



ADDIS ABABA UNIVERSITY

COLLEGE OF NATURAL AND COMPUTATIONAL SCIENCES

DEPARTMENT OF ZOOLOGICAL SCIENCES

*PREVALENCE OF BIRTH DEFECTS AND ASSESSMENT OF POSSIBLE RISK
FACTORS AMONG INFANTS BORN IN SELECTED HOSPITALS AND HEALTH
CENTERS IN ADDIS ABABA*

BY

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DECLARATION

I, the undersigned, declared that this research is our original work and has not been presented for a Master Degree in any other university, and that all sources of material used for the research have been duly acknowledged.

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LIST OF ABBREVIATIONS/ACRONYMS

BDs	Birth Defects
CAS	Congenital anomalies
CDC	Center for Disease Control and Prevention
CF	Cystic fibrosis
CHD	Congenital Heart disease
CL/P	Cleft lip and cleft palate
CSF	Cerebrospinal fluid
G6PD	Glucose 6 phosphate dihydrogenase
ICBDSR	International Clearinghouse for Birth Defects, Surveillance and Research
MOD	March of Dimes
NCDs	Non-Communicable Diseases
NTDs	Neural Tube defects
OFCs	Oro-facial clefts
SPF	sun protection factor
WHA	World Health Assembly
WHO	World Health Organization

TABLE OF CONTENTS

ACKNOWLEDGEMENTS	I
LIST OF ABBREVIATIONS/ACRONYMS	II
TABLE OF CONTENTS	III
LIST OF TABLES	V
LIST OF FIGURES	VI
LIST OF PLATES	VII
ABSTRACT	VIII
1. INTRODUCTION	1
1.1. BACKGROUND OF THE STUDY	1
1.2. OBJECTIVES OF THE STUDY	4
1.2.1. <i>General Objective</i>	4
1.2.2. <i>Specific Objectives</i>	4
2. LITERATURE REVIEW	5
2.1. DEFINITION AND SCOPE OF BIRTH DEFECTS.....	5
2.2. CAUSES OF BIRTH DEFECTS	7
2.3. TYPES OF BIRTH DEFECTS.....	8
2.3.1. <i>Structural Birth Defects</i>	8
2.3.2. <i>Functional Birth Defects</i>	13
3. MATERIALS AND METHODS	16
3.1. DATA SOURCES	16
3.2. PRIMARY DATA.....	16
3.3. SECONDARY DATA	17
3.4. DATA ANALYSIS	18
4. RESULTS AND DISCUSSION	19
4.1. PREVALENCE OF DIFFERENT TYPES OF BIRTH DEFECTS	20
4.2. PREVALENCE OF BIRTH DEFECTS BY SEX.....	21
4.3. THE FREQUENCY OF BIRTH DEFECTS RELATED TO MATERNAL AGE	21

4.4. THE FREQUENCY OF BIRTH DEFECTS RELATED WITH MATERNAL BEHAVIOR AND PRENATAL CARE	22
4.5. THE ANNUAL FREQUENCIES OF BIRTH DEFECTS.....	24
5. CONCLUSIONS AND RECOMMENDATION.....	26
5.1. CONCLUSION.....	26
5.2. RECOMMENDATIONS	26
6. REFERENCES	27
APPENDIX 1.....	32

LIST OF TABLES

TABLE 1. LIST OF HOSPITALS AND HEALTH CENTERS WITH ADDRESSES	16
TABLE 2 THE NUMBER OF PARTICIPANTS FOR QUESTIONNAIRE STUDY FROM EACH HOSPITAL AND HEALTH CENTERS	17
TABLE 3 THE TOTAL DELIVERIES IN EACH HOSPITAL AND HEALTH CENTER	17
TABLE 4 THE OVERALL PREVALENCE OF BIRTH DEFECTS	20
TABLE 5 THE PREVALENCE OF DIFFERENT TYPES OF BIRTH DEFECTS	20
TABLE 6 THE PREVALENCE OF BIRTH DEFECTS BY SEX IN SELECTED HOSPITALS AND HEALTH CENTERS IN THE STUDY PERIODS	21
TABLE 7 FACTORS RELATED TO MATERNAL BACKGROUND	23

LIST OF FIGURES

FIGURE 1 PREVALENCE OF BIRTH DEFECTS AMONG MATERNAL AGE GROUPS.....	22
FIGURE 2 THE ANNUAL FREQUENCY OF BIRTH DEFECTSIN HOSPITALS AND HEALTH CENTERS.....	25

LIST OF PLATES

PLATE 1 PICTURE SHOW THE CLEFT LIP OR PALATE	9
PLATE 2 PICTURE SHOW SPINAL BIFIDA.....	10
PLATE 3 PICTURE SHOW THE CLUB FOOT.....	11
PLATE 4 PICTURE SHOW A LIMB ANOMALY	12

ABSTRACT

A birth defect (BD) can be defined as any structural or functional abnormality determined by factors operating largely before conception or during gestation. It may be recognized prenatally, during delivery or in postnatal developments. The main objective of this study was to document and analyze data on the prevalence of birth defects and assess possible risk factors in selected Hospitals and Health centers in Addis Ababa. These selected hospitals and health centers were Menelike II General Specialized Hospital, Kotebe Health center, Jalmeda Health center, Kebena health center, Kotebe Millennium Health center and Denbrua Hospital . Data were collected from Hospitals and Health centers by questionnaire and medical records between September 2019 and August 2020. during the study period the total birth of 52321 were recorded in the selected hospitals and health centers out of this about 107 infants was born with birth defects. This is about 0.2% or 2 per 1000 birth. from those mothers only 25 could participate in questionnaire. In this research five types of birth defects have been identified. The most frequent type of birth defect was Down syndrome 32.7%, while the least frequent was or facial cleft 7.47%. This difference was statistically significant ($p=0.00$). The infant mother age showed a direct relationship with defective birth where older mothers had higher probability for births with BDs. This was also supported by the presence of a statistically significant difference between younger and older mothers with BDs ($p=0.001$). In addition, about 80% of defective children mothers follow parental care but only 32% do so from the beginning of their pregnancy while 48% started follow-up at a later stage. Even though 60% of mothers take folic acid, only 16% take folic acid from the beginning of their pregnancy while 44% had started taking folic acid at later stage of their pregnancy. Moreover, about 60% of mothers that consume alcohol also had defective births, while smoking had a slight significance for birth defects the percentage of female infants with birth defects compared to males was higher 57% vs 43% . But this difference was not statistically significant (0.147) therefore the finding of this research indicated the disuse and inappropriate use of folic acid, alcohol consumption, smoking, maternal age, and lack of prenatal care follow up properly are possible risk factors with the occurrence of birth defects.

Key Words: Birth Defect, Prevalence, Folic Acid, Health center, Addis Ababa

1. INTRODUCTION

1.1. Background of the Study

Birth defects, also known as congenital anomalies, are structural or functional abnormalities that occur during intrauterine life and may be detected prenatally, at birth or later in life. Worldwide close to 8 million children are born per year with a birth defect and the toll is particularly high in low-and middle-income countries, where approximately 95% of deaths due to birth defects occur. Birth defects remain a major cause of child mortality worldwide, accounting for 5% of all newborn deaths globally. Many birth defects are associated with folic acid insufficiency, non-communicable diseases (NCDs), teenage or advanced age pregnancies, short birth intervals, and exposure to harmful substances. The majority of countries with the highest birth defects prevalence are in Africa, and the East African Community has made important commitments to improving reproductive, child, and adolescent health and nutrition. Although not all birth defects can be prevented, improving the health of a woman before pregnancy and ensuring that she has access to preconception and inter-conception care increases a woman's likelihood of having a healthy infant. On an individual level, women and their partners can reduce their likelihood of having a baby with birth defects by planning their pregnancy and choosing a healthy lifestyle, while on a population level, public health policies and interventions implemented by governments can also have a significant impact on reducing national birth defects prevalence. Although BDs are the most serious cause of infant mortality and disability in both developed and developing countries, about 94% of BDs, 95% of deaths and 15-30% of hospital admissions of infants and children due to BDs are in low and middle income countries. (Walani SR1. et al. , 2020).

In 2019, the World Health Assembly adopted a Birth Defects Resolution encouraging member states to develop national plans to prevent birth defects. Further, the 2013 report from the World Health Organization (WHO) Meeting to Develop a Global Consensus on Preconception Care to Reduce Maternal and Childhood Mortality and Morbidity urged low- and middle-income countries to adopt a package of preconception interventions supported through national-level policies.

Further more in 2020, the World Health report describes as key facts about the birth defects in the world an estimated 295000 new born die within 28 days of birth every year, worldwide due to

congenital anomalies. Congenital anomalies can contribute to long term disability and may have significant impacts on individuals, families, health care system and societies. The most common severe congenital anomalies are heart disease, neural tube defects, down syndrome. Although congenital anomalies may be the result of one or more genetic, infection, nutritional or environmental factors. It is often difficult to identify the exact causes. Some congenital anomalies can be prevented, vaccination adequate intake of folic acid or iodine through fortification of staple food or supplementation and adequate antenatal care are just the example of prevention methods.

Although individually rare, birth defects taken together account for a significant proportion of mortality and morbidity among infants and children in populations where infectious diseases are largely under control and nutritional deficiencies have for the most part been corrected (Jenkins, 1977).

A birth defect is any structural or functional deformity determined by factors operating largely before conception or during gestation. These abnormalities may be apparent immediately after birth, or they may manifest later in life. Birth defects result from a range of factors, but most cannot yet be ascribed to a specific cause (Nelson and Holmes, 1989). There are three major categories of causes: (1) genetic, (2) environmental, and (3) complex genetic or unknown.

Genetic (chromosomal and single-gene) causes are estimated to account for about 25–30% of total birth defects. Chromosomal anomalies have been demonstrated in about 0.5% of newborn infants. This number may increase as modern cytogenetic techniques identify previously unrecognized chromosomal changes. An example of this is the recent use of telomeric probes, which found that 5–7% of mentally retarded children have a cryptic translocation that had not been recognized using traditional techniques (Knight et al., 1999). Approximately 1% of all births are characterized by a mutation at a single genetic locus. Usually there are no previously affected relatives. This is the case with lethal autosomal dominant traits, which typically arise as a result of a fresh mutation in the sperm. Not all mutant genes manifest at birth or lead to structural malformations. However, the proportion of birth defects caused by known single-gene mutations is likely to be higher than for chromosomal abnormalities, based on Nelson and Holmes' (1989) survey of nearly 70,000 newborns, in which there were three times as many single-gene mutations. Many mutations are likely to remain unrecognized until a function has been established for most of the thousands of human genes.

Environmental causes are estimated to be responsible for about 5–10% of total birth defects (Nelson and Holmes, 1989). Environmental causes include nutritional deficiencies, maternal illnesses, and infectious agents.

Complex genetic or unknown causes are estimated to account for 65–70% of all birth defects, some of which are lethal. Complex birth defects may involve a few interacting genes (oligogenic), many genes (polygenic), the environment, or an interaction between genes and environment (multifactorial). Families with an affected child have an increased occurrence of almost all the birth defects that are restricted to a single organ system, such as cleft lip and/or cleft palate, developmental hip dysplasia, and most forms of cardiac anomalies (Simpson and Golbus, 1992).

In early human history, birth defects in both animals and humans were often attributed to a curse from God or because of evil. Even today, some cultures think that mothers who give birth to infants with BDs have had communication with a devil or evil spirits. But it is not true at all (Adane and Seyom, 2018). It happens in early stage of embryo development which is extremely vulnerable to various factors, leading to congenital anomalies. Birth defects usually begin during organogenesis (from the 3rd to the 8th embryonic periods). In developing countries, maternal infectious disease, such as rubella and syphilis, are supposed to be common causes of birth defects (WHO/World Alliance 1999, Penchaszadeh 2010).

In Ethiopia, the causes of birth defects have not been adequately studied. In fact, whether the causes are environmental or genetic factors or interactions between environmental and genetic factors are not known. In addition, it is obvious that children born with major birth defects are prone to die or even if they survive, they may face up to a long-term morbidity and disability and may also undergo repeated surgical interventions (Adane and Seyom, 2018). Evidence based information about particular risk factors for birth defect is very essential to provide health education to communities, especially to females in the reproductive age. This could not only help to create awareness so as to reduce the occurrence of anomalies but also to assist policy makers to develop preventive strategic plans. So this study was conducted to document and analyses data on the prevalence of birth defects in selected Hospitals and Health centers in Addis Ababa. The study also attempted to analyses association patterns between maternal background and occurrence of birth defects. In doing so, the study is taken as a valuable contribution in understanding of birth defect prevalence for improved health care management.

1.2. Objectives of the Study

1.2.1. General Objective

The main objective of this study was to document and analyses data on prevalence of birth defects and assess possible risk factors in selected Hospitals and Health centers in Addis Ababa.

1.2.2. Specific Objectives

The specific objectives of this study were to:

- Analyse the yearly prevalence rate of birth defects.
- Asses variability in types of birth defects among male and female infants.
- Assess the prevalence rate of different birth defect types.
- Asses possible risk factors based on maternal background.

2. LITERATURE REVIEW

2.1. Definition and Scope of Birth Defects

A birth defect (BD) is any structural or functional abnormality in a neonate that is determined by factors operating before conception or during gestation (Nelson and Holmes, 1989). These abnormalities may be apparent abnormalities immediately after birth or manifest later in life. These are described by different terms like congenital disorders, congenital anomalies, congenital malformations (Universal Public Health, 2014).

A congenital physical anomaly is an abnormality of the structure of a body part. A malformation is associated with a disorder of tissue development. A typical combination of malformations affecting more than one body part referred to as a malformation syndrome. A dysplasia is a disorder at the organ level that is due to problems with tissue development. A disruption involves breakdown of normal tissues. When multiple effects occur in a specified order, it is known as a sequence. When the order is not known, it is a syndrome (Seashore and Wappner 1996).

Worldwide, lifelong disability and mortality of children are the outcome of the adverse effects of birth defects. Approximately 3.3 million children under the age of five die per year, because of birth defects. Furthermore, 303,000 infants die within a month of being born because of birth defects, and 3.2 million live-born children are disabled for life, which have direct effects on children, family, health care systems and communities (MOD, 2006; WHO, 2006). Although birth defects are the most serious causes of infant mortality and disability in both developed and developing countries, around 94% of birth defects, 95% of fatalities and 15-30% of hospital admissions of infants and children because of birth defects are in low and middle income countries. Worldwide, the prevalence of birth defects varies from region to region (Hiebert L2.etal, 2020).

Every year, an estimated 7.9 million children are born with a serious birth defect of genetic or partly genetic origin. More infants are born with serious birth defects of post-conception origin including those that result from maternal exposure to environmental agents (Teratogens) such as alcohol, rubella, syphilis, and iodine deficiency that can harm the developing fetus (MOD, 2006). Thus, an estimated 9 million infants representing approximately 7% of all births are born annually with a serious birth defect that may kill them or result in lifelong disability.

An estimated 3.2 million of those who survive without appropriate care may be disabled for life. For those who survive, these disorders can cause lifelong mental, physical, auditory, and visual disabilities that exert a harsh human and economic condition to on those defective children, their families, and their communities (MOD, 2006).

In 2010, the World Health Assembly (WHA) adopted a Birth Defect Resolution encouraging member states to develop national plans to prevent birth defects. Further, the 2013 report from the World Health Organization (WHO) meeting to Develop a Global Consensus on Preconception Care to Reduce Maternal and Childhood Mortality and Morbidity urged low- and middle-income countries to adopt a package of preconception interventions supported through national-level policies. An increasing body of evidence shows that many of the birth defects are associated with teenage or advanced age pregnancies, short birth intervals, exposure to harmful substances (for example, tobacco), folic acid insufficiency and non-communicable diseases (Hiebert L2.etal, 2020).

The prevalence of specific conditions varies widely in different populations. In countries where basic public health services are not available, the birth prevalence of serious birth defects is generally higher than in developed countries. At least eight conditions may contribute to a higher incidence of birth defects: (1) inadequate pre-conception intake of folic acid, (2) iodine deficiency in the mother's diet, (3) lack of vaccination against rubella, (4) women giving birth after 35 years of age, (5) Marriages between relatives, (6) alcohol consumption during pregnancy, (7) the use of medications for a long time that harm the body, and (8) the lack of prenatal diagnosis and termination of pregnancies where the fetus is severely affected. The prevalence of specific birth defects varies widely with the ethnic, geographic, cultural, and economic characteristics of populations (Kuliev and Modell, 1990).

In Ethiopia, a significant number of babies are born with birth defects. In fact, whether the causes are environmental or genetic factors or interactions between environmental and genetic factors are not known. In addition, there are no preventive strategic plans to reduce or control the occurrence of these problems (Adane and Seyom, 2018).

According to a study report by Andrew et al. (2004) the major parts of birth defects (83.3%) are preventable. Andrew also has outlined the classification of the three levels of prevention approaches,

The first approach is called the primary prevention, which refers to avoiding the cause(s) of birth defects, for example by vaccination of rubella or preconception supplementation with folic acid and other necessary multivitamins.

The second approach or secondary prevention is taken through the focus on the early detection followed by early effective treatment .Here again an example is neonatal orthopedic screening which is very effective for early detection and treatment of deformities such as congenital dislocation of hip.

The third approach which is also known as tertiary prevention refers to the complete recovery of congenital abnormalities by early surgical intervention without residual defects.

Therefore, investigating these causes and risk factors may help to prevent the anomalies. At present, vaccination, dietary intake of folic acid or iodine, and preconception health care are available options for prevention (WHO, 2000).

2.2. Causes of Birth Defects

According to the CDC (2005), most birth defects are believed to be caused by a complex mix of factors including genetics, environment, and behaviors though many birth defects have no known cause.

The causes of birth defects can be grouped in three main categories(Nelson and Homes,1989): (1) genetic (25 to 30% of total birth defects), which includes chromosomal abnormalities and single-gene defects; (2) environmental (5 to 10% of total birth defects), which includes nutritional deficiencies, infectious diseases, maternal medical conditions, alcohol and recreational drugs, and teratogenic pollutants; and (3) complex genetic, environmental and unknown (65 to 70% of total birth defects), which encompasses unknown causes and probably involves more than one gene or environmental factor. Though individually rare, birth defects taken a significant proportion of morbidity and mortality among infants and children particularly in areas where infant mortality due

to more common causes has been reduced. Birth defects may result from genetic or chromosomal disorders or certain infections during pregnancy. Risk factors include deficiency of folic acid, drinking alcohol or smoking during pregnancy, poorly controlled diabetes, and a mother over the age of 35 years old. Many are believed to involve multiple factors (WHO, 1996, WHO/World Alliance, 1999).

2.3. Types of Birth Defects

The types of BDs were classified by using WHO/CDC/ICBDSR manual (2014) based on WHO/CDC/ICBDSR classification method. Birth defects are divided into two main types as structural and functional (Jenkins, 1977).

2.3.1. Structural Birth Defects

Structural defects are when a specific body part is missing or malformed. The most common structural defects are:

Heart defects, malformation of the heart or large blood vessels near the heart is present at birth. Both right and left ventricles can be hypoplastic. In some cases, hypoplastic ventricles are secondary to stenotic or atretic out flow vessels while in others it is a primary failure of specification of the ventricular chambers. In the case of stenotic or atretic vessels or valves, it is easy to see the importance of haemodynamic factors in growth and remodelling of the cardiac chambers. However, almost nothing is known about the molecular mechanisms that underlie deficient ventricular growth in the absence of haemodynamic deficiency. The transcriptional network that controls ventricular development is conserved across all vertebrate species. HAND genes play a role in ventricular specification and growth (Srivastava, 1999). Epigenetic factors that regulate gene expression through chromatin remodelling appear to be important in ventricular growth. Bop is one such factor that acts through regulation of histone methylation. Mouse embryos lacking Bop expression have right ventricular hypoplasia, while atrial myocytes develop normally (Gottlieb et al., 2002).

The developmental mechanisms leading to lateral and oblique facial clefts are not understood. but there is currently no animal model for this birth defect. In theory, failure of fusion of adjacent

primordia for all orofacial clefts may be caused by insufficient growth, so that the edges are not closely apposed at the appropriate developmental stage, or by the failure of epithelial breakdown at the apposing surfaces. For facial clefts that do not coincide with embryonic lines of fusion, amniotic bands are the only plausible explanation (Bagatin et al., 1997). Cleft lip and cleft palate have been much more extensively investigated. Human genetic studies on cleft lip with or without cleft palate (CL/P) show the characteristics of a complex genetic trait, compatible with either a multifactorial threshold trait (i.e. incorporating both genetic and environmental factors) or with an oligogenic cause (Mitchell and Risch, 1992). In a summary of genes associated with human orofacial clefting, Spritz (2001) listed growth factors transforming growth factor-alpha (TGF), TGF1, TGF and TGF3], transmembrane cell adhesion molecules (Nectin-1, Nectin-2) and transcription factors (MSX1, AP2) as well as a cell cycle regulator, an enzyme involved in folate metabolism, and endothelin-1. On the basis of previous mouse knock-out studies, Scapoli et al. (2002) carried out linkage disequilibrium and linkage analysis studies of five candidate genes. The results suggested a major role for the 3 subunit of the aminobutyric acid receptor (GABRB3) and minor roles for retinoic acid receptor alpha (RAR) and transforming growth factor receptor beta 3 (TGF3). Generally cleft lip or palate mean there is an opening or split in the lip or roof of the mouth.



Plate 1 picture show the cleft lip or palate

These encompass a range of congenital malformations that result from incomplete development of the brain and spinal cord or their protective coverings. The three major types are anencephaly, spina bifida, and encephalocele. Spina bifida is the incomplete closure of the neural tube, which is the predecessor of the spinal cord. The birth outcome varies with the location of the genetic defect and whether it affects the neural tube, skeletal components, and/or skin. In some cases, the affected infant is born with the spinal cord exposed on the surface as a neural plaque, and it may include meningeal tissue. This interrupted development of the spinal cord occurs in the first 4 to 5 weeks of fetal development and causes serious clinical problems that may include hydrocephalus, paralysis, incontinence, or skeletal deformities depending on the location and nature of the defect. Although spina bifida has long been considered to be a lethal condition, surgery at birth saves some infants, but they may be significantly handicapped (Shibuya and Murray, 1998; Hunt, 1990). In resource-poor situations, the future of an affected child is severely compromised. Spinal bifida, when the spinal cord doesn't develop properly.



Plate 2 Picture show spinal bifida.

This involves a spectrum of common abnormalities in ankle joints and in the bones, muscles, and ligaments of the foot. The main types of deformities include abduction of the whole foot with plantar inversion, external rotation of the foot, concave profile of the sole, convex profile of the sole, and medial deviation of the anterior third of the foot (Winter et al., 1988). Pathological changes resulting from the deformity vary among patients. In severe cases, bones may be smaller than normal, with displacement of the

talocalcaneonavicular joint. When bones are normal in shape and size, the deformity is maintained by contracted muscles, tendons, and ligaments (Sinha, 1987). Transient deformities not requiring treatment are not considered here. Clubfoot is abnormalities in ankle joints in the bones, muscles and ligaments of the foot. The malformation of the hip joint in the head of the femur is not correctly positioned in the acetabulum. The cause is unknown, but genetic factors may play a role.



Plate 3 Picture show the club foot.

Limb defects are often associated with other malformations affecting, for example, craniofacial, kidney, cardiac and skin development (Stevenson and Meyer, 1993). Limb defects associated with other abnormalities are often heritable, either as autosomal recessive or autosomal dominant conditions. X-linked inheritance of limb defects is observed only in few syndromes. The various causes believed to lead to each syndrome displaying limb abnormalities, including rare ones, can be found in the review by Stevenson and Meyer (1993).

A malformation of the hip joint in which the head of the femur is not correctly positioned in the acetabulum. The cause is unknown, but genetic factors may play a role. Problems range from the relatively rare congenital dislocation of the hip where the head of the femur is completely outside the acetabulum and the hip is very unstable to conditions where the displacement shortens one leg and causes limping, joint and knee problems, pain, and the degenerative changes of osteoarthritis (Leck, 2000). A limb anomaly (dysmelia), these include all forms of limb anomalies, such as amelia and ectrodactyly



Plate 4 Picture Show a limb anomaly

Congenital anomalies of the nervous system include neural tube defects such as spina bifida, encephalocele and anencephaly. Other congenital anomalies of the nervous system include the Arnold-Chiari malformation, Congenital anomalies of the gastrointestinal system include numerous forms of stenosis, atresia, and perforation, such as gastroschisis.

2.3.2. Functional Birth Defects

Functional or developmental birth defects cause a body part or system not to work properly. These often cause disabilities of intelligence or development. These defects include metabolic defects, sensory problems, and nervous system problems. Metabolic defects cause problems with the baby's body chemistry. The most common types of functional or developmental birth defects include:

Down syndrome, which causes delay in physical and mental development. This is a common chromosomal disorder in which a child is born with three—not two—copies of chromosome 21. It causes varying degrees of mental and growth retardation, a characteristic facial appearance, and multiple malformations. It is associated with a major risk for heart malformations, a risk of duodenal atresia in which part of the small intestine is not developed, and a small but significant risk of acute leukemia. It frequently results in spontaneous abortion. Congenital heart disease associated with Down syndrome can be fatal and is the major cause of death. Inadequate intellectual development can cause severe, lifelong disability and dependence. The estimated birth prevalence of Down syndrome in developing countries is higher than in developed countries (Kuliev and Modell, 1990).

Sickle cell disease, which occurs when the red blood cells become misshapen. This is a genetic blood disease that results from the pairing of an abnormal hemoglobin S (HbS) with another abnormal hemoglobin. Heterozygote carriers have the largely asymptomatic sickle cell trait (HbAS); homozygotes (HbSS) have variable symptoms and are said to have sickle cell anemia; and HbS compound heterozygotes, the most prevalent being hemoglobin C (HbSC) and hemoglobin E (HbSE), have the most severe symptoms. Sickle cell disease affects millions of people worldwide but is particularly common among people from sub-Saharan Africa; Spanish-speaking regions; Saudi Arabia; India; and Mediterranean countries. The high frequency of sickle cell disease in these populations is attributed to the lower rates of mortality from malaria infection among carriers, who are asymptomatic, compared with non carriers (Ashley-Koch et al., 2000). Relatively high rates of consanguineous marriage in the Eastern Mediterranean region have increased the prevalence of sickle cell disease in that population as well (World Health Organization, 1997).

Cystic fibrosis, dysfunction of exocrine glands. A generalized disorder in which there is widespread dysfunction of the exocrine glands, characterized by signs of chronic pulmonary

disease (due to excess mucus production in the respiratory tract), pancreatic deficiency, abnormally high levels of electrolytes in the sweat and occasionally by biliary cirrhosis. There is an ineffective immunologic defense against bacteria in the lungs. Without treatment, CF results in death for 95% of affected children before age 5. With diligent medical care patients with CF can survive beyond middle age. Although survival has improved in developed countries, CF often results in early mortality. The diagnosis of CF—complicated even in developed countries—requires tests for sweat chloride and, if positive, molecular screening to identify the mutation (Grody, 2001).

G6PD deficiency. This enzyme defect results from recessive mutations in the gene for the enzyme G6PD, which is carried on the X chromosome. This enzyme defect results from recessive mutations in the gene for the enzyme G6PD, which is carried on the X chromosome. Hundreds of variants of G6PD deficiency have been identified among the 400 million people estimated to be affected worldwide. Individuals deficient in G6PD are vulnerable to developing acute hemolytic anemia as a result of infections, exposure to oxidant drugs (the anti malarial, primaquine, and the sulfonamide antibiotics or sulfones), or chemicals (naphthalene in mothballs), or ingestion of fava beans. Severe hemolysis in these cases can be fatal (Steensma et al., 2001). Some affected newborns develop severe hemolytic jaundice and kernicterus, which can result in death or serious neurologic impairment.

Oculocutaneous Albinism, which is the disorder in pigmentation of skin, hair, eyes. For affected children, the symptoms of the disorder can be treated, and health education can improve the home care (and, eventually, self-care) of affected children and dispel misconceptions that surround the condition. Affected children are extremely sensitive to the sun and have poor vision. Sun protection is critical since those affected can be severely sunburned from minute-long exposures, which over time make them vulnerable to skin cancer. Covering the skin with long-sleeved shirts, long pants, and wide-brimmed hats helps protect from exposure to ultraviolet A (UVA) radiation. Sunscreens with a sun protection factor (SPF) rating of greater than 25 should be used at all times (King et al., 1996). Vision problems, such as hyperopia, myopia, and astigmatism, require correction to obtain the best possible visual acuity (King et al., 1996). Nearly every respondent among 138 school children with albinism in rural Zimbabwe reported problems in school due to poor vision (Lund, 2001). Yet most of these children can function in a regular classroom, provided the teacher and school attend to their special vision needs (King et al., 1996). Adults with albinism frequently

encounter social problems associated with their appearance, including difficulty in finding employment (Lund, 1998). A survey of attitudes toward people with albinism conducted in urban Soweto, South Africa, found that although they may be accepted in their community, people with albinism were regarded as abnormal and perhaps not fully human (Kromberg, 1992). Negative attitudes persist and are based on myths and superstitions concerning albinism, the most pervasive being that people with the condition do not die normally, but “vanish.” Treatment of the condition and education of the public about the medical cause should be used to dispel this and other myths, and allow affected individuals to be accepted (and to accept themselves)

Congenital brain defects are abnormalities in the brain that are present at birth. There are many different types of these defects. They can vary greatly from mild to severe conditions. Some congenital brain defects don't have symptoms until adulthood and never have symptoms at all.

Children born with congenital brain defects also may have the cardiovascular disorders, gastrointestinal defects, seizures, head pain, muscle weakness ,reduced vision, bladder and bowel problems. While other types of congenital brain defects develop within the structure of the brain which include;

Hydrocephalus: Also called fluid on the brain, this is an excessive buildup of cerebrospinal fluid (CSF) caused by impaired circulation of the CSF. When there is excess fluid, it can put too much pressure on the brain.

Dandy-Walker syndrome: This involves the absence or defective growth of the central section of the cerebellum.

Holoprosencephaly: The brain doesn't divide into two halves, or hemispheres.

Megalencephaly: This condition causes a person's brain to be abnormally large or heavy.

Microcephaly: This occurs when the brain doesn't develop to full size.

3. MATERIALS AND METHODS

3.1. Data Sources

The data on birth defect prevalence were collected from the following hospitals and health centers that provide maternal and neonatal health care services (Table1).

Table1. List of Hospitals and Health Centers with Addresses

N_o	Name of Hospitals and Health Centers	Address
1	Denberua Hospital (Private)	Yeka sub city worda 6
2	MenelikII Hospital (Public)	Arada sub city worda 7
3	Kotebe Millennium Health Center	Yeka sub city worda 9
4	Jalmeda Health Center	Arada sub city worda 6
5	Kebena Health Center	Yeka sub city worda 6

3.2. Primary Data

The primary data collection was done by using questionnaire which was intended to get maternal background information for defective births. The questionnaire was filled by the researcher upon a one to one question and answer with the consent of the participant. The questionnaire took 30 min/participant on the average. The mothers were contacted during hospital visits where the data collection also took place. The questionnaire focused on background information such as alcohol or other substance use, folic acid use, prenatal follow up etc (see Appendix 1 for more details).The number of participants in the questionnaire is given in Table 2.

Table 2 The number of participants for questionnaire study from each Hospitals and Health Centers

N_o	Name of Hospitals and Health Centers	Participants
1	Denberua Hospital (Private)	3
2	Menelike II Hospital(Public)	9
3	Kotebe Millennium Health Center	7
4	Jalmeda Health Center	3
5	Kebena Health Center	3
	Total	25

3.3. Secondary Data

Secondary data on prevalence of birth defects will be obtained from medical records accessed with permission strictly on the basis of confidentiality. A total of 52321 birth records were examined during the study (Table 3).

Table 3 The total Deliveries in each Hospitals and Health Centers

N_o	Name of Hospitals and Health Centers	N_o of Birth records	Duration
1	Denberua Hospital (Private)	9450	2016-2020
2	Menelike II Hospital (Public)	12450	2019-2020
3	Kotebe Millennium Health Center,	10241	2016-2020
4	Jalmeda Health Center	10130	2017-2020
5	Kebena health Center	10050	2016-2020
	Total	52321	

3.4. Data Analysis

Variability in frequency of BDs between types, sexes, and maternal age groups were statistically analyzed using the nonparametric chi-square test. The difference in frequency of BD types between males and females was analyzed using pair-wise t-test. The analyses were done on SPSS software ver. 17. The level of significant was set at $p < 0.05$.

4. RESULTS AND DISCUSSION

Birth defects are a major health problem for infants worldwide. The prevalence of individual conditions in different populations varies with the health concern; use and coverage of preventive methods; and access to prenatal care program, diagnosis, and possible termination of pregnancy for severe birth defects (WHO, 1997, 1999). Approximately 3.3 million children under the age of five die per year because of birth defects. Based on the WHO report in 2013 the rates of total structural and functional birth defects were higher in the regions of eastern Mediterranean and South East Asia with respective prevalence rates of 69 per 1000 and 51 per 1000 live birth every year. Higher prevalence rates of BD in those studies in Europe may be due to well organized and better birth registry system compared to African.

From September 2016 to June 2020, 52321 total deliveries were recorded. Out of these, 107 births were with a BD. This shows that the overall prevalence of BD was about 2 per 1000 birth (0.2%) (Table 4). According to the findings of the present study, alcohol consumption during early pregnancy or throughout pregnancy, maternal age and folic acid supplementation before and during early pregnancy had significant associations with the occurrence of birth defects. In this study, the observed prevalence of birth defects (0.02%) compared to previous studies is less in percentage where a prevalence of 1.6% was reported in North West Ethiopia (Adane and Seyoum, 2018). This discrepancy might be due to the fact that difference in study design; population sampling may also a factor that contributes for higher prevalence rates.

Table 4: The Overall Prevalence of Birth Defects

N_o	Name of Hospitals and Health Centers	Total birth	Defective birth
1	Denberau Hospital (Private)	9450	25
2	MenelikeII Hospital (Public)	12450	30
3	Kotebe Millennium Health Center	10241	15
4	Jalmeda Health Center	10130	17
5	Kebena Health Center	10050	20
	Total	52321	107

4.1. Prevalence of Different types of Birth Defects

In this study only five types of birth defect were recorded. The most frequent types of birth defect were the Down syndrome which is accounted about 32.71% while the limb anomaly, musculoskeletal defects, Neural tube defect and Orofacial clefts accounts 28.0%, 23.35%, 8.41% and 7.47%, respectively This difference was statistically significant ($p=0.00$) (Table 5). In the previous study the record on Down syndrome, limb anomaly, musculoskeletal defects, Neural tube defect and Orofacial clefts accounts for 3.2%, 8.8%, 3.9%, 32.5 % and 27.1% (Adane and Seyoum, 2018).

Table 5 The Prevalence of Different types of Birth Defects

N_o	Types of Recorded Birth Defects	Total number of Cases (%)
1	Orofacial Clefts cleft lip and palate, and cleft palate	8 (7.47)
2	Neural tube defects (Spina bifida)	9 (8.41)
3	Masculoskeletal Defects (reduction defects of tibia, femur, ulna)	25 (23.35)
4	A limb anomaly(ectrodactyly)	30 (28.03)
5	Down syndrome	35 (32.71)
	TOTAL	107

4.2. Prevalence of Birth Defects by Sex

This study also tried to assess the prevalence of birth defect in relation to sex. Generally both sexes could be susceptible for birth defect while most of the numbers of infants with defective birth was female about 57% and male about 43% the difference was not significant. While in the previous study the proportion of male infants who had birth defects was greater than that of female infants about 59% of male with 41% of female (Adane and Seyoum, 2018). The percentage of female infants with birth defects compared to males was higher (57% vs 43%). However, this difference was not statistically significant ($p=0.147$). However, the frequency of BD types among males and females were statistically significant ($p=0.023$) (Table 6).

Table 6 The prevalence of Birth Defects by Sex in selected Hospitals and Health Centers in the study periods

No	Types of Recorded Birth Defects	Female (%)	Male (%)
1	Orofacial Clefts cleft lip and palate, and cleft palate	5 (4.67)	3 (3.73)
2	Neural tube defects (Spina bifida)	5 (4.67)	4 (3.73)
3	Masculoskeletal Defects (reduction defects of tibia, femur, ulna)	15 (14.01)	10 (9.34)
4	A limb anomaly is called dysmelia (ectrodactyly)	16 (14.85)	14 (13.08)
5	Down syndrome	20 (18.69)	15 (14.01)
	Total	61 (57.0)	46 (42.9)

4.3. The frequency of Birth defects related to maternal age

Maternal age also had a significant effect on birth defects. Women above 35 years old were around five times more likely to have neonates with birth defect as compared to those women who are in the age group of 20–35 years old (WHO 2019). Here again maternal age has relation with BDs frequency where the older women having higher risk of defective birth. There was a directional correlation between age and defective birth where the rate is higher among older women (Figure 1). The difference in frequency of BD among the different age categories of mothers with BDs was statistically significant ($p=0.001$).

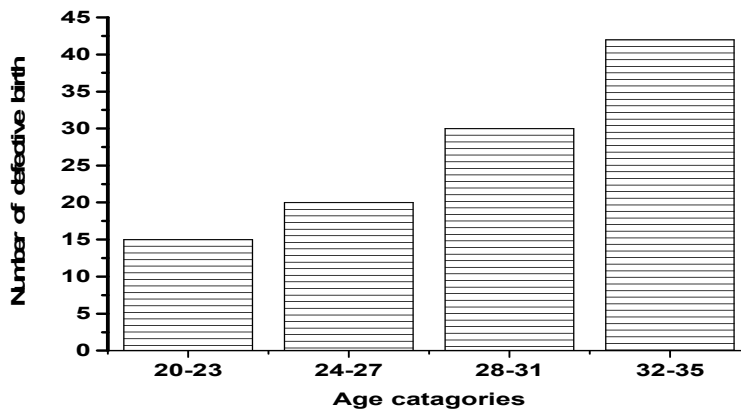


Figure 1 Prevalence of Birth Defects among Maternal age groups.

4.4. The frequency of Birth Defects related with Maternal behavior and Prenatal care

Table 7 describes about certain risk factors of the birth defects. The findings of this study showed that most pregnant women do not take folic acid appropriately. This was evident from the fact that 40% of the women in the present study did not use folic acid at all while 44% of those who used folic acid started doing so at a later stage of their pregnancy. (Walani SR1. et.al. , 2020). Presently the Federal Ministry of Health recommended folic acid supplementation to all pregnant women signifying the importance of folic acid for healthy pre- and postnatal development of the new born. Neural defects can be reduced if a pregnant woman appropriately takes the recommended dose of folic acid. Women that take folic acid are less likely to have babies with birth defects compared to those who do not take folic acid during and before early pregnancy (WHO 2000). Folic acid also has a role in amino acid metabolism that is needed for DNA and RNA synthesis and plays an important role as an antioxidant agent.

About 60% of the birth defect was seen in those mothers who consume alcohol. Alcohol is capable of crossing the placenta membrane and being carried to all developing cells and tissues of the embryo and fetus, and as a result causes damages to the developing tissues and cells and subsequently leads to a structural deformity (Nelson and Holmes, 1989). The association of alcohol drinking during and before early pregnancy and birth defects was also reported by (Breunis et al,

2021). Furthermore, alcohol drinking during pregnancy results in serious consequences marked with physical and mental disorders, abnormal facial appearance after a baby is born.

The majority of mothers (80%) with defective births in the current study were non-smokers which suggests other causes might have contributed to their defective births. It is commonly known that smoking is a contributing factor for defective births and the avoidance of smoking by the majority of the mothers can be taken as positive behavioral trait.

Even though 80% of the mothers reported prenatal follow up during their pregnancy, only 32% followed the prenatal care at the beginning of their pregnancy, while 48% do so at later stages. This might have contributed to some level to the observed BDs in these mothers. It is known that timely and consistent prenatal follow up help to detect birth defects at early stages to be able to decide appropriate intervention decisions (Kuliev and Modell, 1990).

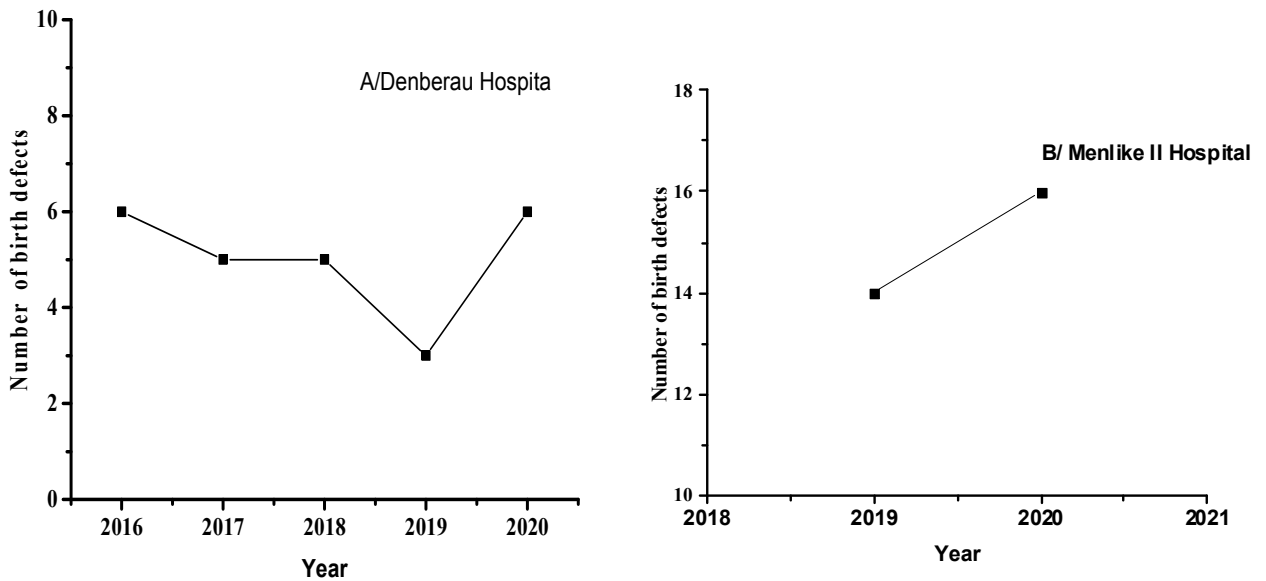
About 60% of the defective children mothers consume alcohol. While about 80% of the defective children mothers follow prenatal care but only 32% do so from the beginning of their pregnancy period, while about 48% of mothers started in later pregnancy period. In the case of folic acid intake, also about 60% of mothers take folic acid but only 16% of mothers take from the beginning of their pregnancy period, while about 44% of mothers used in later stage of pregnancy. Smoking did not show a significant association with the occurrence of the birth defect .

Table 7 Factors related to maternal background

Factors	Response	
	Yes	No
Smoking	5 (20%)	20 (80%)
Drinking alcohol	15 (60%)	10 (40%)
Use of folic acid (early stage of pregnancy)	4 (16%)	10 (40%)
Use of folic acid (late stage of pregnancy)	11 (44%)	-
Prenatal care follow up from beginning	8 (32%)	5 (20%)
Late prenatal care follow up	12 (48%)	-

4.5. The annual frequencies of Birth defects

Figure 2 shows the frequencies of BDs in the selected hospitals and health centers in the study period. Lack of consistency was observed in the annual prevalence of birth defects in the selected hospitals and health centers. For example in Denberua, defective birth declined until 2019 and showed an increase in 2020. For Kotebe Millennium Health Center, birth defect prevalence showed a sharp decline between 2018 and 2019 from Five to Zero and the highest birth defect was observed for 2020. For Kebna Health Center, birth defect prevalence showed a rise for 2017 and 2018 and decline to Zero in 2020. For Jalmeda Health Center, birth defect prevalence showed oscillation pattern of increase and decrease between each year. The plot for the combined data including Menelike II where only two year data is available shows a continuous increase in BD prevalence (Figure2).



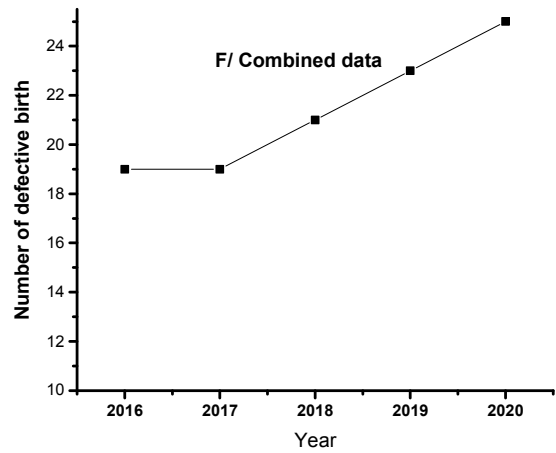
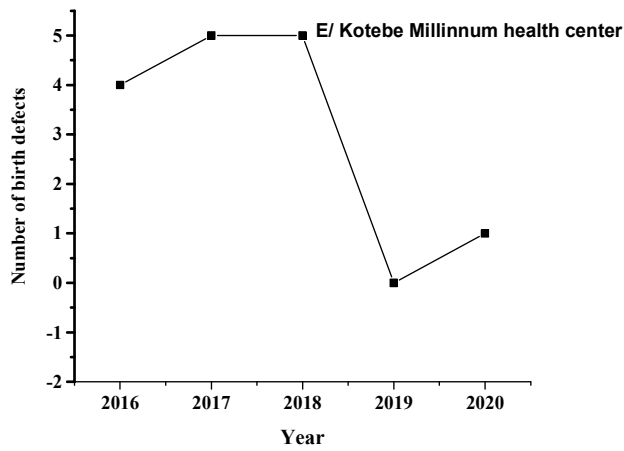
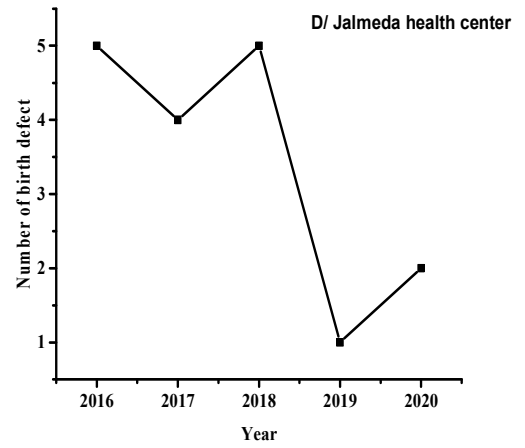
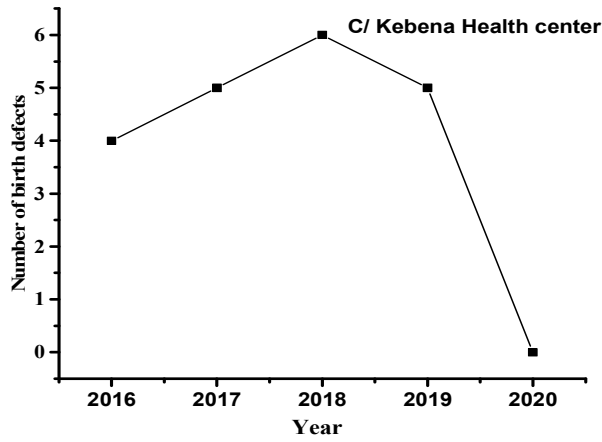


Figure 2. The annual frequency of Birth defects in A/ Denberau Hospital B/ Menlike II Hospital C/ Kebena Health center D/ Jalmeda Health center E/ Kotebe Mellinium Health center F/ Combined data

5. CONCLUSIONS AND RECOMMENDATION

5.1. Conclusion

The finding of this research indicated the disuse and inappropriate use of folic acid, alcohol consumption, smoking, maternal age, and lack of prenatal care follow up properly are possible risk factors with the occurrence of birth defects. The present study has given an insight into the magnitude of the prevalence of birth defects in Addis Ababa. The study shows that the prevalence of birth defects is unacceptably high. It is necessary to conduct further population based investigations in different parts of the country to further ascertain. The finding of this study provided baseline data for future detailed studies, as there was very little data available previously. In addition, information from this study would be useful in developing strategies for the prevention of birth defects as well as for better management.

Finally both female and male infants could be susceptible for birth defects, so that awareness creation for the communities concerning the risk factors of birth defect is essentials for the new generation.

5.2. Recommendations

- Women should be discouraged from reproducing after age 35 to minimize the risk of birth defects.
- Awareness should be given about folic acid intake before and during pregnancy period.
- Awareness creation should be given for women to limit or avoid alcohol consumption and drugs addiction during pregnancy including during the early weeks.
- Prenatal care follow up should be strongly recommended for pregnant women.
- Awareness creation should be given about the risk factors of birth defects for the communities.
- The country should build up its public health capacity for recognizing and implementing interventions in reducing the impact of birth defects, which includes monitoring and regulating interventions for clinical and cost effectiveness in local setting.

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6/ Child Father's occupation Employed No job/un employed

7/ Economic status Low Middle High

Part II. Questionnaire on birth defects

1. Does your child have a birth defect? Yes No

2. If your answer is yes which type does your child have? (observable or not observed)

A/Neural tube defects such as spina bifida, clubfoot B/Orofacial clefts (cleft lip and palate

C/Muscular skeletal defects D /Down syndrome E/ A limb anomaly

3. How many children do you have? One 2-3 >4

4. How many times do you have pregnancy? once 2-3 4 and above

5. Have you got miscarriage? 1-2 times 3 and above None

6. Have you lost a child? None 1-2 3 and above

7. Do you attend prenatal care visit? During 1-3 months months and above no visit

8. Where do you follow the antenatal care visit?

Governmental Hospital Private Hospital Public Health center

9. Did you take multivitamin or other supplements during pregnancy Yes No

10. Do you consume alcohols? Yes No