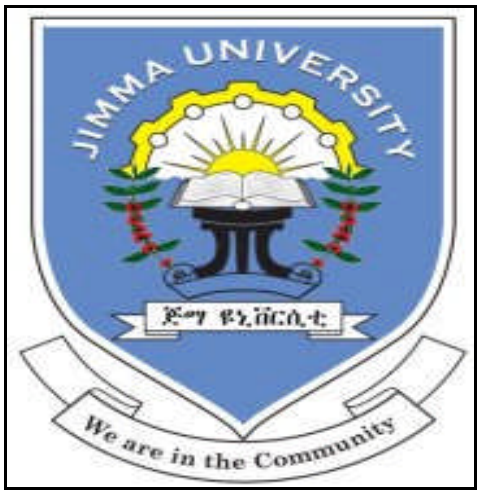

EFFECT OF PARITY ON OCCURRENCE OF SOME FETAL GROWTH INDICES AND ASSOCIATED FACTORS IN GILGEL GIBE FIELD RESEARCH CENTER, SOUTHWEST ETHIOPIA

By

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A master's thesis to be submitted to the Department of Epidemiology, College of Public Health and Medical Sciences, Jimma University; in Partial Fulfillment for the Requirement of Masters of Public Health in General MPH

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Abstract

Background:-*Studies in a number of countries have shown that wherever fertility is high maternal, infant and child mortality rates are high. In addition to this, some studies show that parity has direct effect on fetal outcomes, while other studies report that they were not sure about its effect on fetal outcomes.*

Objective:-*To assess the association between parity and fetal growth indices:-Low birth weight (LBW), Macrosomia, and Prematurity at Gilgel Gibe Field Research Center, Southwest Ethiopia.*

Methods:-*Comparative cross sectional study was conducted to assess the association between parity and fetal outcomes; low birth weight (LBW), Macrosomia and Prematurity. Information about parity, LBW, Macrosomia, Prematurity and associated factors was obtained from secondary data in Gilgel Gibe Field Research Center. Descriptive analysis and Generalized estimating equations (GEE) method was used to assess the association between parity and fetal outcomes. In the mean time crude and adjust OR, 95% CI was calculated to assess the magnitude of association in both bivariate and multivariable analysis respectively using SPSS16.*

Results:-*The study analyzed 2,487 births from a total of 2,096 mothers. Of these, 1,079 births (43.4%) were from high parity women and the rest 1,408(56.6%) were from low parity women. The newborn with the outcome of interest were 141 LBW, 522 Macrosomia and 495 premature. High parity has no association with LBW AOR=1.05(95%CI=0.63-1.75), Macrosomia AOR=0.98(95%CI=0.77-1.27) and prematurity AOR=1.01 (95%CI= 0.76-1.34), when compared with low parity. LBW was significantly associated, with maternal income, address baby born, number of live birth at a pregnancy, gestational age of the babies and year of delivery. Macrosomia was found to be significantly associated with sex of the babies and year of delivery. Similarly preterm birth had significant association with maternal age, educational status, address baby born and number of live birth.*

Conclusion:-*Fetal growth indices (LBW, macrosomia and preterm birth), were not found to be significantly associated with high parity. Further studies with similar or different study design on other important maternal factors are recommended.*

Acknowledgement

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Abbreviations

BMC	Biomed central
EDHS	Ethiopia Demographic and Health Survey
FHD	Family health department
GGFRC	Gilgel Gibe Field Research Center
IUGR	Intra uterine growth retardation
LBW	low birth weight
MoFED	Ministry of Finance and Economic Development
MOH	Ministry of health
NIH	National Institute of Health
PASDEP	A Plan for Accelerated and Sustained Development to End Poverty
SGA	Small for gestational age
TFR	Total fertility rate
UNICEF	United Nations Children's Fund
WHO	World Health Organization

1. Introduction

1.1. Background Information

Even if health reporting system is poor in developing countries, Obstetric histories should always record parity, gravidity and outcomes of all previous pregnancies as: Outcomes of previous pregnancies give some indication of the likely outcome and degree of risk with the current pregnancy. In addition to this the number of previous pregnancies and deliveries will also influence the risks associated with the current pregnancy and what is considered normal labour varies according to parity: Normal labour in a primigravida is significantly different to normal labour in multiparous women [1].

According to Federal Democratic Republic of Ethiopia Ministry of Health Maternal and Child Health Package July 2003 Addis Ababa report, it recommended the need to make close follow up and know the outcome, if the maternal parity is over five. Also, the report stated that Poverty, backwardness, malnutrition, limited access to health services and unbalanced population growth are the structural causes for the high maternal and child morbidity and mortality rates in Ethiopia [2].

Birth weight and gestational age are two very important determinants not only of disability and death among newborn infant but also of their subsequent health among well being [3]. Low birth weight has been defined by the World Health Organization (WHO) as weight at birth of less than 2,500 grams (5.5 pounds). This is based on epidemiological observations that infants weighing less than 2,500 g are approximately 20 times more likely to die than heavier babies. More common in developing than developed countries, a birth weight below 2,500 g contributes to a range of poor health outcomes. The reduction of low birth weight also forms an important contribution to the Millennium Development Goal (MDG) for reducing child mortality. Activities towards the achievement of the MDGs will need to ensure a healthy start in life for children by making certain that women commence pregnancy healthy and well nourished, and go through pregnancy and childbirth safely. Low birth weight is therefore an important indicator for monitoring progress towards these internationally agreed-upon goals [4].

As different web site report the term macrosomia is used to describe a very large fetus or a neonate. According to obstetrical practice weight more than 4 kgs is taken as large baby. Different countries use their own criteria to define macrosomia. According to American college of obstetricians and gynecologists it is 4500 gms or more. Not all mothers who have delivered Macrosomic babies will show risk factors. Only 40% of women with Macrosomic fetuses will show some risk factors like: maternal diabetes mellitus, familial, multiparity, prolonged pregnancy, in elderly mothers, male fetus, previous Macrosomic baby, ethnicity and weight gain of the mother. Macrosomia increases maternal morbidity due to: chances of prolonged labor leading to infections, operative deliveries and injuries to the genital tract. In neglected cases even uterine rupture may occur leading to maternal mortality. In addition to this postpartum hemorrhage can occur due to either atonicity because of excessive distension of uterus or traumatic due to operative interference [5].

Few countries have reliable national preterm birth prevalence data. Globally, an estimated 13 million babies were born before 37 completed weeks of gestation annually. Rates were generally highest in low- and middle-income countries, and increasing in some middle- and high-income countries, particularly the Americas. Preterm birth is the leading direct cause of neonatal death (27%); more than one million preterm newborns die annually. Preterm is also the dominant risk factor for neonatal mortality, particularly for a death due to infections with Long-term impairment is an increasing issue [6].

According the study report showed, short gestation (preterm birth) is the main cause of death, morbidity and disability. As result of shorter the gestation, the smaller the baby and higher the risk of death, morbidity and disability. It has been shown that the mortality range can vary 100-fold across the spectrum of birth weight and rises continuously with decreasing weight [7]. Preterm birth occurs in about 5% to 10% of all births in resource-rich countries, but in recent years the incidence seems to have increased in some countries, particularly in the USA. We found little reliable evidence for incidence in resource-poor countries. The rate in northwestern Ethiopia has been reported to vary from 11% to 22%, depending on the age group of mothers studied, and was highest in teenage mothers [8].

1.2. Statement of the problem

Always talking, searching and reporting about maternal and child mortality are becoming a routine activity in developing countries including Ethiopia. The situation is made more complex by the high prevalence, in the population, of infectious and communicable diseases as well as malnutrition in the countries. Beside this the health reporting system of most developing countries is also poor which directly hinder the identification of the causes of poor birth outcomes. For example the 2011 EDHS questionnaire recorded birth weight, if available from written records or mother's recall, for all births in the five years preceding the survey. Due to birth weight may not be known for many babies, and particularly for babies delivered at home and not weighed at birth, the mother's estimate of the baby's size at birth was also obtained [9]. It is clear that using subjective, mothers' estimates can directly affect the validity using this invalid data affects the identification of the real association of factors with poor birth outcomes.

Low birth weight is associated with fetal and neonatal morbidity and mortality, impaired cognitive development, and the advent of chronic diseases in later life. The incidence of preterm birth is increasing, particularly in developed countries such as Canada. The reported rate of low birth weight births in Canada was 5.9% in 2003; an increase from the 2001 rate of 5.5%. While the rising incidence of multiple births has been cited as the main contributor to this trend, there are many other interrelated factors that play a role. Low birth weight and preterm births are indicators of potential lifelong Consequences to individuals, families, and communities at large. The incidence of low birth weight is higher in the developing world compared to the developed world; however, the incidence is on the rise in the developed world [10].

Similarly addressing the low birth weight burden of disease would contribute significantly towards the MDG for reducing child mortality. Moreover, it has been shown that low birth weight could predispose individuals to cardiovascular risk factors, such as hypertension, diabetes and obesity. Thus, the infant born with a birth weight under 2500g could be an 'at risk' individual for life! [11]

Preterm birth is an important perinatal health problem across the globe. Developing countries, especially those in Africa and southern Asia, incur the highest burden in

terms of absolute numbers, although a high rate is also observed in North America. A better understanding of the causes of preterm birth and improved estimates of the incidence of preterm birth at the country level are needed to improve access to effective obstetric and neonatal care [12].

National Institutes of Health reports as there is no information from previous pregnancy outcomes to guide assignment of risk or mitigating interventions, adverse pregnancy outcomes in nulliparous are especially unpredictable. At least 12% of nulliparous women will have a preterm delivery, with associated higher rate of neonatal mortality and long term morbidity. Premature birth is highlighted as a critical area and one that needed novel approaches for the future including more focus on the etiology of preterm birth taking into consideration. As National Institutes of Health concluded, prematurity remains the major challenge facing researchers who work in the field of reproductive health and pregnancy, with broad ramifications. While extensive research is currently underway, few successful interventions have been identified. Additionally National Institutes of Health recommend, the future research efforts should focus on identifying the causative factors for preterm birth, and its prevention [13].

Even if the report shows in 2009/10 the under-five mortality rates and infant mortality rates decreased to 101/1000 and to 45/1000 live births respectively still the attention should be given to Prematurity/low birth weight which accounts 17% of the major cause of infant mortality, to realize this country dream, taking measure on exacerbating factor is one strategy to reduce morbidity and mortality. Early marriage, early pregnancy and low levels of family planning, short spacing between births is reported as one of the factors, which exacerbate the problem [14]. Also a Plan for Accelerated and Sustained Development to End Poverty supports the close association of large family size, with its high dependency ratio, and poverty. It is to be noted that total fertility rate is higher in the rural (6.0) than urban areas (2.4). As a result, burden of poverty is higher in the rural people of Ethiopia, so that the threat to the socioeconomic development of the country is too higher [15].

So identifying the major associated factors of the cause of problem is the first step to find solution, So that this research assessed the effect of maternal Parity on fetal outcomes (low birth weight, preterm and macrosomia).

2. Literature Review

Studies in a number of countries have shown that wherever fertility is high maternal, infant and child mortality rates are high. In addition to this, fetal deaths, low weight at birth and related problems are also associated with unregulated fertility. High parity is one of the predisposing causes of obstetrical complications for such as post partum hemorrhage. So by preventing high parity using FP we save children's life by helping women space births and LBW, infant malnutrition and mortality rates is reduced [16].

As the survey collected information from a nationally representative sample of 15,367 women age 15-49 as part of the follow up to the 2000 Ethiopian Demographic and Health Survey showed, high parous women were 50% less likely to receive delivery care in health institution than parity one women [11]. But EDHS 2011 report shows that on average, Ethiopian women attain a parity of 7.3 children per woman by the end of their childbearing years which was considered as high parity in this study. Also women age 40 or older have much higher parities, with substantial proportions having 10 or more births each by the end of their childbearing years [9]. Which indicates as high fertility is still one problem of the country.

Now a day studies are reporting contradictory findings about the association of birth weight and gestational age of the newborn with different maternal factors such as parity. Additionally they recommended further investigation to assess other associated factors. According to a cross-sectional descriptive study carried out at four health centers and Jimma University hospital report, A total of 145 (22.5%) of the newborns were LBW. Urban setting mothers had higher risk of delivering LBW babies and the difference was statistically significant ($p = 0.00$). Also the study revealed that those mothers who delivered before 37 weeks of gestation had higher risk of delivering LBW babies and the difference was statistically significant ($p = 0.01$) Similarly, mothers had multiple gestations had a higher risk of delivering LBW babies, the difference was statistically significant ($p = 0.00$) [17]. A retrospective study conducted at Tikur Anbessa Teaching Hospital report the overall proportion of LBW is 8.4% [18]. This is lower than Jimma report. WHO reported the prevalence of LBW in Ethiopia, estimated at 14%, as one of the highest in the world [19].

In addition to the local and national studies report, different African countries also reported the associated factors with poor fetal outcomes. According to a descriptive retrospective cross - sectional study done in Tanzania using existing data report, LBW was strongly associated with gestational age below 37 weeks (OR = 2; CI=1.5, 2.8) contributing to 42% of LBW deliveries in the study population, also mothers without formal education were 4 times more likely to give birth to LBW neonates than those who had attained higher education (OR= 3.6; 2.2, 5.9) [20].

Also a Cross-sectional Retrospective study which carried out in Catholic Hospital, Nigeria on 200 women, reported the gestational age was found to have effect on the birth weight of the baby ($p<0.05$), but as the sex of the baby has no significant relationship with birth weight and length of gestation ($p>0.05$) [21].Similarly according to cross-sectional study carried out at tertiary care hospital among 350 mothers delivering live born neonate report the prevalence of LBW (76.5% vs 31.4%) were higher among mothers with gestational age of (<37 Vs $\geq$ 37 weeks) and this association was statistically significant ($p<0.0000$). In contrast to the above studies the proportion of LBW was decreased with increased parity [22].

In contrast to the above, studies done in European countries reported slightly different report. According to study done in Spain reported primiparous women were at significantly higher risk of having low birth weight babies when compared with multiparous, also showed as besides late maternity and primiparity also Caesarean section increases the risk for low birth weight [23]. According to case-control study done in western Maharashtra, India which reported as maternal parity has no association with LBW babies OR=1.45(95%CI=0.94-2.21)[24]. Similarly demographic research done in 32 sub-Saharan countries concluded as high parity may lead to various adverse outcomes for Africa families, but as low birth weight appears not to be among these outcomes [25].

According to, a cohort study done in the urban community of Indian on the 210 pregnant women reported that the LBW prevalence was 30.3% and significantly associated with low socioeconomic status (OR-3.96), but in contrast to other studies the association of short birth interval (OR-3.84), and primiparity (OR-1.58) with LBW was also reported [26].

Only few studies assess the geographical effect on fetal outcomes, According the record reviewed study done in Canada report, living in rural areas was associated with LBW with the OR=1.15 (95%CI=1.05-1.26), the difference was statistically significant [27].

In contrast to the above studies, but similarly with Indian and Spain studies, a hospital-based study of birth outcomes in Liverpool done reports the prevalence of LBW was significantly higher for primiparous women compared with multiparous (9.4% vs. 5.3%, p=0.005). But there were no differences between these parity groups for gestational age or prevalence of preterm birth [28].

Even though the prevalence of macrosomia is increasing with economic development urbanization in the world, there is limited studies are found, to report its impact on the maternal and fetal health. But web site is the only informal reference that reports as only 40% of women with macrosomic fetuses will show some risk factors, and as macrosomia increases maternal morbidity due to: chances of prolonged labor leading to infections, operative deliveries and injuries to the genital tract. According to population-based retrospective cohort study conducted in Arab country reported, low parity (<5), high parity (≥5) was found to be associated with less risk of LBW ([RR] =0.76; [95%CI]:0.44–1.1) and Prematurity (RR = 0.82; 95% CI: 0.54–1.27), but greater risk of macrosomia (RR = 1.8; 95% CI: 1.2–2.4) [29].

In addition to the above, as the prospective case-control study done in the two university hospitals of Tehran reported, macrosomia was significantly more frequent with grandmultiparity than nulliparity. Also, study revealed that the history of previous Macrosomic baby is ten times higher in the Macrosomic birth [30]. Williams Obstetrics book twenty second edition also reports as maternal diabetes and multiparty are an important risk factor for development of fetal macrosomia.

In National Institutes of Health (NIH) report, premature birth is highlighted as a critical area and one that need novel approaches for the future, including more focus on the etiology of preterm birth taking into consideration. Also NIH concluded, as prematurity remains the major challenge facing researchers who work in the field of reproductive health and pregnancy, with broad ramifications. While extensive research is currently underway, few successful interventions have been identified. Finally NIH recommend, as the future research efforts should focus on identifying the causative factors for preterm birth, and its prevention [13].

In addition to NIH recommendation, different studies are reporting contradictory findings about the association of maternal parity and preterm birth. According to across sectional study conducted, in Addis Ababa health facility on 1339 mothers, report a preterm birth was occurred in 7.1% of the cases. Also report as mothers of the age group >35 Vs unable to read and write has the highest proportion of preterm delivery 18(11%) Vs 26(9%) , respectively. But the variations are not statistically significant [31]. Population-based retrospective cohort study conducted in Arab country report, as prematurity was not significantly associated with high parity (≥5) with (RR = 0.82; 95% CI: 0.54–1.27) [29]. A prospective cohort study in Pakistan reported as preterm birth was not significantly associated with higher parity (OR=4.21 95%CI 0.91 - 19.53), past delivery of a male infant, and higher levels of paternal education [32].

In contrast to the above finding, A comparative cross sectional study which done in the Qom Hospitals, Iran showed the significant relationship between maternal parity and premature delivery (p-value < 0.04). Additionally report the frequency of preterm and term delivery among live births was 5.6%, and 64% in women had low socio-economic status, respectively. This difference was also statistically significant (p-value= 0.000) [33].Similarly the literature review report on determinants of preterm/LBW/SGA/IUGR births, reported as maternal parity is one determinant, and the problem of preterm/LBW/IUGR/SGA births is multifactorial [34].

As the prospective study done in Shariati Hospital; Tehran, Iran reported the incidence of low birth weight of the newborns was significantly higher for pre-term babies (P < 0.001) [35]. Also, a register-based cohort study done in North western region of England, reported teenage mothers were at increased risk of preterm birth compared to adult mothers and as this risk increased in the second time pregnancy (OR=1.93 95%CI: 1.38-2.69) [36]. Additionally, register-based study in Italy reported as women with no more than 8 years of education were 1.76 times more likely to have preterm delivery than women with high educational level with p-value<0.05 [37].

As different studies reported above the effect of parity and other associated factors on birth outcome looks contradictory. Some studies show as parity has direct effect on fetal outcomes, while others report as parity has no effect on fetal outcome and also as they are not sure about the effect of parity on fetal outcomes. So, this research has contributes its own findings.

Conceptual framework for the study

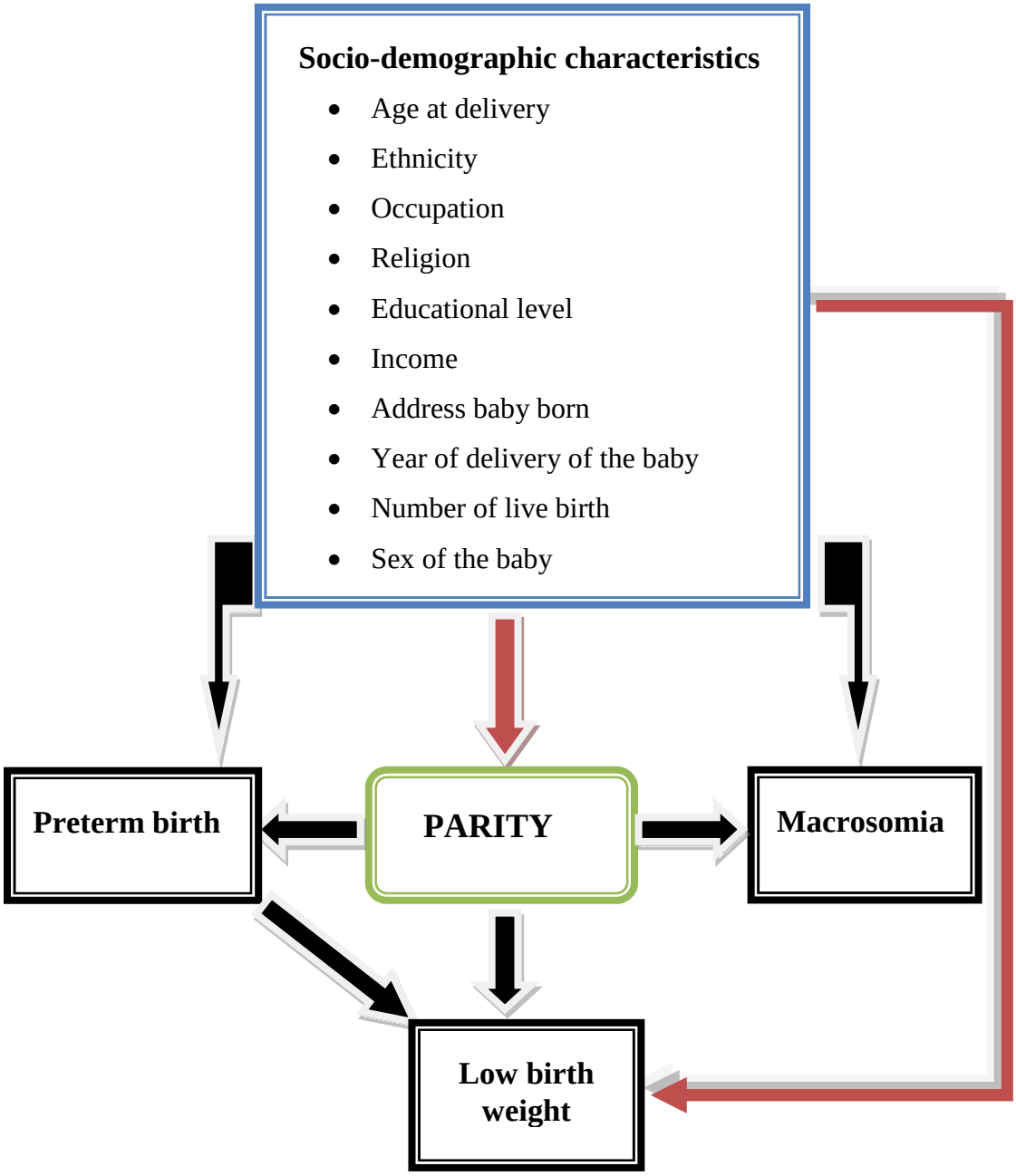

Figure 1- Conceptual framework developed after literature review.

Significance of the Study

Even though the use of modern technology allows survival of many neonates in developed countries, due to the economic scarcity in the developing countries, such care is unthinkable. Thus, identifying the major determinants or the cause of problem is the first step to find solution. The development of preventive strategies will also depend on a better understanding of the etiology.

Beside this, different studies report, about the effect of parity and other associated factors on fetal outcome is contradictory. Some studies report as parity has direct effect, while others say that it has no effect and the rest report as they are not sure about the effect of parity on fetal outcomes.

Additionally, since health reporting system of our country is poor, for example, only 5 percent of children in Ethiopia are weighed at birth. Because the majority of births do not take place in a health facility, and children are less likely to be weighed at birth in a non-institutional setting [9], it is clear that using subjective, mothers' estimates can directly affect the validity of the data. Using invalid data affects the identification of the real association of factors with poor birth outcomes. So, to get adequate and valid measurement of fetal outcome directly collected from community, the Gilgel Gibe Field Research Center record is used for this study.

Based on the above assumption, the purpose of this study is to assess the association between maternal parity and fetal outcomes, additionally to assess other associated factors that might affect fetal outcome. Finally the result of this study will improve the understanding of the associated factors of fetal outcome, and will also contribute to build up preventive strategies.

3. Objectives

3.1. General Objective

- To assess the association between parity and fetal growth indices (Low birth weight, Macrosomia and Prematurity) at Gilgel Gibe Field Research Center, Southwest Ethiopia.

3.2. Specific objectives

- To assess the association between parity and Low birth weight (LBW) at Gilgel Gibe Field Research Center.
- To assess the association between parity and Macrosomia at Gilgel Gibe Field Research Center**.**
- To assess the association between parity and Prematurity at Gilgel Gibe Field Research Center.
- To identify the associated socio-demographic factors with fetal growth indices at Gilgel Gibe Field Research Center.

4. Methods

4.1. Study area and period

The study was conducted in Gilgel Gibe Field Research Center (GGFRC) from Jan, 2006-Sep, 2010 which serves as health and demographic surveillance site for Jimma University. The center comprises of 8 rural and two urban kebeles (the lowest administrative unit in Ethiopia). A population of 50,000 resided in the area. The center is located in Southwestern Ethiopia, Jimma zone, around Gilgel Gibe Hydroelectric dam, 260 km southwest of Addis Ababa and 55 km Northeast of Jimma town [38].

4.2. Study design

Comparative cross sectional study based on recorded data of the GGFRC was employed.

4.3. Source population

All parous women in child bearing age (15-49) and whose records were available at research center for five years (2006-2010).

4.4. Study Population

All parous women in child bearing age (15-49) and whose records were available at research center for five years (2006-2010) that fulfilled inclusion criteria.

4.5. Inclusion and exclusion criteria

❖ **Inclusion-**All parous women in child bearing age (15-49) whose neonates gestational age and birth weight was fully recorded and available at research center were included in the study.

❖ **Exclusion**-All parous women in child bearing age (15-49) whose neonates' gestational age less than 28 weeks and/or birth weight less than 1000 g was excluded.

4.6. Sample size and technique

All parous women in child bearing age (15-49) and whose record were available at research center from (Jan, 2006-Sep, 2010), 2,487 births were included.

4.7. Data collection procedures

Recorded (secondary data) of parity, low birth weight, macrosomia, prematurity and associated factors, which were collected by Gilgel Gibe Field Research Center from Jan, 2006-Sep, 2010 were used.

4.8. Study variables

- **Dependent variables**- Low birth weight, Macrosomia, Preterm birth

- **Independent variables**- **Maternal parity**, **Socio-demographic and fetal characteristics** like:-Maternal age at delivery, ethnicity, occupation, religion, educational level, income, address the baby born, Year of delivery of the baby, No of live birth, Sex of the baby.

4.9. Data analysis procedures

The data were edited and coded in the SPSS Version 16. Descriptive analysis such as frequencies and proportions were computed. The association between the independent and outcome variables was first investigated using bivariate analysis. Those variables with p value ≤0.25 were included into multivariable analysis to determine the predictor variables for the outcome variables. Finally further analyses were carried out using multivariable analysis at significance level of p-value ≤ 0.05.

In the process of analyses the effect of factors on low birth weight were assessed after categorizing neonatal birth weight in to low birth weight (LBW) and normal birth weight, by excluding macrosomia. Then LBW was coded as “one”, while normal birth weight was coded as “zero” which was assigned as a reference group. In the same manner the effect of factors on macrosomia were assessed by using normal birth weight, as a reference group and excluding LBW. Finally the effect of factors on prematurity were assessed after categorizing neonatal gestational age in to premature baby and normal date delivered baby, then prematurity was coded as “one”, while normal was coded as “zero” which was assigned as a reference group.

In both bivariate and multivariable analysis generalized estimating equations method with a link function “Logit”, subject effect ”Individual child id” within-subject effect “Individual maternal id” and working correlation matrix structure ”Exchangeable” was used to assess the association between parity and fetal outcomes.

In the mean time crude OR, 95% CI and adjust OR, 95% CI was calculated to assess the magnitude of association in both bivariate and multivariable analysis respectively.

Generalized estimating equations method was used due to the nature of the recorded data correlated to each other as a result of the possibility, that a mother could have more than one child leading children having similar maternal characteristics. In addition to the above this analysis method was preferred over ordinary logistic regression model because of its ability to provide a method of inference for a wide variety of models when responses are correlated. Factor analysis was also used to create a common maternal income variable from a given other four scaled maternal income variables.

Individual fetal outcomes, rather than women, were the unit of analysis for this study. Outcomes of interest were: LBW= ≤2.5 kg, macrosomia= ≥4 kg, and Prematurity= ≤37 weeks of gestation. Finally, the outputs were presented using tables, and graphs and all statistical analyses were performed using SPSS Version 16.

4.10. Data quality management

The principal investigator checked completeness of the secondary data before and during analysis of the data. In the mean time extreme, missing and outlier values were cross checked with hardcopy data of the center.

4.11. Ethical consideration

Before obtaining secondary data from Gilgel gibe field research center, ethical clearance was obtained from Ethical Review Board of Jimma University, College of Public Health and Medical Sciences. Then formal support letter was sent to Gilgel Gibe Field Research Center. Finally the data were used only for the study purpose and kept confidentially in a safe place.

4.12. Dissemination plan

The results of this study will be presented to Department of Epidemiology, College of Public Health and Medical Sciences, Jimma University. After having secured approval from the Department, it will be communicated to Federal Ministry of Health, Oromia Regional Health Bureau, Jimma Zone Health Department, all District Health Offices of the Zone and other concerned bodies through reports.

The findings will also be disseminated to different organizations that have a contribution to improve the status of maternal and child health in the region. The findings will also be presented in various seminars and workshops. Efforts will be made to publish the findings in a reputable journal.

4.13. Operational definitions

- **Birth weight-** Was calculated from the baby's weight measured during the first seven days of life by using the following assumptions.

  - ✓ The term neonates lose 1-3% of their birth weight daily with a cumulative loss of 5-10%, while preterm neonates lose 2-3% of their birth weight daily with a cumulative loss of 15-20% in the first week of life. Failure to lose weight in the first week of life should be an indicator for fluid restriction, however excessive weight loss would be non-physiological [39]. And gender, maternal education and parity have no any effect on the neonatal birth weight reduction in the first days of life [40].

- **Low birth weight-** Newborn weighing ≥ 1000 g and < 2,500 g and who have achieved a gestational age of 28 weeks or more.

- **Macrosomia-** Newborn weighing heavier than 4000g and who have achieved a gestational age of 28 weeks or more.

- **Parity**- the number of times that the Mother has given live births to a fetus.

- **High parity**- a woman who has already delivered five or more infants with a gestational age of 28 weeks or more.

- **Low parity**- a woman who has already delivered less than five infants with a gestational age of 28 weeks or more.

- **Preterm or premature birth-** Neonates who were born ≥ 28 weeks and before 37 completed weeks of gestation.

- **Fetal growth indices-**The fetal growth indicators like Low birth weight, Macrosomia and Prematurity [29].

5. Results

5.1. Socio-demographic characteristics of low and high parity women

A total of 2,487 births were enumerated of which 1,079(43.4%) and 1,408(56.6%) were HP (high parity) and LP (low parity) respectively. **Table1-** shows the socio-demographic characteristics of the study participants.

Majority of LP 654(46.4%) and HP 435(40.3%) women were found in the 20-24 and 25-29 age groups. The majority of both low parity and high parity mothers were housewives 1,012(71.9%) Vs 790 (73.2%), Muslim by religion 1,229(87.3%) Vs 1,028(95.3%), Illiterate 1,051(74.6%) Vs 933(86.5%), gave birth at rural 1,082(76.8%) Vs 960(89.0%), and Oromo by ethnicity 1,292(91.8%) Vs 1,043(96.7%) , respectively.

Women who gave one live births in a pregnancy and gave male birth were the dominant 1,381(98.1%) Vs 1,044(96.8%) and 753(53.5%) vs 544(50.4) in both low parity and high parity group respectively [**Table 1**].

Table 1- Socio-demographic characteristics of the study participants in Gilgel gibe field research center records from Jan, 2006-Sep, 2010.

Variables		Total	low parity No (%)	high parity No (%)
Maternal age at delivery	15-19	201	201(14.3)	-
	20-24	757	654(46.4)	103(9.5)
	25-29	846	411(29.2)	435(40.3)
	30-34	441	110(7.8)	331(30.7)
	35-49	242	32(2.3)	210(19.5)
Maternal occupation	House wife	1,802	1,012(71.9)	790(73.2)
	Farmer	547	272(19.3)	275(25.5)
	Others	138	124(8.8)	14(1.3)
Maternal religion	Muslim	2,257	1,229(87.3)	1,028(95.3)
	Orthodox	147	111(7.9)	36(3.3)
	Protestant	83	68(4.8)	15(1.4)
Maternal educational level	Illiterate	1,984	1,051(74.6)	933(86.5)
	Can read and write	113	58(4.1)	55(5.1)
	Primary	332	250(17.8)	82(7.6)
	2^{dry} and above	57	49(3.5)	8(0.7)

Maternal overall income	very good	440	231(18.9)	209(21.2)
	Good	438	247(20.2)	191(19.4)
	Moderate	461	246(20.1)	215(21.8)
	Poor	447	272(22.2)	175(17.8)
	very poor	422	227(18.6)	195(19.8)
Address baby born	Rural	2,042	1,082(76.8)	960(89.0)
	Urban	445	326(23.2)	119(11.0)
Maternal ethnicity	Oromo	2,335	1,292(91.8)	1,043(96.7)
	Others	151	115(8.2)	36(3.3)
No of live birth	Singleton	2,425	1,381(98.1)	1,044(96.8)
	Twins	62	27(1.9)	35(3.2)
Sex of the baby	F	1,190	655(46.5)	535(49.6)
	M	1,297	753(53.5)	544(50.4)
Year of delivery of the baby	2006	540	352(25.0)	188(17.4)
	2007	492	282(20.0)	210(19.5)
	2008	467	291(20.7)	176(16.3)
	2009	597	302(21.4)	295(27.3)
	2010	391	181(12.9)	210(19.5)

Note: In the maternal religion, the figure of catholic and others were zero, so that any conclusion made here was not executed for them.

5.2. Proportion of birth outcome by maternal parity status

In the **figure 2**-below, the proportion of LBW (5.3% Vs 6.0%) with overall proportion of 5.7%, and prematurity (16.9% Vs 22.2%) with overall proportion of 19.9% were lower in high parity women when compared with low parity women, but the proportion of Macrosomia (21.8% Vs 20.4%) with over all proportion of 21.0% was higher in high parity women when compared with low parity women **[Figure 2]**.

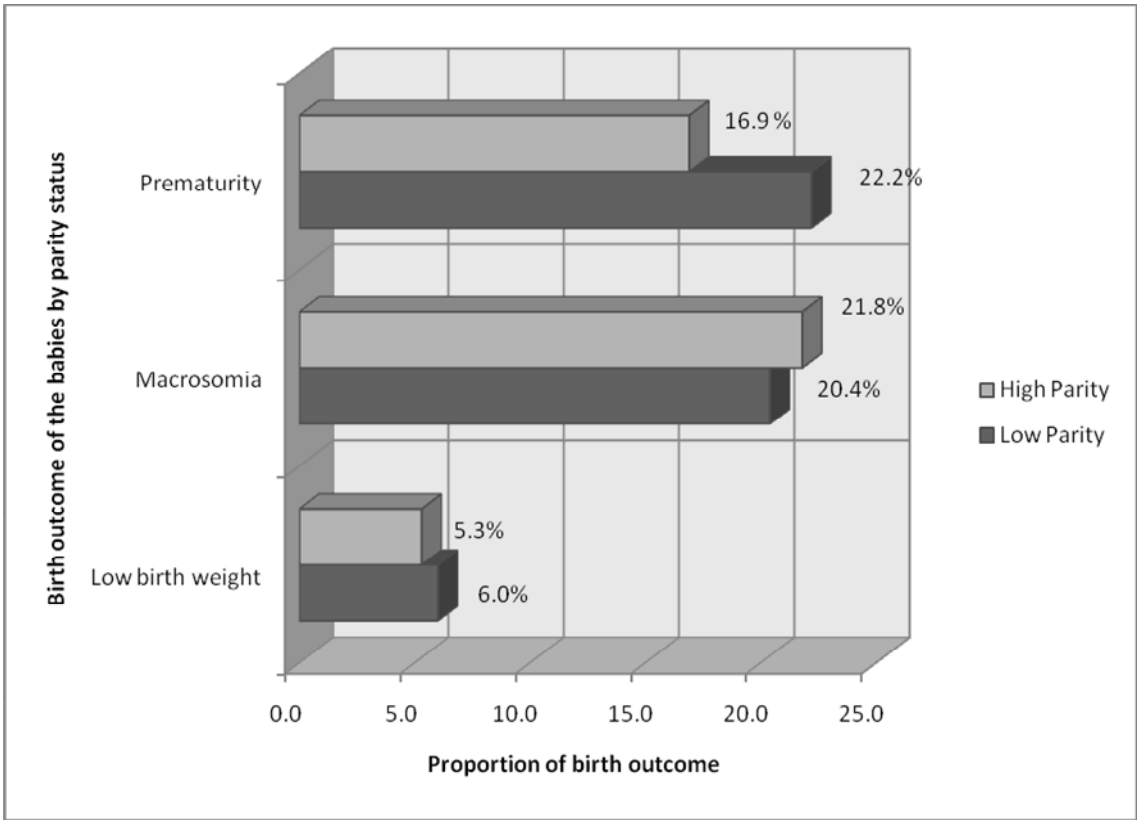

Figure 2- Proportion of birth outcome of the babies by parity status in Gilgel gibe field research center records from Jan, 2006-Sep, 2010.

5.3. Factors associated with low birth weight

In the **table 2**-below, maternal age at delivery, income, address where baby born, No of live birth, Sex of the baby, gestational age of the babies and year of delivery of the baby were found to be associated with low birth weight of the babies in the bivariate analysis. All those factors that turned out to be associated with LBW at the level of p-value ≤ 0.25 were selected for multivariable analysis. `

Table 2- Bivariate generalized estimating equations analysis on associated factors for low birth weight fetal outcome among parous women in child bearing age in Gilgel gibe field research center records from Jan, 2006-Sep, 2010.

	Low birth weight		
Variables	**No** =1824	**Yes** =141	**COR(95% CI)**
Parity dichotomous(1965)			**P-value=0.53**
LP	1037(92.5)	84(7.5)	1.00
HP	787(93.2)	57(6.8)	0.89(0.63,1.27)
Maternal age at delivery (1965)			**P-value=0.07**
15-19	151(88.8)	19(11.2)	1.00
20-24	564(93.1)	42(6.9)	0.59(0.33,1.05)
25-29	603(93.5)	42(6.5)	0.55(0.31,0.98)
30-34	327(94.8)	18(5.2)	0.44(0.22,0.86)
35-49	179(89.9)	20(10.1)	0.89(0.46,1.73)
Maternal ethnicity (1964)			**P-value=0.35**
Oromo	1710(92.7)	135(7.3)	1.00
Others	113(95)	6(5)	0.67(0.29,1.56)
Maternal occupation(1965)			**P-value=0.29**
House wife	1296(92.8)	101(7.2)	1.00
Farmer	425(93.8)	28(6.2)	0.85(0.55,1.30)
Others	103(89.6)	12(10.4)	1.50(0.80,2.81)

Maternal religion(1965)			**P-value=0.78**
Muslim	1649(92.7)	130(7.3)	1.00
Orthodox	110(94)	7(6)	0.81(0.37,1.77)
Protestant	65(94.2)	4(5.8)	0.78(0.28,2.18)
Maternal educational level (1964)			**P-value=0.53**
Illiterate	1452(92.5)	118(7.5)	1.00
Can read and write	80(92)	7(8)	1.08(0.49,2.38)
Primary	246(95)	13(5)	0.65(0.36,1.17)
Secondary and above	45(93.8)	3(6.3)	0.82(0.25,2.68)
Maternal overall income (1752)			**P-value=0.15**
very good	326(94.8)	18(5.2)	1.00
Good	325(95.6)	15(4.4)	0.83(0.41,1.68)
Moderate	332(92)	29(8)	1.58(0.86,2.90)
Poor	322(91.5)	30(8.5)	1.68(0.92,3.08)
very poor	331(93.2)	24(6.8)	1.31(0.69,2.46)
Address baby born (1965)			**P-value=0.008**
Rural	1490(92.1)	128(7.9)	1.00
Urban	334(96.3)	13(3.7)	0.45(0.25,0.81)
No of live birth(1965)			**P-value=0.001**
Singleton	1794(94.3)	109(5.7)	1.00
Twins	30(48.4)	32(51.6)	17.55(10.28,29.95)
Sex of the baby(1965)			**P-value=0.09**
F	890(91.8)	79(8.2)	1.00
M	934(93.8)	62(6.2)	0.74(0.53,1.05)

GA of the baby(1965)			**P-value=0.001**
normal(>=37)	1451(94.1)	91(5.9)	1.00
prematurity(<37)	373(88.2)	50(11.8)	2.13(1.48,3.07)
year of delivery of the baby (1965)			**P-value=0.001**
2006	394(85.7)	66(14.3)	1.00
2007	351(94.1)	22(5.9)	0.37(0.22,0.61)
2008	346(94.8)	19(5.2)	0.32(0.19,0.55)
2009	442(95.1)	23(4.9)	0.31(0.19,0.50)
2010	291(96.4)	11(3.6)	0.22(0.11,0.43)

NB. P≤0.25 was used as selection criteria for multivariable analysis (AOR)

In the **table 3-** below, maternal income, address baby born, number of live birth, gestational age of the babies and year of delivery of the baby had shown significant association, but age of the mother at delivery of the baby and sex of the baby were not significantly associated with low birth weight when entered in to multivariable analysis at significance level of p-value ≤ 0.05.

In this study, mothers who were categorized in poor income status were two times more likely to give low birth weight babies than those with very good income status. Mothers who gave birth at urban area were less likely to give low birth weight babies than the mothers who gave birth at rural area. On the other hand women who gave two live births in a pregnancy (twins) were more than 25 times more likely to give LBW babies than women who gave one live births in a pregnancy and women who gave birth prior to expected date of delivery were more than two times more likely to give LBW babies than those who delivered during the expected date. Similarly women who experienced birth in 2006 were more likely to give LBW babies than who experienced birth after 2006 when compared with normal birth weight by excluding macrosomia [**Table 3**].

Table 3- Multivariable generalized estimating equations analysis on associated factors for low birth weight fetal outcome among parous women in child bearing age in Gilgel gibe field research center records from Jan, 2006-Sep, 2010.

	Low birth weight		
Variables	**No** =1824	**Yes** =141	**AOR(95% CI)**
Maternal age at delivery (1965)			
15-19	151(88.8)	19(11.2)	1.00
20-24	564(93.1)	42(6.9)	0.99(0.49,2.02)
25-29	603(93.5)	42(6.5)	0.71(0.35,1.46)
30-34	327(94.8)	18(5.2)	0.57(0.24,1.34)
35-49	179(89.9)	20(10.1)	1.15(0.49,2.71)
Maternal overall income (1752)			
very good	326(94.8)	18(5.2)	1.00
Good	325(95.6)	15(4.4)	0.89(0.39,2.01)
Moderate	332(92)	29(8)	1.64(0.81,3.31)
Poor	322(91.5)	30(8.5)	2.09(1.03,4.24)*
very poor	331(93.2)	24(6.8)	1.31(0.65,2.67)

Address baby born (1965)			
Rural	1490(92.1)	128(7.9)	1.00
Urban	334(96.3)	13(3.7)	0.39(0.21,0.75)**
No of live birth (1965)			
Singleton	1794(94.3)	109(5.7)	1.00
Twins	30(48.4)	32(51.6)	25.72(13.17,50.24)**
Sex of the baby (1965)			
F	890(91.8)	79(8.2)	1.00
M	934(93.8)	62(6.2)	0.72(0.47,1.09)
GA of the baby (1965)			
normal(>=37)	1451(94.1)	91(5.9)	1.00
prematurity(<37)	373(88.2)	50(11.8)	2.49(1.55,4.02)**
Year of delivery of the baby (1965)			
2006	394(85.7)	66(14.3)	1.00
2007	351(94.1)	22(5.9)	0.27(0.14,0.51)**
2008	346(94.8)	19(5.2)	0.27(0.15,0.52)**
2009	442(95.1)	23(4.9)	0.20(0.11,0.38)**
2010	291(96.4)	11(3.6)	0.23(0.11,0.49)**

NB. *P≤0.05, **P≤0.01 was considered as statistically significant.

5.4. Factors associated with macrosomia

In the **table 4**-below the bivariate analysis showed maternal age at delivery, occupation, income, Sex of the baby and year of delivery of the baby, were associated with macrosomia. But factors that were associated with macrosomia at p-value ≤ 0.25 were included into multivariable analysis model.

Table 4- Bivariate generalized estimating equations analysis on associated factors for macrosomic fetal outcome among parous women in child bearing age in Gilgel gibe field research center records from Jan, 2006-Sep, 2010.

	Macrosomic babies		
Variables	**No** =1824	**Yes** =522	**COR(95%CI)**
Parity dichotomous (2346)			**P-value=0.45**
LP	1037(78.3)	287(21.7)	1.00
HP	787(77)	235(23)	1.07(0.88,1.31)
Maternal age at delivery (2346)			**P-value=0.08**
15-19	151 (83.0)	31(17.0)	1.00
20-24	564(78.9)	151(21.1)	1.30(0.85,2.00)
25-29	603(75.0)	201(25.0)	1.62(1.07,2.47)
30-34	327(77.3)	96(22.7)	1.43(0.91,2.24)
35-49	179(80.6)	43(19.4)	1.17(0.70,1.95)
Maternal ethnicity (2346)			**P-value=0.95**
Oromo	1710(77.7)	490(22.3)	1.00
Others	113(77.9)	32(22.1)	0.99(0.66,1.48)
Maternal occupation (2346)			**P-value=0.01**
House wife	1296(76.2)	405(23.8)	1.00
Farmer	425(81.9)	94(18.1)	0.71(0.55,0.91)
Others	103(81.7)	23(18.3)	0.72(0.45,1.14)
Maternal religion(2346)			**P-value=0.59**
Muslim	1649(77.5)	478(22.5)	1.00
Orthodox	110(78.6)	30(21.4)	0.94(0.62,1.43)
Protestant	65(82.3)	14(17.7)	0.74(0.41,1.34)

Maternal educational level (2345)			**P-value=0.72**
Illiterate	1452(77.8)	414(22.2)	1.00
Read & write	80(75.5)	26(24.5)	1.14(0.72,1.79)
Primary	246(77.1)	73(22.9)	1.04(0.78,1.38)
Secondary and above	45(83.3)	9 (16.7)	0.70(0.34,1.45)
Maternal overall income(2092)			**P-value=0.13**
very good	326(77.3)	96(22.7)	1.00
Good	325(76.8)	98(23.2)	1.02(0.74,1.41)
Moderate	332(76.9)	100(23.1)	1.02(0.74,1.40)
Poor	322(77.2)	95(22.8)	1.01(0.72,1.38)
very poor	331(83.2)	67(16.8)	0.68(0.48,0.97)
Sex of the baby (2346)			**P-value=0.01**
F	890(80.1)	221(19.9)	1.00
M	934(75.6)	301(24.4)	1.29(1.06,1.57)
Address baby born (2346)			**P-value=0.81**
Rural	1490(77.8)	424(22.2)	1.00
Urban	334(77.3)	98(22.7)	1.03(0.80,1.32)
No of live birth (2346)			
Singleton	1794(77.5)	522(22.5)	###
Twins	30 (100)	-	
Year of delivery of the baby (2346)			**P-value=0.03**
2006	394(83.1)	80(16.9)	1.00
2007	351(74.7)	119(25.3)	1.67(1.21,2.29)
2008	346(77.2)	102(22.8)	1.45(1.04,2.01)
2009	442(77)	132(23)	1.47(1.08,2.00)
2010	291(76.6)	89(23.4)	1.50(1.07,2.11)

NB. 1. Selection criteria from bivariate (COR) to multivariate analysis (AOR) was P≤0.25.

2. ###- indicate Zero case in the macrosomia.

Table 5- Concerning factors associated with macrosomia in this study, sex of the babies and year of delivery were the only variables that significantly associated with macrosomia. In contrast maternal age at delivery, occupation and overall income were not significantly associated when entered in to multivariable analysis at p-value ≤ 0.05.

The **table 5**, also shows that those mothers who gave birth to male baby were more likely to have macrosomic babies than mothers who gave birth to female baby, and mothers who had birth from 2007-2010 were more likely to give macrosomic babies than who had birth in 2006 mothers, when compared with normal birth weight by excluding low birth weight.

Table 5- Multivariable generalized estimating equations analysis on associated factors for macrosomic fetal outcome among parous women in child bearing age in Gilgel gibe field research center records from Jan, 2006-Sep, 2010.

	Macrosomic babies		
Variables	**No** =1824	**Yes** =522	**AOR(95%C)**
Maternal age at delivery (2346)			
15-19	151(83.0)	31(17.0)	1.00
20-24	564(78.9)	151(21.1)	1.24(0.78,1.98)
25-29	603(75.0)	201(25.0)	1.41(0.89,2.24)
30-34	327(77.3)	96(22.7)	1.28(0.78,2.11)
35-49	179(80.6)	43(19.4)	1.13(0.65,1.97)
Maternal occupation (2346)			
House wife	1296(76.2)	405(23.8)	1.00
Farmer	425(81.9)	94(18.1)	0.79(0.60,1.03)
Others	103(81.7)	23(18.3)	0.74(0.43,1.27)
Maternal overall income (2092)			
very good	326(77.3)	96(22.7)	1.00
Good	325(76.8)	98(23.2)	1.03(0.74,1.42)
Moderate	332(76.9)	100(23.1)	1.03(0.75,1.42)
Poor	322(77.2)	95(22.8)	1.06(0.76,1.47)
very poor	331(83.2)	67(16.8)	0.71(0.49,1.01)
Sex of the baby (2346)			
F	890(80.1)	221(19.9)	1.00
M	934(75.6)	301(24.4)	1.29(1.04,1.59)*

Year of delivery of the baby (2346)			
2006	394(83.1)	80(16.9)	1.00
2007	351(74.7)	119(25.3)	1.67(1.17,2.37)**
2008	346(77.2)	102(22.8)	1.58(1.11,2.26)*
2009	442(77)	132(23)	1.63(1.16,2.28)**
2010	291(76.6)	89(23.4)	1.67(1.16,2.41)**

NB. *P≤0.05, **P≤0.01 was considered as statistically significant.

5.5. Factors associated with preterm birth

Concerning preterm birth, in the **table 6**-below, parity, maternal age at delivery, ethnicity, occupation, religion, educational level, income, address baby born, No of live birth and year of delivery of the baby, were found to be associated with preterm birth of the babies. But only sex of the babies was not shown an association in the bivariate analysis at selection criteria of p-value ≤ 0.25. As a result of this it was not selected for multivariable analysis.

Table 6- Bivariate generalized estimating equations analysis on associated factors for premature fetal outcome among parous women in child bearing age in Gilgel gibe field research center records from Jan, 2006-Sep, 2010.

	Premature babies		
Variables	**No** =1992	**Yes** =495	**COR(95% CI)**
Parity dichotomous (2487)			**P-value=0.001**
LP	1095(77.8)	313(22.2)	1.00
HP	897(83.1)	182(16.9)	0.71(0.57,0.86)
Maternal age at delivery (2487)			**P-value=0.001**
15-19	131(65.2)	70(34.8)	1.00
20-24	616(81.4)	141(18.6)	0.43(0.30,0.60)
25-29	677(80.0)	169(20.0)	0.47(0.33,0.65)
30-34	363(82.3)	78(17.7)	0.40(0.28,0.59)
35-49	205(84.7)	37(15.3)	0.34(0.21,0.53)
Maternal ethnicity (2486)			**P-value=0.001**
Oromo	1920(82.2)	415(17.8)	1.00
Others	71(47)	80(53)	5.21(3.72,7.30)
Maternal occupation (2487)			**P-value=0.001**
House wife	1426(79.1)	376(20.9)	1.00
Farmer	478(87.4)	69(12.6)	0.55(0.42,0.72)
Others	88(63.8)	50(36.2)	2.16(1.50,3.11)
Maternal religion(2487)			**P-value=0.001**
Muslim	1864(82.6)	393(17.4)	1.00
Orthodox	67(45.6)	80(54.4)	5.66(4.02,7.98)
Protestant	61(73.5)	22(26.5)	1.71(1.04,2.82)

Maternal educational level (2486)			**P-value=0.001**
Illiterate	1658(83.6)	326(16.4)	1.00
Can read and write	78(69)	35(31)	2.28(1.51,3.46)
Primary	228(68.7)	104(31.3)	2.32(1.79,3.01)
2^{dry} and above	28(49.1)	29(50.9)	5.27(3.09,8.97)
Maternal overall income(2208)			**P-value=0.22**
very good	354(80.5)	86(19.5)	1.00
Good	351(80.1)	87(19.9)	1.02(0.73,1.42)
Moderate	357(77.4)	104(22.6)	1.20(0.87,1.65)
Poor	374(83.7)	73(16.3)	0.80(0.57,1.13)
very poor	343(81.3)	79(18.7)	0.95(0.68,1.33)
Address baby born(2487)			**P-value=0.001**
Rural	1731(84.8)	311(15.2)	1.00
Urban	261(58.7)	184(41.3)	3.92(3.14,4.91)
No of live birth (2487)			**P-value=0.001**
Singleton	1954(80.6)	471(19.4)	1.00
Twins	38(61.3)	24(38.7)	2.62(1.56,4.41)
Sex of the baby(2487)			**P-value=0.98**
F	953(80.1)	237(19.9)	1.00
M	1039(80.1)	258(19.9)	0.99(0.82,1.22)
Year of delivery of the baby (2487)			**P-value=0.23**
2006	435(80.6)	105(19.4)	1.00
2007	402(81.7)	90(18.3)	0.93(0.68,1.27)
2008	373(79.9)	94(20.1)	1.04(0.77,1.43)
2009	460(77.1)	137(22.9)	1.23(0.93,1.64)
2010	322(82.4)	69(17.6)	0.89(0.63,1.24)

NB. Selection criteria from bivariate (COR) to multivariable analysis (AOR) was P≤0.25.

On the **table 7**- below, Even though, in the bivariate analysis maternal parity, ethnicity, occupation, income and year of delivery had significant association with preterm birth of the babies, they did not show detectable significant effect when entered into multivariable analysis. But, maternal age at delivery, religion, educational level, address baby born and No of live birth, were found to be associated with preterm birth of the babies at significance level of p-value ≤ 0.05.

Those mothers who gave birth after twenty years old were less likely to give premature babies than mothers who gave birth at the age of 15-19.Concerning maternal educational status, those mothers who reported as an illiterate were less likely to give premature babies than those mothers who can read and write and women who gave birth at urban area were more than two times more likely to give premature babies than those women who gave birth at rural area. Similarly those women who gave two live births in a pregnancy (twins) were more than three times more likely to give premature babies than women who gave single live birth at a pregnancy when compared with normal gestational age birth [**Table 7**].

Table 7- Multivariable generalized estimating equations analysis on associated factors for premature fetal outcome among parous women in child bearing age in Gilgel gibe field research center records from Jan, 2006-Sep, 2010.

Variables	Premature babies		
	No =1992	**Yes** =495	**AOR(95% CI)**
Parity dichotomous(2487)			
LP	1095(77.8)	313(22.2)	1.00
HP	897(83.1)	182(16.9)	1.01(0.76,1.34)
Maternal age at delivery (2487)			
15-19	131(65.2)	70(34.8)	1.00
20-24	616(81.4)	141(18.6)	0.45(0.30,0.69)**
25-29	677(80.0)	169(20.0)	0.57(0.36,0.88)*
30-34	363(82.3)	78(17.7)	0.52(0.31,0.85)*
35-49	205(84.7)	37(15.3)	0.48(0.27,0.85)*
Maternal ethnicity(2486)			
Oromo	1920(82.2)	415(17.8)	1.00
Others	71(47)	80(53)	1.77(1.00,3.12)
Maternal occupation(2487)			
House wife	1426(79.1)	376(20.9)	1.00
Farmer	478(87.4)	69(12.6)	0.81(0.59,1.11)
Others	88(63.8)	50(36.2)	1.59(1.00,2.54)
Maternal educational level (2486)			
Illiterate	1658(83.6)	326(16.4)	1.00
Can read and write	78(69)	35(31)	1.82(1.13,2.95)**
Primary	228(68.7)	104(31.3)	1.05(0.74,1.48)
2^{dry} and above	28(49.1)	29(50.9)	1.34(0.66,2.72)
Maternal overall income(2208)			
very good	354(80.5)	86(19.5)	1.00
Good	351(80.1)	87(19.9)	0.97(0.68,1.39)
Moderate	357(77.4)	104(22.6)	1.32(0.93,1.87)
Poor	374(83.7)	73(16.3)	1.00(0.69,1.46)
very poor	343(81.3)	79(18.7)	1.07(0.74,1.55)

Address baby born(2487)			
Rural	1731(84.8)	311(15.2)	1.00
Urban	261(58.7)	184(41.3)	2.75(2.01,3.75)**
No of live births (2487)			
Singleton	1954(80.6)	471(19.4)	1.00
Twins	38(61.3)	24(38.7)	3.21(1.82,5.65)**
Year of delivery of the baby (2487)			
2006	435(80.6)	105(19.4)	1.00
2007	402(81.7)	90(18.3)	0.90(0.62,1.30)
2008	373(79.9)	94(20.1)	1.06(0.74,1.52)
2009	460(77.1)	137(22.9)	1.14(0.81,1.61)
2010	322(82.4)	69(17.6)	0.94(0.63,1.38)

NB. *P≤0.05, **P≤0.01 was considered as statistically significant.

6. Discussion

This study provided information on the association between maternal parity and some fetal growth indices (Low birth weight, Macrosomia and Prematurity). Additionally it assessed the effect of other associated factors by using generalized estimating equations (GEE) analysis method.

In this study maternal parity was found to be HP (high parity) 1,079(43.4%) and LP (low parity) 1,408(56.6%) which was almost in similar range with the retrospective cohort study done in Oman Arab country which reported as 48.7% and 51.3% for HP and LP respectively [29**]**. In this study the proportion of high parity women, accounted almost half of the study population. This highest magnitude might be due to the highest unmet need of FP in the Oromiya region [30%] than country wide [9] or/and due to dominant number of the study population is from rural area where unmet need of FP is almost twice than urban women (28% in rural and 15%in urban) [9].

The overall proportion of LBW 5.7% was lower than 8.4% reported from Tikur Anbessa Teaching Hospital [18] and lower than nationally reported 14% [19]. This difference might be due to the study was takes place at hospital where the complicated cases are high. With regard to maternal parity and low birth weight, the proportion of LBW (5.3% Vs 6.0%) was lower in high parity women when compared low parity women respectively. But the difference was not statistically significant AOR=1.05(95%CI=0.63-1.75). This report was consistent with prevalence of LBW (8.5% in HP and 11.1% in LP) reported from Oman (29) and another study from Western Maharashtra, India (24). A demographic research done in 32 sub-Saharan countries, Pooling 60 demographic and health surveys data-sets concluded that high parity may lead to various adverse outcomes for Africa families, low birth weight appears not to be among these outcomes [25]. But this finding is not consistent with the significant relationship between maternal parity and LBW reported from cohort study conducted in urban community of Indian [26]. This inconsistency might be due to the study design difference (cross sectional vs cohort) and/or study population difference (majority rural community vs totally urban community) in this study Vs Indian study, respectively.

The proportion of Macrosomia (21.8% Vs 20.4%) with over all proportion of 21.0% was higher in high parity women when compared with low parity women. But the difference was not statistically significant AOR=0.98(95%CI=0.77-1.27). This report is consistent with the prevalence of macrosomia (2.3% in HP and 1.2% in LP) reported from Oman, but in contrast of this study the difference was statistically significant [29].

Finally the effect of maternal parity on the birth of premature babies was assessed. The proportion of prematurity (16.9% Vs 22.2%) with overall proportion of 19.9% was lower in high parity women when compared with low parity women, respectively, the difference was not statistically significant (AOR=1.01(95%CI=0.76-1.34). Also this finding is consistent with the prevalence of prematurity (3.0% in HP and 4.1% in LP) reported from Oman [29] and another study from Pakistan [32]. But this finding is not consistent with the significant relationship between maternal parity and premature delivery reported from Iran [33].

The effect of other factors on fetal growth indices (LBW, Prematurity and Macrosomia) was also assessed. Mothers who were categorized under poor income status were more than two times more likely to give low birth weight babies than those with very good income status (AOR=2.09(95%CI:1.03,4.24) [p-value≤0.05]. Low socioeconomic status may be a social determinant of other nutritional factors that may themselves be causal factors for low birth weight. This finding is consistent with the significant association of LBW with low socioeconomic status reported from urban community of Indian [26].

Mothers who gave birth at urban area were less likely to give low birth weight babies than mothers who gave birth at rural area (AOR=0.39(95%CI: 0.21, 0.75) [p-value≤0.01]. This result is consistent with the record review study done in Canada which reported as living in rural areas was associated with LBW with the OR=1.15 (95%CI=1.05-1.26) [27]. But it is inconsistent with a cross-sectional descriptive study carried out at four health centers (Jimma, Agaro, Asendabo and Shebe) and Jimma University hospital that reported mothers residing in the urban setting had higher risk of delivering LBW babies (p = 0.00) [17]. This difference might be due to the study was takes place at health facilities where the complicated cases are high and/or the urban community are dominant in number.

This study showed that women who gave two live births in a pregnancy (twins) were more than **25** times more likely to give LBW babies than women who gave one live birth in a pregnancy (AOR=25.72 **(**95%CI: 13.17-50.24) with [p-value≤0.01]. This result is consistent with another report from a study carried out at four health centers and Jimma University hospital that showed mothers with multiple gestations had a higher risk of delivering LBW babies [17]. This might be related to nutritional competition of the fetus in the maternal womb that results in adverse effect on the weight of the babies and maternal health that might also result in preterm birth which by itself is causal factor for low birth weight.

Women who gave birth prior to expected date of delivery were 2 times more likely to give LBW babies than those who delivered on expected date (AOR=2.49 (95%CI: 1.55,4.02) [p-value≤0.01]. This result was consistent with descriptive retrospective cross sectional study done in Tanzania, that reported LBW strongly associated with gestational age (OR=2, 95%CI=1.5-2.8) [20]. Also it was consistent with prospective study done in Shariati Hospital; Tehran, Iran that reported the incidence of low birth weight of the newborns was significantly higher for pre-term babies ($P < 0.001$) [35]. Similarly women who experienced birth in 2006 were more likely to give LBW babies than who experienced birth after 2006 when compared with normal birth weight babies.

The effect of other associated factors on macrosomic babies was similarly assessed in this study. Those mothers who gave birth to male babies were more likely to have macrosomic babies than mothers who gave birth to female babies (AOR=1.29 (95%CI: 1.04-1.59) [p-value≤0.05]. This finding might be explained by; biologically male bone is heavier than female bone that may results in birth weight increment. Beside this mothers who gave birth from 2007-2010 were more likely to give birth to macrosomic babies than mothers who gave birth in 2006. This might be due to the increasing prevalence of chronic diseases such as DM with economic development.

The effect of other associated factors on prematurity was finally assessed in this study. Mothers who were older than twenty years were less likely to give birth to premature babies compared to mothers who were at the age of 15-19. This report is consistent with a register-based cohort study done in North western region of England, reported teenage mothers were at increased risk of preterm birth compared to adult mothers and this risk increased in the second time pregnancy (OR=1.93 95%CI: 1.38-2.69) [36].

Concerning maternal educational status, those mothers who reported as can read and write were more likely to give premature babies than those mothers who reported as illiterate (AOR:1.82 (95%CI: 1.13-2.95) and [p-value≤0.01]. This finding is inconsistent with the register-based study done in Italy which reported as women with no more than 8 years of education were 1.76 times more likely to have preterm delivery than women with high educational level with p-value<0.05 [37]. This might be due to the highest number of study population that was illiterate. Also in this study women who gave birth at urban area were almost three times more likely to give premature babies than those women who gave birth at rural area (AOR=2.75 (95%CI: 2.01-3.75) [p-value≤0.01]. This finding might also contradict with the fact that education and information related to reproductive health is more available for urban area women especially girls, to reduce early age pregnancy, which is a risk factor for preterm birth.

Finally this study assessed those women who gave two live births in a pregnancy (twins) were three times more likely to give premature babies than women who gave single live birth at a pregnancy when compared with normal gestational age birth (AOR=3.21 (95%CI: 1.82-5.65) [p-value≤0.01].This might be related to nutritional competition of the fetus in the maternal womb that causes adverse effect on the fetus and maternal health. That might result in early cessation of the pregnancy.

➢ Strength and Limitations of the study

❖ Strength

- The study used generalized estimating equations (GEE) analysis method to control dependent cases or different babies from the same mother, so all study population recorded for five years were used.
- Wide study area.

❖ Limitations

- Cause and effect cannot be ascertained since it is cross sectional study.
- Literatures done on macrosomia are limited to make comparison.
- Possible potential confounders such as the nutritional status and health conditions of both mother and child were not available in the research center to adjust for them.

7. Conclusion and Recommendations

7.1. Conclusion

This study finding concluded that fetal growth indices (low birth weight, macrosomia and preterm birth), were not found to be significantly associated with high parity. Low birth weight was significantly associated, with maternal income, address of baby born, number of live birth at a pregnancy, gestational age of the babies and year of delivery of the baby. Additionally macrosomia was found to be significantly associated with sex of the babies and year of delivery. Similarly preterm birth had significant association with maternal age at delivery, educational status, address baby born and number of live birth at a pregnancy.

7.2. Recommendations

Based on this study finding the following recommendations were stated.

In this study the proportion of high parity women, accounted almost half of the study population. So, considering the highest number of high parous women and rural study population, we are forced to recommend MOH, ORHB and Jimma Zone Health Department, Should give attention to reduce number of births at this area. Additionally Regional and Zonal offices should facilitate in providing health information about risk of having many children and early age pregnancy for those rural area dominant study population.

This study finding showed the risk of having low birth weight increases in the economically poor mothers. Because of this all District Health Offices and Health Facilities should encourage the community to involve in the social and economical supports of pregnant mothers.

Also in this study mothers who gave birth at rural area are at risk of giving low birth weight babies. So by considering the risk of rural mothers giving LBW in this study, all District Health Offices and Health Facilities should also encourage the Community to Increase the use of health services during pregnancy to early identify risks of low birth weight (twins' pregnancy in this study).

Teenage mothers have high risk of giving preterm birth compared to mothers who were older than twenty years. So this study highlights the importance of giving attention to prevent teenage (15-19) pregnancy. In the other way preventing risks of preterm birth is an important tool to prevent low birth weight, because the risk of having low birth weight babies increases with preterm birth in this study.

To summarize this finding, further prospective cohort studies with important maternal factors are recommended. Additionally we strongly recommended further study to assess other contributory factors that might found behind the increased risk of macrosomia and decreased risk of low birth weight from 2006 to 2010 years of delivery in this study.

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