PREVALENCE OF LOW BIRTHWEIGHT IN URBAN AREAS OF SOUTH WESTERN ETHIOPIA

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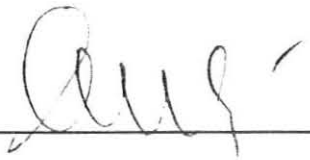
Dr. Ahmed Ali Advisor	
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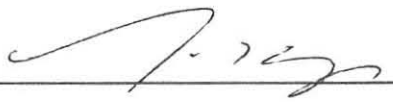
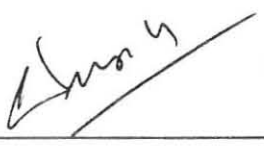
Dr. Tesfaye Shiferaw Examiner	
Dr. Derege Kebede Examiner	

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LIST OF ABBREVIATIONS

ANC - Ante Natal Care

ARI - Acute Respiratory Tract Infections

CI - Confidence Interval

GNP - Gross National Product

IUGR - Intrauterine Growth Retardation

LBW - Low Birth Weight

LMP - Last Menstrual Period

MCH - Maternal and Child Health

NBW - Normal Birth Weight

NCHS - National Center for Health Statistics

RR - Relative Risk

SD - Standard Deviation

oTTBA - Trained Traditional Birth Attendants

USA - United States of America

VLBW - Very Low Birth Weight

WHO - World Health Organization

ABSTRACT

A cross sectional study of low birth weight (LBW) with a case control analysis was carried out in 30 villages of Jimma zone, South-western Ethiopia with the objectives to determine the prevalence of (LBW), its determinants and to assess the performance of trained traditional birth attendants (TTBAs) in recording birth weight using simple modified salter spring balances. Exposure variables of interest related to study mothers were collected and birth weight of the new born were recorded by enumerators and TTBAs.

A total of 537 mother-newborn pairs were included in the study revealing an overall LBW rate of 10.6%. The frequency distribution of health unit and home deliveries were nearly equal (47% vs 53%). LBW rate was higher among home deliveries (12.9%) than health unit deliveries (8.0%). Statistically significant mean birth weight difference favouring health unit delivered neonates was observed when compared to home delivered neonates ($t=2.03$, $P<0.05$).The present study has demonstrated LBW rate is higher among home deliveries unattended by trained personnel.

TTBAs can be used as a potential source of birth weight information to the health system. On the basis of the study finding, it is recommeded that efforts have to be made to motivate mothers to utilize the maternal and child health (MCH) services to minimize the risk of LBW, and further that regular refresher training and periodic supervision of the TTBAs should be made to utilize them as a potential source of vital event data of their communities.

INTRODUCTION

The birth weight of an infant is a function of its gestational age and intrauterine growth rate (1). Birth weight has been identified as an important predictor of neonatal outcome. The proportion of babies who are LBW have been suggested as indicators of socio-economic development (2). The various socio-economic determinants for the occurrence of LBW are highly prevalent in the developing world. The study was intended to measure the magnitude of LBW, its determinants and to assess the performance of TTBAs in recording birth weight in urban areas of south western Ethiopia.

Ethiopia being one of the least developed countries, more than 65% of the nation's population live below absolute poverty level. The frequent drought and famines may contribute to the deterioration of the country's economy. The world bank estimated the gross national product (GNP) per capita to decline at an average rate of 1.4% per year (3). An estimated 45% of the total population of Ethiopia have physical access to health facilities. Economic and socio-cultural barriers to health services might have an influence on the utilization pattern of the available health services. Mothers and children constitute the majority (70%) of the population and are most vulnerable to various health and health related hazards including LBW (4). The public health importance of LBW in Ethiopia is significant as it is related to the larger sector of the population.

The scarce data available on birth weight distribution and its determinants are from deliveries conducted by health institutions. Not more than 15% of the deliveries in Ethiopia are attended by trained personnel and take place in

health units (3). The estimates made on the basis of secondary data sources lack accuracy, comprehensiveness and are unrepresentative. Although they have such limitations the existing institution based data indicated higher magnitude of LBW in Ethiopia (5,6,7,8,9).

The majority of births in rural areas are attended by either untrained traditional birth attendants or elderly women. Their training and deployment in the community was considered as an integral part of the national health strategy. TTBAs are believed to reduce the risk of mortality and morbidity resulting from poor midwifery practice. They can also improve vital events reporting related to mothers and children. Yet,their utilization is very limited. TTBAs have to be encouraged to practice what they have been taught.

It is hoped the findings of this study will provide better and representative data on magnitude of LBW of the communities studied and will help in designing a mechanism and suggest means to improve the contribution of the TTBAs to maternal and child health care of their communities.

LITERATURE REVIEW

What Is LBW?

Among the parameters measured in the newborn birth weight has been recognized as the most crucial . "Until 1976 the definition of LBW was based on the international definition of prematurity adopted by the first world health assembly in 1948 " (10). In this definition prematurity was defined as a birth weight of 2500 g or less. In it's twenty ninth assembly (in 1976) the World Health Organization (WHO) revised the definition of LBW to birth weight of less than 2500 g (up to and including 2499 g). Below this cut off value birth weight specific infant mortality begins to rise rapidly. Later on prematurity is defined as a gestational age of less than thirty-seven weeks.

The most widely utilized reference standard, the National Center for Health Statistics (NCHS) define LBW as birth weight of 2500 g or less (11).

Chen and his colleagues (12) identified sex of an infant as an important factor in determining the weight and consequences of LBW in the newborn. Based on 1978-80 data of the national task force for reduction of infant mortality in Israel, they described the mean birth weight of female new-borns is usually lower than that of males in the same population group. Thus, what may be considered an"extremely" LBW for males may be a common value for females and the risk for a male new born with a birth weight less than 2500 g may be higher than that for a female newborn of the same birth weight. They also stressed on the need to replace the standard definition of LBW by one that is suitable to each specific population group (defined by sex, ethnic group, etc) with respect to its specific birth weight distribution.

Impacts Of LBW.

LBW is one of the most serious challenges in maternal and child health (MCH) in both developed and developing countries,and is probably the single most important factor that affects neonatal mortality. More over birth weight has also been identified as a significant determinant of post neonatal infant mortality and of infant and childhood morbidity and mortality.Half of all perinatal and one third of all infant deaths are due to LBW(13,14).

LBW babies are more vulnerable to a range of infections, including Acute Respiratory tract Infections (ARI) and diarrhoeal diseases. Victoria (15) in Brazil found that LBW infants are twice as likely to die from diarrhoea as babies weighing 2500g or more at birth. They attributed the differences observed to the higher risk of dehydration in the proportionally greater intestinal surface area of small infants per kilogram of their body weight.

"The association between LBW and mortality, morbidity and performances does not necessary mean that eliminating a given cause will result in lower morbidity or mortality or improvedperformance. For example an infant who was IUGR as a result of an intrauterine rubella infection will have a much poorer prognosis than another of similar birth weight who is small because his mother is short "(1).

Factors Responsible For LBW.

"The causality of LBW is 'multifactorial'. Nonetheless, there is considerable controversy about the factors that have independent effects on LBW as well as the quantitative importance of those effects. One of the reasons for this has been a failure to distinguish between IUGR and

prematurity. Many of the potential determinants are highly associated and their effects are thus mutually confounded. Failure to control for confounding variables can lead to erroneous associations between a factor and IUGR or prematurity" (1).

Kramer (1) reviewed several studies of the English and French Medical literature published from 1970-1984. He used critical assessment and meta analysis to identify determinants of LBW. He made special reference to some studies done in USA. He described that mean birth weights and LBW rates (mostly IUGR) differ across ethnically heterogeneous population groups. However the author cautioned that other factors (eg. socio economic status) could explain a large part of the observed differences in birth weight. Hence he recommends that isolation of a genetic effect of racial ethnic origin requires control for these other variables.

Jefrey and his colleagues (16) made racial comparison in the association of socio economic status and LBW. It was found that the percentage of LBW increased as the median family income of an area decreased, despite racial differences between singleton cohorts. In their study the authors concluded , for any geographic area, the more socio-economically disadvantaged the subpopulation, the poorer the perinatal outcome, and the higher the incidence of LBW. Other socio-demographic variables (age , marital status, income, education etc.) also influence the occurrence of LBW in varying degrees.

Pregnancy outcomes, including birth weight are generally less favourable among adolescents (15-19) and women over 35 years of age. Moreover young teen-age girls who may not have completed development of pelvic structures, are likely to have lower weight for height than older women and their nutritional status may not be optimal to support fetal growth and may also put them at risk (1).

In another study in Bendel state of Nigeria Osafu and Wlkaija (17) reported higher birth weight of babies born at the university hospital as compared to those obtained from a general hospital. They attribute the differences to the improved nutritional status of the women and better standard of living conditions since the university hospital provide service to priviledged population. The likelihood of having short birth intervals and less use of antenatal care in women of lower socio-economic status could also support their explanation.

A study conducted in Ethiopia reported excessive maternal physical activity during pregnancy to be one factor in the etiology of LBW, particularly where maternal dietary intake is border line (18).

Conversely, Barnes and et al (19) in their longitudinal analysis of effects of physical activity on pregnancy outcome in Filipino women, observed no difference in risk of LBW or preterm delivery in economically active compared to economically inactive women. However they found that increased amounts of standing activity affected pregnancy outcome in certain groups of women.

Education (usually maternal) and paternal occupation and family income are said to have an effect on the birth weight of an infant (1).

In an effort to examine maternal risk factors in infants with very low birth-weight(VLBW), Padbury and his colleagues (20) reported that hypertensive vascular disease and previous fetal death are maternal risk factors that are associated significantly with VLBW alone. The same study revealed the differences in the physical parameters pre-pregnancy weight, maternal height, and maternal race are associated significantly with changes in the incidence of LBW deliveries but are not associated with changes in the rate of VLBW. In concluding their finding the authors suggested research into the causes and prevention of VLBW infants should be designed carefully to avoid the loss of meaningful information by dilution of the study population with the more common LBW infants.

In their systematic analysis of the independent effect of maternal age throughout the reproductive period on the incidence of LBW at term, Kwang and his colleagues (21) reported that the incidence of term LBW apparently declined with advancing maternal age, from 3.2% in women aged $\leq$ 15 years to 1.3% in women aged 25 to 34 years, increasing to 1.7% for those $\geq$ 35 years (with out adjusting for other maternal factors). The incidence of term LBW was also high in blacks, women with parity $\geq$ 3, unmarried status, low educational status and poor prenatal care. Clustering of these risk factors in the young age group has been suggested as an explanation for the differences observed in this study. Logistic regression analysis performed to separate the independent effect of maternal age on the incidence of LBW at term revealed

the risk for LBW at term increase progressively as maternal age advanced.Poor maternal nutrition, smoking, drug addiction, alcohol use and complications of pregnancy such as toxaemia, chronic hypertension, and infection have also been shown to be associated with intrauterine fetal growth retardation.

In his review, Kramer (1) reported that both the processes that govern birth weight (gestational duration and intrauterine growth rate) can benefit from antenatal care. The benefit can be achieved through early identification and proper management of risk factors and pregnancy complications. The author cautioned against firm conclusions about the possible benefit of early or frequent antenatal visits on either intrauterine growth or gestational duration. He recommends the need for well controlled randomized clinical trials to measure and account for the potentially conflicting confounding factors who might have observed a beneficial effect.

Kessel and his colleagues (11) reviewed a 10 year birth data published by the NCHS to see the changing pattern of LBW in the USA. It was found, during the past 15 years, the US infant mortality rate has declined rapidly compared with relatively little change in the birth weight distribution. They attributed the improved infant survival principally to reduced birth weight specific mortality resulting from advances in perinatal medicine with little evidence accumulated to support the contribution of preventive efforts.

Prematurity and IUGR.

Birth weight is governed by two major processes: duration of gestation and intrauterine growth rate. LBW is thus caused by either a short-gestation period or retarded intrauterine growth (or a combination of both) (1).

Differences in the IUGR rates of developing and developed countries are far greater than those for prematurity with relative risk (RR) of 6.6 and 2.0 respectively (1). Unfortunately most studies done on LBW do not distinguish between prematurity and IUGR. Nevertheless valid measurement of gestational age is mandatory to differentiate between premature and growth retarded infants.

Distinguishing between these sub-categories needs advanced diagnostic facilities, which is a major drawback in most developing countries. On the contrary Schelp and Pongpaew (22) argue from public health point of view that distinguishing between the subcategories of LBW is unnecessary. The explanation given was that both gestational age and foetal growth depend on similar factors. A recent study by Kramer and his colleagues (13) conducted to determine impact of intrauterine growth retardation (IUGR) and body proportionality on fetal and neonatal outcome concluded that IUGR, especially when severe and regardless of cause, is an important determinant of numerous adverse metabolic and asphyxic fetal and neonatal outcomes.

Incidence of LBW.

The overall public health importance of LBW in the world is significant as its frequency (prevalence) and risks for subsequent morbidity and mortality are higher in a given population.

Although the predictive utility of LBW is more appreciated in routine clinical practices, the WHO recommends its use as a social and health status indicator for monitoring progress towards HFA/2000 (2). This is because as a health indicator low birth weight is very sensitive to socio-economic conditions.

The incidence of LBW babies is not uniform throughout the world. WHO estimates the global rates of such deliveries as 17-18%. Some 22 million LBW babies are born in the world each year. Of LBW babies born in the world the majority (over 90%) are born in developing countries. The proportion of infants with LBW ranges from 3-4% in some developed countries to 25-30% in many areas of developing countries. The highest estimates of LBW rates were 30% for India and 27% for Pakistan both from the Asian continent. Lowest rates (4-8%) were reported for some countries of Western Europe and North America. LBW rates for the African continent range from 7% in North Africa (Egypt) to 18% in West Africa (Nigeria). In East Africa 12.8% was reported for neighbouring Kenya and 14.4% for Tanzania (10).

Data on distribution of birth weight in Ethiopia are scanty. The few available are also from deliveries conducted by health institutions. The proportion of deliveries conducted by health institutions is small. Of all deliveries in Ethiopia more than 85% are attended by lay personnel and take place outside health units (23). Although they are inconsistent in defining LBW the existing institution based data indicated a high magnitude of LBW in Ethiopia (5,6,7,8,9). The WHO estimated the incidence of LBW for Ethiopia as between 10-20% (10). A similar estimate made by UNICEF

indicate the percentage of LBW in Ethiopia as 13% and the average birth weight in Ethiopia to be 10% lower than those born in some developed countries (23). Relatively higher rates of LBW (26%) have been observed when the available data are disaggregated by health institutions (7). Apart from uncertainties as to the reliability of the values recorded, the representativeness of institution based data are highly questionable.

Role of TTBAs.

In most developing countries the majority (90%) of infants are born at home and about 75% of these deliveries are inadequately attended by trained personnel. Further more female literacy is low and women are unsure of their last menstrual period (LMP) to determine their gestational age. Therefore the application of birth weight as an indicator of development is often difficult and costly (22). The training of TTBAs is a means of extending the coverage of the limited health service available in developing countries. Apart from consideration of tradition and culture, the TTBAs nearness and easy availability to the community make them most suitable person for conducting deliveries in rural areas (24).

Effective use of TTBAs is a problem in most developing countries. Their potential could contribute much to the national health strategy of their community where they attended the majority of births. They can improve the health information of their community by reporting vital events related to mothers and infants to concerned bodies.

Kumar and Walia(25) in their study concerning the feasibility of recording birth weight ranges by TTBAs report that TTBAs can identify "at risk" babies using appropriate modification of the weighing scale (i.e using three different colours to denote weight ranges for the identification of normal babies, those requiring special care at home and those who need hospital referral). This implies that the TTBAs can generate such vital data at much lower cost when compared to highly qualified institution based health workers.Similarly trained lay workers can help in the collection of pertinent data to the health information system of a country. A recent study by Shamebo and his colleagues (26) in rural Ethiopia reported the usefulness of health information collected by properly trained lay workers. In their study validation confirms the usefulness of the method in providing reasonably accurate information .

MATERIALS AND METHODS

Study area

The study was undertaken in 30 villages of Jimma administrative zone in South-western Ethiopia.

20 villages are from Jimma town (zonal capital), and the remaining ten villages are located in three woreda towns (Agaro, Yebu and Serbo). Agaro is the furthest (45 km) and the other two towns (Yebu and Serbo) are at a distance of 22 km away from Jimma. All the study towns are accessible by tarred roads throughout the year. A regular city bus and occasional taxis travel between Jimma and the three towns. Local means of transport (horse, mule, car and foot) also used in these areas. All the study areas have similar geographical and climatic features throughout the year.

The health service facilities of the study areas comprised a government clinic, staffed by Health Assistants for each of the two small towns (Yebu and Serbo), a health center staffed by two Doctors and auxiliary staff for Agaro town, and a teaching hospital, a health center and a maternal and child health clinic staffed by different specialists and other para medical staff for Jimma town.

In addition to the above government facilities there are a number of rural drug vendors private clinics providing health service in these areas. The Jimma teaching hospital is a referral center for those who require further treatment and care from all the study areas and the neighbouring regions (Keffa, Illubabor, Gambella). All the government health units are involved in providing delivery and Ante Natal Clinic (ANC) service. Most home

deliveries are attended by TTBAs.

There are about 50 TTBAs in these towns. The majority of them are considered active (on the basis of regular reporting to their supervising health units). Most of the TTBAs are illiterate and they are not supported for the service they give neither by the community nor by the health sector.

The study areas have a total population of about 120,000 and they belong to three predominant ethnic groups, Oromo, Amhara, and Kullo. Socio-economic characteristics of the population in these study areas are similar. The majority of heads of households are mainly government employees, or earn their living from subsistence farming and trading.

Study Design

A descriptive cross sectional study followed by a case-control analysis was conducted to determine prevalence of LBW among delivered new borns in these four towns from october 1992-January 1993, during a period of four months. (see figure below for study design and selection hierarchy)

Reference Population

The source population from which the study subjects were derived consisted of approximately 1800 deliveries, (based on the assumption that 1.5% of women in the general population will be pregnant in the study area within a year).

Since female literacy is low in most developing nations, data of last menstrual period (LMP) is not reliably reported to determine gestational age. Hence the present study includes all newborns regardless of gestational age. From these source population still births and multiple deliveries were excluded.

Study Population and sample size determination:

All live newborns delivered in the study areas in four months period (from 1st of October, 92 to 31st of January, 93) were included. Four months were considered to be adequate to obtain the needed 600 sample size new borns to detect the prevalence of LBW. p= .13 (8) Hence

C.I = 95% (1.96) L = .03

$$n = \frac{(z)^2 (P) (1-p)}{L^2}$$

$$= \frac{(1.96)^2 (.13) (1-.13)}{(.03)^2}$$

$$= 600$$

The LBW and NBW newborn and their mothers served as cases and controls respectively in analysis of the data.

Measurement

Exposure Measurement

The exposure variables of interest were related to both pre-natal and natal events experienced by mothers. Characteristics of index mothers and their family members included were age, sex, ethnicity and religion etc. Maternal variables included were total number of pregnancies, live births, still births and abortions, index mothers' experience concerning present pregnancies such as whether or not they have attended antenatal care service and place of birth, and attendant of the deliveries. Socio economic characteristics of index mother and her husband such as literacy, marital, occupational and family income status were collected.Life style determinants were not included in the questioner since the comment was noted after data collection started. Data on maternal exposure parameters were collected by interviewer administered questionnaire. The structured questionnaire consists of demographic, socio-economic, obstetric, and MCH service utilization pattern of the index mother and her family. It was pretested and appropriate revisions were made before the final version.

Outcome Measurement

The outcome to be measured in this study was the anthro- pometric measurement of the index new born (Birth weight) to determine the prevalence rate of low birth weight and the relation of maternal socio-demographic characteristics to low birth weight.

Data Collection

Potential female interviewers who have good knowledge of the local language and completed 12th grade were recruited from the respective study areas. They were given a three day training by the principal investigator on how to complete the questionnaire and how to read and record birth weight of the new born.

At the end of the training sixteen of them were selected for the study on the basis of overall performance during the training.

They were responsible for completing the questionnaire, recording birth weights and collecting birth weight records from TTBAs, in their respective assigned kebeles. Each enumerator was responsible for two kebeles and they were assigned in or close to their resident Kebele to facilitate communication with the TTBAs in their kebeles.

All TTBAs reporting to their supervising health unit on regular basis were given a three day refresher training by the principal investigator. The purpose of the training was to refresh their knowledge and improve their skill with special emphasis on recording birth weight of newborns they deliver. Simple practical and informal teaching methods were used to ensure acceptability by TTBAs. Wrong beliefs regarding harmful effects of weighing newborns were discussed.

At the end of the training, each of the TTBAs and the selected enumerators were provided with a salter spring balance with a capacity to weigh up to 10,000 grams. The accuracy of the balances was checked using

a standard weight by the principal investigator during the weekly and monthly meetings with the enumerators and TTBAs respectively. They were also provided with a piece of cloth (size 100 x 90 cm) weighing less than 5 grams to be used as a weighing pan.TTBAs were also given monthly cash incentive during the four months of the study period.

Since most of the TTBAs are illiterate, tapes of two different colours were pasted on the dial of the balance. A green tape will mark weights of 2501 grams and above, and a red tape marking weights below and equal to 2500 grams. TTBAs are expected to record either the colour or both the colour and the figure they read. In all the readings both the TTBAs and the enumerators were trained to check the balances at zero.

The TTBAs and the enumerators used to meet twice daily (morning and afternoon) in their respective kebele offices. During these brief meetings they exchanged information, if a woman was found to have delivered. The birth weight was recorded within 24 hrs after delivery and the structured questionnaire was completed within 72 hrs. after delivery. Questionnaires completed every day were submitted twice weekly to the principal investigator and were checked for their completeness. Weekly and monthly meetings were conducted with the enumerators and TTBAs respectively to review progress.

Methods of data analysis.

Descriptive statistics such as frequency distributions for demographic, obstetric, socio-economic and MCH service utilization of index mothers and their family members were computed primarily. Secondly birth weights were categorized into LBW and NBW groups, to examine differences among exposure variables of interest between study mothers of new borns using chi-square statistics. Thirdly analysis of variance (ANOVA) was conducted in order to identify exposure difference between groups and to determine exposure variables predictive of the outcome (birth weight) measured. The data was analysed using SPSS/PC+ statistical package.

RESULTS

A total of 543 newborns were reported during the study period (October 92 to January 93). Of the 543 new borns reported six (two still births and two set of twin deliveries) were excluded while the remaining 537 mother new born pairs were included in this study. The distribution of birth weight of the new borns and factors influencing birth weight were assessed for the 537 singleton live births. Out of the 537 singleton live births reported, 393 (73.1%), 123 (22.9%) and 21 (3.9%) were from Jimma, Agaro and, Yebu and Serbo towns respectively.

Maternal Characteristics

Table 1 shows the distributions of index mothers by age group and ethnicity. The majority (74.1%) of the study mothers were between thoe ages of 20-34.

Table 1. Distribution of study mothers by age group and ethinicty, Jimma,1993.

Age Group	Ethnicity											
	Oromo		Amhara		Gurage		Kullo		Others		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
<20	21	11.5	19	19.0	16	18.8	5	5.7	11	13.6	72	13.4
20-34	132	72.1	71	71.0	60	79.6	70	79.5	65	80.2	398	74.1
>34	30	16.4	10	10.0	9	10.6	13	14.8	5	6.2	67	12.5
Total	183	34.1	100	18.6	85	15.8	88	16.4	81	15.1	537	100

Among the study mothers 24.7% were primiparous, 27.7% grand multiparous ($\geq$ 5) and 47.6% were with 2-4 previous pregnancies. History of prior abortion and still births were reported in about 11% and 2% of the index mothers respectively .

The majority (90.1%) of the study mothers were married and the remaining 9.9% were unmarried at the time of study period.

Among the total study mothers' 72.9% were literate, of which 11.4% have completed literacy class, 34.1% completed 4-8 grade, 26.3% had completed secondary school and above. Occupational status of study mother showed that 82% were housewives while the others 18% were students and employees (Table 2).

Table 2. Distribution of study mothers by Socio-economic characterstics, Jimma, 1993.

Characteristics	N	%
Marital Status		
Married	484	90.1
Unmarried	53	9.9
Total	537	100.0
Education Status		
Literate	391	72.9
Illiterate	145	27.1
Total	536	100.0
Occupational Status		
House Wife	442	82.5
Students + Workers	94	17.5
Total	536	100.0
Family Income		
No income	50	9.3
≤ 100 birr	181	33.7
101-200 birr	137	25.5
201-300 birr	67	12.5
301-400 birr	28	5.2
401+	74	13.8
Total	537	100.0

Table 3 summarizes the distribution of study mothers ANC status by attendant and place of delivery. As indicated in the table, among study mothers who were booked for ANC during the current pregnancy, 332 (86.0%) were attended by trained personnel during delivery including by TTBAs of which 207 (53.6%) tookplacein health units. Among those who were not booked for ANC only 105 (69.5%) attended by trained personnel of which 44(24.1%) gave birth in health units. The Chi-square test was performed revealed a statistically significant difference ($P < 0.05$) between the two groups.

About 72% of the study mothers were booked for antenatal care during the current (last) pregnancy. Of these mothers booked for ANC, about 12% had attended only one visit, 17% had attended two visits, 16% had attended three visits and 54% had attended four and more visits.

About 47% of the deliveries occurred in health institutions and 81.5% were attended by trained personnel including TTBAs.

Table 3. Distribution of study Mothers ANC Status by Attendant and place of delivery, Jimma, 1993.

Place of Delivery	Antenatal Clinic				
	Yes		No		Total
	Attendant at Delivery		Attendant at Delivery		
	Trained Personnel	Untrained Personnel	Trained Personnel	Untrained Personnel	
Health Unit	207	0	44	0	251
Home	125	54	61	46	286
Total	332	54	105	46	537

II. Characteristics of New-born

Table 4 shows the distribution of newborns by sex and weight category of birth weight. As indicated in the table about 56% and 44% of the newborns were males and females respectively . The overall LBW rate was 10.6% . Of these LBW new borns about 49% were males and 51% were females. The overall male to female ratio was 1.3:1.

Table 4. Distribution of Newborns by Sex and Category of birth weight,Jimma,1993.

Category of Birth Weight	Males		Females		Total	
	N	%	N	%	N	%
Normal Birth Weight	273	56.9	207	43.1	480	89.4
Low Birth Weight	28	49.1	29	51.9	57	10.6
Total	301	56.1	236	43.9	537	100.0

The mean, standard deviation (SD), and 95% confidence interval (CI) for the mean for both sexes are shown in Table 5. Analysis of the mean birth weight for sex in this study was not statistically significant ($P > 0.05$). The likely explanation for this finding is that, the sample size in this study was small.

Table 5. Mean, SD and CI of birth weight by sex of the newborn, Jimma,1993.

Sex	N	Mean birth weight*	SD	95% CI for the mean
Males	301	3222	461	3183-3260
Females	236	3177	464	3137-3216
Total	537	3202	462	3123-3280

* The birth weight does not include TTBAs report.

Similarly newborns delivered to study mothers who were booked for antenatal care (ANC) and known to have visited an ANC at least on one occasion during the current pregnancy had higher mean birth weight from newborns whose study mothers did not have ANC follow ups. The finding was statistically significant, ($P < 0.05$). Mean birth weight was not influenced by number of events of abortion, religion and literacy status of the index mother. Marital status of the index mother had a significant effect on mean birth weight of an infant. But mean birth weight about 3000g were found for infants born to those non-married mothers and those who did not have ANC foiiow ups. The relatively higher literacy rate (72.9%) is an important confounder which may give them better chance of higher mean birth in this study (Table 6).

Table 6. Mean and SD of Birth Weight by Socio Demographic and Obstetric Variables, According to Enumerators Report, Jimma, 1993.

Variables	Mean birth weight	t-value	SD	P
Sex of Baby				
Male	3169.1	1.11	456.3	NS
Female	3122.5		455.6	
Place of delivery				
Health unit	3191.2	2.12	453.4	*
Home	3111.2		456.0	
Attendant of delivery				
Trained	3179.3	3.25	446.1	*
Untrained	3117.6		477.0	
ANC				
Yes	3179.2	2.32	445.8	*
No	3071.9		473.9	
Marital status				
Married	3162.1	3.48	450.6	*
Not married	2961.1		496.4	
Religion				
Christians	3118.8	-1.71	439.6	NS
Moslems	3196.8		483.2	
Literacy status				
Literate	3154.5	.54	452.4	NS
Illiterate	3130.3		467.8	
Abortion				
Yes	3248.3	1.83	468.1	NS
No	3196.1		453.6	

* $P<0.05$
NS $P>0.05$

Factors influencing the outcome measurement (birth weight) were assessed for normal and LBW categories. The results of these comparisons are summarized in table 7. The over all LBW rate was 10.6%. The proportion of females with LBW were higher than that of females. However the observed difference between sexes was not statistically significant for birth weight categories (chi-square .94,d.f=1, $P>0.05$). Delivery of LBW babies was noted significantly more frequently among single and poor family income mothers than among those married and better family income mothers (Chi-square = 11.2, d.f = 5, $P<0.05$). A higher proportion of study mothers with LBW babies were not booked for ANC and their delivery were attended by untrained personnel than did women whose pregnancy ended in NBW babies. The difference is statistically significant ($P<.05$) (Table 7)

Table 7. Distribution of Birth Weight Group by Demographic, Socio-economic, and Health Service Use Factors of Study Mothers, Jimma, 1993.

Characteristics	Birth Weight Category					
	LBW		NBW		chi-sq	
	N	%	N	%	X^2	P-Value
Age of the index mother						
<20	3	5.3	68	14.2	4.05	NS
20-34	48	84.2	351	73.3		
35+	6	10.5	60	12.5		
Abortion						
Yes	4	7	56	11.7	.61	NS
No	53	93	424	88.3		
Marital status						
Married	48	84.2	453	94.4	6.86	*
Unmarried	9	15.8	27	5.6		
Literacy status						
Literate	19	33.3	353	73.7	.94	NS
Illiterate	38	66.7	126	26.3		
Family income						
No income	10	17.5	40	8.3	11.20	*
< 100	25	43.9	156	32.5		
101-200	12	21.1	126	26.3		
201-300	3	5.3	63	13.1		
300-400	2	3.5	26	5.4		
401+	5	8.8	69	14.4		
Occ. status of index mother						
Home life	41	73.2	401	83.5	3.02	NS
Others	15	26.8	79	16.5		
Sex of newborn						
Male	28	49.1	273	56.9	.94	NS
Female	29	50.9	207	43.1		
ANC						
Yes	23	40.4	128	26.7	4.06	*
No	34	59.6	352	17.3		
Attendant of Delivery						
Trained	38	66.7	397	82.7	7.51	*
Untrained	19	33.3	83	17.3		
Place of Delivery						
Health units	20	35.1	231	48.1	2.97	NS
Home	37	64.9	249	51.9		

* P<0.05
NS P>0.05

One way ANOVA was performed on factors considered as a source of variation to determine differences between group means. Among the factors analyzed, mean birth weight of newborns differed significantly between the different levels of family income of the index mother ($P < 0.0001$), the mean level being lowest to the no-income group and steadily rising to the high income group (Table 8).

Table 8. Results of ANOVA Tests of Birth Weight by Selected Variables, Jimma, 1993.

Variables	F-ratio	F- prob (sig level)
Maternal age	.5273	.5906
Ethnicity	1.0408	.3855
Total Live Birth	2.1979	.1127
Total Pregnacies	2.2719	.1045
Higest grade attended	1.5805	.2080
Place of delivery	1.9051	.1683
Attendant of delivery	3.1142	.0783
Family income	5.1916	.0001*

* Significant at 0.01

TTBAs Performance

A total of 178 (33.1%) deliveries were attended by the TTBAs, 257(47.9%) by health unit professionals and 102 (19.0%) by lay individuals. Among the 40 TTBAs trained and provided with the kit, 22 (55%) have reported at least one birth record of which they had attended. Of the total 178 deliveries conducted by the TTBAs birth weight records of 72 (40.4%) were reported. It was found that 9.7% (7/72) of the reported birth records were within LBW ranges. The proportion of LBW as recorded by the TTBAs was comparable to the weight records of the enumerators which were not statistically significant.

DISCUSSION

It should be remembered, that as a non-experimental study, this study has failed to detect cause effect relationship of LBW and its determinants. This study can only show association between LBW and some of the determinants.Furthermore,characters in life styles of studied mothers (smoking,chewing chat,work load etc) were not included in the questioner and possible confounders were not analized by multivariate analysis were also important limitations of the study.

The available published data on LBW and its determinants in Ethiopia are institution based and use different cut off points in defining LBW. In addition to having problems of coverage, data from health units lack validity and reliability. There is a tendency among health unit staffs to record the observed weight to the nearest round number {round kg} (16).

Though strict comparisons may be difficult, the overall prevalence rate of LBW observed in this study is close to the reports from Gondar and Jimma (7,9). The overall mean birth weight in this study is slightly higher than previous report from Jimma (9). Males in this study tend to have lower mean birth weight than their female counterparts when compared to other studies in Jimma (8,9). The frequency distribution of health unit and home deliveries in this study were nearly equal (47%vs 53%).

However the proportion of LBW was higher among home deliveries than those deliveries conducted in health units. Yet, the observed difference was

not statistically significant (chi-square = 2.97, df=1,P>0.05). Significantly, different mean birth weight favouring health unit delivered newborns was observed when compared to home delivered newborns (t=2.03, P<0.05).

A three year retrospective study from Jimma hospital reported (8) a LBW prevalence rate of 13.1% which is higher than the overall prevalence rate (10.6) and prevalence rate found in health unit (8.0) in this study. The likely explanation for the higher incidence of LBW among home deliveries is that, they are more likely to be of lower income and may have less economic access to health care facilities. They might make less use of ANC and their nutritional status may also be sub optimal. This could account for the lower mean birth weights and higher incidence of LBW babies among home deliveries than health unit deliveries in this study.

The prevalence of LBW were compared among different family income groups in the study. A statistically significant difference (P<0.05) was observed, suggesting a statistical association between LBW and family income level. Yet, it is difficult to reach at a conciusion on the basis of subjective responses to sensitive questions like income, where under reporting is very common . Similarly other studies have reported that income did not differ significantly between LBW mothers and their NBW controls (1,14). They recommend the need for well controlled studies to demonstrate the independent effect of income on birth weight.

Higher rate of LBW babies were found among mothers without ANC and attended by lay personnel than those mothers with ANC and attended by trained personnel. Consistent findings were observed when mean birth weight

of the two groups were compared.

A study by Jeffrey and his colleagues (22) found that as the median family income of an area decreased, its percentage of LBW increased. They attribute the difference to an increase in the incidence of women at risk in the more disadvantaged areas . Their finding is consistent with the explanation made in this study.

Higher mean birth weight of newborns delivered at a university hospital in Nigeria was observed than those delivered in a general hospital. The authors attributed the differences to better socio-economic status and living condition of mothers utilizing the university hospital as the university hospital serves the privileged population(23).

Marital status of the index mother was also significantly associated with birth weight of the newborn. Higher incidence of LBW and lower mean birth weight were observed among non-married mothers, when compared to those married index mothers. These findings may be explained by the fact that non-married mothers may be nutritionally poor, lack time to rest and the pregnancy might be unwanted.

Among the factors included in this study sex of the neonate, age, education, parity and ethnicity of the mother were not found to be associated with birth weight of an infant. Teen age and older age women are known risk groups for unfavourable pregnancy outcomes (1). Primiparous and grand multiparous women are also associated with poor pregnancy outcomes. Several factors may confound the association between these factors and birth weight of an infant. Control for confounding is essential even when significant

association is observed. The factors mentioned were among the most important factors predicting birth weight by other studies (1,24). The observed non significant difference might be due to smaller sample sizes used in this study.

An attempt was made to assess the proportion of mothers delivered in health units or by trained personnel among mothers booked for ANC. It was found that mothers who had ANC are more likely to deliver in health units or by trained personnel than mothers without ANC. This implies that the provision of ANC is a means for better utilization of trained personnel and health units for delivery services. We have to be cautious of this interpretation unless health service utilization pattern of mothers with and without ANC is studied. The overall mean birth weight in this study, found to be higher than expected for developing countries. The relatvely better literacy status found in this study may partly explain the finding in the study.

Assessment of TTBAs Performance

Since the Alma-Ata conference on PHC in 1978, most developing nations recognize the important contribution of TTBAs, in delivering better maternal and child health care including family planning to their communities. Recording and reporting of vital events relating to mother and child to the health center concerned is among the major tasks expected of the TTBAs (18). The overall record keeping of TTBAs is unsatisfactory. The lower literacy level among them is a known contributing factor (19).

The second purpose of this study was to answer how best the TTBAs perform

this task in their communities.

It was found that one-third of the deliveries in this study were assisted by TTBAs. However, birth weight record was reported for only 40% of them by 55% of the TTBAs in the study. No difference was observed between LBW recorded by TTBAs and enumerators.

In Sierra-Leone a study was conducted to evaluate the performance of traditional birth attendants after training. It was reported that the majority of the TTBAs had kept records but of varying quality and coverage. Most of them had failed to record one or more of the vital items. The authors concluded that the record keeping practices of TTBAs were far below the desired standard (18).

In a similar study in India it was reported that, the collection of data on births and deaths by TTBAs showed no improvement as a result of training (18). Kumar (19) using similar design to this study demonstrated that even illiterate TTBAs can record birth weight and identify "at risk" newborns.

Despite the short study period to bring such attitudinal and practical change the finding of the study is encouraging. Further improvement can be attained through periodic refresher training and follow-up of the TTBAs in the study areas.

CONCLUSIONS

The present study has demonstrated that the prevalence rate of LBW is higher among home deliveries, unattended by trained personnel than health unit deliveries and attended by trained health personnel. The fact that the mean birth weight is lower among home deliveries and mothers without ANC is in favour of the general principles of the importance of national health policy to provide a comprehensive MCH service to the under privileged population group.

ANC services and deliveries at health unit or by trained health personnel seem to be related to higher mean birth weight. Considering the lack of effective transport to nearby health units in addition to other economic constraints, the higher percentage of health unit and trained personnel deliveries among ANC attendants is encouraging. This will help the timely correction of perinatal complications occurring in the process of parturition.

The performance of TTBAs in this study seems satisfactory. They have assisted one third of the deliveries in the study, and reported useful weight records. The accuracy of the weight records was within acceptable range. Simple modification of the weight scale may motivate illiterate TTBAs to record birth weight. In situations where the majority of deliveries took place outside health unit, TTBAs can be used as a potential source of birth weight information to the health system.

RECOMMENDATIONS

Based on the findings of the present study, the following recommendations are made:

1. Efforts have to be made to encourage mothers to utilize the MCH services in order to minimize the risk of LBW.
2. Regular refresher training,incentive and periodic supervision of the TTBAs should be made to utilize them as a potential source of vital event data of their communities, including birth weight recording.This should be supported by provision of simple weighing scales.

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Annex A

I Census

Identification:

Case No ☐☐☐☐

Kefetegna_____Kebele _____ House No._____

Name Head of Household(HH)_____

Date of interview ☐☐ ☐☐☐

☐☐☐☐

101 Name usual members of household	102 Relation to HH	103 Sex	104 Age in comp. yrs.	105 Ethnic group	106 Religion	107 Identify eligibles mother 1 baby 2

Male	1
Female	2

Oromo	1
Amhara	2
Tigre	3
Kullo	4
Keffa	5
Gurage	6
Janjero	7
Other	8

Christian	1
Moslems	2
Other	3

II Fertility (maternal) history

Case No ┌┬┬┬┬┐
└┴┴┴┴┘

Kefetegna _____Kebele ____ House No_____

Name of eligible _____

Now I want to ask you about your fertility (maternal) history. Some of these you may have told me about but I do like to ask you about them again to be sure I have all the information correctly.

108 Have you any children who are now living with you ?

Yes _____

How many ? _____ of these, how many

Are boys ? _____, how many are girls? _____

No _____ (write 0)

109 Have you any children who are living elsewhere (including any who are now grown up and married)

Yes _____

How many ? _____ of these, how many

are boys ? _____ how many girls ? _____

No _____ (write 0)

110 Have you ever given birth to any children who later died (even if they lived for only a short time) ?

Yes _____

How many ? _____ of these, how many were boys ?

_____ how many girls ? _____

No _____ (write 0)

111 Total _____ Now ask: Just to make sure I have this right,

you have had _____ births. Is that correct?

If no, probe and correct as necessary

If at least 1 birth, continue with 112

112 Could you tell me the number of pregnancies you had so far?

_____

113 Have you ever had an abortion?

Yes_____1 No_____ 2

114 If yes, how many?

_____

115 Have you ever had a still birth ?

Yes_____ 1 No_____ 2

116 If yes, how many?

_____

III Women's (respondents) background (socio-economical)

Case No ┌┬┬┬┬┐
└┴┴┴┴┘

Identification Keftegna _____ Kebele____ House No____

Name of eligible _____

We have talked about your maternal history and now I would like to ask you more about your life and home.

117 How old are you ?

_____ Years

(Record the best estimate)

118 Can you tell me the date of your birth ?

Day or saints day ☐☐

Month ☐☐☐

Year ☐☐☐☐

Don't Know _____

119 What is your marital status now ?

married _____ 1 Divorced _____ 3

Widowed _____ 2

120 Are you able to read and write ?

Yes _____ 1 No _____ 2

121 If yes, can you read this piece of text to me ?

(text recommended by literacy campaign department)

Reads easily _____ 1

" with difficulty ___ 2

" not at all _____ 3

122 If 1 or 2 : have you ever been to school ?

Yes _____ 1 No_____ 2

123 If yes, what was the highest level or grade you attended ?

Primary or literate (grades 1-6) 1

Junior S. (" 7-8) 2

Primary or literate (grades 1-6) 1

Junior S. (" 7-8) 2

Senior S. (" 9-12) 3

Other higher eduction 4

124 What is your occupation?

House wife full time _____1

House wife with occasional income _____ 2

Student _____ 3

Maid/cleaner _____ 4

Clerical /typist, casher) _____ 5

Professional (nurse, sec., teacher) _____ 6

Other _____ (specify) 7

125 Do you earn an income currently ?

Yes _____ 1 No _____ 2

126 If yes, how much ?

Birr _____/Month

Now I have some questions about your present husband

127 As far as you know, can your husband read a letter or news letter ?

Yes _____ 1 No _____ 2

128 If yes, can he read a letter or news letter easily or with difficulty?

easily _____ 1 with difficulty _____ 2

129 As far as you know, did your husband ever attended school ?

Yes _____ 1 No _____ 2

130 If yes, do you have any idea what was the highest level or grade he

attended?

Primary (1-6) _____ 1

Junior (7-8) _____ 2

Secondary (9-12) _____ 3

Other higher ed._____ 4

131 What is the occupation of your husband ?

Gov. employee _____ 1

Teacher _____ 2

Trader _____ 3

Driver _____ 4

Farmer _____ 5

Daily lab. _____ 6

Others _____ 7

132 What is his monthly income ?

Birr _____ /month

133 When you were pregnant with this baby, did you ever attend antenatal clinic ?

Yes _____ 1 No _____ 2

134 If yes, how many times ?

_____

135 Where did you deliver this baby ?

Hospital _____ 1 Home _____ 3

Health Centre _____2 Other _____ 4

136 Who assisted you to deliver ?

Doctor/nurse____ 1 Relative _____ 4

TTBA _____ 2 Other _____ 5

TBA _____3 (specify)

137 Sex of the baby : Male __ 1 Female _____ 2

138 Weight of baby in gm ☐☐☐☐

In colour _____

	Name	Signature	Date
Enumerator	_____	_____	_____
Supervisor	_____	_____	_____

DECLARATION

I, the undersigned, declare that this thesis is my original work and has not been presented for a degree in this or any other University, and that all sources of material used for the thesis have been duly acknowledged.

Name Seleshi T/Mariam MD

Signature _____

Place Addis Ababa University

Date of submission 21 May 1993

This thesis has been submitted for examination with our approval as University Advisor(s).

Dr. Ahmed Ali	Dr. G.Olwit
_____	_____
Advisor	Advisor