66.4% attended by untrained personnel.

Birth weight

Due to the nature of the study it was difficult to weigh infants immediately after birth to get birth weight data. Because of this we are forced to give a contextual definition to birth weight. Knowing the fact that "the new-born's weight may drop 10% below birth weight in the first week as a result of excretion of excess extra-vascular fluid and possibly poor intake (31)", we took all measurements taken within one week after delivery as birth measurements. Therefore, all the analysis on birth weight is based on those infants whose weight was measured within one week after birth (n=7,586,7,426 singleton and 160 multiple births).

Based on measured weights within one-week period, the mean birth weight of the 7,586 live births was 3,065.6 (SD=503.8) gm (3,084.3 (SD=488.3) gm for singletons and 2,196.1 (SD=440.9) gm for multiple births). Moreover, of the total 7,586 live births 761 had birth weight below 2,500 gms that gives an estimated low birth weight rate of 10.0% (8.0% for males and 12.1% for females and 8.7% for singletons and 71.3% for multiple births). Birth weight distribution at different ages within the first one week is presented in table 1 and the low birth weight rate varied between 9.3 and 11.0%. The rate of low birth weight was higher for rural (14.6), unmarried (13.7%) and families with monthly income below 100 birr (12.8%). With regard to maternal characteristics, those primi- parity, with at least one child death experience and no latrine facility gave birth to low birth weight infants at a higher proportion (table 2).

To find important predictors for birth weight distribution, the logistic regression analysis was used, with forward stepwise likelihood ratio method. During this process all variables were entered together for their independent and significant effect on birth weight. Of the variables included in the model, residence, marital status, monthly income, number of ANC visits, parity, experience of previous child deaths, sex, month of birth, source of drinking water and latrine facility were found to be significant predicators of low birth weight. Consequently, babies born to rural (2.76) and semi-urban resident (1.56), single (2.10) and divorced / unmarried mothers (1.72), families who earn monthly income below 100 birr (1.87), No ANC attendance (1.75), primi- parity (2.16), previous child death experience (1.43), multiple births (41.57), female newborns (1.62), born between March-May (1.36) and September

- November (1.54), and families without latrine (1.55) had higher risk of being low birth weight compared with the respective base group (Table 3).

Birth weight of infants significantly affected survival and subsequent growth of the child. In this study the infant mortality rates varied according the birth weight of the infant that ranged from 471.8 to 70.3 per 1000 for birth weights below 2,000 gm and greater than 2,999 gm (Table 4).

Table 1. Distribution of low birth weight rates at different ages at weight measurement, Community Based Study, South West Ethiopia, 1992-94

Age at which weight was measured	Birth weight (in gm) <2,500 n	%	≥2,500 n	%	Total n	%
Soon after birth	40	10.6	339	89.4	379	5.0
24 hours	168	9.4	1,623	90.6	1,791	23.6
48 hours	313	11.0	2,534	89.0	2,847	37.5
3 - 7 days	240	9.3	2,329	90.7	2,569	33,9
Total	761	10.0	6,825	90.0	7,586	100.0

Table 2. Low Birth Weight Rates by Social, Maternal, Health Services, Environmental, and Infant Characteristics, Community Based Study, South West Ethiopia, 1992-1194

	Birth weight (in gm) ≥2,500 n	%	<2,500 N	%	Total N	%
Residence						
Urban	1,680	96.2	66	3.8	1,746	23.0
Semi-urban	1,677	94.2	103	5.8	1,780	23.5
Rural	3,468	85.4	592	14.6	4,060	53.5
Total	6,825	90.0	761	10.0	7,586	100.0
Marital status						
Married	6,376	90.2	690	9.8	7,066	93.2
Single	234	86.0	38	14.0	272	3.6
Divorced/Widowed	213	86.6	33	13.4	246	3.2
Total	6,823	90.0	761	10.0	7,584	100.0
Monthly family income						
300+	872	97.6	21	2.4	893	11.8
200-299	477	95.2	24	4.8	501	6.6
100-199	1,166	92.8	91	7.2	1,257	16.6
<100	3,924	87.2	576	12.8	4,500	59.4
Total	6,819	90.0	756	10.0	7,575	100.0
Parity						
> 4	2,175	89.1	266	10.9	2,441	32.2
2-4	3,164	91.9	278	8.1	3,442	45.4
Primi	1,486	87.3	217	12.7	1,703	22.4
Total	6,825	90.0	761	10.0	7,586	100.0

Continued

	Birth weight (in gm)				Total	
	≥2,500		<2,500			
	n	%	n	%	n	%
Number of child deaths						
None	4,644	90.7	474	9.3	5,118	67.5
One or more	2,181	88.4	287	11.6	2,468	32.5
Total	6,825	90.0	761	10.0	7,586	100.0
Number of ANC visits						
>4	900	96.2	36	3.8	936	12.3
1-4	2,886	92.2	245	7.8	3,131	41.3
None	3,039	86.4	480	13.6	3,519	46.4
Total	6,825	90.0	761	10.0	7,586	100.0
Type birth						
Single	6,779	91.3	647	8.7	7.426	97.9
Multiple	46	28.8	114	71.3	160	2.1
Total	6,825	90.0	761	10.0	7,586	100.0
Sex of the infant						
Male	3,531	92.0	309	8.0	3,840	50.6
Female	3,294	87.9	452	12.1	3,746	49.4
Total	6,825	90.0	761	10.0	7,586	100.0
Season of birth						
June-August	1,608	91.9	141	8.1	1,749	23.1
December-	1,799	90.9	181	9.1	1,980	26.1
February	1,791	88.8	226	11.2	2,017	26.6
March-May	1,627	88.4	213	11.6	1,840	24.3
September-						
November						
Total	6,825	90.0	761	10.0	7,586	100.0
Source of water						
Pipe	1,347	94.8	74	5.2	1,421	18.7
Protected	2,217	92.6	177	7.4	2,394	31.6
spring/well	3,259	86.5	510	13.5	3,769	49.7
Unprotected source						
Total	6,823	90.0	761	10.0	7,584	100.0
Type of latrine						
Pit latrine	2,378	96.0	100	4.0	2,478	34.7
Water carriage	225	90.7	23	9.3	248	3.5
None	4,216	86.9	633	13.1	4,849	67.8
Total	6,439	90.0	712	10.0	7,575	100.0

Table 3. Independent factors contributing for low birth weight, Community Based Study, South West Ethiopia, 1992-94

Characteristics	RR	95% CI for RR	P-value
Residence (Urban)	1		<0.001
Semi-urban	1.56	1.06 -2.31	0.026
Rural	2.76	1.85 - 4.13	<0.001
Marital status (Married)	1		0.013
Single	2.10	1.12 - 3.92	0.053
Divorce/widowed	1.72	0.99 - 2.99	0.038
Monthly family income (300+)	1		0.016
200 - 299	1.10	0.57 - 2.13	0.771
100 - 199	1.44	0.84 - 2.49	0.188
<100	1.87	1.10 - 3.16	0.020
Number of ANC visits (>4)	1		0.004
1-4	1.36	0.89 - 2.07	0.158
None	1.75	1.14 - 2.67	0.010
Parity (>4)	1		<0.001
2-4	0.91	0.73 - 1.13	0.383
One	2.16	1.65 - 2.83	<0.001
Previous child death (None)	1		<0.002
One or more	1.43	1.15 - 1.78	
Type of birth (Single)	1	27.29 - 63.32	<0.001
Multiple	41.57		
Sex (Male)	1		<0.001
Female	1.62	1.37 - 1.93	
Month of birth (June-August)	1		0.003
December - February	1.13	0.87 - 1.46	0.361
March - May	1.36	1.06 - 1.74	0.015
September - November	1.54	1.20 - 1.98	<0.001
Source of drinking water (Pipe)	1		0.025
Protected spring/well	0.92	0.65 - 1.31	0.650
Unprotected source	1.24	0.88 - 1.75	0.219
Latrine (Pit latrine)	1		0.115
Water carriage	1.61	0.91 - 2.85	0.099
None	1.55	1.15 - 2.09	0.004

Table 4. Infant Mortality Rates by Type of birth and birth weight, Community Based Study, South West Ethiopia, 1992-94

	Singletons		**Multiple births**		**Both**	
Birth weight (gm)	**n**	**IMR**	**n**	**IMR**	**n**	**IMR**
<2,000	92	426.3	42	571.4	134	471.8
2,000 - 2,499	555	156.4	72	411.1	627	185.9
2,500 - 2,999	1,869	94.6	38	198.1	1,907	96.6
≥3,000	4,910	70.4	8	0.0	4,918	70.3
Total	7,426	95.2	160	461.2	7,586	104.1

Note that the IMR in this table are not exactly equal to the estimated mortality rates for the cohort they are estimates only for those births whose weights are taken within one week after birth. In addition, due to the small number of multiple births the estimated IMR to this group may not be reliable.

DISCUSSION AND CONCLUSION

Birth weight data are routinely measured and recorded for infants born in health institutions. In areas where vital events registration system is non-existent and a substantial number of births occur at home, getting data on birth weight within a short time of birth is difficult and often impossible. The data obtained from health institutions in such areas lack representativeness and this will limit our understanding of low birth weight and its preventable causes in the larger population (10). In this study, therefore, we tried to measure birth weight at a community level to see the potential influence of socio-demographic, obstetric, health care and environmental factors.

The data from our study revealed that weights of newborns measured within one-week for the different ages didn't show statistically significant difference in the low birth weight rate of the study population (P=0.16).

A study done in Jimma Hospital found a low birth weight rate of 9.2%. In our study for birth measurements taken within one-week period the estimated low birth weight rate was 10.0%; this is consistent with the above estimate and lower than the estimate for Ethiopia, Zambia and Africa (8, 13, 14, 15). Other estimates include 8.1% for Addis Ababa and 13.1% for Jimma (4, 7). The low birth weight rate was higher for rural and semi-urban compared to urban areas (P<0.001), and females than males (p<0.001), which are considered to be contributing factors for low birth weight (1, 9, 16).

Anthropometric measurements on weight and height at birth resulted in a mean birth weight of 3066 gm with standard deviation of 504 gm and mean length of 49.0 cm with standard deviation of 2.8 cm. The mean birth weight of our cohort is lower than the estimate from the study of Jimma Hospital (15), Egypt, Kenya and Zaire but higher than India and Pakistan as reported by Kramer, 1987(1). On average, rural infants and females weight 254 and 107 gm less and measure 1.1 and 0.4 cm less in length than urban infants and males at birth. Data from Kramer (1) calculated birth weight difference in males and females for developing countries to be 93.1 gm. Multiple births were lower by 888 gm and 3.3 cm for their weight and length at birth with singletons.

Several, often interrelated, conditions are associated with low birth weight, including socioeconomic status, ethnicity, maternal nutrition, environmental and health status (9.16). Studies also showed that mothers of younger age at first marriage and lower educational attainment were associated with higher low birth weight rates (17, 18, 19). For our study the result from the logistic regression model indicated that of the socio-demographic factors, marital status of mothers showed a significant association with low birth weight. Single mothers were more than twice at risk of giving low birth weight babies compared with married mothers and divorced/widowed had 72% higher risk compared with married mothers. Monthly family income also showed a significant effect of low birth weight. In this regard, babies born to those families who earn monthly income below 100 birr had 87% higher risk of being low birth weight compared with those who earn 300 birr or more. Similar findings were reported in Sudan, Brazil (20, 21).

On the other hand rural and semi-urban mothers had nearly three times and 56% increased risk of delivering low birth weight babies compared with urban mothers. Similar findings were reported in the Sudan (20). Mothers from families with no latrine had a 55% increased risk of giving low birth weight babies compared

with those who had pit latrine. In this study seasonality of birth weights was also reflected. Compared to those who were born between June and August those who were born between March and November had 36-54% higher risk of being low birth weight. This might be attributable to better food availability where the pregnancy period spans over the harvest seasons that was also supported by other study (9). Primiparae and mothers who experienced at least one child death had more than twice and a 43% higher risk of giving birth to a low birth weight baby compared with mothers who had more than 4 children and who had no child death. Female sex of the foetus also showed a 62% increased risk of being low birth weight compared with males. The preceding findings are consistent with reports made from other studies (1).

It is believed that health initiative is influenced by available resources. With this understanding we have attempted to measure the distribution of birth weight at community level using the grass-root structure. The findings depicted the pattern of birth weight and its contributing factors. The study outcomes are similar to other community-based studies in the Sudan, Brazil and Kramers review (1, 20, 21).

According to the findings of the study, improving antenatal visits, delaying the age of first birth, increase access to safe water and pit latrine are factors which could improve birth weight. These are modifiable factors within local resources that could lend for public health intervention at a community level.

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