ADDIS ABABA UNIVERSITY

DETERMINANTS OF INAPPROPRIATE BIRTH WEIGHT FOR GESTATIONAL AGE AMONG NEONATES BORN AT DESSIE REFERRAL HOSPITAL, NORTHEAST ETHIOPIA, 2018

THESIS ON MASTER'S DEGREE IN PEDIATRICS AND CHILD HEALTH NURSING

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ACRONYMS AND ABBREVIATIONS

AAU	Addis Ababa University
AGA	Appropriate Gestational Age
ANC	Antenatal Care
APGAR	Appearance, Pulse, Grimace, Activity and Respiration
BMI	Body Mass Index
CH	Chronic Hypertension
CI	Confidence Interval
CVSD	Cardio Vascular System Disorder
DM	Diabetes Mellitus
DRH	Dessie Referral Hospital
GDM	Gestational Diabetes Mellitus
GWG	Gestational Weight Gain
HTN	Hypertension
HDP	Hypertensive disorders of pregnancy
IBWGA	Inappropriate Birth Weight for Gestational Age
LGA	Large for Gestational Age
LMICs	Low and Middle Income Countries
NGDM	None Gestational Diabetes Mellitus
SGA	Small for Gestational Age

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Abstract

Background: Inappropriate birth weight for gestational age is neonates with birth weight below 10^{th} and /or above 90^{th} percentiles of reference population. Globally ten percent of newborns are large for gestational age, while 23.3 million newborns are small for gestational age in low-middle income countries. Neonates with inappropriate birth weight for gestational age are proxy of serious perinatal morbidity and mortality.

Objectives: The study was aimed to assess determinants of inappropriate birth weight for gestational age among neonates born at Dessie referral hospital, Northeast Ethiopia.

Methods: A retrospective facility based cross-sectional study was conducted at Dessie referral hospital among 422 systematically selected mother charts (gave birth from 2013-2017). Epi-data version 3.1 & SPSS version 20 were used to data processing and analysis. Binary logistic regression analysis and adjusted Odds ratio with 95%CI were used to see the possible association between determinants and dependent variables. Texts, tables and graphs were employed to present the results.

Result: The prevalence of inappropriate birth weight for gestational age was 34.36%. Maternal age 35 year or more (AOR = 2.079, 95%CI(1.100,3.929), inadequate prenatal care (AOR = 2.387, 95%CL(1.326,4.299), maternal anemia during pregnancy (AOR = 2.00195%CI(1.062,3.768), gestational diabetes mellitus (AOR = 3.035, 95%CI(1.413,6.519), and chat chewing during pregnancy (AOR = 2.390, 95%CI(1.319,4.329) were significantly increased IBWGA births.

Conclusion and recommendation: Inappropriate birth weight for gestational age was outpaced. Advanced maternal age, inadequate prenatal care, anemia, gestational diabetes mellitus and chat chewing during pregnancy are determinants of inappropriate birth weight for gestational age births. Prevention of gestational diabetes mellitus, anemia, and giving proper prenatal care may improve maternal and neonatal outcomes.

Key words: - Inappropriate birth weight for gestational age, large for gestational age, small for gestational age

1. INTRODUCTION

1.1 Background

Inappropriate birth weight for gestational age(IBWGA) is a birth weight below 10^{th} and/or above 90^{th} percentiles of a reference distribution of weights to gestational ages [1]. Inappropriate birth weights-for-gestational ages are two types: small-for-gestational age (SGA, which is newborn's birth weight $<10^{th}$ percentile of the population) and large for gestational age (LGA, which is newborn's birth weight $>90^{th}$ percentile in the same population) [1, 2]. The comparison of weight at birth to a fetal growth by weeks of gestation helps to identify newborns that are SGA and LGA births[2].

SGA could be constitutionally small (healthy babies) and growth restricted (i.e. proxy of IUGR), as well as moderate (3-10^{th} percentiles) and severe ($<3^{rd}$ percentiles) as the basis of severity[3, 4]. LGA babies could also be constitutionally large due to large parental size and a macrosomia if it has both birth weight > 90th percentile for that population, and birth weight > 4000 grams [5, 6]. On the basis of contributing factors; placental insufficiency, maternal obstetrics, medical problems and maternal nutritional status are a major contributor to the pathophysiology in IBWGA (SGA and/or LGA) pregnancies[7, 8].

Different studies conducted in European countries, showed that the prevalence of SGA and LGA babies are among the highest health care burdens and are priority areas due to their significantly higher rates of morbidity and mortality[9-11]. Even if it shows little improvement in the last decade, SGA is a more critical problem for countries in South Asia especially India and some countries in Africa, as well as LGA is increasing in some Middle East countries like Kuwait[12, 13]. In sub-Saharan countries, SGA & LGA are growing simultaneously but unacceptably outpace in some East African countries with highest neonatal mortality [14-17].

Most common known factors associated with SGA births are: early labor, multiple pregnancy, nulli/primi-parious, various maternal illnesses, drug abuse, maternal age, [14, 18, 19]**,** While LGA associated with post-dated pregnancies, gestational diabetes mellitus, multiparty, advanced maternal age, marital status, & smoking[20].

1.2 Statement of the problem

Inappropriate birth weight for gestational age (SGA and/or LGA) babies are becoming more prevalent and obstetric care burdens in the world[2, 21]. Globally, there has been a progressive increase in the prevalence of LGA babies during the last 3 decades that is now approximately 10% of all newborns, while SGA was twice the prevalence of low birth weight (LBW) births and twice the death of their appropriate for gestational age (AGA) counterparts [2, 22-24].

The overall prevalence of LGA babies has ranged from 5-20% in the developed world: with grossly escalated in Belgium (45.2%) and it was also high in African-American ethnicity (25.1%) [9, 11, 25]. Even if the prevalence of SGA has shown a slight improvement in Italy since 1993, it is still obstetric burden in the UK and Ireland (both having 11.2%). As well as the mortality rate of preterm SGA was quite high in USA with 39% that have 44-fold of death at age of the first month and 22-fold of death at age of the first year compared to term AGA [10, 11, 26].

In low and middle- income countries (LMICs) there are more than 19% of infants are born birth weight $<10^{th}$ percentiles, which represents more than 23 million SGA babies(22% of them were dying)[13]. In South or Southeast Asia, approximately two-third of babies was born with SGA, which in turn accounts 26-50% neonatal death [2, 13, 27]. India, Pakistan, and Nigeria were suffered approximately half million SGA babies of these countries [2, 13, 28]. In Sub-Saharan Africa, the SGA rate was estimated to be 16.5%, which accounts two-third of LBW babies and 26-28.7% of neonatal mortality (up to 58.3% preterm SGA death). Whereas LGA prevalence was 16-34% in some Western & East African countries with approximately 33.3 % of preterm LGA death [13, 14, 17, 29, 30].

IBWGA birth is a major predictor of neonatal mortality and morbidity. Failure to thrive, asphyxia, necrotic enterocolitis, neurodevelopment delay, congenital heart diseases, traumatic deliveries, diabetes mellitus, hypertension, polycythemia, stillbirth, low Apgar score, delivered by Caesarean section and chronic diseases were among the complications of IBWGA births. [6, 8, 31-35].

Even if there had been an improvement in IBWGA and its adverse outcomes, through implementations of routine perinatal care services and other advance procedures such as

cesarean section, administration of antiplatelet for pre-eclamptic women, administration of single course of antenatal corticosteroid for preterm, and promotion of smoking cessation, it is still a health care burden in the glob [36-38].

Hence, to prevent inappropriate birth weight for gestational age and its adverse outcomes, its magnitude & availability of its modifiable determinants need to be understood and investigated. Nevertheless, studies on this topic with its determinants are much limited in Ethiopia in general and specifically in the study area. Therefore, this research will aim to decide prevalence and identify determinants of inappropriate birth weight for gestational age in the study area.

1.3 Significance of the study

IBWGA is a serious risk for neonatal morbidity & mortality as well as predisposing to chronic disease in later life [8, 32, 34]. Therefore, preventing this risk through identifying modifiable risk factors will benefit many stakeholders.

First, this study will help to improve maternal and neonatal health by showing to mothers, their major modifiable risk factors associated with IBWGA babies. Second, the study will help to local governmental and non-governmental bodies who are working on maternal and child health to put emphasis on prevention and treatment of complications following inappropriate birth weight for gestational age babies early. Third, the result of this thesis will also serve as a baseline data for further studies. Generally, this study will provide reliable and accurate information about prevalence and determinants of IBWGA to policymakers and program designers to make health policies and programs focusing on reducing neonatal morbidity and mortality following SGA and LGA to achieve sustainable development goals-3 (neonatal mortality <12/1000 live births by 2030).

2. LITERATURE REVIEW

Literature searches were conducted through Pub Med, Hinary, Google scholar, BMC, Plos one and other different international journals in English literature after 2009. First, I searched for papers on what potential magnitudes of inappropriate birth weight for gestational age looks like. Second, what potential factors had previously been identified on inappropriate birth weight for gestational age babies**.** I then explored in depth the characteristics of potentially constitutional and pathological factors identified. Finally, I searched for evidence of effectiveness screening and interventions with IBWGA to prevent its adverse outcomes.

2.1 Magnitude overview of inappropriate birth weight for gestational age

As to Up-to-date 2014, Over 70% of IBWGA (SGA) occur due to constitutional factors, such as female sex, ethnicity, parity or maternal body mass index (BMI). In these situations, the SGA newborns are not at risk of perinatal morbidity and mortality. Approximately 30% of SGA neonates are subject to early and late disorders[39]. Whereas the global burden of IBWGA (LGA) babies is 10%[24].

A study in the USA, showed that, the magnitudes of IBWGA (LGA) newborns was highest in African- American women (25.1%), lowest in Asians (13.9%), and intermediate among Hispanic (17.3%), white (16.4%), and Filipino women (15.3%) [25]. Another study conducted in Australia and New Zeeland indicated that the prevalence of inappropriate birth weight for gestational age was 20.15%[40]

A Secondary Analysis of the WHO Multi-Country Survey on Maternal and Newborn Health, the overall prevalence of IBWGA (SGA) was highest in Cambodia (18.8%), the Occupied Palestinian Territory (16.1%), and Japan (16.0%), while the lowest was observed in Afghanistan (4.8%), Uganda (6.6%) and Thailand (9.7%)[41].

A cross sectional study done in Thailand the prevalence of IBWGA was13.1% [4]. IBWGA (SGA) is also as high as 17.9% in Latin America, Sao Paulo, Brazil, intermediate in Ohio Canada, and USA, with 10.3%, 8.0% respectively. IBWGA babies in Kuwait was 30.4%, but IBWGA (SGA) as low as approximately 3% in China, where as IBWGA (LGA) was 9.2% and 7.4% in the USA and Ohio Canada respectively [12, 42-45]. Inappropriate birth weight for gestational age (BWGA) was 2.1% in china[46]

A research carried out in low and middle-income countries (LMICs) in 2012 indicated that more than 23 million neonates were IBWGA (SGA), which accounts more than 19% of these countries' newborns. The vast majority IBWGA (SGA) births occurred in South or South East Asia ranged from 10.5% to 72.5% in Nepal, and 12.0% to 78.4% in India, depending on the reference population and 16.5% IBWGA (SGA) in sub Saharan Africa [13, 47].

A study conducted in Nigeria in 2013, the prevalence of IBWGA was 23.1%, and a study on singleton Tanzanian newborns included, IBWGA (SGA) was 16.1%. According to secondary analysis (2012) of the WHO's LMICs 2010 study, the prevalence of IBWGA (SGA) babies in Ethiopia was 21.4 % [13, 14, 48].

2.2. Determinants of inappropriate birth weight for gestational age

2.2.1. Maternal socio-economic factors

Socio-economic factor is one of the predictor of IBWGA births. Women who are poor, young, black, less educated, and unmarried, are more likely to give IBWGA (SGA) but women who are rich, old, white, highly educated and married are more likely to give IBWGA (LGA) births.

A Meta-analysis of cohort studies conducted in USA, Small for gestational age (SGA) was highest with mothers age <35 years (nulliparous) and maternal age ≥35 yr had slightly increased risk for term SGA. Maternal age between 18-<35 women had a significant protective effect for term SGA babies in Canada [19, 49]. A meta analysis in Ontario, Canada, indicate that older women are more likely to deliver an LGA infant when compared to women 17 years and younger, but opposite in India[20, 48]. According to study in Nigeria SGA was also high in teenage mothers' approximately 20% and lowest in maternal age 35 yr or more [50]. Another study conducted on singleton Tanzanian newborns showed that maternal age <20 years and maternal age >30 years have significant association with term SGA and preterm SGA respectively[15] .

The likelihood of having an LGA baby was increased for mothers who did not smoke during pregnancy in Australia, but Smoking had a protective effect to give LGA in Ontario, Canada [8, 51]. Studies in Canada, Italy, and Nepal reported that, maternal smoking during pregnancy increases the likelihood of SGA babies [11, 19, 52]. A study conducted in public maternity

hospital in São Paulo smoking, alcohol consumption, and the uses of illicit drugs increase SGA babies by 2.58 times,3.12 times, and 5.26 times respectively [42]. But IBWGA baby was decrease on mothers who had a higher education level, however, it was high mothers who were married than unmarried[8].

2.2.2 Maternal medical problems

The prospective cohort study in London, Ontario, Canada found factors that increased severe SGA and moderate SGA were: preeclampsia & preterm labor (PTL) [19]. Meta analysis conducted in Boston, USA, Moderate to severe maternal anemia had an association with risk of SGA births [53].

A study in São Paulo, Brazil, showed that maternal medical problems significantly associated with SGA were hypertensive disorders of pregnancy (HDP) and syphilis (inc. by 13.292 times in china), with increased risk of SGA by 2.61-fold and HDP by 1.82-fold. As well as SGA infants were higher among mothers with chronic hypertension (CH), HDP, anemia and other medical conditions [42, 43, 47].

In Ontario, Canada, mothers having gestational diabetes had approximately 8% LGA babies and mothers having pre-existing diabetes had 3% of LGA babies[48]. And gestational diabetes was also risk factors for LGA births in Italy as well as similar in India [8, 20].

A retrospective chart analysis in Southern Nigeria, major factors identified for SGA was and hypertensive disorders (26.4%) [54].

2.2.3 Maternal obstetrics factors

Maternal obstetrics factors (including parity, previous history of birth outcome, ANC, GA, gestational weight gain) are major predictors of birth outcomes.

A Meta-analysis in Baltimore, USA, indicated that, the risk of preterm IBWGA $< 10^{th}$ percentiles infants was the highest among nulliparous (age <35 year) mother and parity ≥ 3 (age ≥ 35 year), whereas multiparty ≥ 3 was a protective factor of term IBWGA (SGAs) [49]. Furthermore, primiparity was associated with both severe and moderate SGA in Canada [19].

Several studies showed that, maternal factors that increased risk of inappropriate birth weight for gestational age (SGA) infants were previous miscarriage, where as previous inappropriate birth weight for gestational age $> 90^{th}$ percentile pregnancy increases inappropriate birth

weight for gestational age (LGA) births in Italy[8, 11]. In São Paulo Brazil, the statistically significant maternal obstetrics factors associated with the birth of SGA babies were:- positive history of another SGA child (approximately 4-fold) and inadequate prenatal care (approximately 2-fold) [42]. A study conducted in a tertiary care center based on collection of retrospective data about large for gestational age (LGA) babies born over a period of one year in Mahatma Gandhi Medical College and Research Institute, Pondicherry, India, maternal factor associated with large for gestational age babies was post-dated pregnancies[20]. In rural china women who took oral hormonal contraceptives had increased risk of preterm inappropriate birth weight for gestational age (SGA) babies[43]. Other risk factor for term inappropriate birth weight for gestational age (SGA) was starting ANC in 3rd trimester in Tanzania[15].

A Case-Control Study in Seattle Children's Hospital, USA, indicated that, uteroplacental malperfusion was more common in inappropriate birth weight for gestational age (SGA) versus AGA term placentas[55]. A study conducted in china showed that, avascular villi and villous infarcts were significantly higher in SGA group[56]. A study in São Paulo Brazil showed that, placental bleeding & infarction increase risk of inappropriate birth weight for gestational age (SGA) by 4.28 – fold and 2.01 – fold respectively[42].

2.2.4 Neonatal factors

Females had higher rates of inappropriate birth weight for gestational age (SGA) than males using reference populations that are not sex specific[47]. Inappropriate birth weight for gestational age > 90th percentile was increased in males by 1.21 times in Italy[11]. Preterm SGA males were account approximately 60% in China, however, females account 20% in Nepal [43, 52]. Another study conducted in Nigeria in 2013, the prevalence of inappropriate birth weight for gestational age < 10th percentile was predominant in females than males (8.8% and 5.7% respectively) [14]. A retrospective chart analysis of babies in South Nigeria, major congenital abnormality (15.5%) and multiple births was strongly associated with inappropriate birth weight for gestational age (SGA) babies[54]. In the same country (Nigeria), 53.6% of small for gestational age (SGA) babies were low birth weight births[17]. A study in Tanzania showed that ,being firstborn & male sex were high risk factors for term and preterm inappropriate birth weight for gestational age (SGA) infants[15].

2.3 Conceptual framework

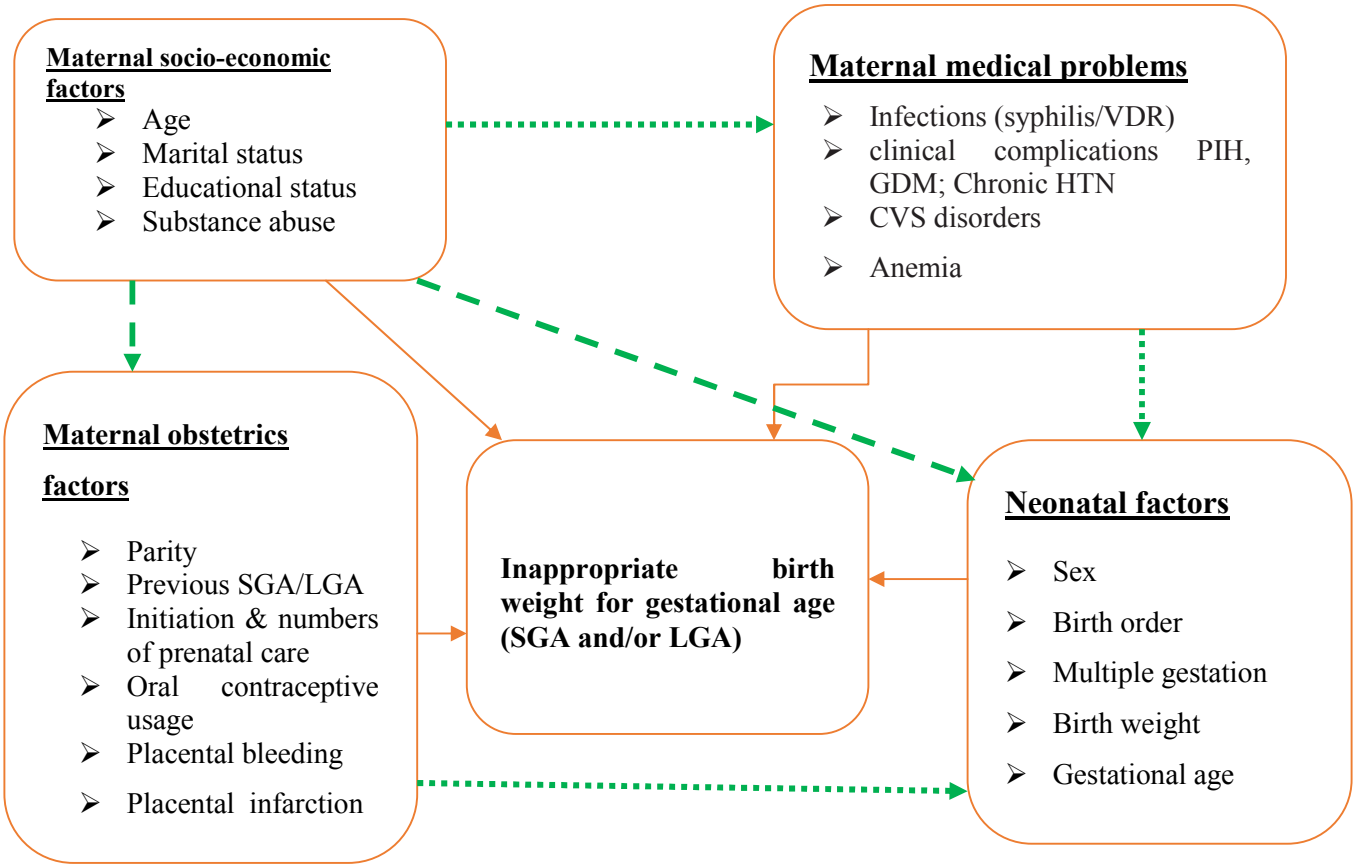

Figure 1: Conceptual framework

This conceptual framework was developed by reviewing different literatures, towards inappropriate birth weight for gestational age [1-2, 4-25, 27-57].

As shown from the diagram above inappropriate birth weight for gestational age affected by maternal socio-demographic, obstetrics, medical problem, and neonatal factors. Maternal socio-demographic characteristics might also affect maternal health as well as neonatal factors. Maternal obstetrics and medical characteristics may also affect neonatal characteristics.

3. OBJECTIVES

3.1 General objective

To assess the determinant of inappropriate birth weight for gestational age among neonates born at Dessie referral hospital, South Wollo Zone, Northeast Ethiopia from February 10-March 10, 2018.

3.2 Specific objectives

1. To determine the prevalence of inappropriate birth weight for gestational age among neonates born at Dessie referral hospital, South Wollo Zone, Northeast Ethiopia from February 10- March 10, 2018.

2. To identify determinants associated with inappropriate birth weight for gestational age among neonates born at Dessie referral hospital, South Wollo Zone, Northeast Ethiopia from February 10- March 10, 2018.

4. METHODOLOGY

4.1 Study area and study period

The study was conducted at Dessie referral hospital, South Wollo Zone of Amhara regional state, Northeast Ethiopia from February 10 - March 10, 2018.

Dessie city is far a distance of 401 km from the capital city of the Ethiopia, Addis Ababa and 484 Km from Bahr Dar, which is the capital city of Amhara regional state. The city has a north latitude and east longitude of 11°8′ and 39°38′ respectively.

Dessie Referral Hospital is the only referral hospital found in Dessie city and in south Wollo Zone. It accounts one-third of the Zone's newborn per year. There are 463 health care workers in Dessie Referral Hospital, among those 251 are nurses, 38 are General Practitioners, 36 are laboratory technologist and technician, 36 are midwifes and 48 are others(emergency surgeon, anesthetics, specialists and pharmacy professionals).

Through this work force, the hospital gives comprehensive care for eight--million-catchment area population from south Wollo Zone, North Wollo Zone, Afar region, and Oromo administrative Zone. Labor and delivery care is the one among many comprehensive services given at Dessie referral hospital with having more than 10 delivery coaches and more than 40 prenatal & postnatal waiting beds. It serves averagely 5107 births per year. It has also well equipped neonatal intensive care unit (NICU).

4.2 Study design

Facility-based retrospective cross sectional study design was employed on neonates born at Dessie referral hospital from 2013-2017

4.3 Sampling technique

Systematic random sampling technique was used to select participants from delivery registration logbooks. K value (48) was calculated by dividing total births from 2013-2017(20,426) to sample size (422). To get the first sample simple random sampling "lottery method" was used between 1 & 48 and taking this as the starting point and go every 48 intervals. If the chart was missing, it was replaced by next chart after a minimum of two days searching.

4.4. Population

4.4.1 Source population

All newborns that got service at Dessie referral hospital

4.4.2 Study population

All newborns that got service and recorded at Dessie referral hospital from delivery registry logbook from 2013-2017

4.4.3 Sample population

All randomly selected newborns on a delivery registration logbook at Dessie referral hospital, by maternal obstetrics chart from 2013-2017.

4.5 Eligibility criteria

4.5.1 Inclusion criteria

All selected maternal records, which was easily readable with birth history greater than or equal to 28 weeks of gestation from 2013-2017

4.5.2 Exclusion criteria

Maternal charts with uncertain/unrecorded gestational age, unrecorded newborn weight, and stillbirth without weighting were excluded.

4.6 Sample size determination

The sample size was calculated for both small for gestational age and large for gestational age by using single population proportion formulas and taking the larger sample size to be representative. 95% confidence interval with 5 % marginal error was taken for both small for gestational age (SGA) and large for gestational age (LGA). The prevalence of small for gestational age was taken from study conducted by WHO, in 2012 in low and middle-income countries (LMICs) with INTERGROWTH-21st project standard; Ethiopia was 7th with 21.4%[13]. On the contrary, the prevalence of large for gestational age was unavailable in Ethiopia.

Therefore, the prevalence of large for gestational age was p= 50%

Sample size for SGA

$$n_o = \frac{Z^2_{\frac{a}{2}} P_1(1-P_1)}{d^2}$$

Where n_o – initial sample size for SGA

$Z_{\frac{a}{2}}$- Standard normal value at 95% C.I that was 1.96

P_1 - Prevalence of small for gestational age

d – Possible margin of error tolerated which was 5%

$$\frac{(1.96)^2\ (0.214)(1-.214)}{(0.05)^2} \approx \mathbf{259}$$

Sample size for LGA

No study was found in Ethiopia, on large for gestational age, so prevalence of large for gestational age was taken p =50%

$$n_o = \frac{Z^2_{a/2} P_2(1-P_2)}{d^2}$$

Where n_o – initial

$Z_{\frac{a}{2}}$- Standard normal value at 95% C.I that was 1.96

P_2 - Prevalence of large for gestational age

d – Possible margin of error tolerated which was 5%

$$\frac{(1.96)2\ (0.5)(0.5)}{(0.05)^2} \approx \mathbf{384}$$

Therefore, the final sample size was **422** with addition of 10% a non-response rate.

4.7 Data collection methods and quality control

The data were collected by using a structured and pretested checklist from the selected client's obstetrics and medical records. The checklist, for IBWGA was adapted from a study conducted in Debre-Markos referral hospital on macrosomia in 2014[57], and adapted from different related studies [2, 4, 6, 10-15, 17,19, 26-32, 34, 35, 37-47, 49, 50, 52-56]. However, this was

not enough to use this tool without validation; therefore five (two from teaching area and three from clinical area) experts had validate it with a result of (content validity index (CVI = 0.9). Out of the total experts two of them were assistant professors in pediatrics and child health nursing, the other three were neonatologists working in different Addis Ababa public Hospitals. After validation completed, training was given to eight BSc nurse data collectors and supervisors about the objectives of the study prior to the pretest for the three consecutive days.

Pretest was employed on 5% (22 maternal card) of the sample size with structured checklist in Dessie referral hospital born in 2018 two weeks prior to the actual study to check usually recorded variables on the client's obstetrics & medical record. Consequently, some unrecorded variables were excluded from the checklist and others had been arranged as per usual records of those variables. Daily evaluation of the data for completeness and encountered difficulties on the time of data collection was revised accordingly.

4.9. Operational definitions

Congenital anomaly: - Any congenital anomaly recorded on maternal chart

Appropriate birth weight for gestational age: - Newborns' birth weight for gestational age between 10^{th} and 90^{th} percentiles recorded on maternal chart that fulfills the cross checking by using hospitals' birth weight for gestational age reference graph.

Inappropriate birth weight for gestational age: - Newborns' birth weight for gestational age below 10^{th} (small for gestational age) and/or above 90^{th} (large for gestational age) percentiles recorded on maternal chart that fulfills the cross checking by using hospitals' birth weight for gestational age reference graph.

Maternal medical problem: - Any medical problems recorded on maternal chart.

Placental bleeding: - Any placental bleeding after 28 weeks of gestation recorded at maternal chart.

Substance abuse: - Mothers who were using substance like chat chewing, cigarette smoking, and alcohol consumption pre- pregnancy and during pregnancy.

4.9 Study variables

4.9.1 Dependent variables

Inappropriate birth weight for gestational age (SGA and/or LGA)

4.9.2 Independent variables

Demographic characteristics of the newborn

Gestational age

Sex

Weight

Birth order

Multiple gestations

Maternal socio-demographic characteristics

Age

Marital status

Educational status

Ethnicity

Substance abuse

Maternal obstetric related factors

Parity

Previous delivery of IBWGA

Gestational weight gain

Threatened preterm labor

Entry into prenatal care

Oral contraceptive usage

Maternal medical disorders related factors

Anemia

Chronic Hypertension

Cardiovascular System disorder

Diabetes Mellitus

Gestational diabetes mellitus

Hypertensive disorders of pregnancy

Syphilis

4.10 Methods of analysis

Data was entered in to Epi-Data version 3.1 and exported to SPSS version 20 for cleaning, recoding and analysis. Binary logistic regression analysis was done to see the association between IBWGA and independent variables (maternal, neonatal, and placental factors). After checking associations of the variables (between dependent and independents), those with $p < 0.25$ in bivariate analysis were process to multivariate logistic regression analysis to control confounding factors in the association. P-value of < 0.05 was used to express statistical significance of the variables. Texts, tables and graphs were employed to present the result.

4.11 Ethical consideration

Letter of ethical clearance obtained from school of nursing and midwifery of Addis Ababa University. School of nursing and midwifery wrote a letter to Dessie referral hospital to get permission to extract maternal obstetrics records. After getting permission from the medical director, obstetrics & pediatric department of Dessie referral hospital, letter wrote to medical record office of hospital from obstetrics & pediatric department. Following these, searching and obtaining of the selected samples were accomplished by medical record stuffs. Finally, strict care and confidentiality kept for the patient's obstetrics and medical record throughout data collection and up to return of medical records to their original place.

4.12 Result dissemination and presentation

Submission of the thesis to Addis Ababa University, school of nursing and midwifery, and Dessie referral hospital was took place. Presentation on Addis Ababa University, school of

nursing and midwifery for Msc defense was carried out, and Presentation on the scientific forum and Publication on the scientific journals will process in the future.

5. RESULTS

5.1 Maternal and neonatal socio-demographic characteristics

The mean age of the mothers' was 26.85 years old (± 6.002 SD) within the ranges of 18-45 years and 25 year was the median age. Majority of mothers (57.3%) were below the mean age. Out of the total, 188 (44.5%) mothers were rural dwellers and 67(15.9%) mothers were unmarried. Most of the mothers (43.8%) were high school and above whereas nearly one-fourth (24.9%) mothers were none read and writers. In total, 233 (55.2%) neonates were male and 19 (4.5%) of them were died. (Table 1)

Table 1: Maternal and neonatal socio-demographic characteristics distribution at Dessie Referral Hospital, South Wollo Zone, Northeast Ethiopia, April 2018

Characteristics	Frequency	Percent	Mean age ±SD
Maternal age			26.85±6.002
< 35 yr	355	84.1	
≥ 35 yr	67	15.9	
Maternal residence			
Rural	188	44.5	
Urban	234	55.5	
Maternal religion			
Christian	129	30.6	
Muslim	292	69.2	
Others	1	.2	
Maternal marital status			
Married	355	84.1	
Unmarried	67	15.9	
Educational status			
Not read & write	105	24.9	
Read & write	47	11.1	
Elementary completed	85	20.1	
High school and above	185	43.8	
Chat chewing			
Yes	87	20.6	
No	335	79.4	
Alcohol consumption			

Yes	79	18.7	
No	343	81.3	
Smoking history			
Yes	26	6.2	
No	396	93.8	
Oral COC usage			
Yes	41	9.7	
No	381	90.3	
Neonatal sex			
Male	233	55.2	
Female	189	44.8	
Birth order			
Firstborn	225	53.3	
Second & above	197	46.7	
Any birth abnormality			
Yes	23	5.5	
No	399	94.5	
Number of newborns at current pregnancy			
Single	390	92.4	
Multiple	32	7.6	
Gestational age			38.79 ± 2.451
Preterm	41	9.7	
Term	346	82.0	
Post term	35	8.3	
Birth weight			2926.79 ± 654.108
< 25000 gm	90	21.3	
25000-3999 gm	307	72.7	
≥ 4000 gm	25	5.9	

5.2 The prevalence of inappropriate birth weight for gestational age

The overall prevalence of inappropriate birth weight for gestational age (IBWGA) births from delivery care unit was 34.36% (145). (Figure 2)

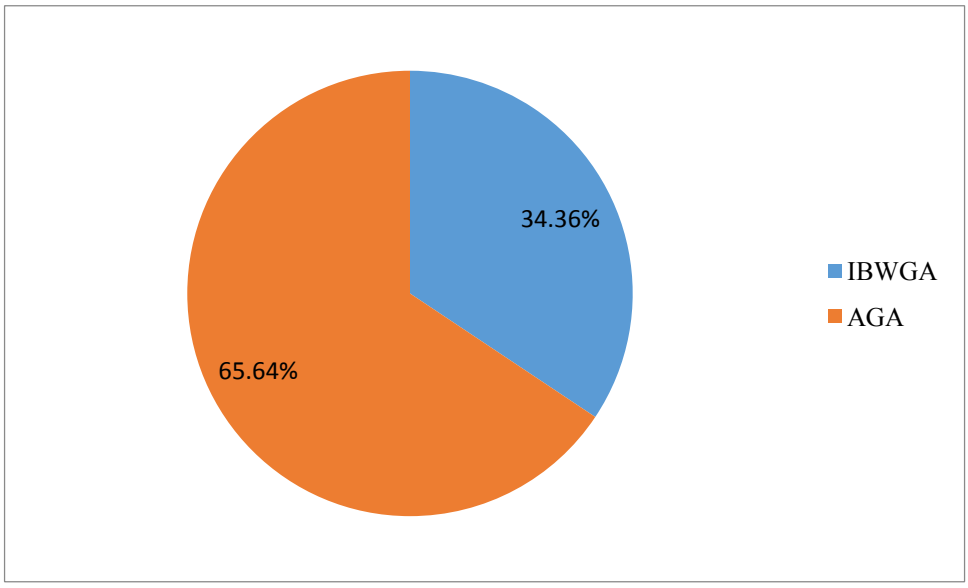

Figure 2: Birth weight for gestational age classification at Dessie referral hospital, South Wollo Zone, Northeast Ethiopia, April 2018

5.3 Proportions of IBWGA on maternal and neonatal socio-demographic characteristics

Out of the total majority 111(76.6%)) of IBWGA babies were from mothers with age < 35 year. Large numbers of IBWGA babies (51.0%) were born from mothers who were urban dwellers. Only 9.7% of IBWGA babies were born from mothers who had smoking history during their pregnancy period. (Table 2) Eight (5.5%) IBWGA babies were born with any birth abnormality. Sixty-seven (46.2%) IBWGA babies were female, whereas Seventy-eight (53.0%) IBWGA babies were male. Twenty-one (30.2%) and fourteen (20.1%) IBWGA babies had previous positive history and positive family history of IBWGA respectively.

Table 2: Proportion of IBWGA babies with maternal socio-demographic characteristics at Dessie Referral Hospital, South Wollo Zone, Northeast Ethiopia, April 2018

Characteristics	IBWGA # (%)
Maternal age group	
< 35 yr	111(76.6%)
≥ 35 yr	34(23.4%)
Maternal residency	
Rural	71(49.0%)
Urban	74(51.0%)
Marital status	
Married	126(86.9%)
Unmarried	19(13.1%)
Educational status	
None-read & write	41(28.3%)
Read & write	19(13.1%)
Elementary completed	32(22.1%)
High school & above	53(36.6%)
Chat chewing	
Yes	43(29.7%)
No	102(70.3%)
Alcohol consumption	
Yes	29(20.0%)
No	116(80.0%)
Cigarette smoking	
Yes	14(9.7%)
No	131(90.3%)
Oral COC usage	
Yes	19(13.1%)
No	126(86.9%)

COC = combined oral contraceptive,

5.4 Maternal obstetrics characteristics

Majority of mothers (46.9%) were entered into ANC follow up in their second trimester pregnancy but only 19.7% of mothers had taken less than the recommended number of

antenatal cares(<4 visits). Two hundred fourteen (50.7%) mothers were nulli-parous whereas 20.6% mothers were multi-parious (≥ 3). Thirty-eight (9.0%) mothers had developed placental bleeding (APH) as well as eight mothers were with placental infarction. (Table 3)

Table 3: Maternal obstetrics characteristics at Dessie Referral Hospital, South Wollo Zone, Northeast Ethiopia April 2018

Characteristics	Frequency	Percent
Parity		
0	214	50.7
1-2	121	28.7
≥ 3	87	20.6
Entrance of ANC		
First TM	148	35.1
Second TM	198	46.9
Third TM and /or no	76	18.0
No of ANC visited		
≥ 4	275	65.2
1-3	83	19.7
Previous history Of miscarriage		
Yes	44	10.4
No	378	89.6
Gestational age classification		
Preterm	41	9.7
Term	346	82.0
Post term	35	8.3
Threatened preterm Labor		
Yes	39	9.2
No	383	90.8

ANC= antenatal care, TM = trimester

5.5 Proportions of IBWGA in maternal obstetric characteristics

One hundred nineteen (82.1%) IBWGA babies were born from mothers having term pregnancy whereas ten (6.9%) IBWGA babies were from mothers who had pos-dated

pregnancy. 16.6% of IBWGA and 3.2% of IBWGA babies were born mothers with having placental bleeding and placental infarction respectively. (Table 4)

Table 4: Proportions of IBWGA babies with maternal obstetric characteristics at Dessie Referral Hospital, South Wollo Zone, Northeast Ethiopia, April 2018

Characteristics	IBWGA # (%)
Parity	
0	80(55.2%)
1-2	30(20.7%)
≥ 3	35(24.1%)
Entrance of ANC	
First TM	45(31.0%)
Second TM	58(40.0%)
Third and/or no	42(29.0%)
Number of ANC visited	
≥ 4	81(66.9%)
1-3	40(33.1%)
Previous history of miscarriage	
Yes	19(13.1%)
No	126(86.9%)
Gestational age classification	
Preterm	16(11.0%)
Term	119(82.1%)
Post term	10(6.9%)

ANC= antenatal care, TM = trimester

5.6 Maternal medical problems

This study showed that majority of maternal medical problems were screened greater than or equal to 89.6% during their ANC follow up and/or labor admission at Dessie referral Hospital. (Table 5)

Table 5: Maternal medical problems screening status with results at Dessie Referral Hospital, South Wollo Zone, Northeast Ethiopia, April 2018

Characteristics	Screening status		Diseases	
	Yes # (%)	No # (%)	Diseased	None-diseased
Maternal DM	378(89.6%)	44 (10.4%)	58(15.4%)	320(84.7%)
Maternal HTN	422(100%)	0(0.0%)	44(10.4%)	378(89.6%)
Maternal CVSD	414(98.1%)	8(1.9%)	2(0.5%)	412(99.5%)
Maternal syphilis	413(98.1%)	9(2.1%)	18(4.4%)	395(95.6%)
Maternal hepatitis(B)	419(99.3%)	3(.7%)	24(5.7%)	395(94.3%)
Maternal anemia	409(96.9%)	13(3.1%)	78(19.1%)	331(80.9%)
Maternal HIV status	394(93.4%)	28(6.6%)	26(6.6%)	26(6.6%)

CVSD= cardiovascular disorder, DM = diabetes mellitus, HTN = hypertension, CH = chronic hypertension, HDP = hypertensive disorders of pregnancy, GDM = gestational diabetes mellitus, NGDM = none- gestational diabetes mellitus

5.7 Maternal diseases and proportions of IBWGA

Twenty (4.7 %), thirty-eight (10.1%), seventy-eight (19.1%) and twenty-six (6.6%) number of mothers were diagnosed for HDP, GDM, anemia, and HIV/AIDS respectively. Ten (6.9%) and eighteen (12.12%) IBWGA babies were from mothers with NGDM & GDM respectively. Thirty-eight (26.21%) of IBWGA babies were from mothers with having anemia during their current pregnancy. (Table 6)

Table 6: Proportions of IBWGA babies on mothers having medical problems at Dessie Referral Hospital, South Wollo Zone, Northeast Ethiopia, April 2018

Characteristics	+VE (IBWGA %)	-VE (IBWGA %)
Maternal DM		
NGDM	20(50.0%)	320(31.5%)
GDM	38(47.4%)	320(52.6%)
Maternal HTN		
CH	24(33.3%)	378(66.7%)
HDP	20(40.0%)	378(46.8%)
Maternal CVSD	2(0.0%)	412(34.4%)
Maternal syphilis	18(44.5%)	395(33.4%)
Maternal HBV	24(50.0%)	395(33.2%)
Maternal anemia	78(47.5%)	331(32%)
Maternal HIV status	26(46.2%)	368(33.7%)

5.8 Variables associated with IBWGA births

Mothers whose age 35 year or more 2.079 times more likely give IBWGA births than mothers whose age less than 35 year old . In addition, mothers who visited less than recommended ANC visits (≤ 4) give 2.4 times more likely to give IBWGA births than mothers who had recommended ANC visits. Mothers with anemia during their pregnancy had 2-fold more likely give IBWGA births than opposite counterparts. Mothers who diagnosed with GDM during their pregnancy 3.035 times more likely to give IBWGA births than mothers without GDM do. Mothers who had chat chewing history during pregnancy increased the risk of IBWGA significantly by 2.39 times. In this study, results indicate that, maternal residence, HIV/AIDS, hepatitis B, HDH, CH, previous history of miscarriage, maternal smoking during pregnancy, history of oral combined contraceptive usage and maternal education; had no significant association with IBWGA babies. (Table 7)

Table 7: Crude and adjusted odds ratio of determinants with IBWGA at Dessie Referral Hospital, South Wollo Zone, Northeast Ethiopia, April 2018

Characteristics	IBWGA		COR	AOR (95%CI)	p-value
	Yes # (%)	No # (%)			
Maternal age					
≥ 35 yr	34(50.7%)	33(49.3%)	2.265	2.079(1.100,3.929)	**0.024***
< 35 yr	111(31.3%)	244(68.7%)	1	1	1
Residence					
Rural	71(37.8%)	117(62.2%)	1.312	0.789(0.373, 1.668)	0.535
Urban	74(31.6%)	160(68.4%)	1	1	1
Educational status					
Not read & write	41(39.0%)	64(61.0%)	1.596	1.699(0.660,4.371)	0.272
Read & write	19(40.4%)	28(59.6%)	1.690	1.535(0.568,4.146)	0.398
Elementary completed	32(37.6%)	53(62.4%)	1.504	1.394(0.628,3.095)	0.414
High school & above	53(28.6%)	132(71.4%)	1	1	1
Maternal HTN					
CH	8(33.3%)	16(66.7%)	0.954	1.826(0.652,5.109)	0.252
HDP	7(35.0%)	13(65.0%)	1.027	1.470(0.490,4.412)	0.492
Normal	130(34.4%)	248(65.6%)	1	1	1
Maternal diabetes mellitus					
NGDM	10(50.0%)	10(50.0%)	2.077	1.328(0.414,4.262)	0.633
GDM	18(47.4%)	20(52.6%)	1.869	3.035(1.413,6.519)	**0.004****
Normal	104(32.5%)	216(67.5%)	1	1	1
Chat chewing					
Yes	43(49.4%)	44(50.6%)	2.232	2.390(1.319,4.329)	**0.004****
No	102(30.4%)	233(69.6%)	1	1	1
Smoking cigarette					
Yes	14(53.8%)	12(46.2%)	2.360	1.188(0.419,3.372)	0.746
No	131(33.1%)	265(66.9%)	1	1	1
Entrance of ANC					
Second TM	58(29.3%)	140(70.7%)	1.233	0.918(0.541,1.558)	0.750
Third TM and/or no First TM	43(56.6%)	33(43.4%)	3.879	2.751(0.558,13.563)	0.214
	44(29.7%)	128(86.5%)	1	1	1

ANC visit					
1-3	40(48.2%)	43(51.8%)	2.724	2.387(1.326,4.299)	**0.004****
≥ 4	70(25.5%)	205(74.5%)	1	1	1
Combined oral contraceptive					
Yes	19(46.3%)	22(53.7%)	1.748	1.383(0.619,3.092)	0.429
No	126(33.1%)	255(66.9%)	1	1	1
Previous history of miscarriage					
Yes	19(43.2%)	25(56.8%)	1.52	1.062(0.460,2.45)	0.888
No	126(33.3%)	252(66.7%)	1	1	1
Maternal anemia					
Present	38(48.7%)	40(51.3%)	2.045	2.001(1.062,3.768)	**0.032***
Absent	105(31.7%)	226(68.3%)	1	1	1
Maternal hepatitis B virus					
Positive	12(50.0%)	12(50.0%)	2.015	1.573(0.579,4.277)	0.375
Negative	131(33.2%)	264(66.8%)	1	1	1
Maternal HIV status					
Positive	12(46.2%)	14(53.8%)	1.687	0.920(0.336,2.518)	0.870
Negative	124(33.7%)	244(66.3%)	1	1	1

*significant association, ** highly significant association, S.E standard error, AOR adjusted odds ratio, CI confidence interval, HTN =hypertension, HDP hypertensive disorders of pregnancy, 1=Reference LGA= large for gestational age, S.E = standard error, AOR = adjusted odds ratio, NGDM = none gestational diabetes mellitus, GDM = gestational diabetes mellitus, ANC = antenatal care, 1 = Reference

6. DISCUSSION

This study identified prevalence and determinants associated with inappropriate birth weight for gestational age (LGA and/or SGA) births. In total, 34.36% (LGA 12.32% and SGA 22.04%) of neonates were inappropriate birth weight for gestational ages. This indicates that it needs a focus health issue in the health care sectors of Ethiopia.

The findings of this study revealed that the overall prevalence of IBWGA was 34.36%, which was sharply higher than a report, in Thailand, China, Nigeria, Australia and Italy [4, 11, 14, 40, 46]. The difference might be due to socio-cultural variations and differences in study population especially in terms of race and ethnicity. However, it was relatively comparable with a report in Kuwait[12]. This comparability could be due to short gap of study period between present study and the previous ones.

Maternal age 35 year or more had significant association with IBWGA babies, which were in line with reports in USA and Canada [48, 49] This similarity might be due to age related complications that interferes in the fetal growth and development in the uterus. Maternal gestational diabetes mellitus was significantly associated with IBWGA babies, which was consistent with studies in Canada, Italy, and India [11, 20, 48]. This similarity could be resulted from the increased prevalence of gestational DM in the developing and developed countries proportionally. In addition, due to hyperglycemia of maternal blood, the fetal tissues had excess glucose; this increases the growth and development of fetal tissue abnormally, which is a similar process throughout the world.

Maternal anemia had strong significant association with inappropriate birth weight for gestational age births that was consistent with study in São Paulo, Brazil [42]. This consistency might be due to lack of blood supply to fetus that increases to fetal tissue undergrowth and underdevelopment. Inadequate prenatal care had statistical significant association with IBWGA births, which was in line with a report in São Paulo, Brazil [42]. This similar finding could be due to maternal problems that refrain from attending full ANC follows up which might be causes to under investigations of inappropriate birth weight for gestational age fetuses early.

Majority of IBWGA (55.9%) babies in this study were low birth weight that was in line with a report in Nigeria[17]. The possible reason might be due to employed similar study design

between current and the previous studies and incase of pathological causes of IBWGA, the weight of the neonate might be goes to under growth.

Even if there was no evidences in literatures, mothers who had history of chat chewing during their pregnancy period had strong significant association with inappropriate birth weight for gestational age births. This might be due to interference of chat on appetite and health condition of the mother may a cause for newborn weight disproportion with gestational age.

Limitation of the study

The study was retrospective chart analysis that encountered incomplete data.

7. CONCLUSION AND RECOMMENDATION

7.1 Conclusion

The prevalence of inappropriate birth weight for gestational age was high, with a prevalence of 34.36%. Mothers those diagnosed with gestational diabetes mellitus, anemia, inadequate prenatal care, and chat chewing during pregnancy had significantly associated with inappropriate birth weight for gestational age babies.

7.2 Recommendation

7.2.1 For federal ministry of health (MOH)

Strengthen strategies on prevention of inappropriate birth weight for gestational age that mainly focuses on pregnancy related medical problem. Advance coverage of ANC services that having good concern on IBWGA births.

7.2.2 For South Wollo Zone health office

Strengthen prenatal service coverage, preventing non-communicable diseases like gestational diabetes and anemia at both areas (rural & urban).

7.2.3 For Dessie Referral Hospital

Increases ANC coverage, strengthen non-communicable diseases control; give special attention for mothers those with advanced age. Create awareness to the community about the impact of chat chewing on fetuses during pregnancy.

7.2.4 For researchers

I would like to recommend for further study especially with different design (cohort) and large coverage (nationwide) to get the representative prevalence the community and more determinants.

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9. ANNEXES

9. 1 Information sheet

Title of the Research Project: - Determinants of inappropriate birth weight for gestational age among neonates born at Dessie Referral hospital, South Wollo Zone, Northeast Ethiopia,

2018.**Name of Investigator**: Setegn Mihret (Msc follows on pediatrics and child health nursing)

Name of the Organization: - Addis Ababa University, College of health science, school of nursing and midwifery.

Name of the Sponsor: - Addis Ababa University.

Introduction: - This information sheet was prepared for Dessie referral hospital administration, delivery and pediatrics coordinating offices. The aim of the form was to make the above-concerned office clear about the purpose of research, data collection procedures and get permission to conduct the research.

Purpose of the Research Project: To identify determinants of inappropriate birth weight for gestational age on neonates born at Dessie referral hospital (2013-2017), South Wollo Zone, northeast, Ethiopia, 2018.

Procedure: In order to achieve the above objective, necessary data were extracted from maternal charts with birth history from 2013-2017.

Risk and /or Discomfort:

Since the study was conducted by taking appropriate information from medical chart, it was not inflict any harm on the patients. The name or any other identifying information was not be recorded on the checklist and all information is taken from the chart had kept strictly confidential and in a safe place. The information retrieved was only be used for the study purpose.

Benefits: The research had no direct benefit for the one whose document/ record was included in this research. However, the indirect benefit of the research for the participant and other clients in the program was clear. This was because if program planners were preparing predicted plan there was a benefit for clients in the program of getting appropriate care and treatment services for those newly born ones. In all, the research work has a paramount direct benefit for health care planners and managers.

Confidentiality: To reassure confidentiality the data on the chart had been collected without the name of the clients and the information collected from this research project had been kept confidential and was stored in a file cabinet. In addition, it was not revealed to anyone except the investigator and it had kept in a key and locked system with computer pass ward.

Person to contact: This research project was reviewed and approved by school of nursing and midwifery ethical review board of Addis Ababa University. If you have any question you can contact any of the following individuals (Investigator and Advisors) and you may ask at any the time you want.

Principal investigator: - Setegn Mihret (Bsc)

Cell phone: +2519 22548443/0967626245, E-mail: matta.5484@gmail.com

Advisors: 1. Sr. Kalkidan Wondosson (Bsc, Msc)

2. Mr. Ketema Bizuwork (Bsc, Msc)

9. 2 Checklist

Addis Ababa University

The checklist is prepared for assessment of determinants of inappropriate birth weight for gestational age (IBWGA) among neonates born at Dessie referral hospital.

Maternal registration number _____ code _____

Part I **Maternal socio-demographic factors**

101	Age in years	_____
102	Maternal residency	1. Rural 2. Urban
103	Religion	1. Christian 2. Muslim 3. Others
104	Marital status	1. Married 2. Unmarried
105	Educational status	1. Not read & write 2. Read and write 3. Elementary completed 4. High school completed 5. College and above
106	Chat chewing	1. No 2. Yes
107	Alcohol consumption history	1. No 2. Yes 3. Unrecorded
108	Smoking history	1. Yes 2 .No 3. Unrecorded
109	Oral contraceptive history	1. No 2. Yes
Part II: Maternal obstetrics factors		
201	Parity	_____
202	Previous history of miscarriage	1. No 2. Yes
203	Entry into antenatal care	1. No 2. First trimester 3. Second trimester 4. Third trimester
204	If she had ANC, follow up, how many number of antenatal care she visited?	1. ≥ 4 2. 1-3
205	Threatened preterm labor	1. No 2. Unrecorded 3. Yes
Part III Maternal medical problem related factors		
301	Maternal diabetes screened	1. No 2. Yes
302	If yes Q number 301, what is the result?	1. Normal 2. Non Gestational Diabetes Mellitus 3. Gestational Diabetes Mellitus

303	Maternal hypertension screened	1. No 2. Yes
304	If yes Q number 303, what is the result?	1. Normal 2. Chronic Hypertension 3. Hypertensive Disorders of Pregnancy
305	Maternal Cardio Vascular System disorders screened	1. No 2. Yes
306	If yes Q number 305, what is the result?	1. Absent 2. Present
307	Maternal syphilis/ VDRL screened	1. No 2. Yes
308	If yes Q number 307, what is the result?	1. Non-reactive 2. Reactive
309	Maternal hepatitis B & C screened	1. No 2. Yes
310	If Yes Q number 309, what is the result?	1. Negative 2. Positive
311	Maternal anemia screened	1. No 2. Yes
312	If yes Q number 311, what is the result?	1. Absent 2. Present
313	Maternal HIV status screened	1. No 2. Yes
314	If yes Q number 313, what is the result	1. Negative 2. Positive
315	Other maternal diseases	Specify_____
Part IV: Placental factors		
401	Placental bleeding/ Antepartum hemorrhage	1. No 2. Yes
402	Placental infarction	1. No 2. Yes
403	Abnormal placental structure	1. No 2. Yes
Part V Neonatal factors		
501	Newborn sex	1. Male 2. Female
502	Birth order	1. Firstborn 2. Second and above
503	Number of newborn at current pregnancy	1.Single 2.Multiple
504	Any birth abnormality	1.No 2.Yes
505	Birth outcome	1. Alive

		2. Dead
Part VI variables measure inappropriate birth weight for gestational age		
601	Birth weight in grams	A._____ B. _____
602	Gestational age in weeks	_____
603	Small for gestational age (SGA)	1. No 2. Yes
604	Large for gestational age (LGA)	1. No 2. Yes
Part VII Questions specific to SGA babies		
701	Family history of SGA	1. Unrecorded 2. No 3. Yes
702	Previous history of SGA	1. Unrecorded 2. No 3. Yes
Part VIII Questions specific to LGA babies		
801	Family history of LGA	1. Unrecorded 2. No 3. Yes
802	Previous history of LGA	1. Unrecorded 2. No 3. Yes