INSTITUTE OF HEALTH, FACULTY OF MEDICAL SCIENCES
DEPARTMENT OF BIOMEDICAL SCIENCES
ANATOMY COURSE UNIT

BIRTH WEIGHT OF NEWBORN, AND GROSS PLACENTAL MORPHOLOGY AND THEIR DETERMINANT FACTORS AMONG PRE-ECLAMPTIC AND NORMOTENSIVE MOTHERS AT BUTAJIRA GENERAL HOSPITAL, SOUTHERN CENTRAL ETHIOPIA.

BY: KALKIDAN GETACHEW (BSc PH)

A THESIS SUBMITTED TO ANATOMY COURSE UNIT, BIOMEDICAL SCIENCES DEPARTMENT, FACULTY OF MEDICAL SCIENCES, INSTITUTE OF HEALTH, JIMMA UNIVERSITY, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR MASTER'S OF SCIENCE DEGREE IN CLINICAL ANATOMY.

JIMMA, ETHIOPIA
JANUARY 2021

JIMMA UNIVERSITY
INSTITUTE OF HEALTH, FACULTY OF MEDICAL SCIENCES
DEPARTMENT OF BIOMEDICAL SCIENCES
ANATOMY COURSE UNIT

BIRTH WEIGHT OF NEWBORN, AND GROSS PLACENTAL MORPHOLOGY AND THEIR DETERMINANT FACTORS AMONG PRE-ECLAMPTIC AND NORMOTENSIVE MOTHERS AT BUTAJIRA GENERAL HOSPITAL, SOUTHERN CENTRAL ETHIOPIA.

By: Kalkidan Getachew (BSc PH)

Principal advisor: Asfaw Gerbi (Assistant Professor of Human Anatomy)

Co- advisors: Bekalu Getachew (MSc in Clinical Anatomy)

Diliab Desta (MSc in Clinical Anatomy)

A thesis submitted to Anatomy Course Unit, Biomedical Sciences Department, Faculty of Medical Sciences, Institute of Health, and Jimma University, in Partial Fulfillment of Requirement for Master's Degree in Clinical Anatomy.

Jimma, Ethiopia

January 2021

ABSTRACT

BACKGROUND: Birth weight is the most important factor determining the survival, healthy growth, and development of a newborn. The healthy intrauterine existence of the fetus depends on the adequate function of the placenta. The placenta is a feto-maternal organ that has two components: a fetal part that develops from the chorionic sac and a maternal part derived from the endometrium. Preeclampsia causes morphological changes in the placenta and fetal hypoxia leading to intrauterine growth restriction which contributes to low birth weight.

OBJECTIVES: To compare the birth weight of newborn, gross placental morphology and their determinant factors among pre-eclamptic and normotensive mothers delivered at Butajira General Hospital, 2020.

METHODS: A comparative cross-sectional study was conducted from September 15 to December 15, 2020, at Butajira General Hospital. A consecutive sampling technique was used to select study subjects. Informed consent was taken from mothers under the study and a total of 158 placentas (79 pre-eclamptic and 79 normotensives) were collected after delivery in the labor room. The placental diameter and thickness were measured, the number of cotyledons was counted and the shape of the placenta was noted. The weight of the placenta and newborn was measured on a standard weight scale. EPI data version 4.2 was used to enter the data and the data were analyzed by SPSS version 22. An independent sample t-test was used to compare the mean differences of the groups. Pearson correlation test was used to investigate the correlation of birth weight with placental morphology in normotensive and preeclamptic pregnant mothers.

RESULTS: Birth weight of newborn and placental morphometric measurements were significantly (<0.05) less in the pre-eclamptic group as compared with the normotensive group. The mean birth weight in the pre-eclamptic group was 2.89±0.389 kg and 3.331±0.0.359 kg in the normotensive group ($p<0.001$). The mean placental weight, thickness, diameter, and number of cotyledons among the pre-eclamptic group were 446.72±83.86 g, 1.74±0.19 cm, 15.61±1.82 cm, and 16.7±1.77 respectively. The mean placental weight, thickness, diameter, and number of cotyledons among the normotensive group were 576.86±130.91 g, 2.03±0.31 cm, 18.91±2.43 cm, and 19.25±3.04 respectively. The placental shape had no significant difference between the two groups ($p> 0.05$). There

was a significant positive correlation between birth weight and placental weight (r=0.636, p<0.001) in pre-eclamptic and (r=0.456, p<0.001) in normotensive groups. The risk of low birth weight was two times more likely to occur in the pre-eclamptic group than in the normotensive group [AOR =2.87 (95%CI =0.72-11.56)]. Low placental weight in pre-eclamptic mothers was four times more likely to occur in at [AOR=4.26; (95% CI= 1.79-10.135)] than in normotensive mothers.

CONCLUSIONS: Most of the placental morphometric parameters except the placental shape in the preeclampsia group were found significantly different between normotensive and pre-eclamptic groups. Birth weight of the newborn was also significantly lower in pre-eclampsia group than the normotensive group. Placental weight had a significant positive correlation with birth weight in both normotensive and pre-eclamptic groups. Preeclampsia, nullparity, maternal age (20-24 years), male sex newborn, and BMI <18.5 kg/m^2 identified as the determining factors for birth weight and placental morphometric parameters. Lower placental weight and birth weight were positively associated with preeclampsia. Therefore, health professionals must screen preeclampsia as early as possible to manage it and reduce its complications.

Keywords: Placenta, Morphology, Birth weight, Preeclampsia, Determinant, Factor

ACKNOWLEDGEMENTS

I would like to acknowledge Jimma University, Institute of Health Sciences, School of Medicine, and Biomedical Sciences Department for the opportunity of postgraduate study and funding the thesis research.

My special thanks go to my advisors Mr. Asfaw Gerbi, Mr. Bekalu Getachew, and Mrs. Diliab Desta for their excellent support, detail, and constructive comments throughout the preparation of this thesis.

I would like to acknowledge Butajira General Hospital staff and all study participants for their cooperation and involvement.

Above all, I want to thank my Almighty God for his strength, wisdom, protection in my journey and for giving me courage, inspiration, refreshment and hope to work hard.

Lastly, I am thankful to Wolayta Sodo University for sponsoring me in this M.Sc program.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACRONYMS AND ABBREVIATIONS

ANC	Antenatal Care
ANOVA	Analysis Of Variance
AOR	Adjusted Odd Ratio
BMI	Body Mass Index
BP	Blood pressure
CI	Confidence Interval
COR	Crude Odd Ratio
C/S	Cesarean section
DM	Diabetes mellitus
GA	Gestational age
GDM	Gestational diabetes mellitus
GWG	Gestational weight gain
HDPs	Hypertensive disorders of pregnancy
HTN	Hypertension
IUGR	Intrauterine Growth Retardation/ Restriction
LBW	Low Birth Weight
SD	Standard Deviation
SNNPR	Southern Nation Nationality and People Representative
SPSS	Statistical Package for Social Sciences
SVD	Spontaneous vaginal delivery
PE	Preeclampsia
PIH	Pregnancy induced hypertension
W H O	World Health Organization

1. INTRODUCTION

1.1 Background

Birth weight, the bodyweight of a baby at its birth, is a relevant indicator of neonatal survival, healthy growth, and development and is directly associated with placental morphology (1). The average birth weight of babies is 3.5 kg; the range of normal birth weight is between 2.5 and 4.5 kg. The healthy survival of neonate depends on the placenta for normal growth and development (2).

Placenta is a feto-maternal organ that has two components: a fetal part that develops from the chorionic sac and a maternal part derived from the endometrium. The Intrauterine existence of the fetus is depending on the adequate function of the placenta. It is the primary site of nutrient and gas exchange between the mother and fetus (3). The placenta structurally and functionally connects the developing fetus to the uterine wall until the end of pregnancy (4). Placenta acts as vital body organs like the lung, kidney, heart, digestive and endocrine organs having wide range of functions including protection, nutrition, respiration, excretion, and hormone production. The placenta is necessary for the maintenance of pregnancy and for promoting normal growth and development of the fetus (5-7).

At term, the expelled normal human placenta is a flattened discoid mass with an approximately oval or circular in outline with an average volume of 500 ml (200-950 ml), average weight about 500 g (200-800 g), an average diameter of 18.5 cm (15 – 20 cm), the average thickness of 2.3 cm (2.0 to 2.5 cm), which tapers from the center to periphery where it continues as the chorion leave (8). A full-term placenta has two surfaces (maternal and fetal) and a peripheral margin. The maternal surface is finely granular, mapped into 15-30 lobes (cotyledons) separated by a placental septum (9). The fetal surface is normally shiny, gray, and translucent enough and covered by amnion with the umbilical cord attached to it. Umbilical cord insertion is usually central but may vary in some specimens like marginal, velamentous, or eccentric (10).

The placenta indicates the most accurate record of the prenatal life of an infant. It undergoes different changes in weight, volume, structure, shape, and function continuously throughout the gestation to support prenatal life (2). When pregnancy is complicated by preeclampsia

(PE) its morphology will be altered, which in turn will impact maternal health as well as the fetus (11).

Preeclampsia is a systemic disorder defined as the development of hypertension and proteinuria after 20 weeks of gestation in previously normotensive women. It is characterized by increased blood pressure (≥140/90 mmHg) recorded twice 6 hours apart or a single measurement of ≥ 160/110 mmHg with either proteinuria (≥300mg/24hr or ≥+1 dipstick) or, without proteinuria, and the following systemic findings: thrombocytopenia (platelet count < 100,000/μL), renal insufficiency, abnormal liver function, pulmonary edema, and cerebral/visual symptoms after 20 weeks in the previously normotensive (12, 13).

Preeclampsia further divided into mild and severe. Mild preeclampsia is when a mother develops a blood pressure of ≥140/90 mm Hg and <160/110 mm Hg with proteinuria of ≥ 0.3 gm/day but < 5 gm/day and without any systemic findings mentioned in preeclampsia. Severe preeclampsia is when a pregnant mother develops a blood pressure ≥160/110 mm Hg, either proteinuria of ≥5 g/day or one or more of the systemic findings of preeclampsia (14).

Preeclampsia is a global health threat in both developed and developing countries and contributing to maternal as well as perinatal morbidity and mortality globally. World Health Organization (WHO) estimated in 2014, globally the prevalence of preeclampsia is 4.6 % and in developing countries ranges from 1.8 to 16.7 % (15, 16). In African women, the prevalence of preeclampsia is around 10% of pregnancies (17).

In normal pregnancies, the spiral arteries wall is surrounded by trophoblastic cells (first and second wave). This gives the ability to the spiral arteries to have wide caliber, tortuous channels that transport a large amount of blood to the intervillous space and resistant to the effects of endogenous vasomotor agents (18). But in preeclampsia, there is a failure of the second wave of endovascular trophoblast migration and failure of the normal physiological adaptations (19). This results in the persistence of muscular tissues in the tunica media of spiral arteries. Therefore, the vessels fail to dilate and remain responsive to endogenous vasomotor influences that result in high resistance and low flow in chorio-decidual circulation (20). With the progress of the pregnancy, the metabolic loads for intact fetoplacental unit elevated but the spiral arteries are unable to dilate to accommodate the required elevated in blood flow, resulting in placental insufficiency or decrease in uteroplacental blood flow. This results in morphological changes in ischemic placentae and fetal hypoxia leading to intrauterine growth restriction (IUGR) which contributes to low birth weight (21, 25).

1.2 Statement of the Problem

Hypertensive disorder during pregnancy (HDP) is one of the fatal triads along with hemorrhage and infection; that results in a large number of maternal and fetal deaths (26). Globally, nearly 10% of all pregnancies are complicated by hypertension and are responsible for a huge burden of maternal as well as prenatal morbidity and mortality, in absolute terms, approximately 76,000 maternal and 500,000 infant deaths each year (27).

Preeclampsia is a unique pregnancy-related disease that complicates 5–10% of pregnancies worldwide and it causes maternal morbidity and mortality (28). Preeclampsia results of 10% to 15% direct maternal mortality (29). It is more prevalent in developing countries range from 1.8 to 16.7% and it probably estimates more than 40,000 maternal deaths worldwide each year (28). According to various studies conducted in Ethiopia prevalence of HDP ranges from 1.2% to 18.25%. The prevalence of pregnancy-induced hypertension (PIH) and preeclampsia alone in Ethiopia was 6.29 % and 5.47 % respectively (30). A maternal mortality trend analysis showed an increasing trend of preeclampsia in Ethiopia (29). The economic burden of preeclampsia in the health care system is significant with the main cost drivers being infant health care costs associated with preterm at birth and greater adverse outcomes (31).

Preeclampsia reflected a change in morphology of the placenta and also contributes to complications like preterm birth, perinatal death, intrauterine growth restriction, neonatal respiratory difficulties, and increased admission to neonatal intensive care unit (NICU) (32).

Abnormal development of the placenta is the leading cause of maternal and perinatal mortality and an important factor in fetal growth retardation. Therefore, there is a need to investigate the extent of structural changes of the placenta, because the severity of these morphological parameters changes i.e. placental weight, shape, thickness, and diameter is correlated with the efficiency of the placenta to support the growth of the fetus (33, 34).

Most of the studies of placental morphology changes to assess the preeclampsia severity were done in Western and Asian countries. These findings have been applied to patients in developing countries, who live under different conditions. Actually, the same physiological changes will be expected irrespective of the nationality. But, in observation of the diverse etiology of preeclampsia; genetic, immunological, environmental, and social-cultural variations cannot be ruled out convincingly without evidence based on research (35). These factors have been revealed to have effects on placental functions, birth weight, and

fetal mortality (36). Therefore, there is a need for local studies to evaluate the placenta morphology change of preeclamptic mothers and develop local data-based information for patients' evaluation.

In developing countries including Ethiopia, the health care system is more focused on preventive, control, investigation, and therapeutic tasks of preeclampsia. But placental examination in post-natal care is poorly practiced. Despite the placenta is important for the survival and wellbeing of the fetus, and mother. The effect of preeclampsia on the placenta, fetus, and mother has not been well investigated. But after delivery, the placenta was immediately discarded as waste without examining its morphology, as well as its association with birth weight. Placental morphology and its relation with birth weight are under-investigated in Ethiopia. Therefore, this study aims to compare the birth weight of newborns and gross placental morphology between pre-eclamptic and normotensive mothers.

1.3 Significance of the Study

Placenta is an organ to which knowledgeable look and touch can provide much insight to prenatal life. Early examination of placental morphology in the postpartum period will improve the skill of clinicians (health care provider) to predict birth outcomes and give a clue for earlier identification of the fetus at risk and give immediate and late management of the maternal and neonatal complications; this gives the ability to prevent maternal and fetal adverse outcomes.

The effect of preeclampsia on the placenta, fetus, and mother has not been well investigated in Ethiopia. The findings from this study will be a good input for health care planners and policymakers to set a plan for early detection, prevention, and immediate management of preeclampsia. It is helpful to decide whether preeclampsia that affects the wellbeing of the fetus is an acute or a chronic process that helps for the medico-legal investigation of cases during perinatal morbidity and mortality. As well, it will provide information for the future care of the mother and her babies.

Finally, it will explore the association of preeclampsia, gross placental morphology, and birth weight. It will also offer baseline data for further researches on the related topics.

2. LITERATURE REVIEW

There is a great deal of evidences showing that preeclampsia is the main cause of complicated pregnancies worldwide. But information available regarding the effect of preeclampsia on birth weight and macro-architecture of the placenta is scarce. Birth weight and gross morphology of the human placenta in terms of its shape, diameter, thickness, weight, and lobes or cotyledons were reviewed as follows.

2.1 Birth Weight

Preeclampsia results in the abnormal cytotrophoblastic invasion that leads to placental ischemia and endothelial dysfunction. The main effect of preeclampsia on the fetus is undernutrition as a result of uteroplacental insufficiency, which leads to growth retardation and low birth weight (25).

A cross-sectional descriptive study conducted in India on 100 placentas (50 were from PIH and 50 from normotensive mothers), found that the mean fetal weight in normotensive mother was 3140.90±73.38 and in pregnancy-induced hypertension case was 2329.72±284.87. The mean birth weight was 2680.29±198.46gm (mild PIH), 2212.06±36.41gm (severe PIH), and 2073.60±9.47gm (eclampsia) respectively. This shows that birth weight was lower as the severity of hypertension increase. It was significantly ($p<0.001$) decreased in PIH as compared to normotensive (22). Another study conducted in Karnataka on a total of 100 placentas where studied, out of 50 placentae belongs to PIH and 50 placentae were from normotensive mothers, revealed that the birth weight of newborns was low with increasing grades of hypertension compared to normotensive mothers. The mean birth weight was 3.015 kg, 2.546 kg, 2.675 kg, and 2.1 kg in normotensive, mild PIH, severe PIH, and (eclampsia) respectively (38).

A comparative observational study conducted in India on 50 placentas from preeclamptic and 50 from normotensive mothers, reported that mean fetal weight in normotensive cases was 2.8±0.46 kg and in the pre-eclamptic case was 2.1± 0.39 kg. This study also observed that increased incidence of IUGR and reduced placental weight with increased severity of HTN (37). Another cross-sectional study was done in Nigeria showed that the mean birth weights of fetuses were 2.75 kg and 2.86 kg for pre-eclamptic and normotensive mothers respectively. There was no statistical difference in mean birth weight ($p=0.25$) (39).

An institutional-based comparative cross-sectional study conducted in Ethiopia at the University of Gondar Referral Hospital carried out on 200 term placentas (150 placentas from normotensive and 50 from pre-eclamptic mothers) showed that the mean birth weight of pre-eclamptic cases (2.62±5.87 kg) was less than as compared to normotensive cases (3.12±4.36 kg). This difference between the two groups was significant (p=0.0001) (40).

2.2 Shape of Placenta

The shape of the placenta is determined by the persistent area of the chorionic villi finally left on the chorionic sac; usually this is a circular area, giving the placenta a discoid shape (41). The definitive shape of the human placenta is a result of the disappearance of villi from all but a circumscribed locus on the chorion (42). Abnormalities of the shape of the placenta like bi-discoidal, lobed, diffused, placenta succenturiata, fenestrated placenta, circumvallate and circummarginate placenta have been encountered in kinds of literature (43, 44).

The study done in Dhaka in Dhaka Medical College Hospital and Sir Sallimullah Medical College Hospital on 60 placentae, 30 were from normotensive pregnant women and 30 from pregnancies complicated by preeclampsia number of the oval-shaped placenta was 10 (33.3%) and 12 (40%), the number of the circular-shaped placenta was 13 (43.3%) and 10 (33.3%), the number of irregular shape placenta was 7 (23.3%) and 8 (26.7%) respectively. The difference was not significant in the shape of the placenta among normotensive and pre-eclamptic mothers (p>0.05) (45).

Similarly, the study done in Era's Lucknow Medical College on 60 placentas, 30 placentae from pregnancy-induced hypertension, and 30 uncomplicated mothers, showed that 73.33% of preeclampsia and 83.33% of uncomplicated mothers' placenta were discoid in shape. Other placental shapes were irregular 16.67% in the preeclampsia group and 10% in the non-complicated group) and discoid, lobed, and diffused (3.33% each) in both preeclampsia and uncomplicated group. The difference was not significant between the two groups (p>0.05) (46). Another research conducted in Rajasthan, India revealed that 60% of the uncomplicated group placenta was an oval shape and 40% was circular. On the other hand in PIH 80% was oval and 20% was circular. The difference between the two groups was not significant (p>0.05) (47).

An institutional-based comparative cross-sectional study conducted in Ethiopia at University of Gondar Referral Hospital shown that the shapes of placentas in normotensive pregnancies

were discoid (68.7%), oval (18%), and irregular (9.3%) shape and in pre-eclamptic mothers were discoid (18%), oval (54%), and irregular (24%) shape. The placental shape difference was statistically significant between the two groups (p-value = 0.001) (40).

2.3 Weight of Placenta

The ability of the fetus to grow and thrive in utero depends on placental function and the average weight of the placenta at term is 500g. The weight of the placenta is functionally important; it is related to villous surface area and fetal metabolism (48). The flow of the blood to the placenta is reduced in hypertension of pregnancy and result in an improperly small fetus (37).

According to an observational study conducted in Era's Lucknow Medical College in India on 60 placentas, 30 placentae from pregnancy-induced hypertension, and 30 uncomplicated mothers showed that placenta weighing ≤ 400 g, in severe preeclampsia, mild preeclampsia and uncomplicated groups were 60%, 50%, and 36.67% respectively. This study reported that the weight of the placenta was significantly smaller in pre-eclamptic compared to that of normotensive mothers ($p<0.05$) (46).

A comparative observational study conducted in India on 50 placentas from preeclamptic and 50 from normotensive mothers, reported that the mean weight of the placenta was 502±58.42 g in normotensive mothers and 430 ±50.69 g pre-eclamptic mothers. This shows preeclampsia is significantly decreased the weight of the placenta ($p<0.05$) (38). Similarly, in another study conducted in India from a total of 42 pregnant women with the hypertensive disorder and 42 matched normotensive pregnant women the mean placental weight was 429.52±99.06 g and 504.29±90.12 g respectively. The result showed that placental weight was significantly decreased in preeclampsia as compared to that of the normotensive mothers ($p<0.001$) (49).

The case-control study done in the University of Babylon in Iraq on 120 placentae, which were 60 placentae from uncomplicated full-term pregnancies (the control group) and 60 placentas from preeclampsia patients (case group), showed that the mean placental weight 439.17±19.42 and 395.5±50.03 respectively. This shows preeclampsia has effects on the placenta by decreasing its weight (43).

The study conducted in Ethiopia at the University of Gondar Referral Hospital Obstetric Ward on a total of 200 term placentas, reported that from normotensive groups the mean placental weight was 497.95 ± 89.1 gm and in the preeclampsia group was 417.6 ±102.41gm. The result showed placental weight is related to preeclampsia and showed that placental weight was significantly decreased in pre-eclamptic as compared to normotensive mothers (p=0.0001). As reported by a study conducted in Ethiopia, the mean fetoplacental weight ratio was 6.34±0.89 in normotensive cases and 6.41±1.03 in preeclampsia. The difference was not statistically significant (p=0.658) (40).

2.4 Diameter and Thickness of placenta

The diameter and thickness of the placenta give an image of the size of the placenta which may intend to give indirect information about the fetal-placental ratio. It affects the amount of nutrients, oxygen, and carbon dioxide that pass from the mother to the child (50). A normal term placenta has 15-25 cm and 2-3 cm diameter and thickness respectively (51).

A comparative cross-sectional study conducted in India on 100 placentas (50 from PIH and 50 from uncomplicated mothers), found that the average diameter and thickness of placenta in PIH was 15.91±2.11cm, 2.39±0.54cm respectively and in the uncomplicated group, placental diameter was 18.40±1.42 cm and 2.77±0.51 cm thickness. Placental diameter and thickness were significantly decreased in pregnancy-induced hypertension as compared to the uncomplicated group ($p<0.05$) (22). Whereas, another descriptive study conducted in India on 25 uncomplicated and 25 PIH mothers showed that the mean placental diameter in uncomplicated was 18.02±2.40 cm and 18.09±2.50 cm in PIH. The difference in the diameter of the placenta was not significant (53).

The study done in Dhaka at Dhaka Medical College Hospital on 60 placentas (30 from normotensive and 30 from pre-eclamptic mothers) reported that; the mean (± SD) diameter of the placenta was 18.80 ± 2.32 cm normotensive mother and 16.08 ± 2.08 cm in pre-eclamptic mother. The diameter of the placenta was greater in normotensive than preeclampsia and it was statistically different from each other ($p<0.001$). But, the mean (± SD) thickness of the placenta was 1.59 ± 0.39 cm in the normotensive mothers and 1.51± 0.37 cm in the pre-eclamptic mothers. Statistically, the difference between normotensive and preeclampsia was not significant (45). On the contrary, another research conducted in Rajasthan showed that; the mean placental thickness was 1.82 ± 0.22 cm in PIH mothers and 1.96 ± 0.23 cm in

uncomplicated mothers. Placental thickness was significantly ($p<0.01$) thinner in PIH as compared to uncomplicated (47).

The study done in Gandhi Memorial and Black Lion Specialized Hospitals on 100 placentas (50 from uncomplicated mothers and 50 from preeclampsia) showed that mean placental thickness was 1.96 ± 0.2 cm in uncomplicated and 1.72 ± 0.11 cm in pre-eclamptic mothers. The placental thickness in uncomplicated mothers was significantly ($p<0.001$) thicker than pre-eclamptic mothers. Whereas the mean placental diameter was 19.4 ± 0.85 cm and 17.66 ± 1.07cm in uncomplicated and pre-eclamptic mothers respectively. It was significantly ($p<0.001$) smaller in pre-eclamptic than in uncomplicated mothers (52). The study conducted in Ethiopia at the University of Gondar Referral Hospital Obstetric Ward on a total of 200 term placenta, showed that the average diameter of placentas among normotensive women was 18.2 cm and for pre-eclamptic women was 17.2 cm. The mean thickness of placentas among normotensive pregnant women was 2.43cm and for pre-eclamptic pregnant women was 1.99 cm. The placental diameter and thickness were significantly decreased in pre-eclamptic mothers as compared to the normotensive mothers ($p<0.05$) (40).

2.5 Number of Cotyledons

As the chorionic villi invade the decidua basalis, decidual tissue is eroded to enlarge the intervillous space. This erosion produces several wedge-shaped areas of decidua, placental septa that project toward the chorionic plate. The placental septa divide the fetal part of the placenta into irregular convex areas called cotyledons (3). A normal term placenta has 15-30 cotyledons. When the placenta is encountered by preeclampsia, it causes significant morphological and structural changes in the terminal villi (8).

A cross-sectional descriptive study conducted in India on 100 placentas (50 from PIH and 50 from uncomplicated mothers) showed that the placental number of cotyledons in preeclampsia and the uncomplicated group was 10.02±4.13 and 16.26±4.14 respectively. The placental number of cotyledons was significantly decreased in pre-eclamptic mothers ($p<0.05$) (22). Another cross-sectional descriptive study was done in India on 50 placentas from pre-eclamptic and 50 from normotensive mothers also showed that the number of cotyledons was also less in pre-eclamptic placentas as compared to normotensive. The mean number of cotyledons was 18.9 in normotensive placentae and 16 in pre-eclamptic placenta (37).

The study done in Ethiopia in Gandhi Memorial and Black Lion Specialized Hospitals on 100 placentas (50 from uncomplicated mothers and 50 from preeclampsia), reported that a placental number of cotyledon was 17.24±1.06 in pre-eclamptic and 18.66±1.21 in uncomplicated mothers (52). An institutional-based comparative cross-sectional study conducted in Ethiopia at University of Gondar Referral Hospital showed that the mean number of cotyledons in normotensive pregnancies was 19 and 15 was for pre-eclamptic pregnancies (40). In both studies, the number of cotyledons of the placenta was significantly ($p<0.001$) decreased in pre-eclamptic mothers as compared to normotensive mothers.

To summarize all the above literature there is a difference in gross morphology of placenta in preeclampsia compared with normotensive mothers. From the above literature, the majority showed that macro-architecture of placenta including diameter, thickness, weight, and numbers of cotyledons were decreased in pre-eclamptic mothers. But much literature listed on the above placental shape wasn't showing any significant change in pre-eclamptic mothers. According to the majority of literature listed above the birth weight of newborns was low with increasing severity of preeclampsia.

2.6 Factors determining Birth Weight and Gross Placental Morphology

Factors that determining the birth weight and gross placental morphology are maternal factors, infant factors, and environmental factors (54, 55).

2.6.1 Infant factor: sex of the neonate

Many studies revealed that sex difference has its impact on birth weight, male babies tend to be slightly heavier than female babies, but girls have higher fat mass at birth than boys. This different distribution is due to the role of insulin action. First babies are usually lighter than later siblings (56). A study conducted in India showed that the placental morphometry of male babies was lower than female babies (57). While another study done in Norway showed that there is no placental morphometric difference between male and female babies (58).

2.6.2 Socio-demographic factors

2.6.2.1 Maternal Age

Mother's age at delivery is associated with infant birth weight. Women < 20 years and > 35 years of age have a higher LBW rate than women 20-29years of age (57). Maternal age had consistent relation with placental morphometry. Several studies showed that mothers with an age group <20 had lesser placental weight, volume, surface area, and thickness (54, 55).

Placental morphometry increased consistently with maternal age. A study conducted in India on mothers in different age groups (<20 years, 20–24 years, 25–29 years, and ≥30 years) reported that placental weight increased by age groups significantly and volume at $p < 0.01$ (57).

2.6.2.2 Maternal education

High maternal literacy (university and above) showed a 33% protective effect against low birth weight, whereas a medium degree of education showed no significant prevention when compared to low maternal literacy (61). Several studies showed that the educational status of the mother did not show any consistent and significant relation with placental morphology and birth weight (57, 62, and 67).

2.6.2.3 Marital status

Unmarried females are more likely to be young, have low literacy levels, smoke during pregnancy, from a minority races, and start antenatal care late. Within almost every determinant factor category, unmarried women have a higher percentage of low birth weight (61). In a study done in India the birth weight was lower although statistically not significant among babies from unmarried women, but placental weight, volume, surface area, and thickness were higher as compared to married women's (58).

2.6.3 Obstetric factor

2.6.3.1 Parity

The birth weights among primiparous mothers were lower as compared to those of multipara. Generally, the incidence of low birth weight (LBW) is higher among primiparous women of age group below 20 and above 35 years as well as older age of primiparous mothers has also been reported as determinant factors of LBW (62). The placentas of multiparous women had higher values of placental weight, volume, surface area, and thickness than those of primiparous women. The parity had consistent relation with placental morphometry (57).

2.6.3.2 Antenatal care

Many studies show that ANC visit; the total number of ANC visits, iron, and calcium supplementation during pregnancy are the significant predictors of birth weight that shows significant association (66). Utilization of ANC also showed a significant relationship, but negatively related if the ANC increases could reduce the placenta morphology. This suggests that the utilization of ANC high quantity did not guarantee the placenta morphology (64).

2.6.3.3 Body Mass Index

Poor nutritional status in pre-pregnancy and during the pregnancy period determines the birth weight concerning placental weight, which alters fetal metabolism leading to a predisposition of hypertension subsequently in adult life. A study conducted in India showed that birth weight increased from 2426 g to 2754 g ($p < 0.05$) of respective mothers with BMI <18.5 to 23 and above (63). Generally, many studies conclude that maternal undernutrition causes the reduction of placental weight, placental diameter, and the number of maternal cotyledons leads to placental insufficiency which impacts fetal growth resulting in low birth weight (64, 65).

2.6.4 Socioeconomic status

Women of low socioeconomic status, such women are likely to be shorter and thinner and to consume fewer calories and other nutrients during pregnancy. Therefore the absence of an independent effect of socioeconomic status does not rule out its role as an indirect effect on birth weight and placental morphology (66).

Conceptual Framework of the Study

The conceptual framework was developed based on the reviewed different works of literature and showed the association between the dependent and independent variables of the study.

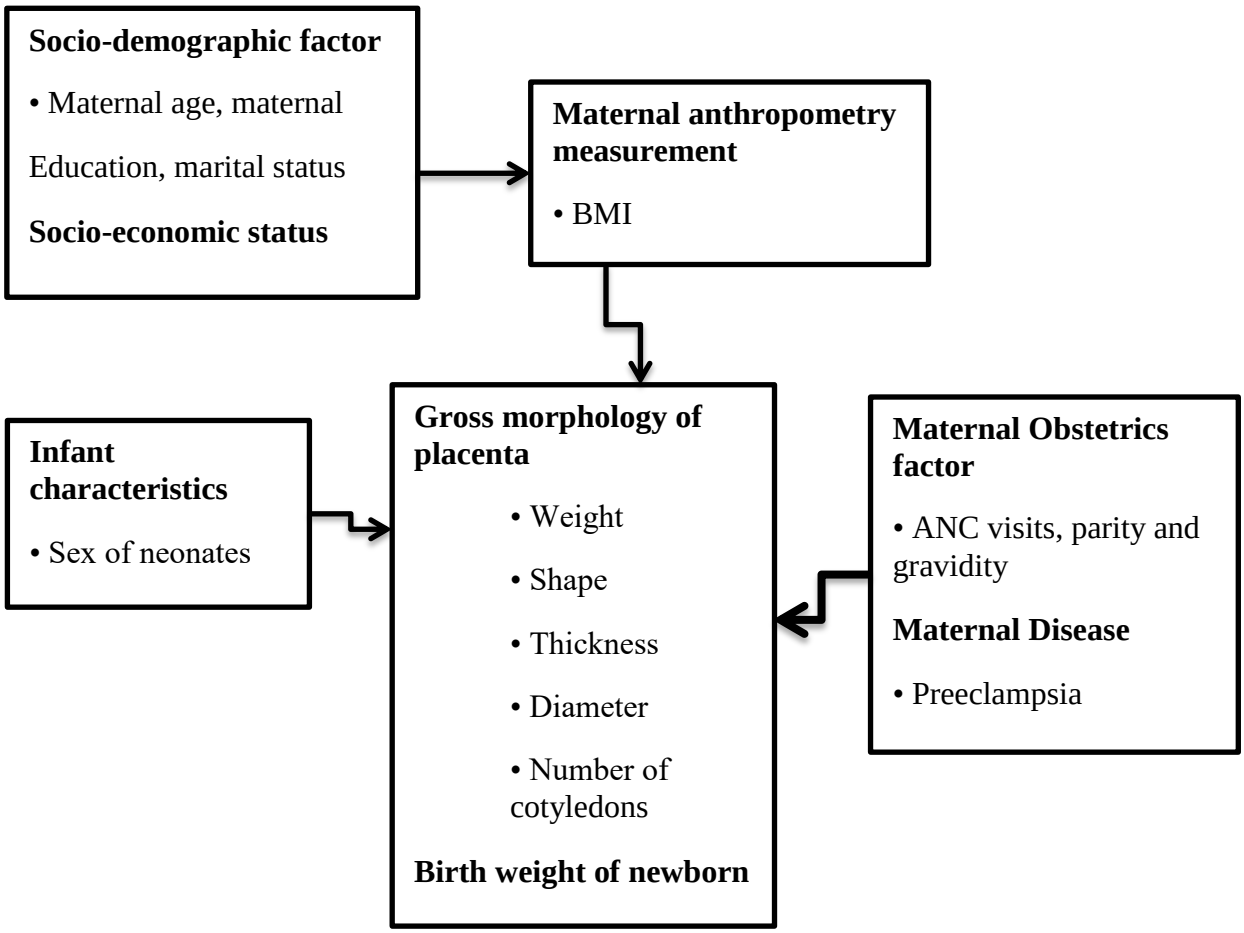

Figure 1: Conceptual framework of factors determining for birth weight of newborn and gross placental morphology adapted after literatures review (54-67).

HYPOTHESIS

Ho 1:- Exposure to preeclampsia has no association with low birth weight.

HA 1:- Exposure to preeclampsia is positively associated with low birth weight.

Ho 2:- Exposure to preeclampsia has no association with decreased weight of placenta.

HA 2:- Exposure to preeclampsia is positively associated with decreased weight of placenta.

3. OBJECTIVES

3.1 General Objective

- To compare the birth weight, gross placental morphology and their determinant factors among pre-eclamptic and normotensive mothers at Butajira General Hospital from September 15 – December 15, 2020.

3.2 Specific Objectives

- To evaluate the birth weight of newborns borne to pre-eclamptic and normotensive mothers.
- To assess the gross morphology and measurements of placenta (weight, thickness, diameter, and number of cotyledons) among pre-eclamptic mothers compared to normotensive mothers.
- To investigate the correlation of birth weight of newborn with morphometric measurements of placenta among pre-eclamptic and normotensive mothers.
- To identify determinant factors for birth weight of newborns and placental morphometric parameters.

4. METHODS

4.1 Study Design and Study Period

A comparative cross-sectional study was conducted from September 15 to December 15, 2020.

4.2 Study Area

The study was conducted at Butajira General Hospital, found in Butajira town in Southern Nations Nationalities and Peoples Representative Region (SNNPR) of Ethiopia. Butajira town is geographically located in South Central Ethiopia, 135 Km away from Addis Ababa the capital city of Ethiopia at an altitude of 2000m-2100m above sea level. According to the Butajira Health Office report the hospital has been serving for 890,564 peoples including the neighboring zones. The hospital has four departments and five wards including the obstetrics and gynecology ward. According to data from Butajira Hospital Maternity Ward Report in 2019, the hospital monthly average delivery is 450 mothers out of these 25-30 mothers who are preeclamptic.

4.3 Population

4.3.1 Source Population

- All term pre-eclamptic and normotensive mothers who attend their delivery at Butajira General Hospital.

4.3.2 Study Population

- Term pre-eclamptic and normotensive mothers who attend their delivery at Butajira General Hospital during the data collection period.

4.4 Eligibility criteria

4.4.1 Inclusion Criteria

Group I

- Term pre-eclamptic pregnant mothers during the data collection period diagnosed based on one or more of preeclampsia diagnostic investigations.

Group II

- Term normotensive mothers having no signs and symptoms of preeclampsia.

4.4.2 Exclusion Criteria

Pregnant mothers who experience any complication during pregnancy like gestational hypertension, chronic hypertension, pre-existing diabetes mellitus, intrauterine fetal death, gestational diabetics mellitus, anemia, Retroviral Infections (RVI), multiple pregnancies, placenta accereta, placenta percreta, placenta previa, abruption placenta, incomplete delivery of the placenta, maternal smoking, pre and post-term pregnancies will be excluded from this study.

4.5 Sample Size Determination

The desired sample size is calculated by using Open Epi info version 4.2, by using formula of mean difference, preeclampsia (N1) to a normotensive (N2) ratio of 1:1. (https://www.openepi.com/SampleSize/SSMean.htm).

Where: - N1= Sample size for preeclamptic / case

N2 = Sample size for normotensive /controls

Zβ = 0.84 for 80% power

Z α/2 = 1.96 for 95% confidence level (two sided)

X-Y= Mean difference of the two groups

$\sigma 1^2$ $\sigma 2^2$= Variance of pre-eclamptic and normotensive mothers

Variables	Mean		Mean difference	Standard deviation (SD)		N1= N2	Total sample size
	Normotensive (X)	Preeclampsia (Y)	X-Y	Normotensive	Preeclampsia		
Placental weight	497.95	417.6	80.35	±89.1	±102.41	23:23	46
Placental thickness	2.43	1.99	0.44	±1.34	±0.39	79:79	158
Placental diameter	19.2	17.28	1.92	±2.31	±2.15	22:22	44
No cotyledon	18.66	14.86	4.20	±3.09	±2.12	8:8	16
Birth weight	3.12	2.62	0.5	±0.436	±0.587	17:17	34

Table 1: Parameters of variables for calculation of sample size taking from the study conducted in Gondar (40).

The final sample size is the value of the placental thickness, it gives the largest sample size value which 79 pre-eclamptic and 79 normotensive = **Total 158 placentas**.

4.6 Sampling Technique

The normotensive mother was selected by systematic random sampling techniques. To determine the sampling frame is by taking the delivery statistics report from the previous year of the same months from the book of registration. To determine sampling interval (K), the number of units in the population (N) divided by the desired sample size (n). K= N/n. Then the calculated sampling interval the total delivery statistics (1350) divide to the total sample size (79) and found to be 17^{th}. For pre-eclamptic mothers a consecutive sampling technique was employed to conduct this study. The mothers who meets the inclusion criteria was included in the study until fulfill the desired sample size.

4.7 Study variables

4.7.1 Dependent Variables

- Gross morphology of placenta:- weight, shape, thickness, diameter, and number of cotyledons
- Birth weight of a newborn

4.7.2 Independent Variables

- Maternal preeclampsia :- mild and severe
- Socio demographic characteristics: -Age, residence, educational level and occupation
- Sex of neonate
- Mode of delivery
- Parity
- Gravidity
- Antenatal checkup
- BMI

4.8 Operational definitions and definition of terms

- **Gross placental morphology**: - the form and structure of placenta such as shape, diameter, thickness, weight, cotyledons.
- **Incomplete delivery of placenta:-**placenta that has not undergone expulsion within 30 minutes of the baby's birth.

- **Newborn: -** a child under 28 days of age.
- **Birth weight**: – body weight of babies immediately after birth.
- **Low birth weight**: - body weight of baby < 2500gram.
- **Normal birth weight**: - birth weight ≥ 2500-4500gram.
- **Normal placental weight**: - average weight of placenta ≥500gram.
- **Low placental weight: -** weight of placenta < 500gram**.**
- **Irregular shape of the placenta:-**all shape of placenta except circular and oval.
- **Low placental diameter:-** diameter of placenta < 18.5 cm
- **Low placental thickness:** thickness of placenta < 2.3cm
- **Preeclampsia**: -increased blood pressure (≥140/90 mmHg) recorded twice 6 hours apart or a single measurement of ≥ 160/110 mmHg with either proteinuria (≥300mg/24hr or ≥+1 dipstick) or, in the absence of proteinuria, new onset of systemic findings: thrombocytopenia, renal insufficiency, abnormal liver function, pulmonary edema, and cerebral/visual symptoms.
- **Mild preeclampsia**: - blood pressure of ≥140/90 mm Hg and <160/110 mm Hg with proteinuria of ≥0.3 g/day but < 5 g/day and in the absence of any systemic findings.
- **Severe preeclampsia**: - develops a blood pressure ≥160/110 mm Hg, either proteinuria of ≥5 g/day or one/more of the systemic findings.

4.9 Data Collection Tool and Procedure

4.9.1 Data collection tools

Data was collected by using a structured questionnaire's which adapted from different works of literature and modified corresponding to the study objectives and checked for clearness, understandability, consistency, and completeness. The questionnaire include; socio-demographic characteristics of the participants include age, marital status and education level of mother and obstetric history and reproductive variable (parity, gravidity, mode of delivery, and ANC follow up). And there also quantitative measurements was assessed including maternal anthropometry and birth weight for neonate and placental morphometric assessments; measured by using materials include standardized weight scale, flat tray, measuring cylinder, meter, gloves, towels, plastic sheet, and sponge, wooden ruler and camera.

4.9.2 Data Collection Procedure

Data were collected and recorded by three BSc midwifery nurses and one supervisor (General Practitioner). The data was collected by using a structured questionnaire via face to face interview and these include socio-economic, demographic characteristic of the mothers, reproductive variables (parity, gravidity). A preliminary history was taken from the mother and clinical sheets regarding their current and past medical, obstetrics, and gynecologic histories which may affect the morphology of placenta and birth weight. For placental gross morphological assessment, fresh placenta was collected as soon as after delivery and checked for its completeness; and then umbilical cord was cut 5cm away from its site of attachment and trimming of a membrane. Then it was washed by running water, cleaned up by towel, labelled with code numbers and prepared for subsequent measurements as described by Elangovan and Raviraj (67).

4.9.3 Measurement of Variables

The placental and fetal parameters will be observed and measured.

A. Shape: Shape of the placenta was noted after proper inspection. Each placenta categorized as circular, oval, and irregular in shape.

B. Diameter: The maximum diameter was measured with a non-stretched scale graduated in centimeters (cm). Then the second maximum diameter was taken at right angles to the first one. The mean of the two measurements was considered as the diameter of the placenta and expressed in centimeter as followed by Shevade Sapna and his colleague's (37).

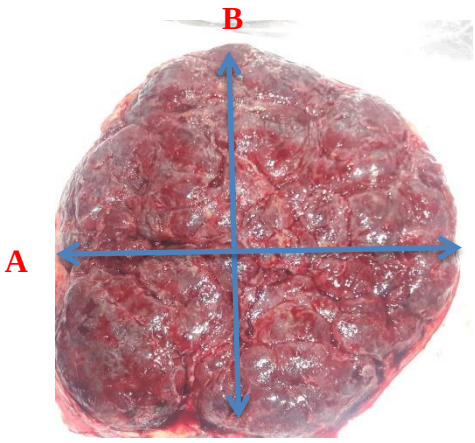

Figure 2: Maximum diameter of full term placenta measured on maternal surface in two axes at right angle to each other at Butajira General Hospital, Southern Central Ethiopia, 2020.

C. Thickness: With a long needle, placental thickness was measured at five points of each placenta. Each placenta was placed on fetal surface and divided arbitrarily into three equal zones by drawing two circles on the maternal surface. One thickness was measured from the center of the central zone, two from middle and two from peripheral zones. Finally, the mean of all five measurements was calculated and considered as thickness of the placenta as described by Segupta K and colleague's (45).

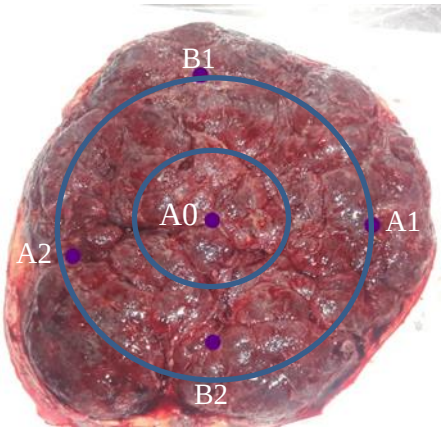

Figure 3: Method of selecting site from different zone of full term placenta for measurement of placental thickness at Butajira General Hospital, Southern Central Ethiopia, 2020.

D. Weight: - Weight of each placenta was record in grams by using standardized a weighting machine scale (WS590 brand and the scale of measurement is in grams) after removal of membranes, umbilical cord and blood clots inside it as followed by Navbir Pasricha (46).

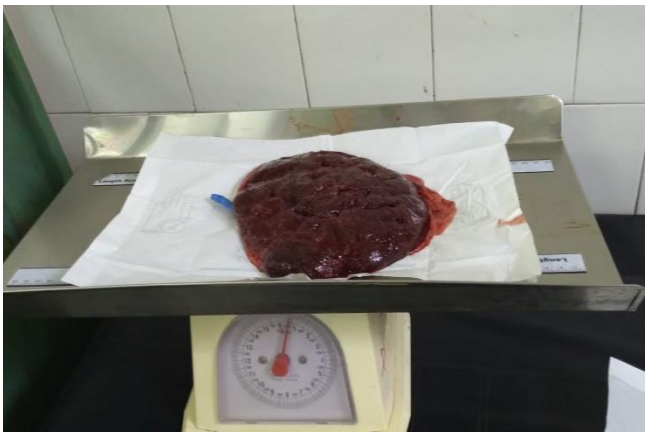

Figure 4: Method of weighting full term placenta by weighting machine at Butajira General Hospital, Southern Central Ethiopia, 2020.

E. Number of Cotyledons: Gentle pressure was applied on the center of the fetal surface of the placenta in order to the cotyledon on the maternal surface became prominent. After that, the placenta was placed on a fetal surface with maternal surface facing upward. Then count of the cotyledon starting from the left side of the one end of the placenta and then going to the right and again turning back to the left in a loop. Finally, total number of cotyledons was count and record as followed by Elangovan and Raviraj (67).

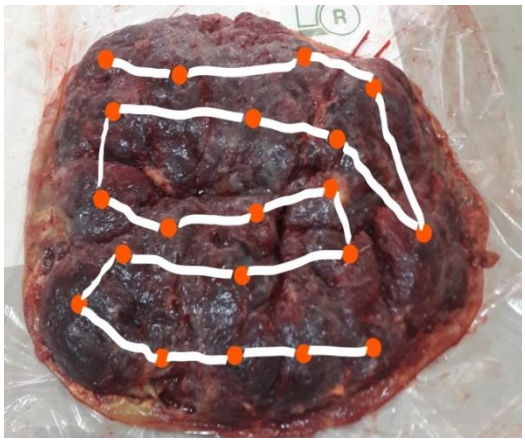

Figure 5: Method of counting full term placental cotyledons from one end to other end in loop manner at Butajira General Hospital, Southern Central Ethiopia, 2020.

F. Birth weight: - Birth weight of the newborn was measured by standard weight scale immediately after delivery.

4.10 Data analysis

After data collection, the data was checked for completeness, edited and entered in to EPI-data Version 4.2 and export to SPSS Version 22 for data analysis. Descriptive statistics like frequency distribution, percentage was computed for categorical variables and presented by tables and graphs. The mean and standard deviation was computed to describe the study variables. Chi –square test and bivariate and multivariate logistic regression was used to confirm the association of independent variables and dependent variable. Comparisons of gross morphology of placenta (weight, diameter, thickness, number of cotyledons) and birth weight of newborn between two groups were analyzed by using independent t-test .If the differences $p<0.05$ was considered as statistically significant. Pearson correlation test was used to investigate correlation of birth weight with gross placental morphology.

4.11 Data quality management

Data was collected by three BSc midwifery staff members working in delivery room and one supervisor. After getting training and discussion by the principal investigator for two days concerning on the placental gross morphology, measurements and appropriate disposal of the placenta. Pre-test was carried out on 10% of the total sample size in Buei Primary Hospital, which located 100 Km away from Addis Ababa capital city of Ethiopia and 35 Km from Butajira town prior to data collection to give the necessary correction, adjustments, important modification and logical flow of ideas was maintained based on pretest result. The collected data was checked for completeness and consistency by the principal investigator daily. All necessary feedbacks were offered to data collectors in the next morning before data collection and quality of equipment was also checked to assure the accuracy.

4.12 Ethical Consideration

Ethical clearance was obtained from Ethical Review Board (IRB) of Institute of Health Research and Postgraduate Studies Director, Jimma University (Ref.No JHRPG1/836/20). Communication with Butajira General Hospital Clinical Director was made through a formal letter of cooperation obtained from Department of Biomedical sciences, Jimma University. All study participants was informed about the objective, benefit and risk of the study. An informed verbal consent was obtained from participants after explaining the information sheet of the study for protecting autonomy and ensuring confidentiality. The respondents was informed the right to refuse to give their placenta if they don't want to participate. COVID-19 infection prevention was considered in all steps of data collection. During data collection the data collectors was practiced COVID-19 infection prevention and control measures (i.e. wearing a mask, practicing hand hygiene by using alcohol based hand sanitizer or soap and water) before and while caring for a neonate and mother.

4.13 Dissemination plan

The result of the study will be submitted and presented to the Department of Biomedical Science, School medicine, Institute of Health Science and Jimma University. The study findings will also submit to Butajira General Hospital. Effort will be made to present the result in scientific seminars, workshops, conferences and meetings. Finally it will be sent to scientific journals for publication.

5. RESULTS

5.1. Socio-demographic and economic characteristics

Among 158 mothers who participated in this study, 79 mothers were normotensive (control group), and 79 mothers were pre-eclamptic. Among pre-eclamptic mothers majority of them, 48 (61%) were of mild preeclampsia and 31 (39%) was severe preeclampsia. The mean (±SD) age of all mothers was 28.89±6.403 years. The mean age of normotensive mothers was 27.57± 6.097 and 29 (36.7%) of mother's age was within 25-29 years. While the mean age for pre-eclamptic mothers was 29.47±6.646 and 23 (29.1%) of the mother's age was within 25- 29 years (Figure 1).

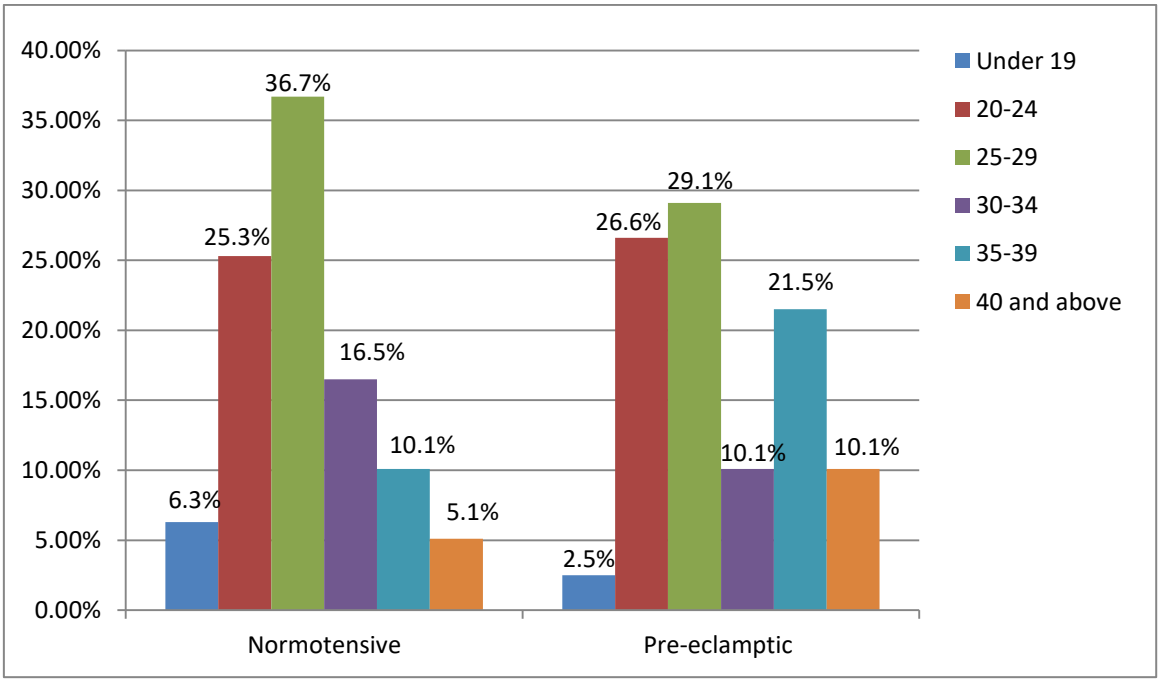

Figure 6: Frequency of age category of normotensive and pre-eclamptic mothers in Butajira General Hospital, Southern Central Ethiopia, 2020.

More than half of normotensive mothers 49 (62%) and 47 (59.5%) of pre-eclamptic mothers were living in an urban areas. Some mothers were married, out of normotensive mothers 70 (88.6%) were married and among pre-eclamptic mothers, 69 (87.3%) were married. The majority of mothers were housewives, out of normotensive mothers 51 (64.6%) were housewives and from pre-eclamptic mothers, 36 (45.6%) were housewives as illustrated in Table 2 below.

Table 2: Socio-demographic and economic characteristics of the mothers in Butajira General Hospital, Southern central Ethiopia, 2020.

Background variables		Normotensive		Pre-eclamptic	
		Frequency	Percent (%)	Frequency	Percent (%)
Residence	Urban	49	62	47	59.5
	Rural	30	38	32	40.5
Educational Level	Cannot read and write	12	15.2	-	-
	Can read and write	13	16.5	13	16.5
	Primary	25	31.6	39	49.4
	Secondary	19	24.1	18	22.8
	Higher Education	10	12.7	9	11.4
Occupation	Un employed	6	7.6	4	5.1
	Housewife	51	64.6	36	45.6
	Employed in government	8	10.1	11	13.9
	Employed in private sector	4	5.1	8	10.1
	Merchant	10	12.7	18	22.8
	Other	-	-	2	2.5
Marital status	Currently married	70	88.6	69	87.3
	Separated	3	3.8	4	5.1
	Divorced	-	-	1	1.3
	Widowed	2	2.5	1	1.3
	Never married	4	5.1	4	5.1

5.2. Maternal and Pregnancy Related Characteristics

The gestational ages of mothers, mean (±SD) were 38.29±1.178 and 37.89±1.098 weeks for normotensive and pre-eclamptic mothers respectively. The mean (±SD) body mass index (BMI) of mothers was 21.78 ± 2.78(Kg/m^2) and 24.39±2.17 (Kg/m^2) in normotensive and pre-eclamptic mothers respectively. There was a significant mean difference BMI between two groups (<0.05).

Among normotensive mothers, 48 (60.8%) were multigravida and 31(39.2%) were primigravida. Similarly, among pre-eclamptic mothers, 45(57%) were multigravida and 34(43%) were primigravida. Concerning to the mode of delivery, among normotensive placentas, the majority 75.9% were delivered by spontaneous vaginal delivery, 20.3% by instrumental delivery, and 3.8% by caesarean section. Similarly, out of pre-eclamptic mothers, 63.3% were delivered by spontaneous vaginal delivery, 21.5 % by instrumental delivery, and 15.2 % by caesarean section (Table 3).

Table 3: Maternal and pregnancy related characteristics of the mothers in Butajira General Hospital, Southern central Ethiopia, 2020.

Variables		Normotensive		Pre-eclamptic	
		Frequency	Percent (%)	Frequency	Percent (%)
Gravidity	Primi-gravida	31	39.2	34	43
	Multigravida	48	60.8	45	57
	Grand-multiparous	6	7.6	8	10.1
Mode of delivery	SVD	60	75.9	50	63.3
	Instrumental delivery	16	20.3	17	21.5
	C/S	3	3.8	12	15.2
Antenatal checkup	No	12	15.2	10	12.7
	Irregular follow up	26	32.9	30	38
	Regular follow up	41	51.9	39	49.4

Regarding parity, among normotensive mothers about 29 (36.7%) and 36(45.6%) preeclamptic mothers were nulliparous as showed on Figure 7 below.

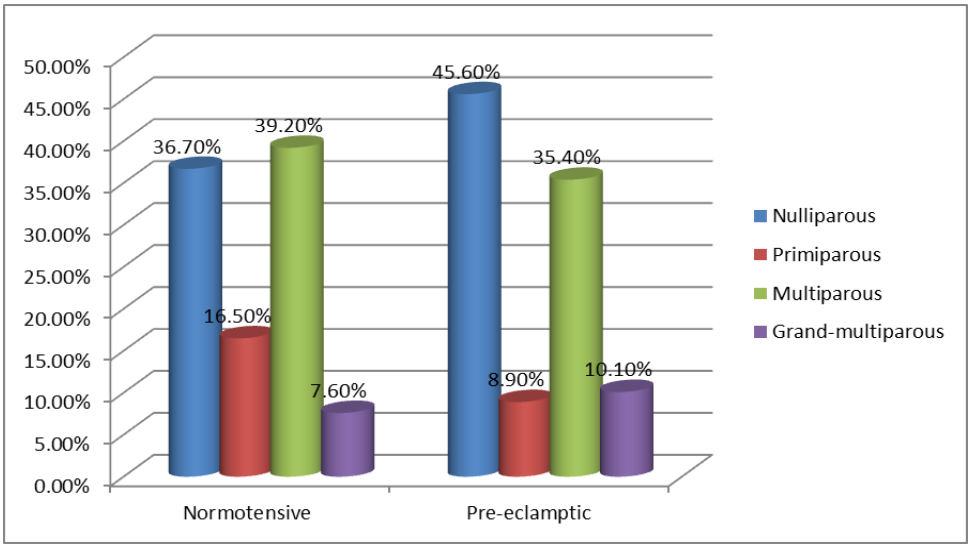

Figure 7: Number of parity distribution in normotensive and pre-eclamptic mothers at Butajira General Hospital, Southern Central Ethiopia, 2020.

5.3 Neonatal outcomes characteristics

Among normotensive mothers the majority of newborn birth outcome was alive 76(96.2%) and 3(3.8%) was a stillbirth. On the other hand among pre-eclamptic mothers 72(91.14%) were alive and 7(8.86%) were stillbirth. The mean Apgar score in the first and fifth minute was 7.56± 1.34 and 8.28±1.45 respectively in normotensive mothers and 7.04± 1.95 and 7.71± 2.12 respectively in pre-eclamptic mothers. Out of 79 pre-eclamptic mothers, 12(15.5%) newborns were admitted to NICU and among 79 normotensive mothers, 6(7.6%) of newborns were admitted to NICU (Table 4).

According to the Chi-square test result, the condition of the newborn, Apgar score at 1st minute, and NICU admission had no statistically significant difference between the two groups (p-value >0.05). But Apgar score at 5th minute has significant variance between normotensive and pre-eclamptic mothers (Table 4).

Table4: Chi-square distribution of fetal outcome in normotensive and pre-eclamptic mothers, at Butajira General Hospital, Southern Central Ethiopia, 2020.

Variables		Normotensive N=79	Preeclampsia N= 79	Statistical significance
Condition of newborn	Live birth	76(96.2%)	72(91.14%)	P-value=0.348
	Still birth	3(3.8%)	7(8.86%)	
APGAR 1st minute	<7	24(30.4%)	34(44.3%)	P-value=0.07
	≥7	55(69.6%)	45(55.7%)	
APGAR 5th minute	<7	5(6.3%)	13(16.4%)	P-value= 0.04
	≥7	74(93.7%)	66(83.6%)	
NICU admission	Admitted	6(7.6%)	12(15.2%)	P-value=0.133
	Not admitted	73(92.4%)	67(84.8%)	

5.4 Birth weight of newborn

The mean (± SD) birth weight babies who were delivered from normotensive mothers were 3.331±0.0.359 kg. Whereas in pre-eclamptic mothers the mean birth weight of babies was 2.89±0.389 kg. The mean birth weight was found to be lower in pre-eclamptic mothers as compared to normotensive mothers. The statistical significance between the two comparison groups ($t = 7.284$, $p<0.001$), shows that there was a significant difference in the mean birth weight of newborn between the two groups (Table 5). Out of 79 normotensive mothers, 5 (6.3%) babies birth weight was less than 2.5 kg and out of 48 mild pre-eclamptic mothers, 7 (14.6%) neonates birth weight was <2.5 kg, and out of 31 severe pre-eclamptic mothers, 9 (29%) neonates birth weight was <2.5 kg. This study showed that as the severity of preeclampsia increase the incidence of low birth weight was higher.

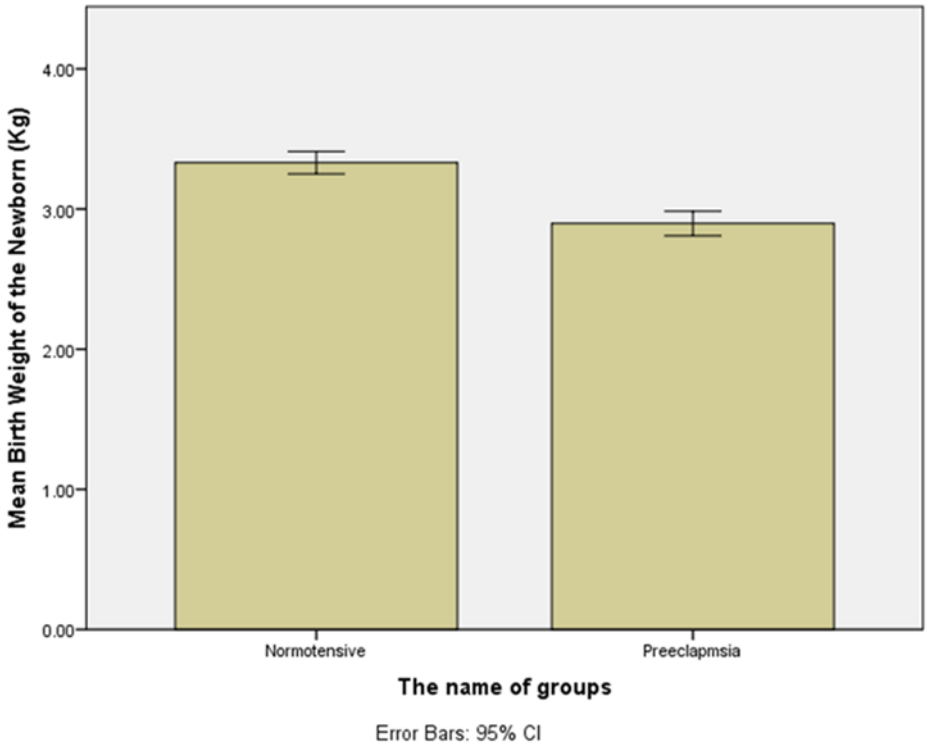

Figure 8: Error bar graph shows the mean birth weight in normotensive and pre-eclamptic mothers at Butajira General Hospital, Southern Central Ethiopia, 2020.

5.5 Placental parameters

5.5.1 Placental Shape

In the present study, in normotensive and pre-eclamptic mothers, the number of the oval-shaped placenta was 30(38%) and 38(48.1%), the number of the circular-shaped placenta was 36(45.6%) and 24(30.4%), the number of the irregularly shaped placenta was 13 (16.5%) and 17(21.5%) respectively (Figure 9). According to the chi-square test result placental shape has no statistically significant between the pre-eclamptic and normotensive mothers (p-value = 0.144, which is >0.05).

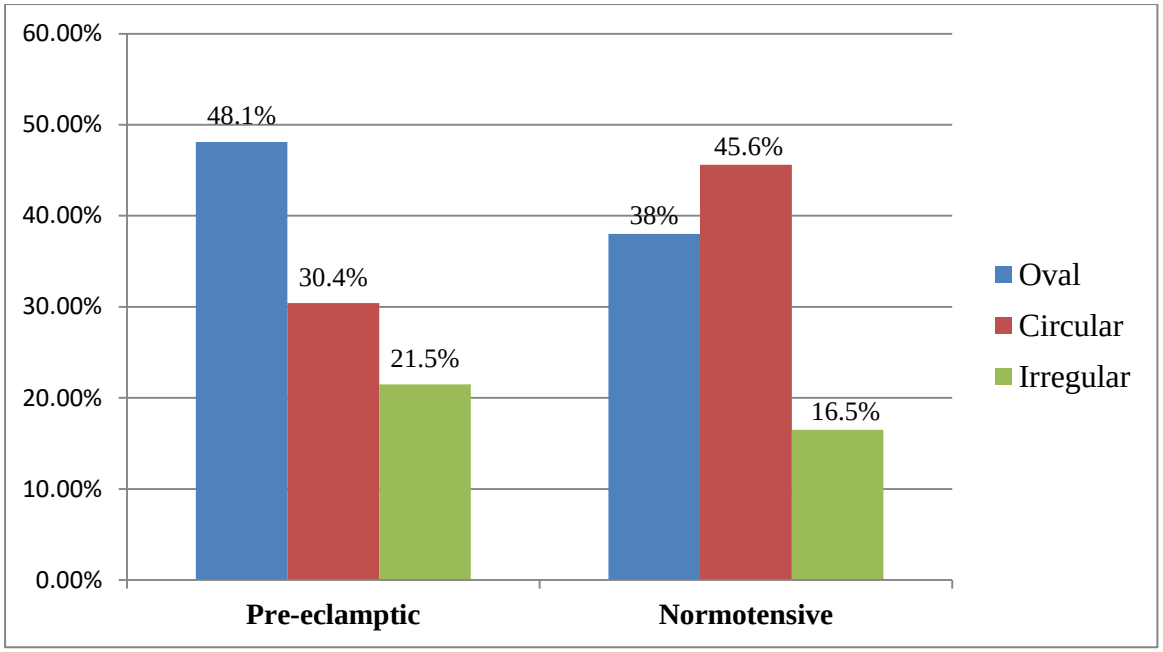

Figure 9: Placental shape in both normotensive and pre-eclamptic mothers at Butajira General Hospital, Southern Central Ethiopia, 2020.

5.5.2 Placental Weight

The mean (± SD) weight of the placenta was 576.86 ±130.91 g in normotensive mothers and 446.72 ±83.86 in pre-eclamptic mothers. The statistical significance between the two groups was (t=7.44, p= 0.003). This shows that normotensive mother's placenta weight was significantly larger compared to pre-eclamptic mothers (Table 5). The mean fetoplacental weight ratio was in 5.78±2.7 normotensive and 6.48±0.46 in pre-eclamptic mothers.

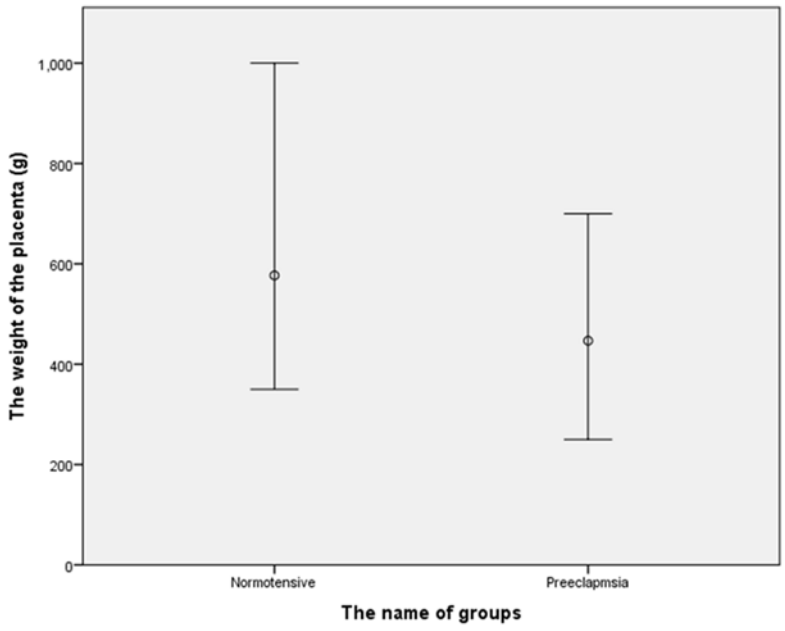

Figure 10: A high-low graph shows the mean placental weight in normotensive and pre-eclamptic mothers at Butajira General Hospital, Southern Central Ethiopia, 2020.

The placental weight in about 53.2% of normotensive mothers was ranging between 401- 500 grams and 26.6% were ranging between 501-600 grams. In mild preeclampsia and severe preeclampsia, the placental weight distribution was 29.2% and 51.6% respectively was in the range 301-400 grams (Figure 11).

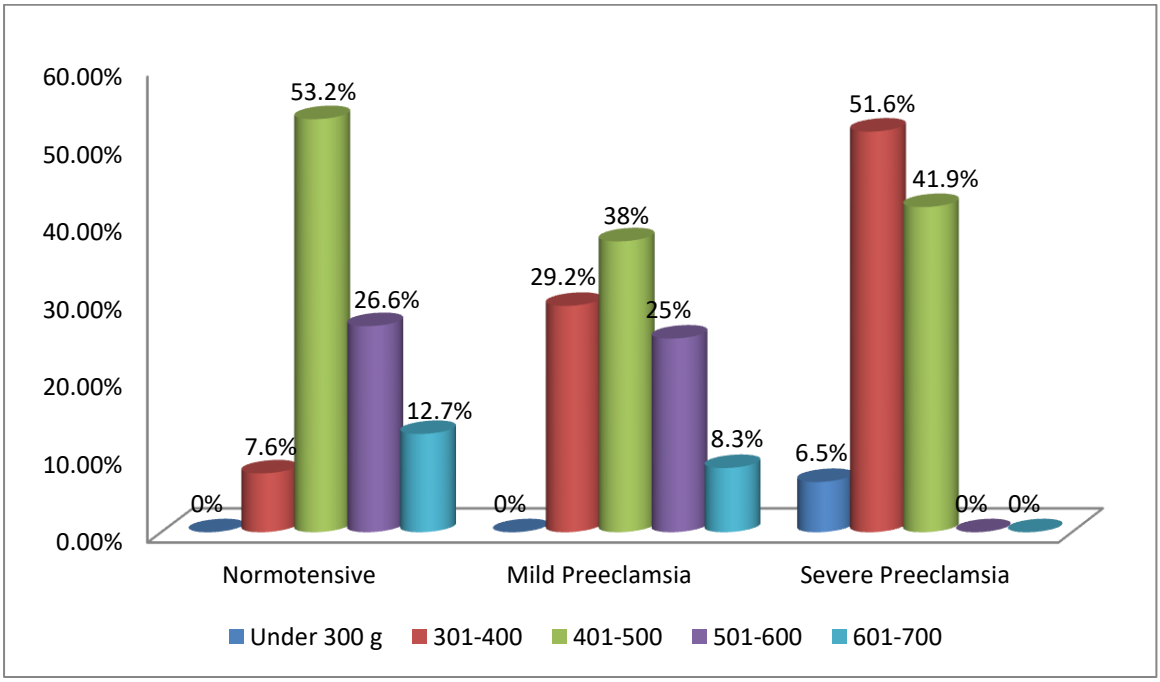

Figure 11: Placental weight distributions among normotensive, mild preeclampsia and severe preeclampsia at Butajira General Hospital, Southern Central Ethiopia, 2020.

5.5.3 Placental Diameter and Thickness

In this study, the mean (± SD) diameter of the placenta was 18.91 ± 2.43 cm in normotensive mothers and 15.61 ± 1.82cm in pre-eclamptic mothers. Accordingly, it was evident that the diameter of the placenta was statistically different from each other at ($t=9.667$, $p< 0.05$) (Table 5).

The mean (± SD) thickness of the placenta was 2.08 ± 0.31 cm in normotensive mothers and 1.74± 0.19cm in pre-eclamptic mothers. There was a statistically significant difference between the two groups ($t=8.225$, $p=0.001$) (Table 5).

5.5.4 Number of Cotyledons

The mean (± SD) number of cotyledon in normotensive mothers and pre-eclamptic mothers was 19.25± 3.04 and 16.7 ± 1.77 respectively. Accordingly, it was evident that the number of cotyledons was a statistically significant difference between the two groups (t=6.452, p=0.001) (Table 5).

Table 5: Independent sample t- test of placental morphometry and birth weight in normotensive and pre-eclamptic mothers, at Butajira General Hospital, Southern Central Ethiopia, 2020.

Variables	Normotensive (control)	Pre-eclamptic (case)	t-statistic	p-value
Placental Weight	576.86±130.91 g	446.72±83.86 g	7.44	0.003
Placental Thickness	2.03±0.31 cm	1.74±0.19 cm	8.225	0.001
Placental Diameter	18.91±2.43 cm	15.61±1.82 cm	9.667	0.015
Number of Cotyledons	19.25±3.04	16.7±1.77	6.452	0.001
Birth Weight	3.331±0.359kg	2.897±0.389 kg	7.284	<0.001

P-value ≤ 0.05 was significant

5.6 Correlation of Birth Weight with Placental Morphometric Measurements

In this study generally, there was a significant positive correlation between birth weight and placental weight, diameter, thickness, and number of cotyledons respectively. Pearson correlation test showed that birth weight was positive and strongly correlated with placental weight, placental diameter, and placental thickness and moderately positively correlated with the number of cotyledons (Table 6).

Relatively in normotensive group birth weight was strongly correlated with placental diameter (r= 0.568, p <0.001) and placental thickness (r= 0.456, p<0.001), moderately correlated with placental weight (r=0.456, p<0.001). But, birth weight has no significant correlation with the number of cotyledons (r= 0.138, p=0.224) in normotensive mothers. While in preeclampsia, birth weight was a significant and strongly correlated with placental weight (r=0.636, p<0.001). However, birth weight has no significant correlation with placental diameter (r=0.019, p=0.866), thickness (r=0.127, p= 0.264) and number of cotyledons (r=0.031, p= 0.788) in pre-eclamptic mothers (Table 6).

Table 6: Pearson correlation test between birth weight and placental weight, diameter, thickness, and number of cotyledon in normotensive and pre-eclamptic mothers, at Butajira General Hospital, Southern Central Ethiopia, 2020.

Variables			Placental weight	Placental diameter	Placental thickness	Number of cotyledons
Birth weight	Overall	R	0.605**	0.525**	0.503**	0.303**
		P	<0.001	<0.001	<0.001	<0.001
	Normotensive	R	0.376**	0.568**	0.456**	0.138
		P	0.001	<0.001	<0.001	0.224
	Pre-eclamptic	R	0.636**	0.019	0.127	0.031
		P	<0.001	0.866	0.264	0.788

**Correlation is significant at the 0.01 level (2-tailed)

5.7 Determinant factors for birth weight

After bivariate and multivariable logistic regression was run independently, nullparity, maternal preeclampsia, and maternal age (20-24 years) were predictors for low birth weight (LBW) and a significant association at p-value <0.05.

This study showed that babies from pre-eclamptic mothers were 2.87 times more likely to be born with low birth weight as compared to those babies born from normotensive mothers [AOR =2.87 (95%CI =0.72-11.56] (Table 6). Also, babies born from nulliparous mothers were 1.17 times more likely to be born with low birth weight than those babies from multiparous mothers [AOR =1.17 (95% CI= (1.03-2.82]. In addition, the odds of being low birth weight among newborns whose maternal age 20-24 were 2 times as compared to those newborns whose maternal age >30 years [AOR=2.07 (95% CI=0.391-10.99] (Table 7).

Table 7: Result of Bivariate and multivariate logistic regression for factor associated with low birth weight in Butajira General Hospital, Southern Central Ethiopia, 2020

Variables	Categories	Birth weight		COR at 95%CI	AOR at [95%CI]
		<2.5 kg N (%)	≥2.5 kg N (%)		
Maternal status	Preeclampsia	16(10.13%)	61(38.61%)	3.76(1,304,10.837)*	2.87(0.72,11.56)*
	Normotensive	5(3.16%)	74(46.83%)	1	1
Maternal age	<20	1(0.633%)	6(3.8%)	0.103(0.19,0.559)	1.62(0.085,31.167)
	20-24	8(5.06%)	33(20.89%)	0.566(0.188,1.709)*	2.07(0.391,10.99)*
	25-29	4(2.53%)	48(30.38%)	1.052(0.33,3.36)	2.82(0.583,13.66)
	>30	8(5.06%)	50(3.16%)	1	1
Educational Level	Cannot read and write	1(0.63%)	12(7.59%)	0.667(0.38,11.716)	0.499(0.006,40.48)
	Can read and write	2(1.26%)	24(15.19%)	0.667(0.56,7.937)	0.372(0.018,7.496)
	Primary	9(5.7%)	54(34.18%)	0.333(0.039,2.815)	0.218(0.16,2.96)
	Secondary	8(5.06%)	29(18.35%)	0.201(0.023,1.747)	0.103(0.008,1.385)
	Higher education	1(0.63%)	18(11.39%)	1	1
Marital status	Currently married	16(16.13%)	120(75.9%)	1.071(0.124,9.283)	0.957(0.058,15.82)
	Separated	1(0.63%)	6(3.8%)	0.857(0.044,16.851)	0.771(0.02,29.442)
	Divorced	2(1.26%)	1(0.63%)	0.071(0.003,1.728)	0.042(0.001,2.59)
	Widowed	1(0.63%)	3(1.89%)	0.429(0.02,9.364)	0.18(0.003,9.78)
	Never married	1(0.63%)	7(4.43%)	1	1
Parity	Nulliparous	15(9.5%)	59(37.34%)	3.305(1.209,9.032)*	1.17(1.03,2.82)*
	Multiparous	6(3.79%)	78(49.37%)	1	1
Sex of fetus	Male	9(5.69%)	74(46.83%)	1.566(0.62,3.959)	1.495(0.461,4.854)
	Female	12(7.59%)	63(39.87%)	1	1
BMI of mothers	<18.5 kg/m^2	1(0.63%)	9(5.69%)	2.538(0.289,22.269)	1.463(0.092,23.18)
	18.5-24.9 kg/m^2	11(6.96%)	89(56.33%)	1.825(0.7,4.76)	1.337(0.383,4.673)
	25-29.9kg/m^2	9(5.69%)	39(24.68%)	1	1
ANC Follow-up	No	2(1.26%)	20(12.66%)	1.594(0.326,7.792)	1.93(0.282,13.26)
	Irregular	8(5.06%)	48(30.38%)	0.957(0.358,2.555)	1.19(0.364,3.917)
	Regular	11(6.96%)	69(43.67%)	1	1

AOR= Adjusted Odd Ratio; CI=Confidence Interval, COR= Crude Odd Ratio; *=p-value <0.05.

5.8 Determinant factors for placental morphometric parameters

Bivariate and multivariable logistic regression was run independently to identifying the determining factors for placental morphometric parameters.

This study showed that placenta from pre-eclamptic mothers was 2 times more likely to have a low placental diameter as compared to the placenta from normotensive mothers [AOR=2.232, (95% CI= 0.246-20.24)]. Similarly, placentas belonging to male neonates were 0.05 times more likely to have low placental diameter as compared to placentas born with female neonates [AOR= 0.046; (95% CI=0.005-0.416)].

This study revealed that placenta from pre-eclamptic mothers was 37 times more likely to have a low placental thickness as compared to the placenta from normotensive mothers [AOR=37.02, (95% CI= 8.76-156.441)]. Similarly, placentas whose mothers educational status cannot read and write were 0.08 times more likely to have a low placental thickness as compared to placentas whose mothers who have higher education [AOR= 0.085; (95% CI=0.009-0.763)].

In present study, preeclampsia had a significant association (<0.05) with the number of cotyledons. Placentas from pre-eclamptic mothers were 6.7 times more likely to have a small number of cotyledons as compared to those placentas from normotensive mothers [AOR =6.738; (95%CI =2.648-17.147].

This study showed that placenta from pre-eclamptic mothers was 4 times more likely to be low placental weight (<500g) as compared to the placenta from normotensive mothers [AOR=4.26; (95% CI= 1.79-10.135)]. Similarly, placentas whose nulliparous mothers had been 0.4 times more likely to have low placental weight (<500g) as compared to placentas whose multiparous mothers AOR= 0.436; (95% CI=1.65-1.153]. In addition, placentas whose from mothers BMI <18.5 kg/mm^2 17 times more likely have low weight of placenta (<500g) than whose mothers BMI 25-29.9kg/mm^2 [AOR= 17.64; (95%CI= 1.53-203.22)] (Table 8).

Table 8: Result of Bivariate and multivariate logistic regression for factor associated with placental weight in Butajira General Hospital, Southern Central Ethiopia, 2020.

Variables	Categories	Placenta Weight		COR at 95%CI	AOR at [95%CI]
		< 500 g N (%)	≥500 g N (%)		
Maternal status	Preeclampsia	58(71.6%)	21(27.4%)	6.73 (3.35, 13.49)**	4.26 (1.79, 10.135)**
	Normotensive	23(28.4%)	56 (72.7%)	1	1
Maternal Age	<20	4 (4.9%)	3 (3.9%)	0.99 (0.203, 4.83)	0.255(0.2, 3.245)
	20-24	19 (23.5%)	22 (28.6%)	1.53 (0.684, 3.42)	1.78 (0.515, 6.112)
	25-29	25 (30.9%)	27 (35.1%)	1.43 (0.672, 3.025)	1.012 (0.368, 7.782)
	>30	33 (40.7%)	25 (32.5%)	1	1
Educational Level	Cannot read and write	3 (3.7%)	10 (13%)	3 (0.622, 14.469)	1.502 (0.217, 10.414)
	Can read and write	11 (13.6%)	15 (19.5%)	1.23 (0.373, 4.034)	0.935 (0.216, 4.042)
	Primary	39 (48.1%)	24 (31.2%)	0.554 (0.197, 1.56)	0.409 (0.115, 1.46)
	Secondary	19 (23.5%)	18 (23.4%)	0.853 (0.282, 2.581)	0.695 (0.182, 2.65)
	Higher education	9 (11.1%)	10 (13%)	1	1
Marital Status	Currently married	70 (86.4%)	66 (85.7%)	0.943(0.28, 3.93)	0.295 (0.038, 2.305)
	Separated	2 (2.5%)	5 (6.5%)	2.5(0.292, 21.4)	1.212 (0.79, 18.621)
	Divorced	2 (2.5%)	1 (1.3%)	0.5 (0.031, 7.994)	0.151 (0.005, 4.89)
	Widowed	3 (3.7%)	1 (1.3%)	0.333 (0.23, 4.736)	0.085 (0.003, 2.15)
	Never married	4 (4.9%)	4 (5.2%)	1	1
Parity	Nulliparous	43 (53.1%)	31 (40.3%)	0.596 (0.317, 1.12)*	0.436 (1.65,1.153)*
	Multiparous	38 (46.9%)	46 (59.7 %)	1	1
Sex of Fetus	Male	44 (54.3%)	39 (50.6%)	0.863 (0.462, 1.612)	0.96 (0.435, 2.12)
	Female	37(45.7%)	38 (49.4%)	1	1
BMI of mothers	<18.5 kg/m^2	1 (1.2%)	11 (14.3%)	24.2 (2.86, 204.9) *	17.64(1.53, 203.22)*
	18.5-24.9 kg/m^2	47 (58%)	51 (66.2%)	2.39 (1.15, 4.94)*	1.73 (0.694, 4.315)
	25-29.9kg/m^2	33 (40.7%)	15 (19.5%)	1	1
ANC Follow-up	No	11 (13.6%)	11 (14.3%)	1.05 (0.409, 2.701)	0.929 (0.254, 3.403)
	Irregular	29 (35.8%)	27 (35.1%)	0.979 (0.494, 1.94)	1.24(0.511, 3.013)
	Regular	41 (50.6%)	39 (50.6%)	1	1

AOR= Adjusted Odd Ratio; CI=Confidence Interval, COR= Crude Odd Ratio; *=p-value <0.05, **p-value <0.001.

6. DISCUSSION

Placenta shows the most accurate record of the prenatal life of an infant. When pregnancies are complicated by preeclampsia; it adversely affects the morphology of the placenta (19). Even though the placenta adapts well to the hypoxic circumstances in preeclampsia, the compensatory modifications that occurred are insufficient. The compensatory alterations cause mal-development and inadequate placental mass, causing placental dysfunction that leads to oxidative stress and fetal hypoxia (23). In Preeclampsia, the placenta tends to be smaller as compared with normal gestation (37). In the current study, comparing pre-eclamptic mother's placentae with normotensive mother's placentae, the mean placental weight, diameter, thickness, and the number of cotyledons were declined significantly.

In the present study, the mean birth weight of newborns was higher at 3.331±0.359kg in the normotensive group compared to the pre-eclamptic group at 2.897±0.389 kg. This difference was found statistically significant. In the study conducted in India, the mean fetal birth weight was 2.1 kg and 2.8 kg in the pre-eclamptic group and normotensive group respectively. Similarly, various studies conducted in Dhaka (19), India (22), Nigeria (39), India (38) and Ethiopia (40), reported that the mean birth weight of the neonate was significantly lower in the mothers with preeclampsia than that of normotensive mothers. This might be due to under nutrition of the fetus because of uteroplacental vascular insufficiency in preeclampsia which leads to low birth weight. In current study showed that the incidence of low birth weight is significantly higher in babies born from (20.25%) pre-eclamptic mothers as compared to babies born from (6.3%) normotensive mothers. This finding is in line with other studies conducted in India, which noted that the incidence of low birth weight in the pre-eclamptic group was 78% and 18% in normotensive groups (37).

The placental shape is typically defined as a flattened discoid with an approximate circular margin. In the current study, the placental shape has no statistically significant between normotensive and pre-eclamptic mothers. But there was more oval and irregular shaped placenta observed in preeclampsia. This variation possibly due to apoptosis and compensatory hyperplasia of the parenchyma run side by side resulting loss and fibrosis of parenchyma tissue. These alterations effect on the shapes of placenta which deviate from normal shape. This finding is parallel to other studies conducted in Dhaka (45), India (46) and India (47); found that the placental shape was no significant difference between the two groups. In a contrary study done in the Ethiopia University of Gondar (40), the placental

shape deviance from the normal was significantly higher in pre-eclamptic placentas than in normotensive placentas. This inconsistency may be due to the point that the difference in the number of study participants and the discrepancy in the severity of preeclampsia cases under the study.

In the present study, it is observed that mean placental weight was significantly less in the pre-eclamptic placenta as compared to the normotensive placenta. The mean placental weight was 576.86±130.91 g in normotensive and 446.72±83.86 g in the pre-eclamptic group. This finding is similar with other studies done in India (37), Iraq (41), India (49) and Ethiopia (40); reported that the mean placental weight was (502±58.42 g in normotensive and 430 ±50.69 g pre-eclamptic), (504.29±90.12 g control and 429.52±99.06 g case group), (439.17±19.42 normotensive and 395.5±50.03 pre-eclamptic mothers), (497.95 g in normotensive and 417.6 g in the pre-eclamptic group) respectively. They found that reduced placental weight in pre-eclamptic mothers as compared to normotensive mothers. This is due to a significant reduction in peripheral villous tissue mass, fetal capillary and intervillous space volume.

In the current study, there was placental weight decrease as blood pressure increase from normal to severe preeclampsia; 576.86±130.91 g (normotensive), followed by 477.54±80.93 g (mild preeclampsia) and 399±50.72 g (severe preeclampsia). This result is comparable study conducted in India (22); the mean placental weight was 435.92±14.18 g (normotensive), followed by 376.41±17.198 g (mild preeclampsia) and 330.72±2.90 g (severe preeclampsia). The placental weight decreases as increase the severity of hypertension is due to uteroplacental vascular insufficiency.

Placental weight maintains intrauterine life and is directly related to fetal weight. In the current study, the mean fetoplacental weight ratio (F/P ratio) was in 5.78±2.7 normotensive mothers and 6.48±0.46 in pre-eclamptic mothers. But, the difference was not statistically significant. This result is in line with other studies done in India (38) and Ethiopia (40); the mean F/P ratio were 6.308±0.364 Vs 6.343±0.953 and 6.34±0.89 Vs 6.41±1.03 in normotensive and pre-eclamptic case respectively. In both studies, the difference between the two groups was not statistically significant.

A present study revealed that placental diameter was significantly reduced in the pre-eclamptic group as compared to the normotensive group. The mean placental diameter in the normotensive group was 18.91±2.43 cm and in the pre-eclamptic group was 15.61±1.82 cm. This finding has comparable results with studies conducted in India (7), India (22) and Norway (23), reported a significant reduction in diameter of the pre-eclamptic placenta. This could be due to placenta from preeclampsia has an underlying pathological process interfering with the normal growth of the placenta (45). In contrary to another study conducted in India, the mean placental diameter in the normotensive group was 18.02±2.40 cm and 18.09±2.50 cm in pre-eclamptic mothers, and the difference was not statistically significant (53). This difference may be due to the variability in inclusion criteria of study participants, the variability of sample size, and the difference in genetic and environmental factors.

The thickness of the placenta gives information about the size of the placenta which may intend to give indirect evidence about the fetal-placental ratio. The current study noted that the mean placental thickness was 2.03±0.31 cm in the normotensive placenta and 1.74±0.19 cm in pre-eclamptic placenta. The pre-eclamptic placentas were smaller and thinner as compared to normotensive placenta. Similar findings have also been reported by studies conducted in India (37) and Ethiopia (40) that found there was a significant reduction in placental thickness of the pre-eclamptic placenta. This might be due to that the pathologic process interferes with the normal placental growth. On the contrary, studies conducted in India (45) and Dhaka (53), reported that placental thickness was no significant decline in pre-eclamptic placenta. The difference could be associated with nutrition, environmental and genetic variations.

The number of cotyledons is directly related to the circulation of chorionic blood vessels. As the number of cotyledons increases, the number and spreading of chorionic blood vessels increase. A higher number of cotyledons increase the transfer of nutrients from the mother to the fetus (50). According to the present study, the mean number of cotyledons was significantly less in pre-eclamptic placenta as compared to normotensive. The mean number of cotyledons was 19.25±3.04 in normotensive placenta and 16.7±1.77 in pre-eclamptic placenta. This finding was in line with the results of studies conducted in India (22), Ethiopia (40) and India (37); found a significant reduction in the number of cotyledons of the pre-eclamptic placenta. This might be due to the degeneration of each cotyledon secondary to preeclampsia.

In the present study, birth weight was positively correlated with placental weight, diameter, thickness, and the number of cotyledons in both normotensive and pre-eclamptic groups as a whole. In the normotensive group birth weight was strongly correlated with the placental diameter and placental thickness, moderately correlated placental weight. While in preeclampsia, birth weight was significant and strongly correlated with placental weight. In both normotensive and pre-eclamptic group, placental weight is directly proportional to birth weight. This result was supported by the studies conducted in Pakistan (7), America (11), and India (21), which revealed that birth weight was significantly associated with placental weight. This might be due to that preeclampsia results low placental perfusion and limits the expansion of the placenta.

In the present study, the risk of low birth weight was two times more likely to occur in pre-eclamptic mothers. This finding in line with study conducted in Canada (69), the risk of low birth weight was four times more likely to occur in the pre-eclamptic group as compared to the normotensive group (AOR=4.14; 95% CI, 3.32 -5.15). This is due to alteration inter-cotyledons vasculature in pre-eclamptic placenta resulting in low birth weight babies. In current study, the risk of low birth weight was 0.8 times more likely to occur in nulliparous as compared to multiparous at [AOR =0.17 (95% CI= (0.037-0.788]. This result was supported by the study conducted in India (57) and Indonesia (62), which showed that the risk of low birth weight in nulliparous mothers significantly higher than multiparous mothers. But until know there is no clear mechanism how parity influence on low birth weight (57, 60). This study showed that, the risk low birth weight among newborns whose maternal age 20-24 were 2 times as compared to those newborns whose maternal age >30 years [AOR=2.07 (95% CI=0.391-10.99]. In contrary to another study conducted in Tanzania the risk of low birth weight is higher whose maternal age <20 years as compared to other age groups (54). This discrepancy is due to genetic, socio-economic, socio-cultural and nutrition variations.

This study showed that the risk of lower value placental morphometric measurement is positively associated with maternal preeclampsia. The risk of lower placental weight was four times more likely to occur in pre-eclamptic mothers at [AOR=4.26; (95% CI= 1.79-10.135)] than normotensive mothers. The risk lower placental diameter was two times more likely to occur in pre-eclamptic mothers as compared to the placenta from normotensive mothers [AOR=2.232, (95% CI= 0.246-20.24)]. The risk of lower placental thickness was 37 times more likely to happen in pre-eclamptic placenta as compared to the placenta from normotensive [AOR=37.02, (95% CI= 8.76-156.441)]. Placentas from pre-eclamptic mothers

were 6.7 times more likely to have a small number of cotyledons as compared to those placentas from normotensive mothers [AOR =6.738; (95%CI =2.648-17.147]. This finding is similar to a studies conducted in Norway (5) and India (13, 68), which reported that the risk of lower placental morphometric measurements was more likely to occur in pre-eclamptic mothers than normotensive mothers. This is due to reduced utero placental blood flow in pre-eclamptic placenta then the placenta tries to compensate for reduced blood supply; these compensatory changes are insufficient and thus fails to develop adequate placental mass (22).

This study showed that, placentas whose nulliparous mothers had been 0.4 times more likely to have low placental weight as compared to placentas whose multiparous mothers [AOR= 0.436; (95% CI=1.65-1.153]. This finding similar with other studies conducted in India (57) and Indonesia (62), which showed that the risk of low placental weight in nulliparous mothers significantly higher than multiparous mothers. This could be due to that the in multiparous mothers have permanent changes in the anatomical structure of spiral arteries after pregnancy assist in effective vascular remodeling by enhancing the trophoblast migration in the successive pregnancies. This study also revealed that, risk of lower placental weight was 17 times more likely to happen in BMI <18.5 kg/mm^2 than whose mothers BMI 25-29.9kg/mm^2 [AOR= 17.64; (95%CI= 1.53-203.22)]. This finding is parallel with another studies conducted in India (63), Sudan (64) and Tanzania (65), the risk of low placental weight is associated with undernutrition (BMI <18.5 kg/mm^2). This might be due to maternal undernutrition causes placental insufficiency which impact on reduction of placental weight. In the present study, placentas of whose male neonate were 0.05 times more likely to have low placental diameter as compared to placentas whose female neonate [AOR= 0.046; (95% CI=0.005-0.416)]. This result supported study conducted in India (57), showed that the placental diameter of male babies was lower than female babies. On contrary another study done in Norway showed that there is no placental morphometric difference between male and female babies (58). The difference might be due to nutritional status, maternal and paternal anthropometry, genetic factors, Rh-incompatibility and other environmental factor.

STRENGTHS AND LIMITATIONS

Strength

As for strengths, the finding of the study could detect the effect of preeclampsia on placental morphology and low birth weight. It also identifies other covariate factors and their association with placental morphology and birth weight of neonate.

Limitation

This study only tried to compare pre-eclamptic and normotensive maternal placenta and the birth weight of newborn, specific types of Pregnancy Induced Hypertension was not identified and studied.

7. CONCLUSIONS

This study concluded that all placental morphometric values, placental weight, diameter, thickness, and the number of cotyledon in the pre-eclamptic group were found significantly lower than that of the normotensive group and this was contributed to the inadequate blood supply due to preeclampsia. But the placental shape was no a significant difference in pre-eclamptic mothers. It also observed that there was a statistically significant difference in the birth weight of the newborn between normotensive and pre-eclamptic groups. In this study, observed that placental weight was positively correlated with birth weight in both normotensive and pre-eclamptic groups. Placental thickness, diameter, and the number of cotyledons were only correlated with birth weight in the normotensive group but not correlated in the pre-eclamptic group. The finding of this study shows, maternal pre-eclampsia, nullparity, maternal age (20-24 years), male sex, and BMI <18.5 kg/mm2 identified as the determining factors for birth weight and placental morphometric parameters. It also confirmed that the weight of the placenta and neonate was positively associated with preeclampsia and the placenta which weighed less was associated with a higher incidence of low birth weight. Therefore this study concludes that the preeclampsia has adverse consequences on the morphology of the placenta and subsequently affects the birth weight.

8. RECOMMENDATIONS

Based on the study findings; the following recommendations were drawn:

- ✓ Clinicians should carry out a careful examination of placental morphology at an early stage of the prenatal period and performed routinely in delivery rooms in the postpartum period, this will provide early detection of mother and child at risk and for further management.
- ✓ Health professionals should screen all pregnant women in antenatal, prenatal, and post-natal care for early identification of preeclampsia and timely referral to hospital, institutional deliveries and give health education recommended for the better fetal outcome.
- ✓ Health care planners and policymakers should be an effort made to drawn standardized guidelines to measure placental parameters.
- ✓ Appropriate training should be incorporated with health professionals especially; midwives, nurses, and others to improve knowledge on proper examination of the placenta.
- ✓ Researchers should conduct a large scale study using the present study as baseline data on the same or different clinical conditions effect on placenta.
- ✓ Researchers should use this data as a baseline to carry out advanced histopathological and immune-histochemical studies in the same or different clinical conditions.

REFERENCES

1. Michael S, & Karmar. (2000). Determinants of low birth weight: methodological assessment and meta-analysis. Bulletin of the world health organization, 655-663.

2. Susmita S, Lopamudra N, Shashi SB, & Prafulla KC. (2015). Morphometric study of placenta of full term new born & its relation to fetal weight: a study in Tertiary Care Hospital of Odisha. Journal of Evolution of Medical and Dental Sciences, 4:742–7.

3. Moore KL, P. T. (2008). the Developing Human Clinically Oriented Embryology 8th edition. Else Health Sc; // Saunders.

4. Mardi K, & Sharma J. (2003). Histopathological evaluation of placentas in IUGR pregnancies. Indian Journal Pathology Microbiolgy, 2:1-4.

5. Kambale T, Iqbal B, Ramraje S., Swaimul K, & Salve S. (2016). Placental morphology and fetal implications in pregnancies complicated by pregnancy-induced hypertension. Medical Journal of DY Patil University, 9:341–7.

6. Gupta C, Harode HA, D'souza AS, & Sharma A. (2015). A morphological and morphometric study of placenta with its clinical implications. Tropical Journal of Medical Research, 18:85-8.

7. Londhe PS, & Mane AB. (2011). Morphometric study of placenta and its correlation in normotensive and hypertensive pregnancies. International Journal of Pharmacy and Bio Sciences, 2:429-37.

8. Elangovan, M, & Raviraj, K. (2016). Analysis of Morphology and Morphometry of Human Placenta and Its Clinical Relevance. Imperial Journal of Interdisciplinary Research, 1531–1534.

9. Ashfaq M, Janjua MZ, & Channa MA. (2005). Effect of gestational diabetes and maternal hypertension on gross morphology of placenta. J Ayub Med Coll Abbottabad, 17(1):44-7.

10. Blundell C, Tess ER, Schanzer AS , & Coutifaris C. (2016). A microphysiological model of the human placental barrier. 16(16):3065-73.

11. Rahman H, KhalilM, Ferdousi R, Uddin M, & Chowdhury MM. (2006). Micro Vascular Changes in the Placenta of Bangladeshi Overt Diabetic Mothers and Hypertensive Diabetic Mothers. Journal of Bangladesh Society of Physiologist, 1:27-34.

12. Steegers EAP, von Dadelszen P, & Duvekot JJ. (2013). Preeclampsia."2013; no.376:631-44. 376:631-44.

13. Rafah H, & Mamori L. (2012). Macroscopical and microscopical study of placenta in normal and in pregnancy induced hypertension. QMJ, 6(10):18-26.

14. Peter von Dadelszen, Laura A. Magee, & James M. (2013). "Sub classification of preeclampsia." Hypertension in Pregnancy. 2292: (143-148).

15. Abalos E, Cuesta C, Carroli G, & Qureshi Z. (2014). Pre-eclampsia, eclampsia and adverse maternal and perinatal outcomes: a secondary analysis of the World Health Organization Multicounty Survey on Maternal and Newborn Health. BJOG, 14-24.

16. Alkema L, Chou D, Hogan D, Zhang S, & Moller A-B. (2016). 1 Global,regional, and national levels and trends in maternal mortality between 1990 and 2015, with scenario-based projections to 2030: a systematic analysis by the UN maternal mortality. 462-74.

17. Nakimuli A, Chazara O, Byamugisha J, & Elliott AM. (2014). Pregnancy, parturition and preeclampsia in women of African ancestry. Am J Obstet Gynecol, 210(6):510-20.

18. Robertson WB, Brosens I , & Dixon HG. (1997). 1The pathological response of the vessels of the placental bed to hypertensive pregnancy. Journal Pathol Bacteriol, 93:581–92.

19. Kishwara S, Asm N, Begum M, Ahmed R, & Ara S. (2008). 2 Study of proportional and absolute volume of placental parenchyma between normal pregnant and preeclamptic women. Journal Dhaka Med, 17(2) :78-82.

20. Granger JP, Alexander BT, Llinas MT, Bennett WA, & Khalil RA. (2001).Pathophysiology of hypertension during pre-eclampsia linking placental ischemia with endothelial dysfunction. 38:718–722.

21. Norwitch ER, Chaur-Dong HSU, & Rapke JT. (2002). Acute complication of preeclampsia. Journal of Clinical ObstetGyneco, 45(2):308–29.

22. Singh Sabita, & Gugapriya TS. (2014). A cross sectional morphometric study of hypertensive with normal placentae and its correlation with fetal outcome. Int J Anat Res, 2 (2):437-42.

23. Teasdale F. (1987). Histomorphometry of the human placenta in preeclampsia, associated with severe intrauterine growth retardation. Placenta. 119-28.

24. Harbinder JS. (2009). Preeclampsia: is it all in the placenta? Malaysian journal of Medical sciences, 16(1): 8.

25.Alicia M, & Lapidus MD. (2011). Effects of preeclampsia on mother, fetus and child. Obgyn.net, 1-3.

26. Romero Gutiérrez G, Maldonado HA Velásquez, Sashid P Mendez, & Lopez A Horna. (2008). [Placental histopathological changes in gestational hypertension. Ginecologia y obstetricia de Mexico, 76(11):673-78.

27. Khan KS, Wojdyla D, Say L, Gülmezoglu AM, & Van Look. (2006.). WHO analysis of causes of maternal death: a systematic review. 367(9516):1066–1074.

28. Abalos E, Cuesta C, Carroli G, & Qureshi Z. (2014). Pre-eclampsia, eclampsia and adverse maternal and perinatal outcomes: a secondary analysis of the World Health Organization Multicounty Survey on Maternal and Newborn Health. BJOG, 14-24.

29. Gaym A, Bailey P, BLuwei P, & Admasu K. (2011). Disease burden due to pre-eclampsia/eclampsia and the Ethiopian health system's response. Int J Gynecol Obstet, 115:112-116.

30. Abadi K, Getachew M, Gedefaw A & Achenef A. (2018). Prevalence of hypertensive disorders of pregnancy in Ethiopia: a systemic review and meta-analysis.BMC Pregnancy and Childbirth , 18: 34.

31. Jing H, Dina H, & Jove Graham. (2019). Maternal and Infant Health Care Costs Related to Preeclampsia. Journal of Obstet Gyneco, 134(6): 1227–1233.

32. Uzan J, Carbonnel M, Piconne O, & Asmar R . (2009). Preeclampsia: Pathophysiology, Diagnosis and management. Vasc Health Risk Manag. 7:467-474.

33. Roberts JM, & Cooper D. (1999). Pathogenesis and genetics of preeclampsia. 357:53-6.

34. Mayhew T. (2000). Patterns of villous and intervillous space growth in human placentas from normal and abnormal pregnancies. eur J obstet Gynecol Reprod Biol, 68(1-2):75-82.

35. Emery SP. (2005). Hypertensive disorders of pregnancy. Claveland Clinical J Med, 4 (72):21-2.

36. Odegard RA, Vatten LJ, Nilsen ST, Salvesen KA, & Austagulen R. (2000). Preeclampsia and fetal growth. Journal Obstet Gynecol, 96 (6) :950-955.

37. Shevade Sapna, Vasanti Arole, Vaishaly Bharambe, & Vaishali Parange. (2015). "Placental Morphology and Fetal Outcome in Preeclampsia and Normotensive Pregnancies.". Journal of Dental and Medical Sciences (IOSR-JDMS), 14 (4):11-15.

38. Raghavendra AY, Vinay KV, & Pai V. (2014). A study of placental weight and fetal outcome in different grades of pregnancy induced hypertension. International Journal of Anatomy and Research, 2:625–9.

39. Gbejegbe B.H. (2008). Placental Changes in Patients with Preeclampsia and Eclampsia. 8:12-13.

40. Shibabaw Tedla Tiruneh, Asegedech Bekele, Edengenet Guday, & Abebe Muche. (2018). Macroscopic morphological varation of human placenta in normotensive and preeclamptic pregnant mothers. Eur. Journal of anatomy, 22(6):489-495.

41. Ban Amer Mousa, Sijal Fadhil Farhood, & Makki Al Jo. (2019). Study of placental shape and histopathological changes in pregnant ladies with pre-eclampsia. Iraq Med J, 41–46.

42. Wynn R. (1999). Development and ultra-structural adaptations of the human placenta. Euro J Obst Gyneco, 5(1):3-21.

43. Benirschke K, Kaufmann P, & Baergen R. (2006). Pathology of the Human Placenta. In Springer Verlag. Architecture of Normal Villous Tree (pp. 121-159). New York: 5th ed. Vol. Chapter 7.

44. Cunningham F.G, Leveno, K.J, Bloom, S.L, Hauth J C, Glistap L .C, & Wenstrom K.D. (1999). Williams obstetrics in Implantation, embryogenesis and placental development. 22nd ed. Newyork: McGraw –Hil; 22: 828-829.

45. Segupta K, Shamim A, Khandaker, & Mahamuda B. (2009). Morphological Changes of Placenta in Preeclampsia. 49-54.

46. Navbir Pasricha. (2012). "Placenta morphology and its correlation with fetal outcome in PIH. International journal of basic and applied sciences, 2 (3):120-125.

47. Agarwal, Gyan Chand, Pankaj Saini, Jai Prakash Pankaj, Laxmi Nidhi Pandey, & Anjali Jain. (2015). “Morphological study of placenta in normal and hypertensive pregnancies. IAIM, 2 (5):121-128.

48. Manjunatha HK, Kishanprasad HL, Ramaswamy AS, Aravindra P, & Parkash H. (2012). Study of histo -morphological changes in placenta in pregnancy induced hypertension. Int J Cur Sci Res, 2(1):255–258.

49. Jashan Chhatwa, Dev Nanda Chaudhary, & Neena Chauhan. (2018). Placental changes in hypertensive pregnancy: a comparison with normotensive pregnancy. International Journal of Reproduction, Contraception, Obstetrics and Gynecology, 3808-381.

50. Appiah PK. (2009). Relationship between the morphology of the placenta umbilical cord and perinatal outcome.

51. Yetter. (1998). "Examination of the placenta. American family physician, 1045-1054.

52. Yibeltal Wubale, & Amenu Menu. (2017). ” GROSS MORPHOLOGICAL STUDY OF PLACENTA IN PREECLAMPSIA. Anatomy Journal of Africa, 6 (2): 977 – 981.

53. Durgesh Singh, Pratap Chandra Shukla, Anshu Mishra, & Paramata Prasad. (2015). "Comparison of morphology of placenta in normal Vs pregnancy induced hypertension with ultrasonography and in gross specimen". Indian Journal of Basic and Applied Medical Research, 293-299.

54. Harold A. (2007). Low birth weight in relation to maternal age and multiple pregnancies at Muhimbili National Hospital. DMSJ, 14:55-8.

55. Accrombessi M, Zeitlin J, Massougbodji A, Cot M, & Braind. (2018). What do we know about risk factors for fetal growth restriction in Africa at the time of sustainable development goals? A scoping review. Paediatr Perinat Epidemiol. 32: 184–96.

56. Nanna V, Kathrine F, Kristin G, Jens B , & Tore H. (2009). Determinates of birth weight in boys and girls. 7-12.

57. Rupa L, Veereshkumar S, Naresh K, Anita M, & Suresh P. (2014). Maternal determinants of placental morphometry and birth weight. 15:22-24.

58. Thomson J, Irgens L, Skjaerven R, & Rasmussen. (2007). Placenta weight percentiles curves for singleton deliveries. BJOG, 114:715-20.

59. Lean SC, Derricott H, Jones RL, & Heazell AEP. (2017). Advanced maternal age and adverse pregnancy outcomes: a systematic review and meta-analysis.

60. Wood C. (1997). The Association of Marital Status with Low Birth weight North Carolina. 104:1-9.

61. Kumar BR KDK, Neupane U CBS, Kumar Y.B, & Hanoon P. (2015). A Case Control Study on Risk Factors Associated with Low Birth Weight Babies in Eastern Nepal. International Journal of Pediatrics, Vol.43:1.

62. Sitti P, Yasmin S , & Razak . (2015). The Correlation between Placental Weight and Birth Weight. Vol. 86.

63. Kiran K, Raj Kumar, Shirin J, & Sapna S. (2012). Morphometrical Changes in Placenta of Undernourished Mothers and Its Effect on Fetal Weight. 2349-9788.

64. Elly O, Peter A , & Athanase . (2019). The effects of maternal Body Mass Index on placental morphology fetal birth weight. https://www.researchgate.net/publication/335105074.Sudan medical journal.

65. Stotland NEB, Cheng YW, Hopkins LM, & Caughey A. (2006). Gestational weight gain and adverse neonatal outcome among term infants. Journal of Obstet Gyneco, 108: 635-43.

66. Bugssa.G DB, & Alemayehu.M. (2014). Socio Demographic and Maternal Determinants of Low Birth Weight at Mekelle Hospital, Northern Ethiopia. A Cross Sectional Study American Journal of Advanced Drug Delivery, 2(5):609-18.

67. Elangovan M, & Raviraj, K. (2016). Analysis of Morphology and Morphometry of Human Placenta and Its Clinical Relevance. IJIR, 2(8):1532-4

68. Motwani R, Sontakke Y, Goyal M.(2013). Effects of Pregnancy Induced Hypertension on human placenta. JEMDS ;2(33):6275-82.

69. Xu Xiong, Nestor N. Demianczuk, Pierre Buekens, and L. Duncan Saunders. (2000). Association of preeclampsia with high birth weight for gestational age. Perinatal Clinical Research Centredoi:10.1067..

ANNEX

Annex: I English version information sheet and consent form

Title of the study: - Birth Weight of Newborn, Gross Placental Morphology and their determinant factors among Pre-eclamptic and Normotensive mothers at Butajira General Hospital, Southern Ethiopia.

Written Consent Form

Dear study participant, Good morning/afternoon, my name is---------- I am one of the data collector for the study being conducted by Jimma University, Institute Health, Faculty of Medical Sciences and Department of Biomedical Sciences, on the Birth weight of newborn, Gross morphology of placenta and its determinant factors among preeclamptic and normotensive mothers. For this study, your permission is important in order to conduct research on your placenta and it will help policy makers to carry out strategies to prevent and control maternal as well as child morbidity and mortality secondary to preeclampsia. There is no possible risk associated with your participation in this study. Your name will not be written in this form and will never be used in related with your placenta and baby. All findings from your placenta will be kept strictly confidential. You are not obligate to give permission without your interest. Your decline/refusal to participate will not affect any of the services you should obtain from the hospital. If you feel discomfort to give permission, please feel free to dropout at any time you want.

Could I have your permission to continue?

1. Yes, signature_____

2. No, skip to the next subject.

Annex II: Data Collectors and Supervisor Agreement

I certify that I have taken written consent form from the participants who have agreed to

Participate in this study and I have confirmed the agreement is correct.

Data collectors name: _____ signature_____

Date |_____Month |_____| Year_____.

Specimen code_____

Supervisor name: _____signature_____

Date |_____Month |_____| Year_____.

Annex III

1. Data collecting check list used in this research to collect data from socio demographic and maternal characteristics, Placental and fetal parameters has been adapted from different literatures and modified according to objectives of this study.

Part I: Socio demographic characteristics

S/no	Variables	Response
1	Maternal age	----------years
2	Residence	1. Urban 2. Rural
3	Educational level	1. Cannot read and write 2. Can Read and write 3. Primary 4. Secondary 5. Higher education
4	Occupation	1. Non employed 2. Housewife 3. Employed in government institution 4. Employed in private sector 5. Merchant 6.If others specify _____
5	Marital status	1. Currently married..... 2. Separated..... 3. Divorced..... 4. Widowed..... 5. Never married.....

Part II: Maternal characteristics

S/no	Variables	Response
1	Gestational age	---------- weeks
2	Gravidity	1. Primi-gravida 2. Multigravida
3	Parity	---------- times
4	Antenatal Checkup	1.No 2.Irregular follows up 3 .Regular follow up

5	Mode of delivery	1.SVD 2.Instrumental delivery 3. C/S
Part III: Fetal Outcomes and Newborn Anthropometry		
1	Condition of the neonate	1. Live birth 2. Still birth
2	Sex of fetus	1.Male 2.Female
3	Birth Weight of fetus	----------Kg
4	APGAR score	At 1 minute ---------- At 5 minute ----------
5	Neonatal Intensive Care Unit Admission	1. Admitted 2. Not admitted
Part IV: Maternal Anthropometric Measurement		
1	Weight	----------Kg
2	Height	----------m
Part V: Placental Morphometric Parameters		
1	Placenta weight	---------- g
2	Placenta shape	1.Circular 2.Oval 3.Irregular
3	Placental diameter	---------- cm
4	Placental thickness	----------mm
5	Number of cotyledons	

Annex IV: Amharic version information sheet and consent form

ጅማ ዩኒቨርሲቲ

የ ህክምናና ጤና ሳይንስ ኮሌጅ

ይህ መጠይቅ በብታጅራ አጠቃላይ ሆስፒታል ከእርግዝና ጋር በተያያዘ የደም ግፊት በሽታ ያለባቸውንና የለለባቸዉን ወላድ እናቶች የእንግዴ ልጅ የቅርፅ ፣ የክብደት፣ የውፍረት፣ የስፋት: የኮቲለደን መጠን ለዉጥ እንዲሁም የ ህፃናኑን ክብደት ለውጥ ለማጥናት የ ተዘጋጀ ነው፡ ፡

የፈቃደኝነት ቅፅ ዉድ ተሳታፊያችን ጤናይስጥልን ደህና ዋሉ/አደሩ፣ ---------- እባላለሁ፡፡ እኔ እዚህ የተገኘሁት ይህንን ጥናት በጅማ ዩኒቨርሲቲ በአናቶሚ ትምህርት ክፍል ለሁለተኛ ዲግሪ መመረቂያ ጥናት መረጃ ለመሰብሰብ ነው፡ ፡ በዚህ ሆስፒታል በወለድሽው የእንግዴ ልጅ ላይ የሚታየውን የቅርፅ ፡ የክብደት፣ የውፍረት፣ ስፋት እና የኮቲለደን ቁጥር እንዲሁም የህፃናኑን የክብደት ለውጥ ለመረዳት እንፈልጋለን፡: ለዚህ ጥናት መካሄድ የርሰወ ፈቃደኝነት ወሳኝ በመሆኑ ጥናቱን እንድናካሄድ ፈቃድወን እንጠይቃለን ፡፡ ስለዚህ ፈቃዱን ከሰጡንና ጥናቱ ከተካሄደ ከእርግዝና ጋር ተያይዞ በሚከሰተዉ የደም ብዛት በሽታ የተነሳ የሚታየውን የእንግዴ ልጅ የመጠን ለውጥና የህፃናኑን ክብደት ለውጥ በመለየት በእናቶች እና ህፃናት ላይ የሚከሰተውን የህመም፤ የሞት እና የጤና ችግር ለመቅረፍ የሚያስችሉ ፖሊሲዎችን ለመቅረፅ የሚያስችሉ መረጃዎችን ለመስጠት ያስችላል፡ ፡ ከእርስዎ ከተወለደው የእንግዴ ልጅ የሚገኘውን መረጃ በሚስጥር እንጠብቃለን፡፡ ከዚህ ጥናት ጋር በተያያዘ በማንኛውም ቦታና ጊዜ ስምዎ እንደማይመዘገብና እንደማይጠቀስ ልንገ ልፅልዎ እንወዳለን ፡፡ ጥናቱን የምናካሂደው የርስዎን ሙሉ ፈቃደኝነት ስናገኝ ብቻ ነው፡ ፡ እርሰዎ በዚህ ጥናት ባለመሳተፍዎ በሆስፒታሉ ዉስጥ በሚያገኙት ማንኛዉም አገልግሎት ጫና እንደማይፈጥርበዎት ልንነግርዎ እንወዳለን፡፡ ፈቃደኝነተዎን ለመስጠትም ሆነ ላለመስጠት ውሳኔው የዕርስዎ ብቻ ነው፡ ፡

በወለዱት የእንግዴ ልጅ ላይ ጥናቱን እንድናካሂድ ፈቃደኛ ነዎት ?

1. አዎ፡ ---------- ፊርማ---------- 2. አይደለሁም————

የጠያቂው ሥም ----------ፊርማ----------መጠይቁ የተሞላበት ቀን ----------ስዓት ----

ቁጥር [illegible]

Ref. No

ቀን 28/01/2015

Date

ከባዮሜዲካል ሣይንስ ዲፓርትመንት

ጅማ ዩኒቨርስቲ

ለቡታጅራ ጠቅላላ ሆስፒታል

ቡታጅራ

ጉዳዩ፡- **ትብብር እንድታደርጉላት ስለመጠየቅ**

በጅማ ዩኒቨርስቲ ባዮሜዲካል ሣይንስ ትምህርት ክፍል የክሊኒካል አናቶሚ ሁለተኛ ዲግሪ ተማሪ የሆነችው ቃልኪዳን ጌታቸው Birth weight of newborn and gross placental morphology among pre-eclamptic and normotensive mothers በሚል ርዕስ ለምትጽፈው መመረቂያ ጽሁፍ የሚረዳ መረጃ መሰብሰብ እንድትችል ትብብር እንድታደርጉላት እየጠየቅን ለሚታደርጉላት ትብብር በቅድሚያ እናመሰግናለን፡፡

ከሠላምታ ጋር

[illegible]

Jimma University Institute of Health

Institutional Review Board

Ref No: JIH/RP621/236/20

Date: 5/10/2020

To: Kalkidan Getachew;

Subject: Ethical Approval of Research Protocol

The IRB of Institute of Health has reviewed your research project **"Birth Weight of Newborn and Gross Placental Morphology among Pere-eclamtic and Normotensive mothers in Butajira General Hospital, Southern Central Ethiopia: A Comparative Cross-Sectional Study".**

Thus, this is to notify that your this research protocol has presented to the IRB meets the ethical and scientific standards outlined in national and international guidelines. Hence, we are pleased to inform you that your research protocol is ethically cleared.

We strongly recommend that any significant deviation from the methodological details indicated in the approved protocol must be communicated to the IRB before it has been implemented.

With Regards!

Million Tesfaye, PhD
IRB chairperson
Tel: +251917063744
E-mail: mtesfaye1@gmail.com

Tel. +251-47 11 114 57
PBX: +25147 111 458 60
Fax: +25147111114 50
+25147111 2040
P.O.Box. 378
JIMMA, ETHIOPIA
e-mail: ervc@ju.edu.et
website: http://www.ju.edu.et

DECLARATION

This is to certify that the thesis prepared by **Kalkidan Getachew** entitled Birth Weight of Newborn, Gross Placental Morphology and its Determinant Factors among Pre-eclamptic and Normotensive Mothers and submitted in the partial fulfillment of the requirements for Degree of Master science in Clinical Anatomy complies with regulation of Jimma University and I undersigned agrees to accept responsibility for the scientific ethical, originality, quality and technical conduct of this research provision of required progress reports.

Name of the student: _____

Date _____ Signature _____

Examiners

_____ Signature _____ Date _____

_____Signature _____Date_____

Approval of Advisor(s)

1. Asfaw Gerbi (Assistant Professor of Human Anatomy)

Signature _____ Date _____

2. Bekalu Getachew (MSc in Clinical Anatomy)

Signature _____ Date _____

3. Diliab Desta (MSc in Clinical Anatomy)

Signature _____ Date _____