

**BEHAVIOURAL AND SOCIO-DEMOGRAPHIC FACTORS ASSOCIATED
WITH PRETERM BIRTH AMONG WOMEN WHO DELIVER IN PUBLIC
HOSPITALS IN WINDHOEK, NAMIBIA**

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KHONZANI MADLELA

201201983

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Main Supervisor: DR L. PRETORIUS (UNAM)

Co-supervisor: DR J.E. DE VILLIERS (UNAM)

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K. Madlela
.....

Khonzani Madlela

Date.....**2018-03-28**.....

DEDICATION

To my dear husband Mduduzi Tshambo and my lovely daughter Balungile Michelle Buhlebuzile Tshambo. Lulu may this thesis be an inspiration to you to pursue education with zeal and purpose when you grow up and be able to read it.

To my late loving father Mr J.J. Madlela, who was passionate about education and did his best to ensure that his children got the best education.

It is also dedicated to Mama aka Granny and Zonke J.J. Madlela, my family.

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ABSTRACT

Preterm birth, the birth of an infant prior to 37 completed weeks of gestation is the leading cause of newborn deaths in their first four weeks of life. In addition to its contribution to mortality, preterm birth has lifelong effects on neuro-developmental functioning such as increased risk of cerebral palsy, impaired learning and visual disorders, and an increased risk of chronic disease in adulthood that often result in huge physical, emotional and economic cost. In Namibia the prevalence of preterm birth is very high. Although preterm birth is a challenge in Namibia, little is known about the causes; therefore this research is an attempt to fill in that gap.

The purpose of this study was to determine behavioural and socio-demographic factors associated with preterm birth among women who deliver at Windhoek Central Hospital (WCH) and Intermediate Hospital Katutura (IHK). A quantitative, observational, analytic case control study design was conducted on 100 women with preterm birth (case group) and 300 women with full term birth (control group), who were interviewed using a structured interview schedule between 01 October 2016 and 30 November 2016. A number of potential exposure variables were investigated and data was analysed using Epi Info software version 7.1.3.0 and Statistical Package for Social Sciences (SPSS) version 24. Both descriptive and statistical analysis were employed. Statistical analysis was performed by univariate analysis and multivariable logistic regression analysis.

Univariate analysis showed that body mass index, age, marital status, education level, work type, antenatal care visits, supplementary tablets intake, inter-pregnancy interval, pregnancy intendedness, staying with smokers and partner smoking were associated with birth term. Multivariable logistic regression analysis revealed that highest level of education, inter-pregnancy spacing interval, work type, BMI, staying with smokers and partner smoking were

significantly associated with birth term even after adjustment for the effects of other variables.

The factors that were found to be risk factors for preterm birth included, low pre-pregnancy BMI, being single or divorced, young and old maternal age, low education level, strenuous work, maternal alcohol drinking, short and long inter-pregnancy spacing intervals, lack of antenatal care and supplementary tablets intake, having unwanted pregnancies and staying with smokers. Most of the risk factors for preterm birth in this study stem from behaviours. Maternal behaviour change interventions are needed in Windhoek in order to reduce the prevalence of preterm birth.

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ABBREVIATIONS

ANC - Antenatal Care

ACOG - American College of Obstetricians and Gynecologists

AIDS - Acquired Immune Deficiency Syndrome

BMI - Body Mass Index

CHDS - Child Health and Development Studies

CI - Confidence Interval

DRC - Democratic Republic of Congo

HIV - Human Immunodeficiency Virus

HPOs - Health Promotion Officers

IHK - Intermediate Hospital Katutura

IVF - In-vitro-fertilisation

IPV - Intimate Partner Violence

LBW - Low Birth Weight

SDGs - Sustainable Development Goals

ME - Ministry of Education

MGCW - Ministry of gender and child welfare

MoHSS - Ministry of Health and Social Services

NGOs - Non Governmental Organisations

OR - Odds Ratio

SPSS - Statistical Package for Social Sciences

USA - United States of America

UK - United Kingdom

UN - United Nations

WCH - Windhoek Central Hospital

WHO - World Health Organisation

CHAPTER 1

INTRODUCTION

This study focuses on maternal socio-demographic factors and health behaviours associated with preterm birth because preterm is a global problem in prenatal and infant health. This chapter begins by stating the background and context of the study and further states the research problem. Thereafter a literature review, research methodology, study results, conclusions and recommendations are highlighted.

1.1 Background and context of the study

A normal full term pregnancy usually lasts from 38 to 42 weeks. Labour that begins before 37 weeks of pregnancy is considered as preterm labour (Alexander, LaRosa, Bader & Garfield, 2014). The World Health Organisation (WHO) defines preterm birth as any childbirth occurring before 37 completed weeks of gestation, or fewer than 259 days since the first day of the women's last menstrual period (Lumley, 2003).

The prevalence of preterm birth has increased in most countries with reliable trend data, producing a dramatic impact on public health (Lopez & Breart, 2013). As from 2010 an estimated 15 million babies are born preterm every year worldwide and around 1 million children die each year due to complications of preterm birth. In addition, preterm birth can result in a range of long-term complications in survivors, with the frequency and severity of adverse outcomes rising with decreasing gestational age and decreasing quality of care (World Health Organisation, 2013).

Globally preterm birth is now the second leading cause of child death after pneumonia, and it was forecasted to become the top cause of death among children by 2015 if there were no interventions (Liu et al, 2010). Preterm birth is actually the leading cause of newborn deaths in their first four weeks of life (World Health Organisation, 2013). A global research by Liu et al (2010) revealed that about two-fifths of deaths in children younger than five years occurred in the first 28 days of their life. This indicates the crucial importance of addressing the problem of preterm birth, if countries are to achieve Sustainable Development Goal (SDG) 4, which aims at reducing child mortality. The global progress in child survival and health will be compromised if the problem of preterm birth is not addressed.

The complications of preterm birth surface more severely in the first month after birth. Compared with infants born at full term, preterm infants have greater rates of temperature instability, respiratory distress, infections, apnoea, hypoglycaemia, seizures, jaundice, kernicterus, feeding difficulties, necrotising enterocolitis, periventricular leukomalacia, and rehospitalisations and are more likely to die within the first month of life (Alexander, LaRosa, Bader & Garfield, 2014).

The rates of preterm birth however, are not uniform across all the regions globally; variation in the rate of preterm birth among regions and countries is substantial. The highest rates on average are found in low-income countries (11.8%), followed by lower middle-income countries (11.3%) and lowest in upper middle- and high-income countries, which is 9.4% and 9.3% respectively (Blencowe et al, 2013a).

Multiple factors may be associated with increase in preterm birth; among them, unfavourable health behaviours (Behrman & Butler, 2007) and socio demographic characteristics of maternal population (Lopez & Breart, 2013).

In 2010, an estimated 14.9 million babies were born preterm, which represents 11.1% of all live births worldwide, ranging from about 5% in several European countries to 18% in some African countries. High birth rate is found in South Asia and Sub-Saharan Africa, where 52% of the global live births occur, among babies born in these regions each year about 60% are preterm babies. Indeed the burden of preterm birth is highest in low-income countries as revealed by the statistics. A high burden is also found in high-income countries as well. For example, the United States of America has high rates and is one of the ten countries with the highest numbers of preterm births. Out of the 65 countries with reliable data trends of preterm birth, only three countries (Croatia, Ecuador, and Estonia), had reduced preterm birth rates from 1990 to 2010 (Blencowe et al, 2012).

Although the risk of preterm birth is high for both poorest and the richest countries, a major survival gap in some regions for babies who are preterm exist. While the problem of preterm births is gaining more recognition in developed countries, the focus in developing countries remains almost exclusively on Low Birth Weight (LBW) (Feresu, Harlow, Welch, & Gillespie, 2004). Until recently, higher level health policy makers in many low and middle income countries have not prioritised preterm birth as a health problem. The challenge in developing countries has been the lack of data showing the national toll of preterm birth and associated

complications and disabilities. This has hindered many developing countries from coming up with interventions to address the challenge of preterm birth.

Most preterm births (more than 80%) take place after 32 completed weeks of gestation and most of these newborns would survive with only supportive care, even without neonatal intensive care. However, as alluded to before, a huge survival and equity gap exists between the richest and poorest countries. Current data reveals that more than 90% of babies born before 28 weeks of gestation survive in high-income countries, but in low-income settings, only 10% or less of these babies survive, a 90:10 survival gap. The risk of neonatal death due to complications of preterm birth is about 12 times higher for an African baby than for a European baby (Blencowe et al, 2013a).

In Afghanistan and Somalia, the estimated cause-specific rate for neonatal deaths directly due to preterm birth is 16 preterm babies per 1,000 births compared to Japan, Norway and Sweden where it is less than 0.5 preterm babies per 1,000 births. This is mainly due to lack of care for premature babies resulting in a major survival gap for babies depending on where they are born (Lawn et al, 2013).

Sub-Saharan Africa is one of the regions that reports high incidences of preterm birth. Highest rates are reported in Malawi (18.1%), Zimbabwe (16.6%), Mozambique (16.4%), Democratic Republic of Congo (DRC) (16.1%) and Botswana (15.1%). Within the mentioned countries poorer families are reported to be at high risk (Howson, Kinney & Lawn, 2012; Panagada, & Parkers, 2014).

Namibia as a middle-income country and like most of the mentioned countries in Sub-Saharan Africa has not been spared from the devastating effects of preterm birth. Statistics reveal that in 2010 Namibia reported 14.4% preterm births, meaning that about 5,000 babies were born preterm in the whole country. This figure is quite high compared to other African countries such as Algeria (7.4) and Egypt (7.3) (Howson, Kinney & Lawn, 2012).

Neonatal mortality in Namibia is high with 19 deaths per 1,000 live births, accounting for 52% of mortality for children under the age of five years (Issac, 2008). Preterm birth is one of the immediate causes of neonatal deaths in Namibia and it is responsible for 39% of mortality for children under five years of age (Issac, 2008). In addition to its contribution to mortality, preterm birth can result in lifelong effects. Preterm infants experience increased neurodevelopment impairments and behavioural sequelae, have greater rates of hospital admissions, and experience a greater rate of cardio-vascular, pulmonary, and vision and hearing impairments compared with their term cohorts (Blencowe et al, 2013b; Simmons et al, 2010). This contributes to the prematurity-related burden of chronic disease in adulthood.

A study in Bangladesh found a 23% risk of severe neurodevelopment impairments among surviving infants born at less than 33 weeks' gestation (Saigal & Doyle, 2008). A cohort study of more than 900,000 preterm and term infants that was conducted in 2008 in Norway demonstrated an increased prevalence of cerebral palsy, developmental delay, and medical disability with decreasing gestational age. Preterm birth was also associated with increased prenatal and infant mortality, diminished long-term survival, and lower rates of reproduction (Simmons et al,

2010). Such impairments may relate to incomplete brain development after birth in preterm infants. At birth, the brain mass of late preterm infants (34 to 36 weeks) is only approximately 70% that of term infants and myelination is markedly underdeveloped (Engle & Kominiarek, 2008).

Moreover, the effects of preterm birth later in life often result in enormous physical, emotional, psychological and economic cost. It also creates burdens on the parents and guardians who are the main carers and exerts a lot of pressure on the health care system and society when already scarce public resources have to be used for taking care of preterm children (Blencowe et al, 2013b; Institute of Medicine, 2006).

The 2005 estimates indicated that the cost that was incurred by the United States of America alone in terms of medical and educational expenditure and lost productivity associated with preterm birth amounted to more than US\$26.2 billion (Beck et al, 2010). During that same year, the average first year medical costs, including both inpatient and outpatient baby care were about 10 times greater for preterm (\$32,325) than for full term infants (\$3,325). The average length of hospital stay was nine times as long for a preterm newborn (13 days), compared with the 1.5 days of a baby born at term (March of Dimes, PMNCH, Save the Children & WHO, 2012).

Defining risk factors for prediction of preterm birth is imperative for several reasons, among others these include; -firstly, the identification of women who are at risk which allows for initiation of risk-specific intervention. Secondly, the risk factors might define a population useful for future intervention studies and thirdly,

identification of risk factors might provide important insights into mechanisms leading to preterm birth (Goldenberg, Goepfert, & Ramsey, 2005).

There are several maternal characteristics that have been associated with preterm birth, including maternal demographic characteristics, nutritional status, pregnancy history, present pregnancy characteristics, psychological characteristics, adverse behaviours, infection, uterine contractions and cervical length, and biological and genetic markers (Goldenberg, Goepfert, & Ramsey, 2005). In addition, Blencowe et al (2012) state that many other maternal factors have been associated with an increased risk of spontaneous preterm birth, including young or advanced maternal age, short inter-pregnancy intervals, low maternal body-mass index (BMI), multiple pregnancy, pre-existing non-communicable disease, hypertensive disease of pregnancy, and infections.

Evidence from some previous studies reveal that unfavourable health behaviours and socio demographic characteristics of maternal population may be associated with preterm birth (Behrman and Butler 2007; Lopez & Breart, 2013). Alexander et al (2014) state that women who seek late prenatal care or no care at all, as well as women who smoke, drink alcohol, use drugs are at a greater risk of preterm birth. Cha and Macho (2013) concur with Alexander et al (2014) that such unhealthy behaviours are associated with preterm birth, adding that physical activity and diet may also influence preterm birth. Drawing on the above studies my study focuses on maternal socio-demographic characteristics and health behaviours associated with preterm birth in Windhoek public hospitals.

Some countries such as Finland and Sweden have assessed maternal socio demographic factors over time and have monitored the maternal population through studies in birth cohorts. These countries have demonstrated that certain maternal socio demographic characteristics are associated with higher risk of preterm birth and they showed that these characteristics may vary significantly over time (Lopez, & Breart, 2013). Some of the identified maternal socio demographic characteristics associated with preterm birth include low socioeconomic and educational status, low and high maternal ages, and marital status (Goldernberg, Culhane, Iams & Romero, 2008).

Consistent evidence from literature suggests that a constellation of favourable lifestyle factors are associated with more favourable pregnancy outcomes. These include a reduced risk of preterm birth among women who engage in leisure time physical activity, women who do not use narcotic drugs, and those who have a favourable diet (Behrman & Butler, 2007).

There is clear evidence that a favourable lifestyle and a greater degree of health consciousness are associated with a reduced risk of preterm birth above and beyond what can be measured effectively and controlled in observational studies. Despite struggles in identifying behaviours that affect the occurrence of preterm birth, continued efforts are needed to better understand and pinpoint the aspects of a favourable lifestyle that are associated with a reduced risk of preterm birth.

1.2 Statement of the problem

The prevalence of preterm birth remains high despite the presence of free antenatal care programmes in Namibia. According to 2010 statistics on preterm birth, Namibia reported 14.4% preterm births and it ranked among the top six African countries with high prevalence of preterm birth (Howson, Kinney & Lawn, 2012). In Windhoek preterm birth rate rose from 8.9% in 2012 to 11.1% in 2014 (Ministry of Health and Social Services, 2016). This increase is alarming considering the detrimental effects of preterm birth, especially on the health of preterm babies.

Although preterm birth is a challenge there is still no evidence of studies that have been conducted in Namibia to determine behavioural and socio demographic factors associated with preterm birth. This research is an attempt to fill in the gap of evidence to factors that may have caused preterm births. The researcher is a Health Promotion Officer dealing with pregnant women in society on a daily basis and considers it important and desirable to have more information about behavioural and socio demographic factors associated with preterm birth. This information can assist the researcher to plan and conduct health education sessions aimed at addressing the challenge of preterm birth.

1.3 Purpose of the study

The purpose of this study is to determine behavioural and socio demographic factors associated with preterm birth among women who deliver at Windhoek Central Hospital (WCH) and Intermediate Hospital Katutura (IHK).

1.4 Objectives of the study

The objectives of the study were to:

- Determine and describe the socio-demographic profile and health behaviours of women with preterm births and women with full term births at WCH and IHK.
- Determine and describe high risk behaviours of partners/family members of women with preterm births and women with full term births at WCH and IHK.
- Determine the socio-demographic and behavioural factors associated with preterm birth.

1.5 Significance of the study

Focusing on behavioural factors associated with preterm birth is important because behaviour can be changed to reduce the frequency of preterm birth directly. Socio demographic factors are important in identifying the groups of women that are at risk of preterm birth so that prevention programmes can be developed for a specific target group.

This study therefore seeks to reveal the behavioural and socio demographic factors associated with preterm birth among women who deliver at WCH and IHK. The results obtained from the study will assist the researcher to do health education sessions which may create awareness among the population and ultimately contribute positively towards reducing the high incidence of preterm births. Since not many studies have been done in Namibia to date, this study will fill in the gap by providing information that can be used in preterm intervention initiatives in the country.

1.6 Definition of key concepts

- **Association**

This is when a relationship exists between two variables such that if one changes, the other changes in a predictable way. Two variables are associated if statistics prove that some of the variability of one can be accounted for by the other. An association can be positive or negative. Two variables have a positive association when the values of one variable tend to increase as the values of the other variable increase for example statistics show that having multiple sexual partners increases the risk of Human Immunodeficiency Virus (HIV) infection. In a negative association, the values of one variable tend to decrease as the values of the other variable increase (Utts, 2010). For this study associations will be determined using odds ratios (OR), 95% Confidence Intervals and Chi-square (p) values < 0.05 .

- **Behavioural factors**

In this study behavioural factors refer to exposures that can increase or reduce the likelihood of women to deliver a preterm baby. High risk behaviours refer to lifestyle activities that place mothers at an increased risk of preterm delivery. Individuals however, have the ability to modify high risk behaviours which include practices such as cigarette smoking, alcohol drinking, domestic violence, use of illicit drugs and unhealthy eating among others. This study focuses on identifying a number of risky health behaviours of mothers, family members and partners in order to determine their association with preterm birth.

- **Delivery**

In this study delivery refers to child birth. Mothers who were recruited in this study were those who had live births and who delivered naturally not by caesarean section.

- **Preterm birth**

As mentioned earlier, preterm birth as any childbirth occurring before 37 completed weeks of gestation, or fewer than 259 days since the first day of the women's last menstrual period (Lumley, 2003). Preterm birth gives the baby less time to develop before birth, therefore subsequent health problems manifest after birth. In this study preterm birth is defined as all childbirth that occurs before 37 completed weeks of gestation.

- **Socio-demographic factors**

These provide important background information about the characteristics of the population of interest. The population of interest for this study was women who delivered at public hospitals in Windhoek. The socio-demographic factors included variables such as age, sex, marital status, educational level, work type and geographic location or place of residence. Body Mass Index was also included as one of the socio-demographic factors.

- **Windhoek Public hospitals**

These are hospitals owned by the government and receive government funding. In Windhoek there are two public hospitals, one is intermediate and the other is high level referral hospital. These hospitals are large in size and have many

departments which provide various services. They provide specialised care to patients referred from lower levels and medical care is provided at an affordable cost. These hospitals host a large number of patients because of their complex clinical care and availability of all health and social services through professionally trained health specialists. The participants for this study were recruited from these two public hospitals because they are the ones in Windhoek that host the largest number of maternal women compared to other hospitals.

1.7 Conclusion

This chapter has outlined the orientation of the study, statement of the problem, purpose of the study, objectives of study, significance of the study, and definitions and key concepts on socio-demographic and behavioural factors associated with preterm birth. Chapter 2 focuses on review of relevant literature regarding socio-demographic and behavioural factors associated with preterm birth.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

A review of literature is aimed at contributing to a clearer understanding of the nature and meaning of the problem that has been identified. Grinnel and Unrau, (2005) as cited in De Vos, Strydom, Fouche and Delpont (2011) state that a thorough background of the phenomenon under review is needed in order to conduct a meaningful piece of research. They further argue that a literature review creates a foundation based on existing related knowledge therefore a thorough scrutiny of literature allows the researcher to learn more about the history, origin and scope of the research problem. This chapter covers literature review on information that has already been published on the topic of behavioural and socio demographic factors associated with preterm birth.

Several studies focusing on factors associated with preterm birth have been conducted in many parts of the world; however, a literature search shows that not much research has been done in Africa thus far. This research highlights issues that have been raised by studies globally but most of the studies were conducted in the European countries and in the United States of America (USA). The researcher is however aware that some of the issues raised in western studies may not be relevant to the Namibian situation. For example, factors that contribute to preterm birth in a developed country may vary from those found in a developing country.

Preterm birth is defined as any child birth that occurs before 37 completed weeks of gestation (Lumley, 2003). There are many maternal or foetal characteristics, that have been associated with preterm birth as highlighted by Blencowe et al (2012) and Goldenberg et al (2008) in chapter one. However, this discussion focuses on maternal socio-demographic and behavioural factors, baby demographic characteristics and paternal influence on preterm birth including adverse behaviours by family members. Each theme is explored in detail in the discussion that ensues.

2.2 Maternal socio demographic characteristics

A number of maternal socio demographic characteristics have been associated with higher rates of preterm delivery. Specifically, young maternal age (below 16), advanced maternal age (35 years or older), marital status (unmarried, cohabiting or single), and socioeconomic condition such as low income or educational attainment have been identified as risk factors for preterm birth (Blencowe et al, 2012; Goldenberg et al, 2008)).

Lopez and Breart (2013) conducted a study in Chile to analyse some socio-demographic characteristics of the maternal population over time (from 1991 to 2008), and their possible association to rates of preterm birth in order to identify groups of mothers at high risk of having a preterm child. Through the entire period the highest prevalence of preterm birth was seen among mothers younger than 18 years, those older than 38 years, primigravid, grand multipara, and those not living with a partner.

Behrman and Butler (2007) note that most of the socio-demographic factors associated with preterm birth are closely intertwined with behavioural risk factors. My study therefore covers both behavioural and socio-demographic risk factors for preterm birth.

2.2.1 Maternal age

Literature reveals that there is a strong association between maternal age and preterm birth. According to a study that was conducted by Offiah, O'Donoghue and Kenny (2012) the age of the mother plotted in a graph was found to have an influence on preterm births in a U-shaped manner. Offiah, O'Donoghue and Kenny (2012) state that women under 16 and those above 35 years of age have a 2 to 4 percent higher rate of preterm birth compared with those between 21 and 24 years of age. This means that both very young and advanced maternal age influence pregnancy outcomes negatively.

In agreement with Offiah, O'Donoghue and Kenny (2012), on the influence of advanced maternal age on preterm birth, Astolfi and Zonta (1999) examined the relationship between advancing maternal age and preterm deliveries and found that the frequency of preterm deliveries was lowest in mothers aged between 20 and 30 years, but it increased sharply as maternal age increased. Preterm deliveries occurred in well below 4% of births among mothers younger than 35 years, which was almost half the frequency observed among the older mothers above 35 years.

The subsequent study that was conducted by Astolfi and Zonta (2002) as cited in Behrman and Butler (2007) to examine the relationship between advancing maternal

age and preterm deliveries in a population sample of Italian women, yielded results that had correlations with the findings of their previous study. Their results revealed a 64 percent increased odds of preterm delivery among mothers 35 years of age or older compared with findings among mothers less than 35 years of age when other factors were controlled for. The risk was particularly striking among mothers over 35 years of age delivering their first-born child. The reasons for the increased risk for preterm delivery among older women are still not clear.

There is still insufficient evidence to determine if advancing maternal age is an independent and direct risk factor for preterm birth. However, some investigators reported that when age-dependent confounders such as parity, socioeconomic status, pre-existing chronic diseases, smoking status, and antenatal complications are controlled, women who are 35 years and older are at minimal increased risk, and their neonatal outcomes are comparable with those of younger women who are of optimal reproductive age (Newburn-Cook, & Onyskiw, 2005).

Advanced maternal age has become a major concern in many parts of the world. Dramatic demographic changes in the late 20th century have resulted in increased levels of education and rates of employment among women in many countries, including the employment of women who are married, pregnant, nursing mothers and mothers of young children (Behrman & Butler, 2007).

Current fertility trends suggest that an increasing number of women in developed countries are delaying childbearing until their mid-thirties and beyond. Since the 1970s, birth rates for women aged 20 to 29 years have decreased, while the

proportion of first births to women in their thirties and forties has risen substantially (Newburn-Cook, & Onyskiw, 2005). Moreover, over the past decade the birth rates among adolescents (ages 15 to 19) and women aged (20 to 24) have decreased especially in developed countries. The current birth rate among adolescents is the lowest rate recorded for this age group in the United States of America (Behrman & Butler, 2007). Women of advancing reproductive age are now responsible for a greater percentage of total live births. In the United States, more than 13% of all births are to women 35 years and older and 22% of these births is to first-time mothers (Martin, Hamilton, & Ventura, 2001).

Women aged 35 years and older may be responsible for the increased rates of preterm birth in industrialised countries where women are delaying childbearing as older mothers are more likely to have underlying medical conditions associated with preterm delivery, such as diabetes, hypertension and obesity. In countries like the USA the number of births among adolescents has decreased in the last decade (Behrman & Butler, 2007). This implies that young maternal age now contributes less to preterm births in developed countries as compared to advanced maternal age.

In contrast most of developing countries are still experiencing high rates of teenage pregnancies implying that young maternal age could be one of the most important maternal risk factors for preterm birth. Statistics reveal that approximately 95% of teenage pregnancies occur in developing countries with 36.4 million girls becoming mothers before the age of 18. The prevalence of teenage pregnancy was found to be highest in Sub-Saharan Africa compared to other parts of the world (United Nations Population Fund, 2013). In Namibia, estimates show that roughly one out of five

teenagers aged 15 to 19 years surveyed in 2013, were either pregnant or had given birth (The Namibia Ministry of Health and Social Services & ICF International, 2014). These statistics on teenage pregnancy are startling and an alarming signal to the nation that children are having sex at a young age.

Some studies have focused on the relationship between young maternal age and the risk of preterm birth. Evidence from population-based and hospital-based studies both in developed and developing countries reveals that pregnant adolescents are at increased risk for preterm labour and delivery compared to older pregnant women who are aged 20 to 35 years (World Health Organisation, 2007). The youngest age groups, especially those who are 16 years or younger are even at the highest risk (Behrman & Butler, 2007) because they are not yet biologically prepared to go through pregnancy and childbirth. In addition due to inadequate nutritional reserves necessary to sustain pregnancy, they are at disproportionately greater risk of having preterm and low-birth weight babies (Dean et al, 2013). Sharma et al (2008) indicate that the adolescent period is a time of significant growth; 45% of adult weight and 15% of adult height is attained during this stage. Continued growth of an adolescent during pregnancy could result in competition between the mother and foetus for important nutrients and may be associated with increased risk of preterm birth and other adverse birth outcomes.

It has also been revealed that both married and unmarried adolescent girls often lack education, support and access to health care, which could empower them to make decisions about their reproductive health. Young girls are also vulnerable to abuse of many kinds, which may include sexual, physical and emotional abuse. Statistics

reveal that one in five pregnant adolescent girls have been abused during pregnancy. Violence against girls and women has been shown to increase the risk for preterm birth (Dean et al, 2013).

Gender-based violence is common in Namibia, it is estimated to affect one in five women and is one of the major challenges facing the country because of its contribution to maternal and child mortalities and morbidities (Haikuti, 2004). From the analysis of previous studies it still remains unclear at present whether the increased risk of preterm birth among young adolescents is due to their biological immaturity or to an increased prevalence of other risk factors associated with their generally poor socioeconomic condition. In a South African study of 229 interviewees, violence alone did not seem to cause preterm labour, but was part of a low socioeconomic lifestyle, including high maternal alcohol use (Schoeman, Grove, & Odenhaal, 2005).

As highlighted above a number of studies indicate that teenage girls have an increased risk for preterm birth. However, there are studies that have found no increased risk of preterm birth in teenage mothers like the study which was conducted by Grjibovski, Bygren, & Svartbo, (2002) in Severodvinsk, Russia to examine the socio demographic determinants of poor infant outcomes.

According to the study that was conducted by Ekwo & Moawad, (2000) in the USA to examine the incidence of preterm birth in a cohort of black primigravidas, the result showed that the risk of preterm birth to teenage mothers was not significantly higher than that for older black gravidas of 20 to 24 years of age. In fact preterm

birth was high for the entire group of black women studied. Further their study confirmed the association of socio-demographic variables with preterm birth independent of maternal age. Young maternal age, however, has been found to be a risk factor of preterm birth among whites. White teenage mothers have been found to have higher risk of preterm and low birth weight infants compared to older white women aged 20 to 24 years (Ekwo and Moawad, 2000).

The inconsistency in the relationship between young maternal age and preterm birth observed in different studies may be due to factors such as differences in the study settings (for example, rural versus urban), population sample being studied, race and country where the study is being carried out. For example, in developed countries the number of teenage pregnancies seems to have decreased in the last decade therefore there are high chances for studies done there to find no increased risk of preterm birth with young maternal age because of few adolescents giving birth in the study population. Other reasons for non-increased risk of preterm birth in teenage mothers may be partly explained by strong family ties and extended parental support to young pregnant women and access to health care facilities especially in developed countries.

In contrast to decrease in birth rate in developed countries social and cultural norms in developing countries perpetuate early marriages, with 60 million women reporting that they were married below the age of 18 (March of Dimes, PMNCH, Save the Children, & WHO, 2012). In Namibia adolescent fertility rate is relatively high at 72 reported births per 1,000 among women aged 15 to 19 years (Central Statistical

Office, 2008), therefore in view of the above this research aims to establish whether young maternal age is a risk factor for preterm birth in Windhoek, Namibia.

Despite a lack of association of teenage age with preterm birth in some studies, teenage pregnancy should be avoided because the majority of teenage mothers have fewer material and emotional resources to manage the consequences of socio-demographic factors. Adolescents should therefore be encouraged to prevent teenage pregnancy or recurrence of pregnancy during the teenage years.

2.2.2 Highest education level

In a study that was conducted by Grijbovski, Bygren and Svartbo (2002) in North West Russia to examine the socio-demographic determinants of poor infant outcomes, education was found to be the most significant factor associated with poor infant outcomes including preterm birth (OR = 1.9, 95% CI 1.2, 3.0 for secondary or less education compared with at least three years of university studies). The strong effect of maternal education persisted even after adjustment for maternal age, marital status, stress, housing situation, smoking, alcohol consumption, parity, infant sex, maternal pre-pregnancy weight and late attendance for prenatal care. The findings contribute to the hypothesis that maternal education is one of the most important social factors influencing pregnancy outcomes in countries in transition.

Previous studies based on populations from Europe (Norway, Sweden and Finland), and Canada have found strong evidence for socio-economic differences in preterm birth, when measured by maternal educational level. Other studies reported a greater elevated risk of preterm birth among women with the lowest educational level (Morgen et al, 2008). These results were contradictory to the findings that were

obtained by Morgen et al (2008). The possible explanation of inconsistencies could be higher level of education in one group than the other and different degrees of socio-economic inequalities in different countries.

2.2.3 Marital status

Marital status is another notorious determinant of poor infant outcomes. Preterm birth rates are higher for unmarried women than for married women across all racial, ethnic and age groups globally (Behrman & Butler, 2007). The reasons for the higher rates of preterm birth among unmarried mothers are not known but are commonly attributed to their relative lack of social support and resources (Arntzen, Moum, Magnus, & Bakketeig, 1996).

In the study conducted by Grijbovski, Bygren and Svartbo (2002) in Russia to determine the socio-demographic factors influencing poor birth outcomes, marital status was found to be the strongest individual determinant of preterm delivery. Unmarried women were more likely to deliver preterm babies as compared to married women and were also more likely to be younger, less educated, nulliparous, smokers, out of work or skilled blue-collar workers and to have psychosocial stress during pregnancy. The frustration and stress of poverty may trigger the increase of certain unhealthy behaviours such as smoking, alcohol consumption, use of illicit drugs and poor nutrition, suggesting one reason why low income women are at risk for preterm birth since many risk factors tend to cluster around them (Gennaro & Hennessy, 2003).

Marital status may also serve as a marker for the “wantedness” of the child, the economic status of the mother, and the social support that the mother has, all of which are factors that may influence the health of the mother and infant (Chomitz, Cheung, & Lieberman, 2016). It is a dream of most married couples to have children but this is not the case with most unmarried women. Unmarried women normally carry unwanted pregnancies, lack support, are stressed and frustrated, as a result unmarried women experience most of the adverse birth outcomes including preterm birth. Early observational studies drew attention to the possibility that prenatal social support might reduce the incidence of adverse outcomes either directly or as a result of their ability to buffer the effects of stress (Behrman & Butler, 2007).

2.2.4 Socio-economic status

Preterm birth and infant mortality are closely related to socio-economic disadvantage. Socio-economic status, however, is difficult to measure accurately. Educational attainment, marital status, maternal age, and income are interrelated factors and are often used to approximate socio-economic status (Chomitz, Cheung, & Lieberman, 2016). As highlighted above, young maternal age, low educational attainment and being single are all reflective of low socio-economic status and predictive of preterm birth.

It becomes apparent therefore that women of low socio-economic status face challenges that are associated with poverty such as lack of access to health facilities and basic needs such as adequate nutrition, proper housing, adequate water for domestic use and safe water for drinking of which all these factors predispose them to preterm birth. On the contrary women of high socio-economic status can meet all

their basic needs and have access to quality health care services; however, they are susceptible to diseases of affluence especially obesity.

2.2.5 Place of residence

The environment where people live is an important determinant of their health. Neighborhood characteristics may directly or indirectly exert their influence on reproductive outcomes by patterning individual-level economic opportunities and health behaviours. For example, the neighborhood structure may restrict or facilitate access to schooling, training programmes, and employment opportunities which in turn have an influence on reproductive outcomes through the socio-economic condition that a woman has attained. Furthermore, the social characteristics of neighborhoods, perhaps through shared cultural norms and values, may influence health behaviours such as smoking patterns, alcohol consumption, and dietary practices that are linked to reproductive outcomes such as birth term and birth weight (Behrman & Butler, 2007).

2.2.6 Body mass index (BMI)

There is evidence from studies that BMI is associated with preterm birth. Women who are underweight before pregnancy with a BMI that is less than 18.5 kg/m² are at significantly greater risk of having preterm and low birth weight newborns (Han et al, 2011). A low pre-pregnancy BMI is one of the important factors associated with a high risk of preterm birth, whereas obesity can be protective (Goldenberg et al, 2008).

Bettioli et al, (2000) argue that BMI is an unlikely factor in increasing preterm births as the current trend has been an increase in obesity which seems to be a protective factor against preterm birth. This knowledge cannot be taken universally, if it is true that obesity is a protective factor then this fact will be more applicable in western countries where there is adequate food security, it can be assumed that most of the pregnant women in the West either have normal weight or are overweight or obese. However, in most developing countries particularly in Africa where there are serious food insecurities and poverty it becomes difficult to rule out the effect of low maternal BMI as a risk factor for preterm birth.

On the other hand, taking obesity as a protective factor against preterm birth is highly risky since obese women are more likely to have infants with congenital anomalies, such as neural-tube defects, and these infants are more likely to be delivered preterm. McDonald, Han, Mulla and Beyene (2010), state that overweight and obese women with body mass index greater than 25 kg/m² have a higher risk for preterm births before 33 weeks, the more obese the woman, the higher the risk of early preterm birth. Obese women are also susceptible to other health conditions such as pre-eclampsia and diabetes and these disorders are risk factors for preterm birth (Goldenberg et al, 2008).

Blencowe et al (2013a) indicate that the underlying maternal conditions such as renal disease, hypertension, obesity and diabetes increase the risk of maternal complications like pre-eclampsia and medically indicated preterm birth. Therefore the worldwide epidemic of obesity and diabetes is, thus, likely to become an increasingly important contributor to global preterm birth.

Di Renzo et al (2011) conducted an observational retrospective, cross-sectional study in a population of Italian women to identify maternal risk factors for spontaneous Preterm Birth (PTB) compared to delivery at term, in order to identify high risk women and to provide an overview of the Italian situation. A significant increased risk of PTB was found in women with BMI above 25 (OR = 1.662; 95% CI = 1.033–2.676; p-value = 0.0365) and in women employed in heavy work (OR = 1.947; 95% CI = 1.182– 3.207; p-value = 0.0089). Optimising weight before and during pregnancy is thus more important since both weight loss and too much weight gain during pregnancy increases the risk of adverse pregnancy outcomes.

2.2.7 Dietary supplements during pregnancy

During pregnancy, the need for calories and nutrients, such as protein, iron, folate, and other B vitamins increases in order to meet the demands of the foetus as well as the expansion of maternal tissues that support the foetus. The nutritional needs of the foetus are second only to the needs of the mother's brain. It is therefore important for a pregnant woman to have a well-balanced, nutritious diet to meet the changing needs of her body and her growing foetus (Chomitz, Cheung, & Lieberman, 2016).

Nutritional status during pregnancy can be described by indicators of body size such as body mass index (BMI), nutritional intake, and serum assessments for various analytes. Women with low serum concentrations of iron, folate, or zinc have more preterm births than those with measurements within the normal range (Goldenberg et al, 2008). A notable exception is the risk factor folic acid deficiency. Since the early 1990s it has been recommended that all women capable of becoming pregnant should consume 400µg daily and those with a history of an affected pregnancy to

consume 4mg of folic acid as this can help prevent neural tube defects (Damus, 2008).

In contrast, in a cohort study that was conducted by Sengpiel et al (2013) the findings revealed no statistically significant association between the amount of folate intake from the diet or supplements and preterm birth in uncomplicated pregnancies. They further argued that folic acid supplementation starting more than 8 weeks before conception was associated with an increased risk for spontaneous preterm delivery.

When interpreting the results, the selection of the study population has to be kept in mind. In the study that was conducted by Sengpiel et al (2013) there was bias because they included preterm birth in uncomplicated pregnancies, all known high risk pregnancies due to maternal disease, pregnancy complications or foetal malformation were excluded from the analysis. There might be an association between the amount of folate intake from diet or supplements and preterm birth in those pregnancies that were excluded.

Recently it was reported that preconception consumption of folic acid for a year reduced the rates of very preterm (less than 32 weeks) by 50% and of extremely preterm (less than 28 weeks) births by 70% (Damus, 2008). A protective effect of folic acid supplementation was supported by evident reduction in the preterm birth rate after the introduction of folate fortification of foods (Shaw, Carmichael, Nelson, Selvin, & Schaffer, 2004). In addition, women who take pre-conception multivitamins appear to have a lower risk of both early (less than 35 weeks) and late (35 to 36 weeks) preterm birth. Furthermore the dietary supplementation of omega-3 has been suggested as a secondary prophylaxis of preterm delivery in response to

data suggesting that omega-3 fatty acids are capable of prolonging the duration of gestation in the range of 4 to 7 days (Murphy, 2007).

Previous research suggests that multivitamin use before and during pregnancy can diminish diet-related deficiencies of certain micronutrients and potentially prevent preterm birth. Vahratian et al (2004) assessed this association in their study and found that compared with nonusers, women who used multivitamin supplements prior to conception and during pregnancy had reduced risk of preterm birth.

Maternal nutritional status has an effect on preterm birth in many ways; spontaneous preterm birth might be as a result of maternal thinness associated with decreased blood volume and reduced uterine blood flow. Thin women also tend to consume fewer vitamins and minerals, of which low concentrations of these are associated with decreased blood flow and increased maternal infections (Neggers, & Goldenberg, 2003). Maternal nutrition can also impact birth weight and in addition maternal weight gain during pregnancy has been positively correlated with birth weight (Bada et al, 2005).

2.2.8 Nutritional needs during pregnancy

Daily diet contains thousands of nutrients and other bioactive substances acting together. This makes it difficult to study the potential influence of single food items in relation to preterm delivery (Englund-Ogge et al, 2014). However the influence of food groups may be studied with a certain degree of success.

- **Fruits and vegetables**

Fruits and vegetables are important components of pregnancy nutrition. They are a good source of various vitamins and minerals, as well as fibre to aid digestion. Vitamin C, found in many fruits and vegetables, helps in the absorption of iron. Dark green vegetables have vitamin A, iron and folate, and other important nutrients needed during pregnancy such as calcium for strong bones (Mayo Clinic staff, 2014).

- **Meat (beef, pork, fish and poultry) and meat products.**

Foods in this group contain plenty of protein, as well as B vitamins and iron. Protein is crucial for foetal growth. Fish is an excellent source of protein as well as omega-3 fatty acids, which can promote the baby's brain development but fish that are potentially high in mercury such as swordfish, king mackerel, tilefish and shark should be avoided (Mayo Clinic staff, 2014).

Healthy foetal development is dependent on the availability of adequate protein, which provides the basic building blocks necessary for formation of enzymes, antibodies, muscle and collagen which is used as the framework for skin, bones, blood vessels, and other body tissues. During pregnancy it is advisable that the mother consumes adequate protein to meet the needs of her growing foetus and her own increased needs as she physically grows in size to accommodate her growing baby (Lisa & Brown, 2011). If the mother is a strict vegetarian or has no access to high quality proteins with all essential amino acids such as meat, eggs, pork, poultry, fish and dairy foods she should be encouraged to eat a variety of plant-based foods to ensure that all essential amino acids are provided in her diet.

- **Dietary carbohydrates**

Carbohydrates are the main source of energy in the diet. They are broken down to simple sugars such as glucose, which provides energy needed for physical activity, brain function and operation of the organs. All the cells and tissues in the body need carbohydrates, and they are also important for intestinal health and waste elimination. Once in the body, carbohydrates are easily converted to fuel (glucose) which pass easily across the placenta and provide energy to support the growing foetus during pregnancy (Lisa & Brown, 2011).

There are different types of carbohydrates and these include starches, sugars and fibre. Choosing healthy carbohydrates during pregnancy is of paramount importance since some of the carbohydrates like sugars are broken down quickly by the body and can cause rapid increase in blood glucose and insulin levels. These carbohydrates are called high glycemic index foods and they include many refined foods like white bread, white rice, sugary foods such as cakes, scones and biscuits. It is advisable therefore for pregnant women to eat complex carbohydrates such as whole-grain breads and pastas, brown rice, vegetables, beans, and legumes instead of refined carbohydrates.

Whole grains and legumes, such as dried peas and beans, and other healthy carbohydrates like fruit and starchy vegetables should comprise nine or more servings a day. They provide B vitamins and trace minerals, such as zinc selenium and magnesium. Grains and legumes are full of nutrients, including the various B vitamins; thiamin (vitamin B-1), riboflavin (vitamin B-2), folate and niacin. The growing baby needs these for the development of every part of the body. Folate

intake significantly reduces the risk of having a baby with spina bifida. These foods supply energy for the baby's development and help build the placenta and other tissues in the mother's body. Dietary fibre prevents constipation (Healthline editorial team, 2016)

- **Milk and milk products**

Milk and milk products are efficient vehicles for the delivery of many nutrients essential for foetal development and foetal growth (Olsen et al, 2007). Dairy products contain calcium, vitamin D and proteins and other micro-nutrients. Calcium and vitamin D are important nutrients for strong bones and teeth and for proper development and function of the heart and other muscles, as well as for the blood clotting system. The foetus requires a huge supply of calcium during development. It is estimated to have a total body store of 25 grams of calcium at birth, all of which is received from the mother (Healthline editorial team, 2016). Proteins as highlighted previously are essential for foetal growth and repair of worn out tissues for the mother.

- **Water**

Water carries nutrients from the food that the mother eats to the baby. It can also help prevent constipation, hemorrhoids and urinary tract or bladder infections. The Institute of Medicine recommends about 10 cups (2.4 litres) of fluids a day during pregnancy. Water and other fluids such as fruit juices, coffee, tea and soft drinks all contribute to daily fluid intake. However, it should be noted that some drinks are high in sugar and caffeine, which may have potentially harmful effects on the

developing baby. It is therefore important to reduce intake of fluids with high sugar and caffeine content such as soft drinks and coffee during pregnancy.

2.2.9 Association between maternal diet and preterm birth

Several studies indicate associations between maternal diet and preterm birth (Haugen et al, 2008; Myhre et al, 2013; Englund-Ogge et al, 2012). Maternal dietary patterns can directly affect the growing foetus, therefore, it is important for a pregnant woman to consume a well-balanced diet rich in a variety of nutritious macro and micronutrients in order to meet the needs of her body and her growing foetus (Chomitz, Cheung, & Lieberman, 2016; Carmichael, Yang & Shaw, 2013). Awareness has increased during recent years that maternal diet may influence the outcome of pregnancy as well as the long term health of the child (Englund-Ogge et al, 2014).

Englund-Ogge et al (2014) conducted a study to examine the association between maternal dietary patterns and the risk of preterm delivery. Their findings revealed that eating what they called “prudent” diet (which consisted of foods such as vegetables, fruits, oils, water as beverage, whole grain cereals and fibre-rich bread) and traditional diet consisting of potatoes and fish, was associated with significantly reduced risk of preterm birth.

Intake of fish twice or more a week has been associated with a lower risk of preterm birth (Haugen et al, 2008). The “Western” diet, which consisted of salty and sweet snacks, white bread, desserts and processed meat products on the other hand, did not

have any independent association with preterm delivery. These findings support dietary advice to pregnant women to eat a balanced diet including vegetables, fruit, whole grains, potatoes, fish, and to drink water as opposed to eating processed food, fast food, junk food, and snacks.

Intake of food with antimicrobial and pre-biotic compounds may be of importance to reduce the risk of preterm birth. Myhre et al (2013) in their study found that eating garlic and dried fruits such as raisins, apricots, prunes, figs, and dates were associated with lower risk of spontaneous preterm birth.

2.2.10 Type of work

Generally majority of women might be employed during pregnancy. Women are employed in a wide range of occupations, which have varying degrees of physical and emotional demands, and varying levels of exposure to employment related chemicals, radiation, or other toxic substances. Some women continue to work late into their pregnancy; work strain is hypothesised to be a contributor to adverse reproductive outcomes, both for the mother and the baby. Physically demanding work such as shift work, long hours spent standing and heavy lifting have been consistently associated with increased risk of preterm birth (Blencowe et al 2013a).

Having a job and being able to maintain it, is considered as an indicator of a higher socio-economic status, working mothers may also accrue positive effects of employment through increased socio-economic status, better access to medical care, and improved overall lifestyle, but on the other hand it has an inverse effect on preterm birth rates. Recent studies have found no increase in the rate of preterm birth

and employment, but these are mainly results from studies that were carried out in developed countries, where physical strain and hazardous working conditions are not the norm (Offiah O'Donoghue and Kenny, 2011).

Chomitz et al (2016) revealed that studies conducted outside the United States have found increased rates of preterm birth and low birth weight among employed women whose jobs required heavy physical labour. However, results of studies conducted in the United States are more mixed and have even demonstrated positive effects of employment.

Croteau, Marcoux and Brisson (2007) conducted a case control study in Quebec, Canada to evaluate whether occupational conditions during pregnancy are associated with preterm delivery. The participants were interviewed through telephone after delivery. Their results revealed that an increased risk of preterm delivery was significantly associated with working for more than five consecutive days, demanding posture (bending, squatting, arms raised above shoulder level) for at least three hours per day, whole body vibrations, and high job strain combined with low social support. Increased risks of very preterm delivery (28 to less than 32 weeks) were associated with high job strain and low social support. No association was found among the potential confounders such as physical activity, ethnicity, caffeine and alcohol consumption, and using illicit drugs during pregnancy (Croteau, Marcoux, & Brisson, 2007).

In agreement with a Canadian study, a large European study in the mid-1990s analysed the relation between preterm birth and working conditions in Europe using

common measures of exposure and to test whether employment related risks varied by country of residence. The findings showed an excess risk of preterm birth for pregnant women employed as manual workers and for those working long hours, standing for long periods, and reporting dissatisfaction with their jobs. For long standing position and long working hours, the magnitude of the association was larger in countries where the prenatal health care status, measured by infant mortality, is not as good. In countries with lower infant mortality rates, no significant association was observed in the group of countries where women had longer maternity leaves whereas significant associations were observed in countries where women worked longer during the pregnancy (Saurel et al, 2004).

In my current study I endeavour to identify employment-related risk factors for preterm birth because unlike other risk factors for preterm birth that cannot be easily changed, work-related risk factors are amenable to change through policies granting work leaves or modifying working conditions during pregnancy.

2.3 Maternal behavioural factors

These are practices, or exposures that may increase or reduce the likelihood of a woman to deliver a preterm baby. Many of the known risk factors associated with preterm birth, such as socioeconomic status, ethnicity, genetic makeup, and obstetric history, are not within a woman's immediate control. However, there are things that a woman can do to improve her chances of having a normal, healthy child. Lifestyle behaviours play an important role in determining foetal growth. Detrimental habits can be modified, but successful modification requires self-control from an individual. Stopping lifelong addictive unhealthy behaviours is very difficult, and a woman who

suffers from them requires support and assistance not only from family members and individuals close to her, but also from the health care system and society.

The prediction models predict that changing a series of behaviours would, in theory, yield a substantial decrease in risk of preterm birth, most notable for those at high baseline risk due to certain socio-demographic characteristics, for example women who are poor, older, and with limited education (Savitz et al, 2012). These models offer some basis to suggest that we may have more of an understanding of modifiable determinants of preterm birth than analysis of individual risk factors would suggest. If we learn that changing this constellation of unhealthy behaviours has a substantial causal impact on risk of preterm birth, public health policies and clinical care that promote such lifestyle modifications would be warranted.

Certain behaviours have been associated with preterm birth. Behaviours such as smoking, alcohol consumption, illicit substance use, physical activity and diet are known risk factors for preterm births (Cha & Masho, 2013). These are of great importance because they are modifiable risk factors, and their elimination can lead to an effective reduction in the preterm birth rate.

Cha and Masho (2013) noted that unfavourable health behaviours tend to cluster in pregnant mothers who are single, of low income, less education, poor diet, lack of physical activity, physically and sexually abused and have high stress levels. For example in a study that was conducted by Grjibovski et al (2002) a large number of smokers (16%) were found among teenage mothers compared with 11.1% in the middle age group and smoking was found to be associated with low level of

education. The proportion of smokers was 16.8% among women with secondary education or less compared with 9.6% among those with at least three years of university education.

Literature on the accuracy on self-reported health behaviours suggest that, although most people report honestly, the respondents tend to underreport behaviours that are considered to be undesirable or negative and this could be more pronounced among women with a low educational level. If some unhealthy behaviours like smoking are underreported by women with a low educational level, the proportion of socioeconomic inequality in preterm birth explained by smoking would be underestimated (Parna et al, 2005).

2.3.1 Cigarette smoking

Cigarette smoking is a well-known cause of preterm birth and intrauterine growth restriction (Barros et al, 2010). More than 80% of all smokers now reside in low and middle income countries. The studies on prevalence of smoking during pregnancy show wide variability, with rates greater than 25% in South America, 8% in urban Africa, and 18% in the Pacific Islands.

There are more than 3,000 chemicals in cigarette smoke and the biological effects of most of them are unknown. Although the mechanisms that increase the risk of preterm birth are not clear, it is known that both nicotine and carbon monoxide are potent vasoconstrictors, produce placental damage, and decrease the utero-placental blood flow. These pathways lead to foetal growth restriction and indicated preterm

births (Goldernberg et al, 2008). Birth weight is reduced by 150 to 320 grams in infants born to smokers compared with those born to non-smokers.

It has been consistently reported that, even after controlling other factors, women who smoke are about twice as likely to deliver a low birth weight baby as are women who do not smoke. Smoking is also associated with a systemic inflammatory response and can increase spontaneous preterm birth through that pathway (Chomitz, Cheung, & Lieberman, 2016; Goldernberg et al, 2008).

Women who smoke during pregnancy tend to be single, of low income and less educated. Other factors associated with smoking, namely physical and sexual abuse and high stress levels are often present (Orr, James, & Blackmore, 2002; Cha & Masho, 2013). Several studies have shown that lower socioeconomic status contributes significantly to persisting to smoke during pregnancy. Approximately 20% to 25% of American women smoke cigarettes during pregnancy. White, young, unmarried, and unemployed women, as well as women with fewer than 12 years of education and low socioeconomic status, are more likely to smoke during pregnancy, compared with non white, older, married women with more than 12 years of education and higher socioeconomic status (Chomitz, Cheung, & Lieberman, 2016).

In a study that was conducted by Mohsin and Bauman (2005) to explore the socio-demographic characteristics of women who continue to smoke during pregnancy, the findings showed that maternal social and demographic characteristics were significantly associated with smoking behaviour. The smoking rate was worryingly high among teenage mothers. Pregnant smokers in their study also were more likely

to begin prenatal care in the second or third trimester, or to receive no antenatal care at all. On the other hand, mothers of higher socio-economic status, first-time mothers and those who attended antenatal care early showed an increased likelihood of smoking cessation during pregnancy but those who were heavy smokers were less likely to quit during pregnancy.

Smokers tend to have less weight gain during pregnancy and inadequate maternal weight gain has previously been associated with spontaneous preterm delivery and low birth weight infants (Cha & Masho, 2013). Smoking in pregnancy (SIP) increases the incidence of maternal complications such as placental abruption, reduced birth weight, placenta previa, ectopic pregnancy, prolonged rupture of membranes, inflammation of the umbilical cord, and amniotic fluid bacterial infections (Mohsin & Bauman, 2005). However, the relationship of cigarette smoking to preterm birth is rather modest and not entirely replicable, its influence on pregnancy outcomes like preterm birth is most notable in the third trimester and there is no increased risk that has been detected for former smokers who quit before the onset of pregnancy or early in pregnancy (Behrman & Butler, 2007).

In many instances even when women themselves do not use tobacco, they are exposed to environmental tobacco smoke. Second hand smoke may also have negative effects on birth outcomes. The involvement of husbands or partners in smoking cessation programmes and preconception counselling is therefore imperative to minimise women's exposure to second hand smoke.

2.3.2 Alcohol consumption

High levels of alcohol use during pregnancy have detrimental effects on foetal development and subsequent neonatal survival. Women who have more than one drink a day are at an increased risk of preterm labour (Offiah, O'Donoghue, & Kenny, 2011). Although heavy alcohol consumption has been associated with preterm birth, neither mild nor moderate alcohol use is regarded safe during pregnancy. The difficulty with studies evaluating alcohol exposure in pregnancy relates to under-reporting of intake and discrepancies in the description of a 'drink' or unit of alcohol, -moderate intake, defined as three or more drinks a day increased the risk of preterm birth in an Italian study with OR 2.0, 1.8 and 1.9, respectively, for each trimester of pregnancy (Parazzini & Benzi, 2003).

In a study that was conducted by Albertsen et al (2004) the results revealed that the relative risk of preterm delivery and very preterm birth among women who had seven or more drinks a week during pregnancy was 1.77 and 3.26 respectively, compared to non-drinkers. Findings showed no increased risk of preterm birth if less than 4 units of alcohol were consumed per week. The relationship between alcohol consumption and preterm birth currently remains unclear because of differing effects of alcohol on the foetus depending on the amount consumed and the limitations associated with self- reporting.

2.3.3 Illicit drugs use

Illicit drug use especially cocaine and heroin have been associated with preterm birth in several studies. Women who use cocaine while pregnant have an increased risk of preterm birth compared with those who do not use it, with an odds ratio of 3.38

(Gouin, Murphy, & Shah, 2011). According to Behrman and Butler, (2007) marijuana smoking does not appear to significantly increase the risk of preterm labour, but children exposed to marijuana in utero may be smaller than non-exposed infants. Other old reports suggest that pregnant women who smoke marijuana are at higher risk of preterm labour, miscarriage, and stillbirth. However, other studies found no difference between users of marijuana and non-users in terms of rate of miscarriage, type of presentation at birth, and frequency of complications or major physical anomalies at birth (Fried, & Makin, 1986).

2.3.4 Physical activity

Historically and largely based on socio-cultural reasons more than on scientific evidence, pregnant women have been encouraged to reduce physical activity and stop working during pregnancy because of perceived increased risk of problems such as early pregnancy loss or reduced placental circulation (Schramm, Stockbauer, & Hoffman, 1996). In 1985 the American College of Obstetricians and Gynaecologists (ACOG) provided conservative recommendations for exercise during pregnancy; women were told to avoid intense activities (such as jogging or cycling) for more than 15 minutes per session, and limit their heart rate to 140 beats/minute (Artal, & O'Toole, 2003).

Concerns about weight gain and health have resulted in a high level of consciousness about weight control. In recent years most women are engaging in regular exercise during pregnancy. This habit is supported by the results of several publications over the last decade, reporting few negative effects of physical exercise on the pregnancy of a healthy gravida. Moderate exercise may be particularly beneficial for women at

risk of developing diabetes during pregnancy and for women who already have some chronic conditions such as obesity, hypertension, diabetes and arthritis (Artal, & O'Toole, 2003).

Some controversy exists over the possibility that exercise during pregnancy might increase the risk of preterm delivery. Barakat, Stirling and Lucia (2008) conducted a case control study among Spanish women aimed at determining the possible cause-effect relationship between regular exercise performed during the second and third trimesters of pregnancy by previously sedentary, healthy gravidae and gestational age at the moment of delivery. In the results obtained no significant differences were found between the cases and controls in those maternal characteristics. The mean gestational age did not differ ($p=0.745$) between the training (39 weeks, 3 days (SD 1 day) and the control group (39 weeks, 4 days (SD 1 day)). The results led to a conclusion that previously sedentary, healthy gravidae with singleton gestation can safely engage in moderate, supervised exercise programmes until the end of gestation as this would not affect gestational age.

2.3.5 Inter-pregnancy spacing interval

A short inter-pregnancy interval appears to be a risk factor for adverse prenatal outcomes. There is a raised risk of preterm birth in pregnancies arising within close temporal proximity to a previous delivery. According to WHO (2005) the recommended interval after a birth before attempting a new pregnancy should be at least 24 months in order to reduce the risk of adverse birth outcomes.

Women in Taiwan with inter-pregnancy intervals of less than 12 months were at an increased risk for a preterm birth in the subsequent pregnancy (OR 4.2, 95% CI 3.0–6.0). The risk decreased as the inter-pregnancy interval increased with a relatively low risk at 18 to 48 months. Similarly, in a case-control study in Israel an interval of less than 12 months was associated with an increased risk of preterm labour before 34 weeks (Murphy, 2007).

Barros, et al (2010) reveals that both short intervals and long intervals for birth spacing may result in preterm birth. An analysis of observational studies according to Goldenberg et al (2008) revealed that there was a 40% increase in preterm births when the birth interval was shorter than six months, relative to babies born after a birth interval of 18-24 months. A 20% increase in preterm births was also found when the birth interval was 60 months or longer. For shorter interval the mother would have not had enough time to replenish her nutritional reserves or treat an infection or other systemic illnesses since pregnancy consumes maternal stores of essential vitamins, minerals, and amino acids. The other potential explanation is that the uterus takes time to return to its normal state, including resolution of the inflammatory status associated with the previous pregnancy (Goldenberg et al, 2008).

Goldenberg, et al (2008) also notes that women whose first birth was preterm are far more likely to have a short interval than women who had a full term first birth, thus compounding the risk. If the previous birth was preterm the recurrence risk of preterm delivery ranges from 15% to more than 50%, depending on the number and gestational age of previous deliveries.

The mechanism for the recurrence is not always clear, however, Goldenberg et al (2006) suggests that the persistent or recurrent intra-uterine infections and the underlying disorders causing indicated preterm births, such as diabetes, hypertension, or obesity, that frequently persists between pregnancies may probably explain many repetitive preterm births.

One way to ensure that mothers and babies have good outcomes is to encourage pregnancy-planning. Encouraging family planning and correct use of contraceptive methods may help more women to space their pregnancies for 18 to 24 months apart, which is ideal. Breastfeeding promotion for 24 months can prevent closely spaced pregnancies, a method that continues to be underused despite strong evidence of its positive effect on maternal and newborn health (March of Dimes, PMNCH, Save the Children, & WHO, 2012).

2.3.6 Intendedness of Pregnancy

According to Behrman and Butler 2007, intention to fall pregnant is measured by self-report by using standard survey questions that can be used to establish whether the woman wanted a child now, not now but at some point (mistimed), or not at all (unwanted). The term *unintended* refers to those pregnancies that are unwanted, mistimed or unexpected, such pregnancies occur earlier than desired by the parents.

It is estimated that approximately 60% of all pregnancies are unintended, and out of these, about half end in a live birth. Women with unintended pregnancies are less likely to seek early prenatal care and are more likely to use alcohol or tobacco. Although unintended pregnancies occur among women across the socio-

demographic spectrum, they are disproportionately likely among mothers who are adolescent, unmarried or over age 40 (Behrman & Butler, 2007).

In a study that was conducted in Baltimore and Maryland by Orr et al (2000) as cited by Behrman and Butler (2007), women with unintended pregnancies were 1.82 times more likely to deliver their infants preterm, after adjustment for clinical and behavioural factors associated with preterm delivery. Although the research available on the association of the intendedness of pregnancy and preterm delivery is limited, available literature suggests that women with unintended pregnancies are more likely to deliver preterm, and as a consequence, their infants are at higher risk of being of low birth weight because preterm babies are more likely to have low birth weight.

2.3.7 Antenatal clinic visits

Antenatal care service delivery provides an opportunity for all women to be reached at multiple times during pregnancy with a package of interventions aimed at prolonging a healthy pregnancy and improving maternal and prenatal health. Basic services are delivered during antenatal care with a potential impact on reducing preterm birth rates. To mention a few, these include identification of women at high risk of preterm birth, screening and treatment of sexually transmitted diseases and other infections, identification and correction of malnutrition and nutrition counselling and behavioural and social support interventions like smoking cessation programmes and programmes aimed at the prevention of violence against women (Leung, 2004).

Bettiol et al (2000) argue that despite an increase in the number of antenatal visits in developed countries; their impact in preventing preterm birth is still controversial. They say making prenatal care available to more women and prenatal visits available to the same women generally does not reduce preterm birth (Bettiol et al, 2000). Although the current debate in developed countries raises questions about the benefits of antenatal care in relation to preterm birth, research has shown that women who receive antenatal care services are at lower risk for having a preterm birth than women who are not reached by the health system prior to delivery (Leung, 2004).

Feresu, Harlow, Welch and Gillespie (2004) conducted a research in Zimbabwe to examine the spectrum of poor birth outcomes across important demographic subgroups. The findings revealed that lack of antenatal care was strongly associated with each of the adverse birth outcomes examined and more particularly for preterm birth.

Bada et al (2005) point out that early and periodic antenatal care could screen for unhealthy behaviours such as smoking, alcohol drinking and use of illicit drugs, and timely management can minimise their impact on preterm birth. Early antenatal visit provides the opportunity for initiating drug prevention and treatment, and for pregnant women to receive health education. Nurses can help pregnant women identify health behaviours that can be modified to decrease the likelihood of preterm birth.

Women in most developing countries delay to seek antenatal care which may help ensure that emergency interventions occur in a timely manner (Bada et al, 2005). For example in Zimbabwe, women enter antenatal care late in pregnancy, booking at 28

weeks or later (Zimbabwe Central Statistical Office, 1994). In contrast antenatal care in the United Kingdom (UK) is a high priority service delivery with a complex care package, within which screening for women at risk of preterm birth is an integral component. It also involves screening for conditions such as pre-eclampsia that might predispose women to preterm delivery. When women are identified as at risk, they may be targeted for more intensive antenatal surveillance and prophylactic measures, either as primary, secondary or tertiary preventions (Honest et al, 2009).

2.4 Other factors

These factors cover paternal influence on preterm birth and the baby's demographic characteristics associated with preterm birth.

2.4.1 Paternal influence on preterm birth

Many studies focus on mothers' risk factors for adverse birth outcomes for the obvious reason that mothers contribute far more to their children during the nine months of gestation than fathers do. That is a biological fact. This does not mean that fathers should be overlooked because they also have an influence on birth outcomes one way or the other. It is biologically plausible that paternal factors could affect birth outcomes through a range of pathways involving material and psychosocial resources as well as stress. Research needs to be conducted to identify paternal risk factors that are associated with adverse birth outcomes such as preterm birth. This section discusses some of paternal factors that may influence preterm birth and these include paternal age, education level, alcohol drinking, smoking habits and intimate partner violence.

2.4.1.1 Paternal age

The age of a man or woman is a factor among others that can affect reproduction outcomes. Many couples nowadays are choosing to delay child bearing because of pursuit of education and other factors. As men grow older, testosterone levels begin to decrease and hypogonadism results. If testosterone is used to treat hypogonadism, it can suppress spermatogenesis. Semen parameters also begin a steady decline as early as age 35. In addition semen volume and motility both decrease and morphology may become increasingly abnormal. After the age of 40, men can have significantly more DNA damage in their sperm, as well as decline in both motility (40%) and viability (below 50%) (Sharma et al, 2013).

Advanced paternal age has been reported to impair pregnancy outcome. In an Italian study of women aged 20 to 29 years the odds (OR) of preterm birth increased with increasing paternal age, with the strongest association for very preterm birth (less than 32 weeks). The OR among men aged 45 to 49 years reached 1.91 (95% CI 1.08–3.38). Similarly, in a Danish study of first born babies to mothers aged 20 to 29 years, the risk of preterm birth increased with increasing paternal age almost entirely resulting from an association with very preterm birth (less than 32 weeks). Compared with fathers aged 20 to 24 years the odds ratios increased linearly to 2.1 for fathers aged 50 years and above (Astolfi, De Pasquale & Zonta, 2006; Murphy, 2007).

2.4.1.2 Paternal education level

Maternal and child health research has routinely considered maternal, but rarely paternal education as a risk factor for many birth outcomes. Paternal education is an

important socio-economic marker that may predict birth outcomes over and above maternal socio-economic indicators (Shapiro et al, 2017).

Blumenshine et al (2011) conducted a study in California on women who gave birth to explore the association between paternal education and preterm birth-; the findings revealed that women whose infants' fathers had not completed college had significantly higher odds of preterm birth than women whose infants' fathers were college graduates, even after adjusting for maternal education and family income [OR (95% CI) = 1.26 (1.01–1.58)]. The effect of paternal education was also greater among unmarried women than among married women (Blumenshine et al, 2011).

In agreement with their study Shapiro et al (2017) research to assess associations between paternal education and preterm birth found that low paternal education increases the risk of adverse birth outcomes, and especially of foetal and infant mortality, independently from maternal characteristics. Paternal education seems to be an important hidden indicator of risk for preterm birth, reflecting social and economic factors not measured by maternal education.

2.4.1.3 Paternal cigarette smoking

Cigarette smoke does not only affect smokers but also contributes to the health problems of non-smokers. Many chemicals in maternal smoking and second-hand smoke pass from the pregnant woman to the foetus through the placenta (World Health Organisation, 2004). Intrauterine exposure to tobacco smoke has been discerned as an important risk factor for low birth weight (LBW), small for gestational age (SGA), and preterm birth infants.

Exposure to second-hand smoke during pregnancy is linked to an increased risk of preterm birth (British Medical Association, 2004). Smoking by fathers causes sperm damage, reduces semen quality and reduces responsiveness to fertility treatment (British Medical Association, 2004). This suggests that fathers who smoke regularly before conception may damage their children (at a genetic level). Heavy smoking by fathers is associated with increased risk of early pregnancy loss, respiratory disease in infants and low birth-weight (Venners et al, 2004).

However, some previous studies have not reported any significant influences of paternal smoking on preterm birth of their children in both urban and rural area (Ko et al, 2014; Andriani, & Kuo, 2014). The possible explanation for this trend could be that fathers may try not to smoke in the presence of pregnant wives thus the foetus in the womb are not directly exposed to the fathers' smoking or it is possible that the average amount of cigarettes smoking per day by fathers were not high enough to observe an adverse effect on birth outcomes in their children.

2.4.1.4 Paternal alcohol drinking

Paternal alcohol use has been associated with a number of adverse reproductive outcomes in laboratory animals and there is one epidemiologic report of a detrimental effect on infant birth weight. To expand the epidemiologic evidence, data from the Child Health and Development Studies (CHDS) were analysed to find out if there were any associations between birth outcomes and paternal alcohol consumption. Pregnancy outcomes included preterm delivery (<37 weeks completed gestation), moderately low birth weight (1,501–2,500 g), very low birth weight ($\leq 1,500$ g), small-for-gestational-age (<10th percentile of weight for gestational age),

and mean birth weight. Paternal alcohol use, analysed in intervals from 0 to 2.0 or more drinks per day, showed no association with any of the outcomes of interest (Savitz, Zhang, Schwingl, & John, 1992). The influence of paternal alcohol consumption on preterm birth thus has not been found so far.

2.4.1.5 Intimate partner violence

Intimate partner or ex-partner violence is of particular concern during pregnancy because it places two lives at risk. Partner or ex-partner violence is one of the most common forms of violence against women and includes physical, sexual, financial, psychological or emotional abuse. In England and Wales, more than one in four women has experienced at least one incident of this type of domestic violence since the age of 16; approximately 1 million women a year experience at least one incident of domestic violence and two women a week are killed by their current or former partner (Donovan et al, 2015).

Intimate partner violence is one of the maternal stressors that has been linked to preterm birth. It has been noted that when such risk behaviours are present before pregnancy, they are likely to continue throughout pregnancy. Moreover, women who are abused by their intimate partners have a greater likelihood of engaging in risky behaviours such as smoking and alcohol use and are less likely to seek health care. Risky sexual behaviours also put these women at greater risk for unintended pregnancies (March of Dimes, PMNCH, Save the Children, & WHO, 2012).

Researchers from the University of Iowa analysed 50 studies on the effects intimate partner or ex-partner violence on risk of preterm birth and other birth outcomes such as low birth weight (less than 2500g) and small-for-gestational-age babies. Overall,

the results revealed that intimate partner violence doubled the risk of preterm birth and low birth weight. The risk was particularly very high for women who experienced two or more types of domestic violence during their pregnancy. Intimate partner or ex-partner violence can directly affect the growing foetus, through physical or sexual trauma, or indirectly due to increased maternal stress, inadequate nutrition and poor prenatal care (Donovan et al, 2015).

Some studies have indicated that certain women may be at increased risk of intimate partner violence during pregnancy due to socio-economic status, age, marital status, or minority status. Intimate Partner Violence (IPV) may be found at all levels of socio-economic status, however many studies identify increased risk of IPV among both pregnant and non-pregnant women with lower socio-economic status (Dunn & Oths, 2004). Younger women, those who are not married, and women from minority groups are also at increased risk for pregnancy IPV (Anderson, Marshak, & Hebbeler, 2002; Saltzman, Johnson, Gilbert, & Goodwin, 2003).

2.4.2 Demographic characteristics of the baby and preterm birth

2.4.2.1 Sex of the baby

Studies show that there is an association between foetal gender and preterm birth. It has been long noticed that female foetuses have a better prenatal survival than male foetuses. Zeitlin et al (2002) argue that male babies have a greater risk of being born before term in a wide range of populations across time and space as compared to female babies. A study measuring the association between foetal sex and preterm birth in four original datasets reported more males among preterm and very preterm

births in most populations, including in-vitro-fertilisation (IVF) births (OR 1.09–1.24) (Murphy, 2007).

In another study using large dataset Astolfi and Zonta (1999) found an excess in the proportion of boys among preterm versus term births. Several mechanisms have been proposed to explain why pregnancies carrying male foetuses could have a higher risk of preterm birth, among those explanations Zeitlin et al (2002) mention heavier average body weight which increases the probability of preterm labour, a greater susceptibility to certain medical complications associated with preterm birth and sex-linked biochemical processes, including labour promoted by oestrogen production from androgen precursors or by interleukin-1 that may differ between male and female foetuses. The higher proportion of preterm births among male babies could significantly contribute to an explanation for their higher mortality in infancy. However, despite numerous studies on the mechanisms of preterm labour influenced by foetal gender, an explanation for this remains uncertain.

2.4.2.2 Baby's birth weight

Low birth weight (LBW) and preterm births are leading causes of neonatal morbidity and mortality. Babies born before 37 completed weeks of gestation are classified as preterm, while infants born weighing less than 2,500g are termed LBW. Preterm birth is a strong predictor of low birth weight; there are low chances that a preterm baby may be born with a normal baby weight. In most instances preterm birth and low birth weight often coexist, meaning that most babies who are preterm are highly likely to be low birth weight babies and vice versa; however, literature

shows that 40% of all LBW babies are born at 37 weeks or later (Mattison et al, 2001).

Preterm and low birth weight infants consume huge amounts of scarce health care resources, and for those babies who survive preterm birth and low birth weight, adverse short-term and long-term outcomes are assured. An infant's gestational age and birth weight at delivery are closely associated and they are the strongest biological predictors of immediate and long-term developmental outcomes. Research documents the effects of preterm birth and low birth weight on children and shows that such children commonly have cognitive deficits, motor delays including cerebral palsy, academic difficulties, language delays, and significantly increased rates of attention problems, behavioural difficulties, and psychological problems (Hack, Klein, & Taylor, 1995; Blencowe et al, 2013b; Simmons et al, 2010).

2.5 Summary

Chapter two has provided a review of literature on maternal socio-demographic factors and health behavioural practices of mothers that have been associated with preterm birth. The behaviours of partners and other family members that may influence preterm birth have been highlighted. The demographic factors of the newly born baby were also provided. There is clear evidence from literature that suggests that a favourable lifestyle and a greater degree of health consciousness are associated with a reduced risk of preterm birth. Many studies have shown that unhealthy behaviours such as alcohol drinking, smoking, use of illicit drugs, poor eating habits, domestic violence and partner smoking to mention a few are risk factors for preterm birth. Certain maternal socio-demographic factors such as low education level, being

single, very young and advanced maternal age were indicated by a number of researchers as risk factors for preterm birth. Most of the research studies were done in Europe and the United States of America and there are still some challenges in identifying behaviours that affect the occurrence of preterm birth since studies keep on producing contradicting results because of different population compositions and settings. In Namibia like many African countries there is no evidence of studies that have addressed this area, however continued efforts are needed to better understand and identify the aspects of a favourable lifestyle that are associated with a reduced risk of preterm birth.

The next chapter (chapter 3) describes the research design and methodology used in this study.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

The previous chapter covered the depth of the literature review drawn from the material that has already been published on the topic of behavioural and socio-demographic factors associated with preterm birth. This chapter outlines the methodology that was used in this study. The research methodology can be defined as a systematic way of solving the identified research problem. It involves procedures by which the researchers go about their work of describing, explaining, and predicting phenomena (Rajasekar, Philominathan, & Chimathambi, 2013).

The methodology in this study describes the study design, population, sample and sampling method, the instrument for data collection, procedures for data collection and data analysis, as well as the ethical considerations of the study.

3.2 Research design

Research design refers to the structured approach followed by researchers to answer a particular research question. The study design has also been called the ‘architecture’ of the study, because the choice of a study design determines how population is sampled, measurements are collected and data is analysed (Joubert, & Ehrlich, 2007). For this study a quantitative, observational, analytic case control study design was used to determine the association between variable factors and birth term outcomes.

Quantitative research is a means for testing objective theories by examining the relationship among variables. These variables are measured on instruments so that numerical data can be analysed using statistical procedures (Creswell, 2009). The goal for quantitative analytic research designs is to determine the relationship between an independent variable and a dependent or outcome variable in a population. A quantitative design has been chosen for this study in order to describe socio-demographic and behavioural factors exhibited by mothers of preterm and mothers of full term babies using numeric data and further using statistical analysis to point out any associations between variable factors and birth term. The quantification of risk associated with each category of variables reveals the risk factors for preterm and protective factors against preterm birth.

Analytic study, unlike a purely descriptive study which focuses on describing patterns or characteristics using the frequencies, involves finding the determinants of an outcome by assessing whether particular exposures are associated to the outcome (Joubert, & Ehrlich, 2007). The ultimate goal of an analytic study is to determine whether a particular exposure causes or prevents disease. Cohort studies and case control studies are examples of analytical studies. For this study a case control design was relevant because the cases and controls were known but there was a need to determine the association between various exposure variables and the outcome variable, birth term. An analytic study allowed the researcher to identify the socio-demographic and behavioural factors that influence birth term through examining associations. The quantification of the level of risk associated with each category of variables on birth term further indicated the categories that are risk factors for preterm birth and those that are protective factors (promote full term birth).

Case control study design helps to determine if an exposure is associated with an outcome (disease or condition of interest). First, the researcher identifies the cases (a group known to have the condition of interest) and the controls (a group known to be free of the condition of interest). Then, look back in time to learn which subjects in each group had the exposure(s), comparing the frequency of the exposure in the case group to the control group. A case-control study is always retrospective because it starts with an outcome then traces back to investigate exposures. When the subjects are enrolled in their respective groups, the outcome of each subject is already known by the investigator (Lewallen & Courtright, 1998).

A case control study design was chosen because the researcher endeavours to estimate the risk of outcome (birth term) in women with certain exposures (socio demographic and behavioural factors). In this study women who delivered preterm babies served as cases and those who delivered full term babies served as controls. First of all, the researcher identified the cases (mothers of preterm babies) and the controls (mothers of full term babies) from Windhoek Central Hospital and Intermediate Hospital Katutura. Then all participants were asked questions in the questionnaire (100 cases and 300 controls) to obtain information on their socio-demographic factors and history of their health behaviours during pregnancy. Finally the researcher compared exposure(s) in cases and controls in order to check whether the exposure(s) is responsible for the observed outcome. A detailed discussion follows in 3.8 and 3.9.

3.3 Population

According to Mouton (1996), population refers to a collection of individuals having some common characteristics which will be able to provide information on the problem. A study population is the “entire group of persons which the researcher is interested in studying or the criteria which set the boundaries with regard to the elements or subjects” (Brink, 2006, p.123). Since this study’s population comprised of many subjects, it would be difficult to examine all of them due to time constraints and limited resources. To make it possible to carry out the research, the population was narrowed down to target and accessible populations from which study samples were drawn.

3.3.1 Target and accessible population

The target population refers to units that the researcher is interested in examining. It is important to delineate the characteristics of the target population; therefore the target population consisted of all maternal women in Windhoek.

The accessible population is a subset of the target population. Women who delivered at Windhoek Central Hospital and Intermediate Hospital Katutura within the study period between 01 October 2016 and 30 November 2016 constituted the accessible population. These hospitals were chosen due to their high annual maternal delivery data. The other reason was that after delivery mothers are admitted at the postnatal ward for at least two or more days before they are discharged, and this created an opportunity for the researcher to access them while they were still admitted in the hospital.

However, since not every member of the accessible population can be studied, a sample was drawn from it and investigated. In this study there were two study samples, one for the cases and the other for the controls. Inclusion criteria for the cases (preterm group) were mothers who gave live birth at less than 37 weeks of gestation, matching criteria for the control group were mothers who gave live birth at or after 37 weeks of gestation. The exclusion criteria for both groups was giving birth to twins, being in an unstable condition after delivery, and being unable to communicate in English. The full term delivery mothers in the control group were matched to cases after delivery in the same hospital. On average about 1,007 full term babies and 111 preterm babies are born every month in WCH and IHK (Ministry of Health and Social Services, 2016). The total accessible population estimate within a month was (N=1,118).

3.4 Sample and sampling

A sample is part or fraction of the whole that is selected by the researcher through sampling to participate in a project (Brink, 2006). Sampling is the process of selecting an adequate sample size from a population of interest so that by studying the sample we may fairly generalise our results back to the population from which they were chosen (Glasow, 2005). For this study women were selected into a case or control group after delivery at postnatal ward.

The sample size for this study was estimated using Epi Info software version 7.1.3.0 statistical package sample size calculator for 80% confidence interval, 80% power, a ratio of 1:3 (case: controls) , 32% expected frequency of exposure for priority socio-demographic and behavioural factors in controls and an odds ratio of 1.703. The

estimated sample size as calculated by epi info statcalc was (N=400) with (n=300) controls and (n=100) cases. The ratio of cases to controls was 1:3; therefore when one preterm delivery mother was recruited as the case, three full term delivery mothers were recruited as controls during the same time period. This process went on until the sample size of 300 full term births (controls) and 100 preterm births (cases) was attained. No sampling was done to the cases since they were few, for the controls a systematic sampling was conducted. The sampling interval was calculated by dividing the population of mothers who give birth to full term babies per month in Windhoek public hospitals by the sample size (1,007/300), and the starting point was chosen randomly. Therefore every third person in the list starting the count at the selected starting point was chosen as a participant as long as she met the inclusion criteria until the sample size of 300 participants was attained.

3.5 Data collection instruments

The hospital records were utilised to obtain the pregnancy gestational age at delivery and birth weight of the babies. Pre-pregnancy Body Mass Index (BMI) of mothers was calculated based on height measured and self-reported pre-pregnancy weight or weight at first prenatal clinic visit. BMI was categorised as underweight (<18.5kg/m²), normal weight (18.5-25kg/m²), overweight (>25-30kg/m²) and obese (≥30kg/m²) based on the body mass index calculator.

A structured interview schedule was used to collect socio-demographic information and health behavioural practices of mothers during pregnancy and the risky behaviours of partners and family members when a woman was pregnant. The structured interview schedule comprised of the following components:

Section A: Questions about birth term, sex, weight and gestational age of the baby.

Section B: Questions on socio-demographic factors of postnatal mothers such as age, Body Mass Index (BMI), marital status, education level, work type and place of residence.

Section C: Questions pertaining to behavioural practices of postnatal mothers such as smoking, alcohol drinking, use of illicit drugs, exercise, antenatal clinic visits, inter-pregnancy interval, intendedness of pregnancy, and dietary habits.

Section D: Questions pertaining to high risk health behavioural practices of spouses and other family members. These included questions on habits such as their smoking, alcohol drinking, physical abuse, sexual abuse and emotional abuse habits.

3.6 Pilot study of the structured interview schedule

A pilot study refers to a small-scale versions of studies conducted in preparation for the main study in order to assess the stability of data collection instrument (Lewis-Beck, Bryman, & Liao, 2004). Data was collected using a structured interview schedule. The data collection instrument was pilot tested using ten postnatal mothers from WCH to check its effectiveness, appropriateness and accuracy prior to the commencement of the actual study. Pilot testing helped the researcher to refine the questions that were not clear to participants. The categories of intendedness of pregnancy were increased to be four (wanted, unwanted, mistimed and unexpected) instead of two (wanted and unwanted) after realising that some participants did not want to classify their pregnancies as unwanted. This also applied to supplementary tablets intake which was initially divided into two categories (yes and no) then after discovering that some participants took supplementary tablets only sometimes or rarely then the supplementary tablets intake was divided into four groups namely;

everyday, sometimes, rarely and never. The rest of the questions were clear to the participants and extracted the expected information from the respondents.

3.7 Validity and reliability of the structured interview schedule

To obtain valid and reliable data it is imperative to ensure that the proposed measurement procedures and instruments are reliable and valid before conducting the study. Validity and reliability are the two most important concepts in the context of quantitative measurement; they determine the precision of the research instrument in providing results that can be generalised to a population (De Vos, Strydom, Fouche & Delpont, 2011; Hopkins, 2000).

3.7.1 Validity

Instrument validity has to do with whether the instrument used actually measures what it is supposed to measure, given the context to which it is applied (Suter, 2012). To ensure validity the research data collecting instrument (structured interview schedule) was assessed for face and content validity because these two types of validity were relevant and the most feasible for this research.

Face validity is the extent to which a test or questionnaire is subjectively viewed as covering the concept it purports to measure based on simple assessment of the test or questionnaire itself. It is considered the weakest form of validity since it is based on subjective views, however some researchers argue that it is more useful especially when little or nothing is known about the variable being measured (Wood & Rorr-Kerr, 2010).

After a thorough literature search the researcher found no other studies that have been conducted in Namibia on the same or similar topic of the study under investigation. Therefore the research instrument was not adopted from another study but it was carefully designed by the researcher specifically for this study ensuring that the questions in the instrument meet the purpose and objectives of the study and are written in a clear and simple manner that will be understood by the respondents. The research instrument was then given to the researcher's supervisors and the supervisor in the maternity section to validate its appropriateness for the intended study.

Content validity refers to the degree with which the content of a test or questionnaire covers the extent and depth of the topics it is intended to cover ((Wood & Rorr-Kerr, 2010). It addresses the match between test questions and the content of the subject area they are intended to assess. Experts in a given performance domain generally judge the content validity. To ensure content validity extensive literature search was conducted and relevant information on the topic (preterm birth) was utilised to develop the structured interview schedule. In addition to that the researcher's project supervisors assessed the data collection instrument, provided their expert input and validated the data collection instruments for content validity.

3.7.2 Reliability

Reliability refers to the degree to which the instrument can be depended upon to yield consistent results if used repeatedly over time on the same person, or if used by

two different investigators (Brink, Van der Walt, & Van Rensburg, 2000). To ensure reliability of the instrument (structured interview schedule) the following was done:

- The researcher ensured that the questions in the instrument were written in a clear and unambiguous manner and were further refined by the pilot test.
- Pilot testing was performed at Windhoek Central Hospital prior to the commencement of the actual study in order to test the stability of the data collection instrument. Stability of a measurement or test-retest reliability is determined by administering a test at two different points in time to the same individuals and determining the correlation or strength of association of the two sets of scores (Kimberlin & Winternstein, 2008). In other words test-retest reliability is determined by ensuring that the same test performed upon the same individuals gives the same results. The results of test-retest reliability indicated that the instrument was consistent and stable. However due to limited resources and time statistical forms of determining reliability could not be performed.
- Careful consideration of the conditions under which the interviews took place was done in order to minimise the effects of external factors. The preferred place was postnatal ward where there was less noise and standardised environment for all participants.

3.8 Data collection

Data collection is the precise, systematic gathering of information relevant to the research purpose or specific objectives, questions, or hypothesis of a study (Burns & Grove, 2005). The data for this study was gathered using a structured interview

schedule. Women who met the inclusion criteria were invited to participate in the study and written informed consents were signed before the interview. Maternal interviews were conducted face-to-face by the researcher at the postnatal ward after delivery. The structured interview schedule is in the format of a questionnaire, therefore the researcher read the questions to the respondents as they appeared on the questionnaire and recorded the respondent's responses on the questionnaire answer slots. The interviews were conducted with one respondent at a time.

This type of data collection method was highly effective as the researcher had more control over the response rate. The researcher asked questions in a standard way, with the same probes and clarification for each respondent and the verbal responses of participants were recorded in a uniform way. The respondents also cooperated more probably because they did not want to disappoint the researcher. The method was also suitable for respondents with low literacy rate and those who found it difficult to read or complete a questionnaire on their own. This method, however, had some loopholes as it was time consuming and the presence of the researcher might have influenced some of the participants' responses thereby compromising the accuracy of data.

3.9 Data processing and analysis

Data analysis is a process of inspecting, cleansing, transforming and modelling data with the goal of discovering useful information, suggesting conclusions and supporting decision making (Ardagna & Zhang, 2010). The data was analysed quantitatively using Statistical Package for Social Sciences (SPSS) version 24.0 and the results are presented in tables and graphs (see chapter four). This statistical

package was chosen because it allows for several ways of data analysis including descriptive and analytic statistical calculations which are relevant in this study.

Descriptive statistics is used to describe the basic features of the data in a study. It provides simple summaries about the sample and the measures. For this study descriptive statistics were used to describe the socio-demographic and behavioural factors of mothers who gave birth to preterm and full term babies, demographic characteristics of their babies and the risk behaviours of their partners and family members.

Firstly, objective 1 and 2 were descriptively analysed focusing on the central values for numerical continuous data and proportions for categorical data. For example, the mean was used to determine the average age, height, BMI and number of ANC visits for the cases (mothers of preterm babies) and for the controls (mothers of full term babies). Cross tabulations were used to compare the characteristics (socio-demographic and behavioural factors) of mothers with preterm births and mothers with full term births. This information is presented using numeric data (counts and percentages) on tables and bar graphs.

Secondly, analytical analysis was employed for objective 3 focusing on results of statistical analysis, using Odds Ratios, Confidence Intervals and p values.

Chi-square was used to determine associations between variable factors and outcome birth term (preterm and full term). In addition to the chi-square test the Logistic regression was performed to show the relationship between birth term and various behavioural and socio demographic factors in order to identify variable factors that

are statistically significantly associated with birth term and further quantify the risk associated with each category of variables on birth term. The logistic regression provided the p-value and 95% confidence interval to indicate any associations between variable factors and outcome birth term and odds ratios to quantify the risk carried by each category of each variable.

The measure of risk revealed the risk factors for preterm birth and the protective factors against preterm birth (those that promote full term birth).

Finally, the multivariable logistic regression was performed to examine how the estimated association between each variable and birth term changed when controlling for multiple variables simultaneously. Only those single variables which were associated with birth term were included in the logistic regression model.

3.10 Research ethics

Permission was obtained from the research committee of the University of Namibia as well as from the Ministry of Health and Social Services (MoHSS). Participation in this study was voluntary with the right to withdraw at any stage of the study without any consequences. A written informed consent was obtained from all participants. The researcher explained to participants the purpose of the research and clarified that the study might not have direct benefits to them, however, all relevant information that could benefit them was shared and also participants were given freedom to ask questions or clarity where they needed to. This helped them to make informed decisions. No undue rewards or coercion was practiced in this research.

The researcher did not use any procedures that resulted in physical harm to participants. Emotional and psychological harm were also avoided by all means.

Sensitive questions that could make participants feel embarrassed or uncomfortable were asked with extra care after creating a friendly atmosphere that made participants feel secure and free to speak. Confidentiality was maintained throughout the whole study. Information that was provided by participants was kept private and confidential and it was used only for the research purposes. Anonymity was ensured, no real names were used, instead, participants were assigned numbers as their identity. The contact details of the researcher which included the name, cell phone number and email address were provided in the written consent that was given to each participant.

3.11 Summary

Chapter three has presented the research design and methodology used in this study to achieve the research purpose. The population, sample and sampling, data collection tool, pilot testing of the data collection tool, validity and reliability were described. The data collection and processing methods were also discussed. Ethical consideration was included because the research was conducted in an ethical manner guided by the research ethics. The next chapter (chapter 4) presents study results and discussion of findings.

CHAPTER 4

STUDY RESULTS AND DISCUSSION

4.1 Introduction

The previous chapter covered the methodology and research design of this study. This chapter focuses on presentation and discussion of results. Both descriptive and analytical statistics are used to present the findings. Odds Ratios (OR); Confidence Intervals (CI) and p-value results are used to show the significance of association between exposure variables and outcome variable birth term and the quantification of the risk associated with each category of variables. Lastly, multiple logistic regression analysis results were used to identify a group of factors that are significant in influencing preterm birth after controlling for other factors and potential confounders. The results are presented in two sections.

The first section focuses on cross tabulations of exposure variables and the outcome variable (birth term) which are presented in graphs and tables followed by description and discussion of the results and the last section presents the statistical analysis results on tables.

4.2 Descriptive results of the study and discussion

In this section the cross tabulations of exposure variables and the outcome variable birth term, were used to present results on the selected socio-demographic and behavioural factors for this study using data that was gathered from Windhoek Central Hospital and Katutura Intermediate Hospital during the period from

1 October 2016 to 30 November 2016. The purpose of this section was to determine the exposure variables that might be risk factors for preterm birth using descriptive statistics. Hence, it should be noted that the results presented in this section cannot be used to make conclusions on association between exposure variables of interest and the outcome variable without statistical evidence; -therefore the last section of this chapter deals with statistical analysis which provides conclusions on the associations.

4.2.1 Sex of participants' babies

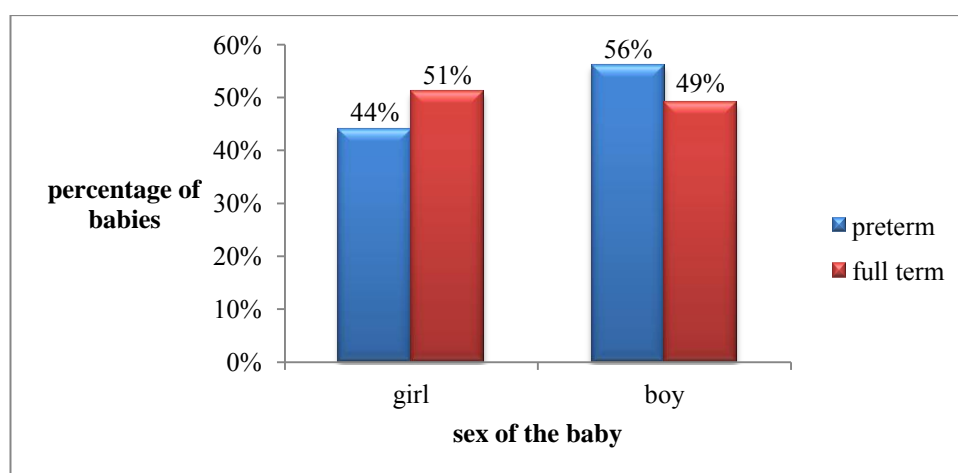


Figure 4.1 Sex of the baby and birth term outcome either preterm or full term (n=400)

Figure 4.1 shows that more boys 56 (56%) were born preterm than girls 44 (44%). The results are in agreement with Zeitlin et al (2002) observation that male babies have a greater risk of being born before term in a wide range of populations across time and space compared to female babies. Several mechanisms have been brought forward to explain this pattern; among them is the heavier average body weight which increases the probability of preterm labour, a greater susceptibility to certain complications associated with preterm birth and sex-linked biochemical processes including labour promoted by oestrogen production from androgen precursors or by interleukin-1 that may differ between male and female foetuses (Zeitlin, 2002).

4.2.2 Birth weight of participants' babies

The birth weight of the babies was divided into three categories namely: (very low birth weight) comprising of babies weighing less than 1500 grams (low birth weight) those babies weighing from 1500 grams to less than 2500 grams and (normal birth weight) consisting of babies weighing 2500 grams and more. Figure 4.2 below shows the results.

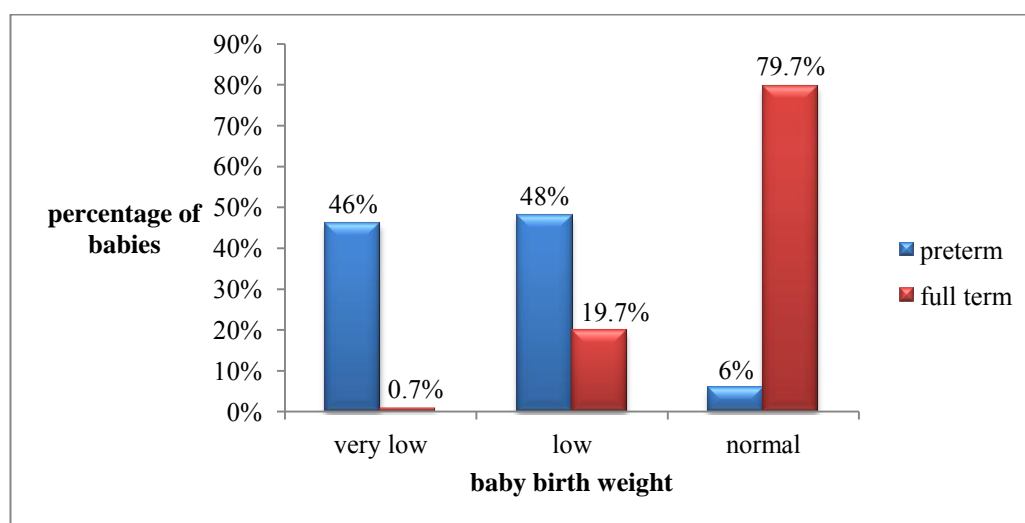


Figure 4.2 Baby weight distribution and birth term outcome either preterm or full term (n=400)

The majority of preterm babies had either very low 46 (46%) or low 48 (48%) birth weight and only 6 (6%) preterm babies had normal birth weight. Since it does not make a reasonable sense to say low birth weight is a risk factor for preterm birth, these findings therefore suggest that preterm birth may be a risk factor for low birth weight since about 92 out of 100 preterm babies had low birth weight. This is a bad scenario because babies who are preterm and have low birth weight are at a higher risk of mortality and other complications (Katz et al, 2013).

Most of the full term babies 239 (79.7%) had normal birth weight but still some full term babies had very low 2 (0.7%) and low 59 (19.7%) birth weight. This raises a lot of concern because it shows that low birth weight is not a problem only affecting preterm babies but is also found among full term babies as well. Low birth weight comes with its own unique health challenges.

4.2.3 Gestational age among preterm group

The gestational age was divided into three categories namely: (extremely preterm) those who gave birth in less than 28 weeks of gestation, (very preterm) those who gave birth from 28 weeks to less than 32 weeks and (moderate to late preterm) those who gave birth from 32 to less than 37 weeks. Gestational age was measured only among the cases since all controls delivered full term babies. The reason for measuring the gestational age was to identify the crucial stages at which most preterm births occur in Windhoek.

Table 4.1 The gestational age among preterm group

	Categories	Frequency	Percentage
Gestational age	Extremely preterm	3	3%
	Very preterm	28	28%
	Moderate or late preterm	69	69%
	Total	100	100%

Most of the participants 69 (69%) had moderate or late preterm births, meaning that they delivered from at least 32 weeks to 36 weeks. These findings are supported by literature which states that most preterm births (more than 80%) take place after 32 completed weeks of gestation and most of these newborns are not extremely delicate, and would survive with only supportive care, even without neonatal intensive care.

However, a huge survival and equity gap exists between the richest and poorest countries as preterm babies born in high income countries are more likely to survive compared to preterm babies born in low income countries due to the attention that high income countries give to the problem of preterm birth (Blencowe et al, 2013a).

There were very few mothers 3 (3%) who had extremely preterm babies, however, 28 (28%) participants had very preterm babies, which raises concern as it is likely to put more burden on the health delivery system since decreasing gestational age is associated with increasing mortality, disability, and a greater requirement for intensive neonatal care if survival is to be assured. The aforementioned are associated with higher costs (Blencowe et al, 2013b).

4.2.4 The Body mass index (BMI)

The body mass index was divided into four categories namely: (underweight) those who had a BMI that was less than 18.5 kg/m², (normal) those who had BMI from 18.5 kg/m² to 25 kg/m², (overweight) those who had BMI above 25 kg/m² up to 30 kg/m², (obese) those whose BMI was above 30 kg/m². The results for the BMI of participants are highlighted in figure 4.3, followed by discussion.

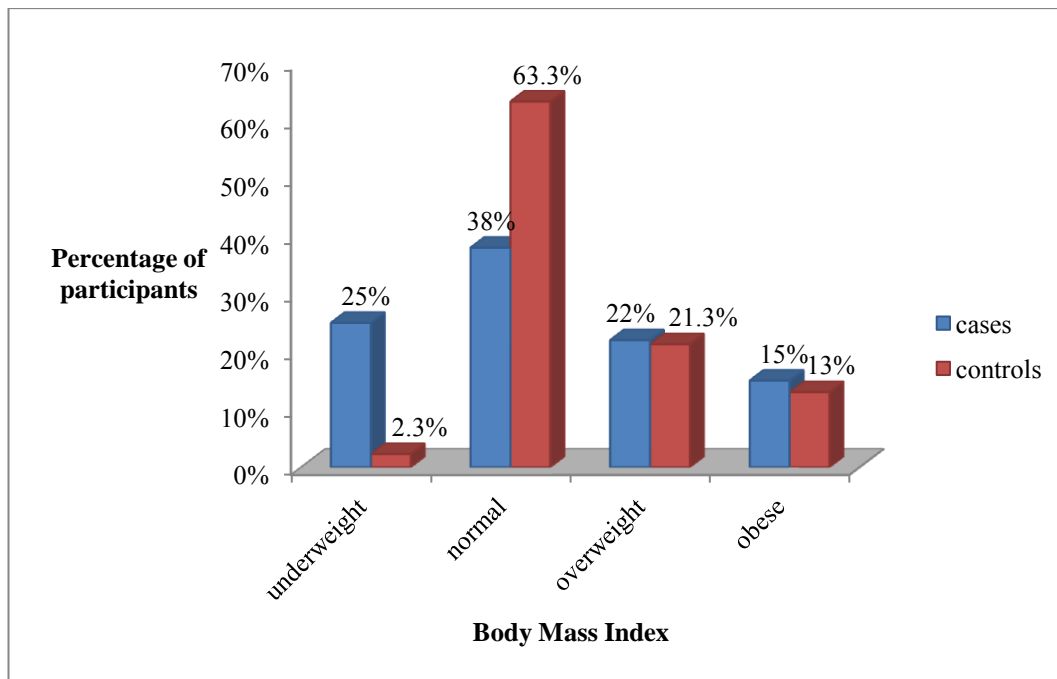


Figure 4.3 Body Mass Index of mothers and birth term outcome either preterm or full term (n=400)

There were more full term births than preterm births among women who had a normal BMI 190 (63.3%) and 38 (38%) respectively. On the other hand, participants who were underweight were more likely to give birth to preterm babies, about 25 (25%) of participants who were underweight gave birth to preterm babies and only 7 (2.3%) gave birth to full term babies. These results are in line with previous research which shows that women who are underweight before and during pregnancy with a body mass index that is less than 18.5 kg/m² are at a significantly greater risk of having preterm and low birth weight newborns (Han et al, 2011).

There was a very small difference of 0.7% in terms of birth term between cases 22 (22%) and controls 64 (21.3%) that were overweight. Meaning that being overweight is less likely to be a risk factor for preterm birth, among obese women the proportion of preterm births was slightly higher 15 (15%) than that of full term births 39 (13%)

but the difference is very small (2%) for one to confidently conclude whether obesity is risk a factor or not for preterm birth before confirming the association through statistical analysis. These findings at face value seem to be in agreement with Goldenberg et al (2008) who argue that since being underweight is a risk factor for preterm birth being obese or overweight can therefore be a protective factor against preterm birth. However, without statistical evidence, it is difficult to disagree with the study by Cnattingius et al (2013) who found a positive association between obesity and preterm birth and also that the association increases along with maternal BMI because the 2% difference may mean either a positive or negative association between obesity and preterm birth.

4.2.5 Age

Age was divided into four categories namely: (below 20) those who were younger than 20 years, (20-29) those who were aged between 20 and 29 years, (30-34) those who were aged between 20 and 29 years, and (35 and above) were those who were 35 years and above. The findings are provided on figure 4.4 and detailed discussion follows thereafter.

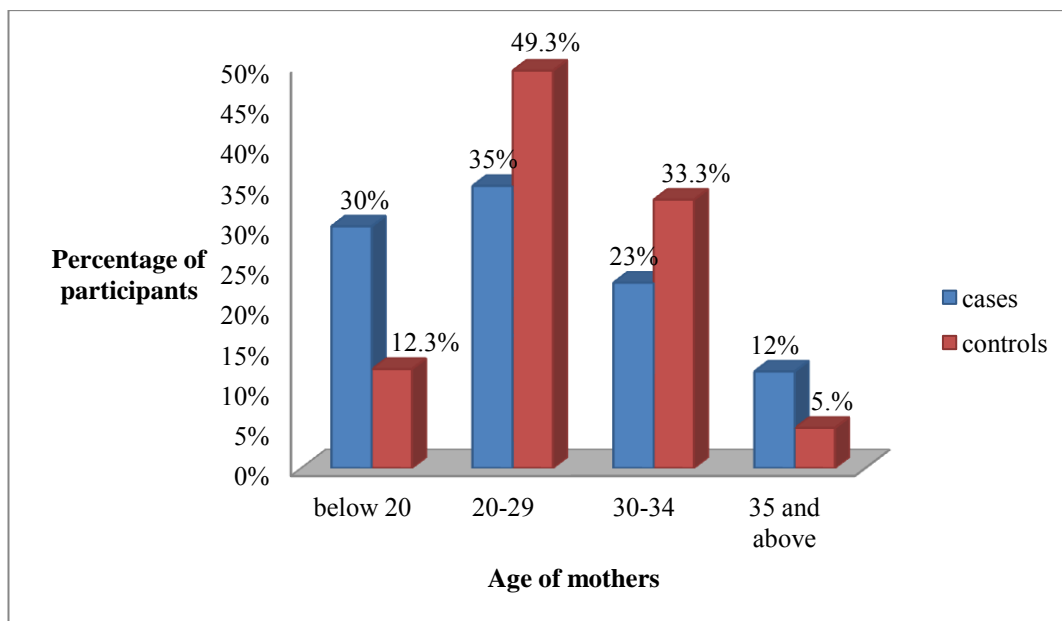


Figure 4.4 Age group distribution and birth term outcome either preterm or full term (n=400)

Figure 4.4 above shows that the majority of women, 306 (76.6%) who gave birth during the study period were in the middle age, that is from the age of 20 up to the age of 34 years. There were more full term babies, 248 (82.6%), born to mothers in the middle age groups compared to preterm babies, 58 (58%). On the contrary mothers below the age of 20 years gave birth to more preterm babies 30 (30%) than full term babies 37 (12.3%) as indicated in the graph above. Few participants gave birth among the older mothers who were 35 years and above 27 (0.1%), however, the results reveal that this age group had more preterm babies 12 (12%) compared to full term ones 15 (5%).

The frequency of preterm birth was high among the younger and older age groups but lower in the middle age groups. The findings are consistent with results from other studies which show that there is a strong association between maternal age and birth term. According to a study that was conducted by Offiah, O'Donoghue and

Kenny (2012) the age of the mother plotted in a graph was found to have an influence on preterm births in a U-shaped manner, meaning that younger and older women had more preterm births compared to middle age women. Offiah O'Donoghue and Kenny (2012) indicated that women under 16 and those above 35 years of age have a two to four percent higher rate of preterm birth compared to those between 21 and 24 years of age. This means that both very young and advanced maternal ages may be risk factors for preterm birth.

The reasons for the increased risk for preterm delivery among older women have not yet been discovered but the increased risk of preterm birth among young adolescents is normally attributed to their biological immaturity and increased prevalence of other risk factors associated with their generally poor socioeconomic condition (Dean et al, 2013; Shama et al 2008; Schoeman, Grove, & Odenhaal, 2005).

4.2.6 Marital status

Marital status was divided into four categories namely: single, married, cohabiting and divorced women. Figure 4.5 below reflects the results of marital status of mothers.

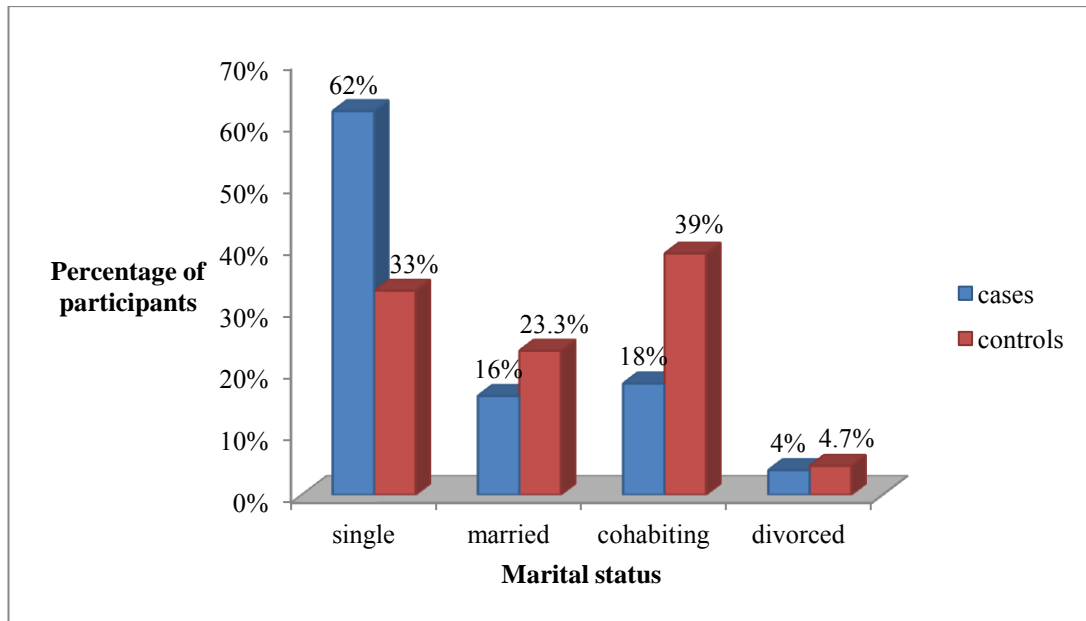


Figure 4.5 Marital status of mothers and birth term outcome either preterm or full term (n=400)

Out of possible 400 mothers who participated in the study 161(40.3%) were single. Figure 4.5 shows that a greater percentage of single mothers 62 (62%) gave birth to preterm babies than full term babies whose number stood at 132 (33%). On the other hand, mothers who were either cohabiting or married 221 (55.3%) gave birth to more full term babies 187 (48%) than preterm ones 34 (34%). There was a small difference in terms of birth term among divorced cases and controls. The reasons for the higher rates of preterm birth among single mothers are not known but are commonly attributed to their relative lack of social support and resources (Arntzen, Moum, Magnus, & Bakketeig, 1996).

The other contributing factor to the high rate of preterm birth among single women in this study could be that, there were many teenagers among cases 30/100 (30%) and almost all the teenagers in this study were single 61/67 (91%). These findings are

in line with the estimates that were revealed by the Namibia Demographic and Health Survey (2013) which showed that roughly one out of five teenagers aged 15 to 19 years surveyed in 2013 were either pregnant or had given birth. This is a very important information to the Namibian nation, and a signal that teenage girls are indulging into sexual activities at a young age.

Part of the findings in this study and evidence from other studies reveal that very young maternal age is strongly associated with preterm birth. Dean et al (2013) state that young girls are not yet biologically prepared to carry pregnancy and lack education, support and basic needs for pregnancy, and all these factors are more likely to be contributing factors to preterm birth.

4.2.7 Highest education level

Education level was divided into four categories namely: (primary school) those who attended between grade one and seven, (junior secondary) those who ended in grade eight or nine or ten, (senior secondary) those who ended in grade 11 or 12, and (tertiary) those who ended at college or university level. The findings on participants' highest education level are displayed on figure 4.6 below followed by discussion.

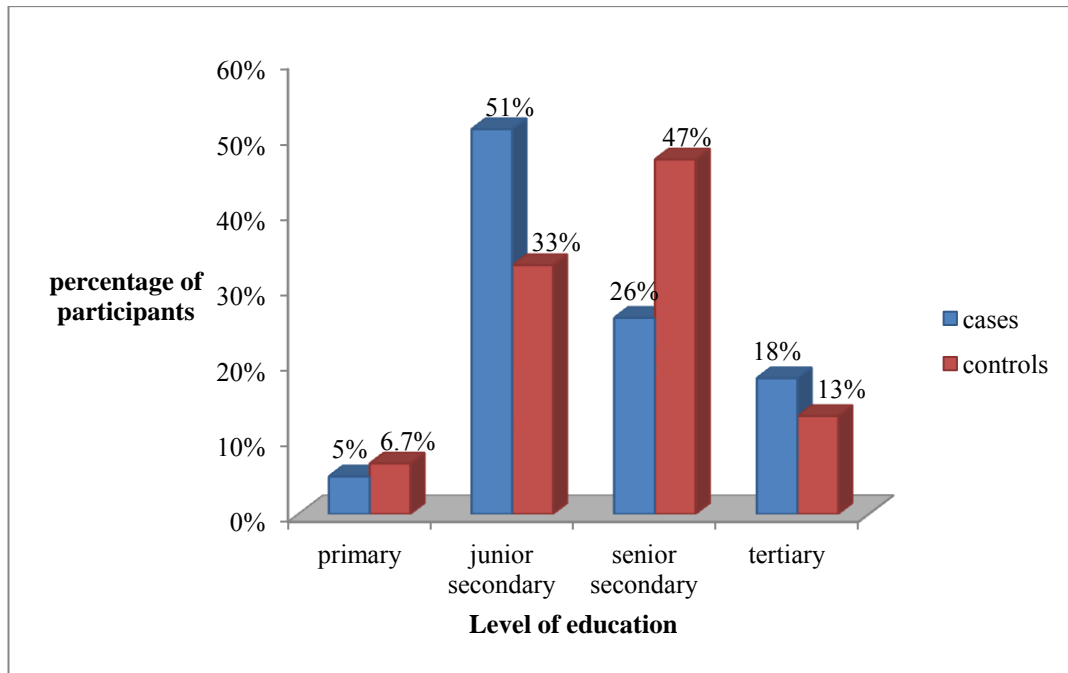


Figure 4.6 Highest level of education that was attained by participants and birth term outcome either preterm or full term (n=400)

The highest number of participants 319 (80%) attained junior and senior secondary level of education. Very few mothers ended at primary level 25 (6.3%) and a small percentage went as far as college or university level. More full term babies were born to mothers who attained senior secondary education level 143 (47.7%) compared to mothers with other education levels. According to the statistics of the study preterm birth seemed to be more common among participants with low education level (junior secondary) than those with high education level (tertiary).

It was not surprising to find more preterm births among women with low education level in this study because this pattern has been found in many countries. Previous studies that were conducted in Europe and other parts of the world reported an elevated risk of preterm birth among women with the lowest education level as compared to women with high education level (tertiary education) (Morgen et al,

2008). Education attainment is one of the factors that are used to approximate socio-economic status (Chomitz, Cheung & Lieberman, 2016).

Low educational attainment as highlighted by Chomitz, Cheung and Lieberman (2016) is reflective of low socio-economic status. Low socio-economic status is generally known of being associated with poverty and poor living conditions such as poor housing, inadequate nutrition and water, unsafe water for drinking and cooking and lack of access to health facilities. All these factors predispose women to preterm birth. Some parts of Windhoek have informal settlements with poor living conditions, -those areas are characterised by lack of electricity for lighting and cooking, houses made up of wood and zinc, overcrowding and inadequate water for drinking and domestic use. The aforementioned living conditions in Windhoek are indicators of low socio-economic status and may be predictive of preterm birth to the population residing in informal settlements.

It was surprising to find a slightly elevated number of preterm births among women who attained tertiary level of education because if low education attainment is reflective of low socio-economic status then it may be assumed that high education attainment may be reflective of high socio-economic status, therefore, women of high socio-economic status are expected to have almost all basic needs and access to quality health care services. The possible explanation for having a slightly elevated number of preterm births among women who attained tertiary level of education could be that some women spend more years studying and only start bearing children when they are old. Advanced maternal age has become a major concern in many parts of the world. Studies including my research have shown that older women who

are 35 years and above are more likely to have preterm babies. Educated women are also likely to be affected by diseases of affluence, especially obesity and diabetes, which are contributing factors to preterm birth (Behrman & Butler, 2007).

4.2.8 Place of residence

Place of residence was divided into three categories namely, high density suburbs, medium density suburbs and low density suburbs. The results on participants' place of residence are presented on figure 4.7 below and further discussed under the table.

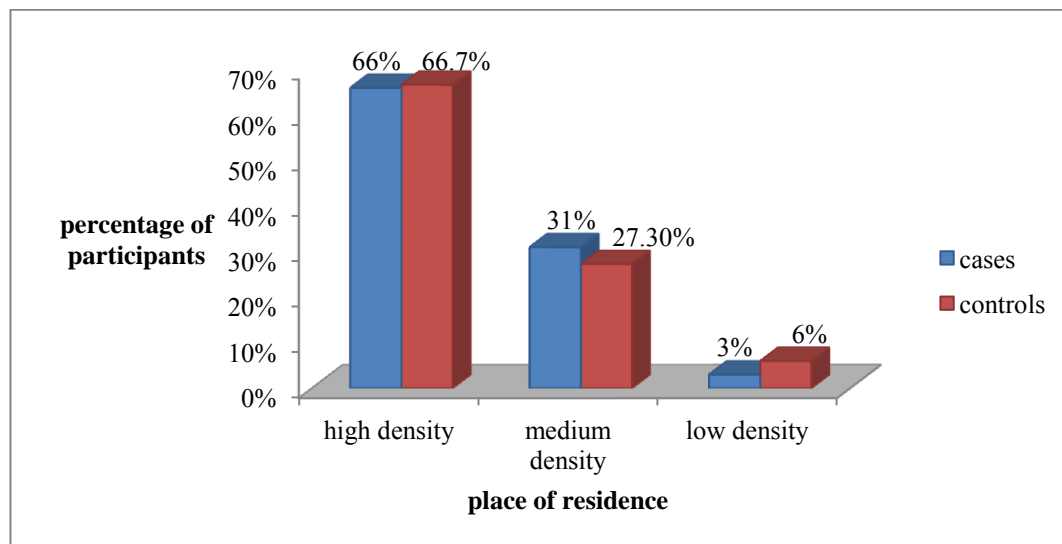


Figure 4.7 Participants' place of residence and birth term outcome either preterm or full term (n=400)

The majority of participants reside in high density suburbs 266 (66.5%) followed by those who reside in medium density suburbs 113 (28.3%) and very few participants 21 (5.3%) came from low density suburbs. There was no difference in terms of birth term among cases and controls who reside in high density suburbs. However, compared to other suburbs, the high density suburbs contributed the largest number of preterm births (66%). Small differences in terms of birth term were identified in

participants who reside in medium and low density suburbs with mothers from medium density suburbs having slightly more preterm births (31%) than full term births (27.3%) and mothers from low density suburbs having more full term births (6%) than preterm ones (3%).

These findings confirm that place of residence might be a risk factor for preterm birth. As highlighted before, some high density suburbs in Windhoek are characterised by poor living conditions (such as lack of electricity for lighting and cooking, houses made up of wood and zinc, overcrowding and inadequate water for drinking and domestic use). All these factors are indicators of low socio economic status and are predictive of preterm birth (Chomitz, Cheung & Liebermaan, 2016). On the other hand low and medium density suburbs in Namibia are characterised with high socio-economic status; high education level, good living conditions and better quality of life, -these factors have been linked to reduced risk of preterm birth (Grjibovski, Bygren & Svartbo, 2002; Chomitz, Cheung & Liebermaan, 2016).

The above explanations give the reason for having a high percentage of preterm births from high density suburbs compared to other suburbs (low and medium density suburbs).

4.2.9 Type of work

Type of work was divided into six categories namely, (physically demanding) those who were doing too much manual work involving lifting of heavy things, (prolonged standing) those who were continuously standing for more than three hours per day (shift work) those who had work shifts including night shifts, (long working hours) those who were working for more than 10 hours per day, (none strenuous work)

those who had office jobs with normal working hours, and (not working) those who were unemployed completely and not even self-employed. Table 4.2 reflects the findings on participants' type of work and birth term outcome, the results are further discussed in detail in the discussion that follows the table.

Table 4.2 Type of work of participants and birth term outcome either preterm or full term (n=400)

	Categories	Birth term outcome	
		Cases (Preterm)	Controls (Full term)
Work type	Physically demanding	19 (19%)	25 (8.3%)
	Prolonged standing	22 (22%)	41 (13.7%)
	Shift/ night work	1 (1%)	17 (5.7%)
	Long working hours	5 (5%)	46 (15.3%)
	None strenuous work	15 (15%)	81 (27%)
	Not working	38 (38%)	90 (30%)
	Total	100 (100%)	300 (100%)

Preterm birth was high among participants who were doing work that was physically demanding or that involved prolonged standing continuously for more than three hours per day 19 (19%) and 22 (22%) respectively. Work strain is hypothesised to be a contributor to adverse reproductive outcomes, both for the mother and the baby. Physically demanding work, shift work, long hours spent standing and heavy lifting have been consistently associated with increased risk of preterm birth (Blencowe et al 2013a). Mothers who were not involved in strenuous work had the highest

percentage of full term births 38 (38%) compared to other groups. Interestingly, those who had long working hours and who were doing shift work also had more full term babies as compared to preterm babies in this study, and this contradicts Blencowe et al (2013a) findings about long working hours and shift work.

Participants who were not working (38%) contributed the highest percentage of preterm births. This was expected because most women who are not working (unemployed) may suffer lack of income and social support and normally have low socioeconomic status which is accompanied by many predisposing factors such as lack of basic needs and access to health care services. Unemployed mothers may be at high risk of delivering preterm babies due to effects of poverty, whereas those who have jobs but decide to take maternity leave may be at a lower risk of delivering preterm babies since they get enough time to rest, exercise, eat and are free from stress and strain related to work, -moreover they experience less or no effects of poverty because they have money to cater for their basic needs and health care services.

4.2.10 Smoking habits

In figure 4.8 below ‘yes’ represents participants who smoked during pregnancy and ‘no’ represents those who did not smoke during pregnancy.

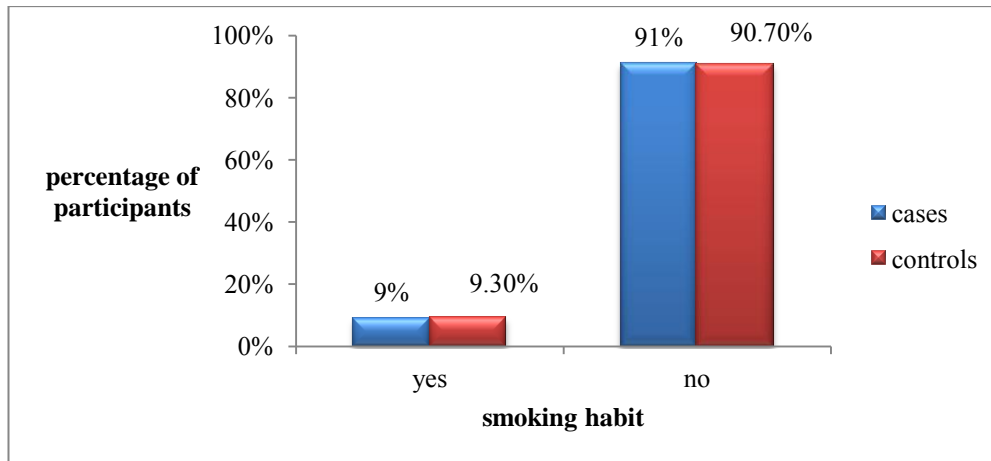


Figure 4.8 Smoking habits of mothers and birth term outcome either preterm or full term (n=400)

The majority of participants 363 (90.8%) did not smoke cigarette during pregnancy, only 37 (9.3%) smoked. The results indicate no differences in terms of birth term between cases and controls meaning that cigarette smoking may not be a risk factor for birth term.

These results seem to refute what is well-known about cigarette smoking because smokers tend to have less weight gain during pregnancy which is associated with spontaneous preterm delivery and low birth weight infants. Smoking during pregnancy also increases the chances of placental abruption and rupture of membranes resulting in preterm labour (Cha & Masho, 2013).

The possible explanation for finding no association between cigarette smoking and birth term in this study might be that, participants who smoked during pregnancy were not regular smokers or maybe they quit smoking during the first trimester before the cigarette affected the pregnancy. Behrman and Butler (2007) indicate that the influence of cigarette smoking on pregnancy outcomes like preterm birth is most

notable in the third trimester and there is no increased risk that has been detected for former smokers who quit before the onset of pregnancy or early in pregnancy. Table 4.3 below shows the number of cigarettes that were smoked by participants per day and the birth term outcome.

Table 4.3 Number of cigarettes smoked per day and birth term outcome either preterm or full term (n=400)

	Categories	Birth term outcome	
		Preterm	Full term
Number of cigarettes smoked per day	None	91 (91%)	271 (90.3%)
	1 to 2 cigarettes	3 (3%)	23 (7.7%)
	3 to 5 cigarettes	6 (6%)	6 (2%)
	Total	100 (100%)	300 (100%)

Among participants who smoked during pregnancy the majority 26/38 (68%) smoked few cigarettes per day (one or two cigarettes). Results could be indicating that probably smoking few (one or two) cigarettes per day is not associated with adverse pregnancy outcomes like preterm birth. This could be another reason for having no relationship between cigarette smoking and birth term in this study. However, even if this might be the case, cigarette smoking during pregnancy should be avoided by all means to prevent adverse reproductive outcomes associated with smoking.

4.2.11 Alcohol drinking habits

Alcohol drinking was divided into two categories namely, (yes) those who drank alcohol during pregnancy and (no) those who did not drink alcohol during pregnancy. The results are presented in figure 4.9 below.

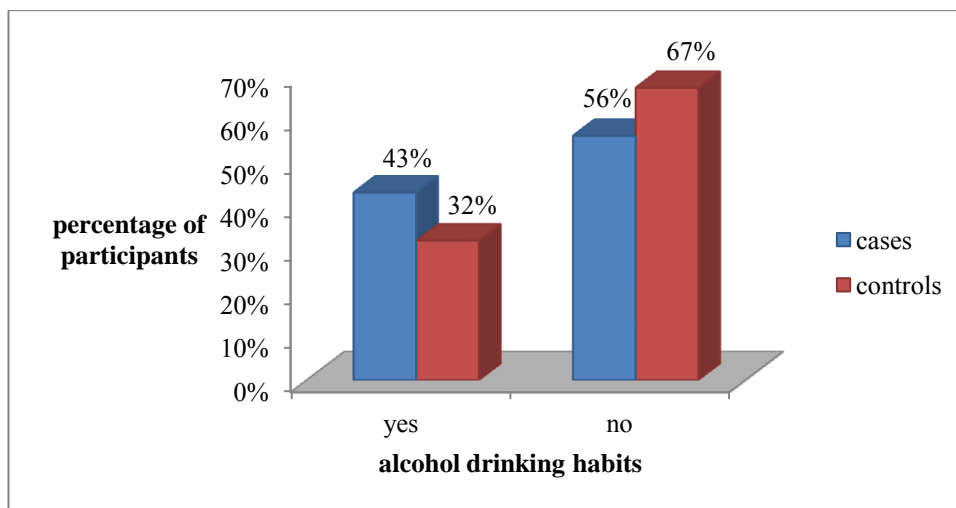


Figure 4.9 Alcohol drinking habits of women and birth term outcome either preterm or full term (n=400)

Mothers who drank alcohol during pregnancy gave birth to more preterm babies 43/100 (43%) than full term ones 96/300 (32%). Among those who did not drink alcohol during pregnancy more full term babies were born 205/300(67%) compared to preterm babies 56/100 (56%). Previous research reveals that consuming high levels of alcohol during pregnancy have detrimental effects on pregnancy outcomes and women who take more than one drink a day are at an increased risk of preterm labour (Offiah, O'Donoghue, & Kenny, 2011). The drinking frequency of participants in this study is shown in table 4.4 below.

Table 4.4 Alcohol drinking frequency and birth term outcome (n=400)

	Categories	Birth term outcome	
		Preterm	Full term
Drinking frequency	Never	57 (57%)	206 (68.7%)
	Occasional	11 (11%)	70 (23.3%)
	1 to 2 times per week	29 (29%)	21 (7.0%)
	Three times or more per week	3 (3%)	3 (1%)
	Total	100 (100%)	300 (100%)

Table 4.4 show that more controls 206 (68.7%) than cases 57 (57%) did not drink alcohol during pregnancy. Among participants who drank alcohol during pregnancy a greater number of controls were occasional drinkers 70 (23.3%) on the other hand more cases drank once or two times per week 29 (29%). There were very few participants who indicated that they drank three times or more per week 6 (1.5%). The results show that the risk of preterm birth was high among participants who drank once or twice per week.

According to Albertsen et al (2004) the risk of preterm delivery was high among women who had seven or more drinks a week during pregnancy was compared to non-drinkers, but no increased risk of preterm birth was found if less than four units of alcohol were consumed per week. The possible explanation for having more preterm births among women who drank only once or twice per week in my study could be due to under-reporting of intake by participants because the respondents tend to underreport behaviours that are considered to be undesirable or negative because of fear of what might follow. The other explanation could be that, may be participants were having heavy drinking sessions that ended up amounting to more than recommended alcohol units per week. The safest approach for pregnant women is not to drink alcohol at all in order to keep the risks to the baby at minimum.

4.2.12 Use of illicit drugs

Use of illicit drugs was divided into two categories namely, (yes) those who used illicit drugs during pregnancy and (no) those who did not use illicit drugs when they were pregnant. The findings are tabulated on table 4.5 and detailed discussion is provided under the table.

Table 4.5 Use of illicit drugs and birth term outcome (n=400)

Use of illicit drugs	Categories	Birth term outcome	
		Preterm	Full term
	Yes	0 (0%)	0 (0%)
	No	100 (100%)	300 (100%)
	Total	100 (100%)	300 (100%)

None of the participants reported drug use during their pregnancy. As mentioned before on literature review, the respondents tend to underreport or not report at all behaviours that are considered to be undesirable or negative (Parna et al, 2005). Since drugs are illegal in Namibia and can result in someone being arrested it is possible that guilty participants withheld the truth about their illicit drug use due to fear of being arrested after disclosing the truth.

4.2.13 Exercise done during pregnancy

Exercise that was done by participants during pregnancy was divided into six categories that is, (gym) those who regularly went to the gym to exercise, (house work) those who did more house work, (walking) those who were walking a lot during pregnancy either as part of exercise or as part of their day to day living, (sports) those who were involved in sporting activities when they were pregnant, (stretching) those who regularly exercised by stretching body parts like the arms, legs, neck and so on and (none) were those who did not do any form of exercise. Table 4.6 reflects the results.

Table 4.6 Exercise done during pregnancy and birth term outcome (n=400)

	Categories	Birth term outcome	
		Preterm	Full term
Exercise done during pregnancy	Gym	3 (3%)	19 (6.3%)
	House work	12 (12%)	51 (17%)
	Walking	30 (30%)	99 (33%)
	Sports	5 (5%)	19 (6.3%)
	Stretching	8 (8%)	29 (9.7%)
	None	42 (42%)	83 (27.7%)
	Total	100 (100%)	300 (100%)

Table 4.6 shows that the most common form of exercise among the participants was walking, probably because most of them live in high density suburbs and they did not have cars to drive around instead they would walk to and from places. All forms of exercise including housework seemed to be protective against preterm birth. Lack of exercise on the other hand, seemed to be a risk factor for preterm birth; mothers who did not exercise during pregnancy were more likely to deliver preterm babies (42%) than full term babies (27.7%).

Some controversy exists over the safety of exercise during pregnancy; some people think that exercise might increase the risk of preterm birth. Years back exercise during pregnancy was discouraged based on cultural reasons rather than scientific evidence because of perceived risk of problems such as early pregnancy loss and reduced placental circulation (Schramm, Stockbauer, & Hoffman, 1996). Nowadays most women are engaging in regular exercise during pregnancy. To the researcher's knowledge and experience, in Namibia, part of antenatal care services include, encouraging expecting mothers to do light exercises such as stretching and walking in order to keep fit during pregnancy.

This study's findings are supported by the American College of Obstetrics and Gynaecologists which recognises the benefits of exercise during pregnancy and has recommended exercise during pregnancy but stresses that intense activities such as jogging and cycling that might lead to complications should be avoided (Artal & O'Toole, 2003). Barakat et al (2008) also confirm that engaging in moderate, supervised exercise programmes until the end of gestation does not affect gestational age.

4.2.14 Number of antenatal clinic visits

Figure 4.10 shows the number of antenatal visits by participants during pregnancy

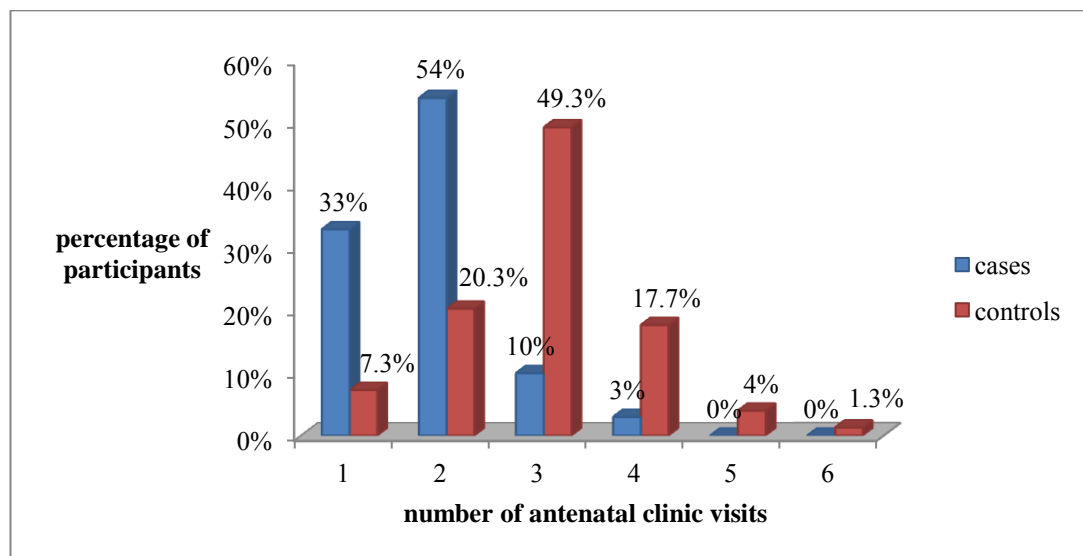


Figure 4.10 Number of antenatal clinic visits and birth term outcome either preterm or full term (n=400).

The above figure shows that the majority of women who visited antenatal clinic once or twice during their pregnancy had more preterm births 87 (87%) than full term births 83/300 (27.6%). Participants who visited antenatal clinic three times or more gave birth to more full term babies compared to preterm ones. These findings suggest

that few antenatal clinic visits seem to be a risk factor for preterm birth. The WHO's new antenatal care model increased the number of contacts a pregnant woman has with health providers throughout her pregnancy from four to eight visits (World Health Organisation, 2016).

Women in most developing countries delay to seek antenatal care (Bada et al, 2005), this might be the reason why most of them end up attending ANC only once or twice for the entire pregnancy. This practice reduces their chance of receiving antenatal care services that may be helpful in identifying emergencies that need interventions on time.

Through mingling and talking to expecting mothers the researcher discovered that most of the women in Windhoek avoid visiting antenatal clinic during the first trimester because they do not want to be given follow up dates which they consider tedious and time consuming. This might mean that women in Windhoek do not fully understand the whole purpose of antenatal care or they simply do not want to comply to it because maybe repeated visits to ANC irritate them. This is an alarm that health education on the importance of ANC visits is needed in Windhoek or the whole Namibia.

4.2.15 First antenatal clinic visit by trimester

A normal pregnancy lasts for nine months, pregnancy gestational age can also be measured by trimesters, there are three trimesters within a normal pregnancy, therefore expecting mothers are expected to visit ANC regularly during pregnancy. The WHO had recommended four ANC visits per pregnancy but now it has increased the number to eight visits. Antenatal clinic visits by trimester were divided

into three categories namely, first, second and third trimester. Figure 4.11 shows the trimester of participants' first ANC visit.

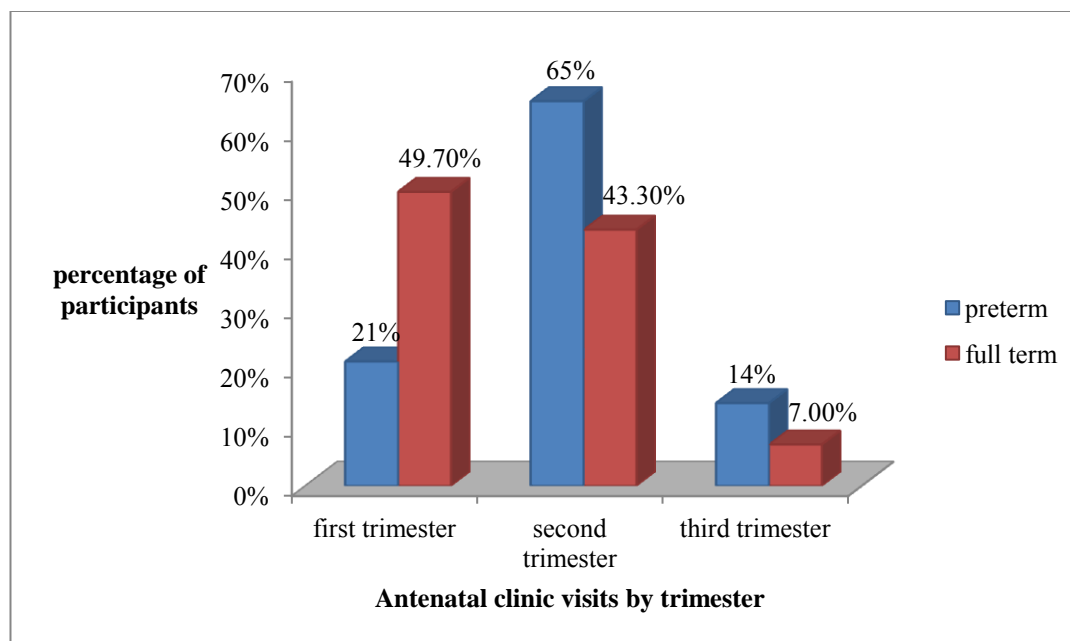


Figure 4.11 First antenatal clinic visit according to trimester and birth term outcome either preterm or full term (n=400).

Out of 170 (42.5%) participants who visited antenatal clinic during the first trimester 149 (49.7%) had full term births and 21 (21%) had preterm births. The explanation for these findings could be that early antenatal clinic visits provide an opportunity for expecting women to be assessed by health professionals at multiple times during pregnancy in order to promote full term birth. Early ANC visit gives pregnant mothers a chance to access a package of interventions aimed at ensuring a healthy pregnancy and improving maternal and prenatal health. Maternal women also receive basic services such as health education which have a potential impact on reducing preterm birth rates and other adverse birth outcomes; - women at high risk of preterm birth may be identified during ANC visitations and prevention measures may be taken (Leung, 2004).

Mothers who started visiting antenatal clinic in the second gave birth to more preterm babies 65 (65%) than full term babies 130 (43.3%), the same applied to those who started visiting ANC in the third trimester as they also had more preterm births 14 (14%) than full term ones 21 (7%). The findings are in agreement with Feresu, Harlow, Welch and Gillespie (2004) who, in their study found that, delayed or lack of antenatal care was strongly associated with adverse birth outcomes, particularly preterm birth.

Women who delay antenatal clinic visits miss out on very important information, services and interventions that could help in prevention of preterm birth. It is not only in Namibia where women delay antenatal clinic visits but in most developing countries including Zimbabwe women delay to seek antenatal care (Bada et al, 2005). This could be due to lack of adequate knowledge on the importance of ANC or inaccessible health care services. Awareness programmes on the importance of ANC visits to women in the child bearing age are needed in Namibia.

4.2.16 Supplementary tablets intake

Supplementary pills intake (multivitamins and iron tablets) was divided into four categories namely; (everyday) those who took the supplementary pills daily, (sometimes) those who were not consistent in their supplementary pills intake, (rarely) those who took the supplementary pills once in a while and (never) were those who did not take supplementary pills at all during pregnancy. The findings are indicated on table 4.7 below.

Table 4.7 Supplementary tablets intake and birth term outcome (n=400)

	Categories	Birth term outcome	
		Preterm	Full term
Supplementary pills intake	Everyday	32 (32%)	144 (48%)
	Sometimes	44 (44%)	122 (40.7%)
	Rarely	14 (14%)	17 (5.7%)
	Never	10 (10%)	17 (5.7%)
	Total	100 (100%)	300 (100%)

Participants who took supplementary tablets everyday were more likely to deliver full term babies. Table 4.7 shows that mothers who took supplementary tablets everyday had more full term births 144(48%) than preterm births 32(32%). This indicates that taking supplementary tablets every day during pregnancy reduces the risk of preterm birth and promotes full term birth. Participants who did not take supplementary tablets every day had an increased risk of preterm delivery compared to those who took them every day.

These results are in agreement with Vahratian et al (2004) study who found that compared with nonusers, women who used multivitamin supplements prior to conception and during pregnancy had reduced risk of preterm birth. Goldenberg et al (2008) also reveals that women with low serum concentrations of iron, folate, or zinc are prone to have more preterm births than those with measurements within the normal range.

From the results of this study and findings by previous researchers highlighted above one can conclude that supplementary tablets intake, in this case multivitamins and

iron or folate tablets, reduce the risk of preterm birth if they are taken every day during pregnancy.

4.2.17 Dietary intake during pregnancy

Dietary intake was divided into six food groups namely, fruit intake, vegetable intake, meat intake, carbohydrate intake, fast food intake and milk and milk products intake. Each food group was further divided into five categories namely, (low) those who took that type of food once or less than once per week, (moderate) those who took that type of food two to four times per week, (high) those who took that type of food five times or more per week, (very high) were those who took that type of food everyday and (never) those who did not eat that type of food at all. The results on participants' dietary intake during pregnancy are provided on table 4.8.

Water intake was also included under dietary intake and it was divided into four categories namely, 1 to 2 glasses per day, 3 to 5 glasses per day, 6 or more glasses per day and (don't know) those who did not remember the number of glasses of water they drank per day on average. Table 4.8 shows the results.

Table 4.8 Dietary intake during pregnancy and birth term outcome (n=400)

Dietary intake	Categories	Birth term outcome			
		Preterm		Full term	
		Count	Percent (%)	Count	Percent (%)
Fruits intake	Low	49	(49%)	100	(33.3%)
	Moderate	25	(25%)	123	(41%)
	High	20	(20%)	65	(21.7%)
	Very high	4	(4%)	4	(1.3%)

	Never	2	(2%)	8	(2.7%)
	Total	100	(100%)	300	(100%)
Vegetable intake	Low	11	(11%)	31	(10.3%)
	Moderate	53	(53%)	99	(33%)
	High	30	(30%)	157	(52.3%)
	Very high	6	(6%)	9	(3%)
	Never	0	(0%)	4	(1.3%)
	Total	100	(100%)	300	(100%)
Meat intake	Low	21	(21%)	15	(5%)
	Moderate	41	(41%)	150	(50%)
	High	20	(20%)	116	(38.7%)
	Very high	17	(17%)	17	(5.7%)
	Never	1	(1%)	2	(0.7%)
	Total	100	(100%)	300	(300%)
Carbohydrate intake	Low	1	(1%)	0	(0%)
	Moderate	3	(3%)	21	(7%)
	High	23	(23%)	71	(23.7%)
	Very high	73	(73%)	208	(69.3%)
	Never	0	(0%)	0	(0%)
	Total	100	(100%)	300	(100%)
Fast foods intake	Low	40	(40%)	144	(48%)
	Moderate	20	(20%)	88	(29.3%)
	High	15	(15%)	27	(9%)
	Very high	5	(5%)	0	(0%)
	Never	20	(20%)	41	(13.7%)
	Total	100	(100%)	300	(100%)
Milk and milk products intake	Low	43	(43%)	51	(17%)
	Moderate	39	(39%)	159	(53%)
	High	6	(6%)	79	(26.3%)
	Very high	6	(6%)	2	(0.7%)
	Never	6	(6%)	9	(3.0%)
	Total	100	(100%)	300	(100%)
Water intake	1 to 2 glasses	30	(30%)	52	(17.3%)
	3 to 5 glasses	20	(20%)	91	(30.3%)
	6 glasses or more	47	(47%)	150	(50%)
	Don't know	3	(3%)	7	(2.3%)
	Total	100	(100%)	300	(100%)

- **Dietary fruit and vegetable intake**

Low fruit intake was more common among mothers who had preterm births (cases) 49/100 (49%) compared to those who had full term births (controls) 100/300 (33.3%). Moderate fruit intake seems to reduce the risk of preterm birth, hence mothers who had moderate fruit intake gave birth to more full term babies 123 (41%) than preterm ones 25 (25%). Because of few participants in other categories the differences between cases and controls in terms of birth term were not clear.

Participants who had high vegetable intake had more full term births 157 (52.3) than preterm births 30 (30%). Moderate vegetable intake did not reduce the risk of preterm birth, as it is evident that, participants who had moderate intake of vegetables had more preterm births (53%) than full term ones (33%).

Fruits and vegetables contain important dietary nutrients that are needed during pregnancy. They are good sources of various essential vitamins and minerals such as vitamin C, iron, folate, vitamin A and calcium just to mention a few, as well as dietary fibre to aid digestion. Vitamin C, found in many fruits and vegetables helps in the absorption of iron. Iron is an essential element for blood production, about 70% of body's iron is found in red blood cells of the blood called haemoglobin which is responsible for transporting oxygen in the blood from the lungs to other body tissues. Iron also forms myoglobin found in muscle cells. Folate found in dark green vegetables is needed in the body to make DNA and other genetic material and also for body cells to divide. Vitamin A helps to maintain healthy bones, soft tissue, mucus membranes and skin and calcium is for strong bones (Mayo Clinic Staff, 2014). The findings of this study reveal that high fruit and vegetable intake is very

important in prevention of preterm births, and promotes full term birth, whereas, low intake of fruits and vegetables during pregnancy may be a risk factor for preterm birth.

- **Dietary meat intake**

On one hand low meat intake was common among cases 21 (21%) than in controls 15 (5%). On the other hand, - moderate and high meat intake was common among the controls. This shows that taking meat on average two to five times per week reduces the risk of preterm birth. Surprisingly participants who had very high meat intake had more preterm births 17/100 (17%) compared to full term births 17/300 (5.7%). This indicates that too much intake of meat may increase the risk of preterm birth. Therefore it is important that mothers be advised on how to maintain a balanced intake of meat.

Meat is a good source of proteins as well as B vitamins and iron. Protein is crucial for the foetal growth. Healthy foetal development is dependent on the availability of adequate protein, which provides the basic building blocks necessary for formation of enzymes, antibodies, muscle and collagen which is used as the framework for skin, bones, blood vessels, and other body tissues. It is therefore advisable that the mother consumes adequate protein to meet the needs of her growing foetus (Lisa & Brown, 2011).

Fish is an excellent source of protein as well as omega-3 fatty acids, which can promote the baby's brain development (Mayo Clinic Staff, 2014). It is however not advisable to take red meat everyday because some red meats are high in saturated

fatty acids which raise blood cholesterol levels. A high level of Low Density Lipoprotein (LDL) cholesterol increases the risk of heart diseases, type 2 diabetes, obesity and some cancers.

- **Dietary carbohydrate intake**

Starch intake was very high across the whole study sample. The majority of participants had either high 94 (23.5%) or very high 281 (70.3%) carbohydrate intake. There were few participants who reported low and moderate intake of starch in their diet. This could be an indication that carbohydrate is a readily available and accessible nutrient in many homes. Since the majority of participants from both cases and controls had high intake of carbohydrates in their diet, the results did not show clear differences between cases and controls in terms of birth term and carbohydrate intake. It is however imperative to balance carbohydrates with other nutrients because to the researcher's knowledge too much carbohydrate intake can lead to health conditions such as obesity, type 2 diabetes and cardiovascular diseases.

- **Fast food intake**

Most of the participants 184/400 (46%) had low intake of fast foods during pregnancy and some participants 61/400 (15.3%) did not consume fast foods at all when they were pregnant. Among those who consumed fast foods preterm birth was higher 15 (15%) than full term birth 27 (9%) among participants who had high intake of fast foods. Moderate intake of fast foods did not seem to increase the risk of preterm birth since they were more full term births 88/300 (29.3%) than preterm births 20/100 (20%) among participants who had moderate intake of fast foods.

- **Dietary milk and milk products intake**

Women who had low intake of milk and milk products gave birth to more preterm infants 43/100 (43%) than full term ones 51/300 (17%). There were more full term births 159 (53%) than preterm births 39 (39%) among women who had moderate intake of milk and milk products. Milk contains proteins that are needed for the growth of the foetus, iron for blood production and calcium for strong bones. According to the results of this study moderate and high intake of milk seemed to promote full term birth and reduce preterm birth.

- **Average glasses of water taken per day**

The majority of the participants, 197 (49.3%) drank six glasses of water or more per day. There were more preterm births than full term births among participants who drank less water (one to two glasses per day) during their pregnancy. Taking three glasses of water or more seemed to reduce the risk of preterm birth and promote full term birth.

To conclude, the results of this study on diet reveal that a balanced diet is needed during pregnancy. Further research is needed on maternal dietary intake and its association with preterm birth looking into specific individual food items.

4.2.18 Inter-pregnancy interval

The inter-pregnancy intervals were divided into six categories namely, (<6 months) those who conceived in less than six months after the previous delivery, (6 months - 1 year) those who conceived from six months to one year after the previous delivery, (18 months - <2 years) those who conceived from 18 months to less than two years after the previous delivery, (2 years – 4 years) those who conceived from two years

to four years after the previous delivery, (first child) those who were giving birth for the first time and (5 years and above) those who conceived in five years or more after the previous delivery. The results are highlighted in figure 4.12 below.

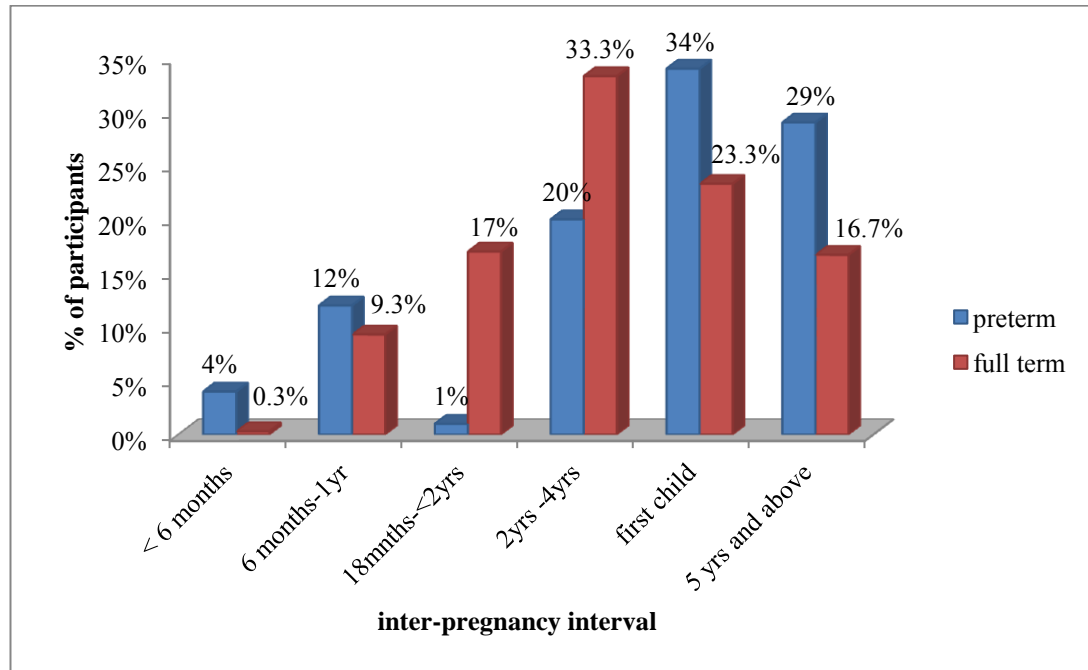


Figure 4.12 Inter-pregnancy interval and birth term outcome either preterm or full term. (n=400)

Figure 4.12 shows that high frequencies of preterm birth were found among women who conceived very early after the previous delivery. These were women who conceived again before a year lapsed after giving birth to the previous baby. The result also indicated that women who were giving birth for the first time and those who had long inter-pregnancy spacing interval of five years or more had more preterm births than full term births.

These results are in line with some research findings detailed under literature review, which show that there is a raised risk of preterm birth in pregnancies arising within

close temporal proximity to a previous delivery and pregnancies that take place after a long inter-pregnancy spacing interval of about 60 months or longer (Barros et al, 2010). According to WHO (2005) the recommended interval after a birth before attempting a new pregnancy should be at least 24 months in order to reduce the risk of adverse birth outcomes like preterm birth. Shorter inter-pregnancy intervals do not give the mother enough time to recover fully from the previous pregnancy in terms of nutrition stores, body strength, uterus recovery and even mental preparedness (Goldenberg et al, 2008).

The explanation for having more preterm births among women who were giving birth for the first time could be that the majority of these women were teenagers. As indicated before very young maternal age has been associated with preterm birth because young girls are not biologically prepared to carry a baby and in most cases they lack education and support (Dean et al, 2013).

4.2.19 Intent to become pregnant

Intention to fall pregnant was divided into four categories namely, (wanted) those who planned for the pregnancy and wanted a child now, (mistimed) those who did not want the child now but who would want to have one at some point, (unwanted) those who did not want to have a child at all, and (unexpected) those who fell pregnant unexpectedly and did not want the child now. Figure 4.13 displays the results.

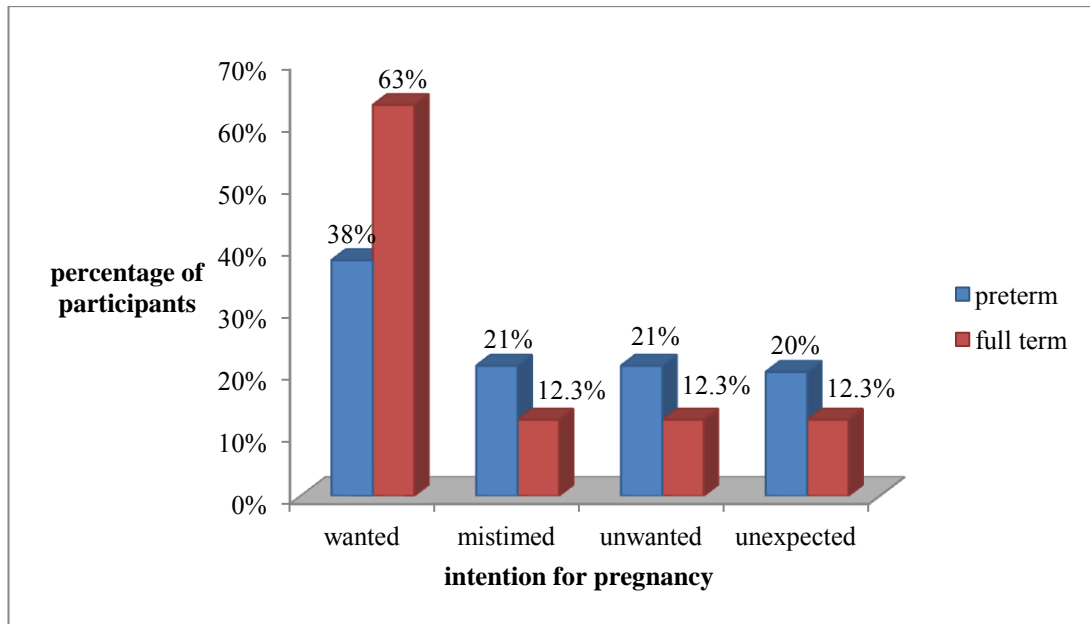


Figure 4.13 Intent to have a pregnancy and birth term outcome either preterm or full term (n=400)

Figure 4.13 reveals that mothers who had wanted pregnancies had more full term births 189 (63%) than preterm births 38 (38%). In contrast, participants who had mistimed, unwanted and unexpected pregnancies had more preterm births compared to full term birth. Having unintended pregnancy increased the risk of preterm birth while having wanted pregnancy seemed to be a protective factor against preterm birth.

Although unintended pregnancies occur among women across the socio-demographic spectrum, they are disproportionately likely among mothers who are adolescent, unmarried or over the age of 40 (Behrman & Butler, 2007). This could explain my study's findings since most of the participants 161 (40.3%) were single women and among single women there were more adolescents 67 (41.6%) who were

probably not yet ready to have children. It is always a dream of most of the married couples to have children but this is not the case with most of unmarried women.

4.2.20 Sexually abused during pregnancy

In the graph below ‘yes’ represents participants who were sexually abused during pregnancy and ‘no’ represents those who were not sexually abused during pregnancy.

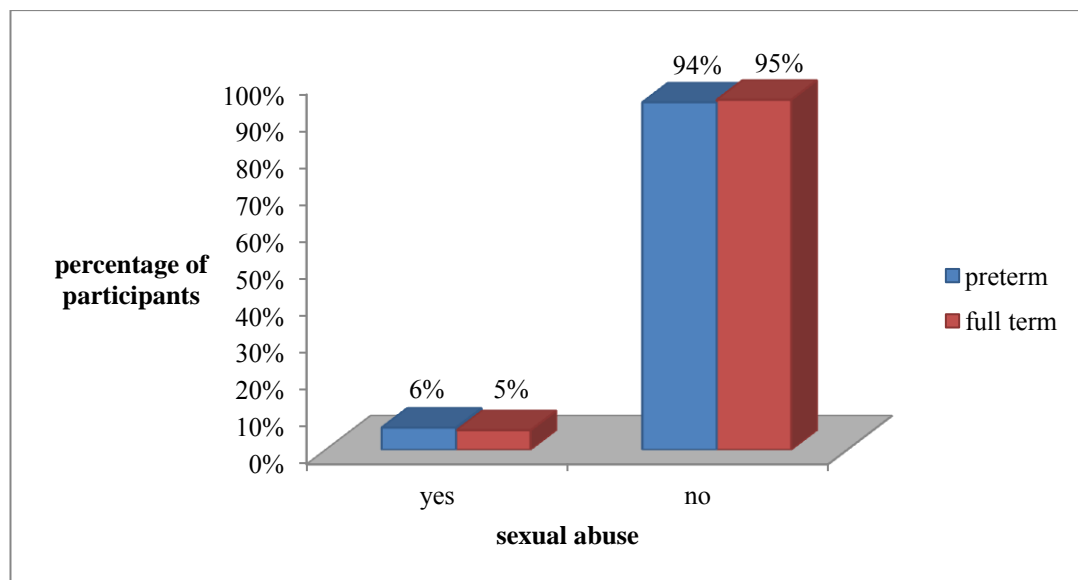


Figure 4.14 Sexually abused during pregnancy and birth term outcome either preterm or full term (n=400)

The majority of participants 378 (94.5%) were not sexually abused during pregnancy. Although there were no differences between sexually abused women and those who were not abused in terms of birth term, the 22 (5.5%) who were sexually abused are worth reporting because it shows that there is sexual abuse that is going on in the communities and intervention is needed to end that risky behaviour.

4.3.21 Staying with smokers

In figure 4.15 below ‘yes’ represents participants who stayed with smokers during pregnancy and ‘no’ represents those who did not stay with smokers during pregnancy.

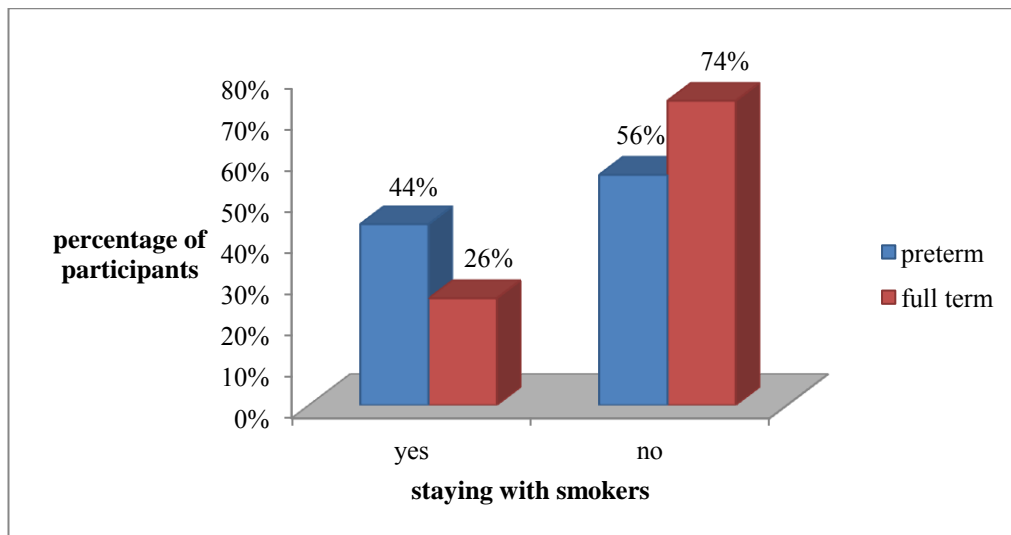


Figure 4.15 Staying with smokers and birth term outcome either preterm or full term (n=400)

Figure 4.15 shows that participants who stayed with smokers had more preterm births 44 (44%) than full term ones 104/300(34.7%). In contrary those who did not stay with smokers had more full term babies 296 (74%) than preterm ones 56 (56%). Most mothers in this study did not smoke during pregnancy and literature reveals that there is no increased risk that has been detected from former smokers who quit before the onset of pregnancy or early in pregnancy Berman & Butler, 2007, therefore the study findings indicate that even if women themselves do not smoke tobacco, second hand smoke might increase the risk of preterm birth.

4.2.22 Partner smoking habits

In figure 4.16 below ‘yes’ represents participants who have partners who smoke and ‘no’ represents those with partners who do not smoke.

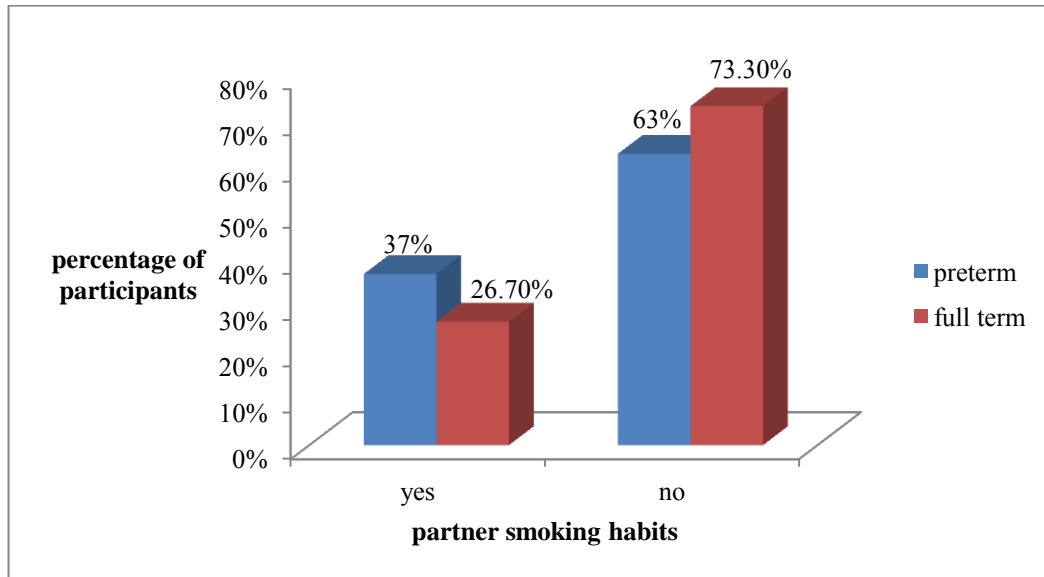


Figure 4.16 Partner smoking habits and birth term outcome (n=400)

Participants who had partners who smoke cigarette had more preterm births 37 (37%) than full term births 80 (26.7%). In contrary those who had partners who do not smoke had more full term births 220 (73.3%) than preterm ones 63 (63%). This still confirms the fact that second hand smoke has negative effects on birth outcomes. It therefore becomes imperative to involve men in smoking cessation programmes and preconception counselling in order to reduce women’s exposure to second hand smoke.

4.2.23 Partner alcohol drinking habits

In figure 4.17 below ‘yes’ represents participants who have partners who drink alcohol and ‘no’ represents those with partners who do not drink alcohol.

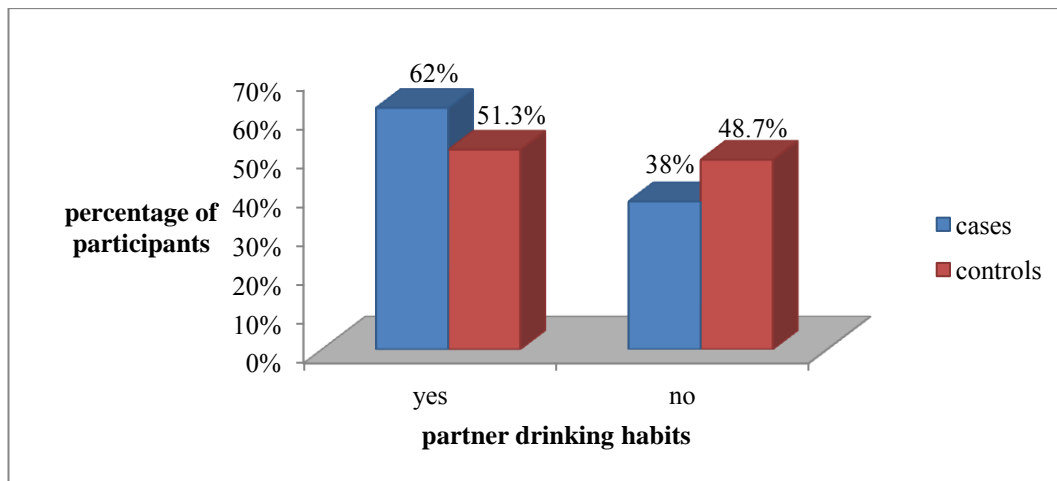


Figure 4.17 Partner alcohol drinking habits and birth term outcome either preterm or full term (n=400)

Women who had partners who drink alcohol had more preterm births 62 (62%) compared to those with partners who do not drink alcohol 38 (38%). From the researcher’s knowledge this trend can be explained by that men who drink alcohol tend to be poor budgeters, abusive and violent to their partners and are less supportive towards the family. Such behaviours may predispose women to preterm birth.

4.2.24 Exposure to partner violence

Figure 4.18 emphasises the exposure of pregnant women to partner violence. Participants who answered ‘yes’ were those who had partners who exposed them to violence during pregnancy and those who answered ‘no’ represents those with partners who did not expose them to violence during pregnancy.

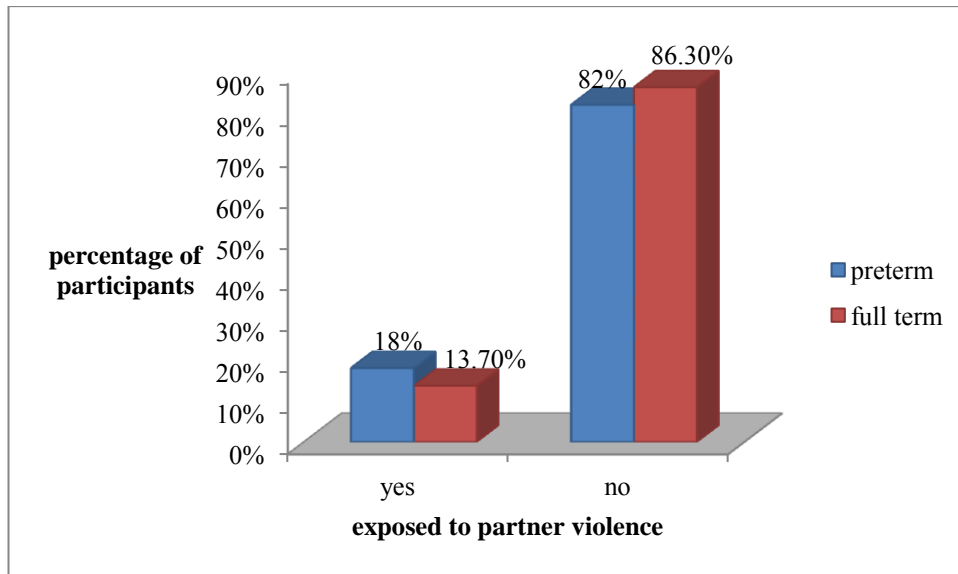


Figure 4.18 Exposure to partner violence and birth term outcome either preterm or full term (n=400)

Women who were exposed to violence gave birth to more preterm babies (18%) than full term ones (13.7%). There was a small difference between cases and controls that were not exposed to violence in terms of birth term but controls were slightly more than cases, 86.3% and 82%, respectively. These results reveal that intimate partner violence during pregnancy increases the risk of preterm birth. This finding is in agreement with findings by researchers from the University of Iowa who found a doubled increase of preterm birth among women who were exposed to intimate partner violence and that the risk was particularly very high for women who experienced two or more types of domestic violence during their pregnancy (Donovan et al, 2015).

Intimate partner violence can directly affect the growing foetus, through physical or sexual trauma, or indirectly due to increased maternal stress, inadequate nutrition and poor prenatal care.

4.2.25 Frequency of exposure to violence and emotional abuse by partner and family members

In addition to 4.2.24 the researcher was interested in the frequency of exposure to violence by partner and emotional abuse. The latter were divided into four categories namely, (more frequently) those who were exposed to violence and emotional abuse by their partners almost every day, (sometimes) those who were sometime exposed to violence and emotional abuse by their partners but not every time, (rarely) those who were rarely exposed to violence or emotional abuse and (never) those who were never exposed to violence or emotional abuse during pregnancy. The findings are presented on table 4.9 below.

Table 4.9 Frequency of exposure to violence and emotional abuse by partner and family members and birth term outcome (n=400)

	Categories	Birth term outcome	
		Preterm	Full term
Exposure to partner violence	More frequently	2 (2%)	5 (1.7%)
	Sometimes	21 (21%)	57 (19%)
	Rarely	10 (10%)	24 (8%)
	Never	67 (67%)	214 (71.3%)
	Total	100 (100%)	300 (100%)
Emotional abuse by partner and family members	More frequently	11 (11%)	11 (3.7%)
	Sometimes	33 (33%)	104 (34.7%)
	Rarely	9 (9%)	26 (8.7%)
	Never	47 (47%)	159 (53%)
	Total	100 (100%)	300 (100%)

According to the results on table 4.9 above most women were not exposed to violence during pregnancy but those who were exposed to violence had more preterm births than full term births. It seems that as the exposure to violence

increases the higher the risk of preterm birth becomes. Emotional abuse also seems to be a risk factor for preterm birth. Women who were frequently abused emotionally had more preterm babies than full term babies.

4.2.26 Numeric continuous variables

The numerical continuous data provided the central values for the following variables, body mass index, age, height and number of antenatal clinic visits for mothers who delivered preterm and those who delivered full term babies. Table 4.10 reflects the outcome results, followed by the description of the findings.

Table 4.10 Presentation of numeric continuous variables

	Descriptive Statistics						
	N Statistic	Range Statistic	Minimum Statistic	Maximum Statistic	Mean Statistic	Std. Error	Std. Deviation Statistic
BMI full term	300	17.5	17.5	35.0	24.833	.2174	3.7647
BMI preterm	100	19.0	17.0	36.0	23.868	.5184	5.1837
Age full term	300	24	16	40	27.00	.306	5.309
Age preterm	100	26	14	40	25.26	.706	7.062
Height full	300	.18	1.55	1.73	1.6349	.00187	.03242
Height preterm	100	.23	1.50	1.73	1.6200	.00479	.04791
Number of ANC visits full term	300	5	1	6	2.95	.056	.977
Number of ANC visits preterm	100	3	1	4	1.83	.073	.726

Table 4.10 shows that the median age for the women in the full term group is 27 years and for those in the preterm group is 25, meaning that the preterm group had more younger mothers compared to the full term group. The youngest mothers in the preterm group were 14 years while in the full term group were 16 years. On average the preterm group visited ANC two times and full term group three times during the

entire pregnancy duration. The results further reveal that the maximum visits of preterm group were fewer (4) than those for full term group (6). These findings suggest that young maternal age and lack of antenatal care or few visits to ANC might be risk factors for preterm birth. The differences in height and BMI between the two groups were small.

4. 3 Statistical analysis results of the study and discussion

The statistical analysis of the data is presented and discussed in this section in order to show associations between variable factors (behavioural and socio-demographic factors) and outcome (birth term) and further quantify the level of risk associated to a risk factor on birth term. The results on the significance of association between individual factors and birth term are presented using p- value and 95% confidence interval (CI) on tables. Odds ratios (OR) are used to measure the level of risk associated to individual risk factors on birth term. The statistical results to reach conclusions on associations between variable factors and outcome at 95% confidence interval (95% CI) can be interpreted as follows:

- If $OR=1$: There is no association between the variable factor and birth term. The exposure does not affect the odds of preterm birth.
- If $OR>1$: Then exposure to the factor is associated with higher odds of preterm birth; -meaning the factor is a risk factor for preterm birth.
- If $OR <1$: Then exposure to the factor is associated with lower odds of preterm birth; -meaning the factor is a protective factor against preterm birth.
- If $p < 0.05$: There is a significant association between the variable factor and birth term.

- If $p > 0.05$: There is no association between the variable factor and birth term.
- If CI includes 1: then there is no statistical significant association.

4.3.1 Association between BMI and birth term

Statistical analysis was used to find out if there is any association between BMI and birth term, and the risk associated with each category of BMI was quantified using the odds ratios. The findings are highlighted on Table 4.11, and further discussed under the table.

Table 4.11 Statistical analysis on the association between BMI and birth term, and quantification of risk associated with categories of BMI on birth term

BMI	p- value	Odds ratio (OR)	95% CI	
			Lower	Upper
Underweight		1		
Normal	0.000	0.056	0.023	0.139
Overweight	0.000	0.096	0.037	0.253
Obese	0.000	0.108	0.039	0.301

The findings in table 4.11 reveal that BMI is a risk factor for birth term, as evident in that compared to children born to mothers who were underweight children born to mothers who have normal BMI were 94% less likely to be preterm ($P < 0.000$); those born to mothers who were overweight were 90% less likely to be preterm ($P < 0.000$) and those born to mothers who were obese were 89% less likely to be preterm ($P < 0.000$).

These findings suggest that on the one hand, normal BMI, being overweight and obese are negatively associated with birth term and may be protective factors against preterm birth. On the other hand, being underweight seems to be positively associated with birth term meaning that it may be a risk factor for preterm birth.

4.3.2 Association between marital status and birth term

Statistical analysis was used to assess whether there is a significant association between marital status and birth term, and the risk carried by each category of marital status was quantified using the odds ratios. Table 4.12 presents the results, followed by discussion.

Table 4.12 Statistical analysis on the association between marital status and birth term, and quantification of risk associated with categories of marital status on birth term

Marital status	p- value	Odds ratio	95% CI	
			Lower	Upper
Single		1		
Married	0.002	0.365	0.195	0.685
Cohabiting	0.000	0.246	0.136	0.443
Divorced	0.183	0.456	0.144	1.449

The results in Table 4.12 show that marital status is a risk factor for birth term, because children who were born to mothers who were married were 63% less likely to be preterm compared to those who were born to mothers who were single ($p < 0.002$). Those born to cohabiting mothers were 75% less likely to be preterm compared to those born to single mothers ($p < 0.000$). Statistics revealed that there is

no difference in terms of birth term between children who were born to divorced mothers and those born to single mothers ($p>0.183$).

The (OR=0.46), however, indicates that children born to divorced mothers were 56% less likely to be preterm compared to those born to single mothers, but this difference was not statistically significant ($p>0.183$); -meaning that children born to single and divorced mothers were at the same level of risk to be born preterm, that is, they were three and four times more likely to be preterm compared to children born to married and cohabiting mothers respectively. These findings revealed that being married or cohabiting may be protective factors against preterm birth whereas being single or divorced may be risk factors for preterm birth.

4.3.3 Association between the mother's age and birth term

Statistical analysis was utilised to determine whether there is an association between the mother's age and birth term, and the risk carried by each category of mother's age was measured by the odds ratios. The results are shown on table 4.13, and discussed below the table.

Table 4.13 Statistical analysis on the association between the mother's age and birth term and quantification of risk associated with categories of age on birth term

Age	p- value	Odds ratio	95% CI	
			Lower	Upper
Below 20		1		
20 to 29 years	0.000	0.292	0.159	0.535
30 to 34 years	0.000	0.284	0.146	0.550
≥ 35 years	0.977	0.987	0.402	2.424

According to the results in Table 4.13 the mother's age is a risk factor for birth term. Mothers who were in the age group 20 to 29 years were 71% less likely to give birth to preterm babies compared to mothers who were younger than 20 years ($p < 0.000$). Those who were 30 to 34 years were 72% less likely to give birth to preterm babies compared to the ones who were younger than 20 years ($p < 0.000$). There was no statistical significant difference in terms of birth term between babies born to mothers younger than 20 years and those born to mothers who were 35 years and above ($p > 0.977$), meaning that both mothers who were younger than 20 years and those who were 35 years and above were three times more likely have preterm babies compared to mothers who are in the 20 to 29 years age group. These statistical findings suggest that very young and old maternal age may be risk factors for preterm birth while middle age from 20 to 34 years may be a protective factor against preterm birth.

4.3.4 Association between highest level of education and birth term

To assess whether there is an association between the mother's highest level of education and birth term statistical analysis was used, and the risk carried by categories of mother's highest level of education were provided by the odds ratios. The findings are detailed on table 4.14 below, and on the discussion that follows the table.

Table 4.14 Statistical analysis on the association between the mother’s highest education level and birth term and quantification of risk associated with categories of education level on birth term

Highest education level	p- value	Odds ratio	95% CI	
			Lower	Upper
Primary school		1		
Junior secondary	0.267	0.528	0.171	1.632
Senior secondary	0.802	0.088	0.565	2.093
Tertiary	0.007	0.384	0.191	0.772

The findings in Table 4.14 reveal that education level is a risk factor for birth term, since , -babies who were born to mothers who attained tertiary level of education were 62% less likely to be preterm compared to those born to mothers who only attained primary school level of education ($p < 0.007$).

There was no statistical significant difference in terms of birth term between babies born to mothers who attained primary level of education and those who attained junior and senior secondary levels of education ($p > 0.267$) and ($p > 0.802$) respectively. This means that babies who were born to mothers who attained primary, junior secondary and senior secondary level of education were 2.60 times more likely to be preterm compared to babies born to mothers who attained tertiary level of education. Although the difference in terms of birth term might not be statistically significant between those with primary level of education and those with secondary levels of education, the odds ratios showed that babies born to mothers who attained junior secondary level of education were 47% less likely to be preterm compared to babies born to mother who only attained primary school level of

education and babies born to mothers who attained senior secondary level of education were 91% less likely to be preterm compared to the ones born to mothers who had primary school level of education.

These findings imply that higher level of education (tertiary) may be a protective factor against preterm birth while lower education level (primary school) is a risk factor for preterm birth.

4.3.5 Association between type of work and birth term

In order to find out whether there is relationship between type of work and birth term statistical analysis was used. The odds ratios were utilised to quantify the risk associated with each category of work type. The results are displayed on table 4.15 below, followed by the discussion.

Table 4.15 Statistical analysis on the association between type of work and birth term and quantification of risk associated with categories of work type on birth term

Type of work	p- value	Odds ratio	95% CI	
			Lower	Upper
Physically demanding		1		
Prolonged standing	0.103	1.800	0.888	3.650
Shift work	0.464	1.271	0.669	2.415
Long working hours	0.060	0.139	0.018	1.085
None strenuous work	0.008	0.257	0.095	0.698
Not working at all	0.016	0.439	0.225	0.856

The results presented in Table 4.15 show that work type is a risk factor for birth term, that is mothers who did none-strenuous work during pregnancy were 74% less likely to give birth to preterm babies compared to mothers who are involved in physically demanding work ($p < 0.008$). Mothers who were not working at all (seated at home) were 56% less likely to have preterm birth compared to those who do physically demanding work ($p < 0.016$).

There was no statistical significant difference in terms of birth term between babies born to mothers who were involved in physically demanding work and those born to mothers who were involved in work that requires prolonged standing, shift work and long working hours ($p > 0.103$), ($p > 0.464$) and ($p > 0.060$), respectively. Statistics indicated that mothers in all these categories were four times more likely to give birth to preterm babies compared to those who do none-strenuous work, and 2.27 times more likely to have preterm birth compared to those who were not working at all.

The odds ratios show that mothers who do work that requires prolonged standing were at the highest risk of having preterm babies compared to other categories, followed by mothers who do shift work. This is revealed by (OR=1.80) meaning that mothers who do work that requires prolonged standing were almost two times more likely to give birth to preterm babies compared to those who were involved in physically demanding work. Those who do shift work were 1.3 time more likely to have preterm babies compared to those who do physically demanding work.

These findings indicate that none-strenuous work or not working at all during pregnancy may protective against preterm birth and promote full term birth while work that is physically demanding, involving prolonged standing, working for long hours and shift work may be risk factors for preterm birth.

4.3.6 Association between cigarette smoking and birth term

Statistical analysis was used to find out if there is any association between cigarette smoking and birth term, and the risk associated with smoking was measured using the odds ratios. The result are indicated on Table 4.16, and further discussed under the table.

Table 4.16 Statistical analysis on the association between cigarette smoking and birth term

Variable	Categories	p- value	Odds ratio	95% CI	
				Lower	Upper
Cigarette smoking	Yes	0.921	1	0.437	2.112
	No		0.961		

Cigarette smoking was divided into two categories namely (yes) those mothers who smoked cigarette during pregnancy and (no) for those who did not smoke when they were pregnant. The findings in Table 4.16 reveal that cigarette smoking is not a risk factor for birth term ($p > 0.921$; $CI = 0.437-2.112$). The measure of risk, however, indicates that babies born to mothers who smoked cigarette during pregnancy were 4% more likely to be born preterm compared to those born to mothers who did not smoke.

4.3.7 Association between alcohol drinking and birth term

To assess the association between alcohol drinking and birth term statistical analysis was used, and the odds ratio provides the quantity of risk associated with alcohol drinking on birth term. Table 4.17 below reflects the results.

Table 4.17 Statistical analysis on the association between alcohol drinking and birth term

Variable	Categories	p- value	Odds ratio	95% CI	
				Lower	Upper
Alcohol drinking	Yes	0.046	1	0.392	0.992
	No		0.624		

Alcohol drinking was divided into two categories namely (yes) those mothers who drank alcohol during pregnancy and (no) for those who did not drink alcohol when they were pregnant. The results highlighted in Table 4.17 show that alcohol drinking during pregnancy is a risk factor for birth term ($p < 0.046$) and (CI=0.392-0.992). Babies born to mothers who drank alcohol during pregnancy were 38% more likely to be born preterm compared to those born to mothers who did not drink alcohol during pregnancy.

4.3.8 Association between supplementary tablets intake and birth term

Statistical analysis was used to assess whether there is a significant association between supplementary tablets intake (multivitamins, iron or folate tablets) and birth term, and the risk carried by each category of supplementary tablets intake was quantified using the odds ratios. The results are presented on table 4.18, followed by discussion.

Table 4.18 Statistical analysis on the association between supplementary tablets intake and birth term and quantification of risk associated with categories of supplementary tablets intake on birth term

Variable	Categories	p- value	Odds ratio	95% CI	
				Lower	Upper
Supplementary tablets intake	Everyday		1		
	Sometimes	0.065	1.623	0.969	2.717
	Rarely	0.001	3.706	1.658	8.284
	Never	0.028	2.647	1.109	6.318

The results shown in Table 4.18 reveal that supplementary tablets intake is associated with birth term. Mothers who did not take supplementary tablets (iron tablets and multivitamins) during pregnancy were at an increased risk of having preterm birth compared to those who took them every day.

Compared to mothers who took supplementary tablets every day during pregnancy, those who took them only sometimes were almost two times more likely to have preterm birth (OR=1.62), those who rarely took them were almost four times more likely to have preterm birth (OR=3.70) and those who did not take them at all were 2.65 times more likely to give birth to preterm babies.

4.3.9 Association between trimester of first ANC visit and birth term.

The association between trimester of first ANC visit and birth term was assessed using statistical analysis. The odds ratios reflect the risk carried by each category of

trimester of first ANC visit. The results are tabulated on table 4.19 below, and further discussion for more detail is provided under the table.

Table 4.19 Statistical analysis on the association between trimester of first ANC visit and birth term and quantification of risk associated with categories of trimester of first ANC visit on birth term

Variable	Categories	p- value	Odds ratio	95% CI	
				Lower	Upper
Trimester of first ANC visit.	3 rd trimester		1		
	2 nd trimester	0.445	0.750	0.358	1.570
	1 st trimester	0.000	0.211	0.093	0.478

Table 4.19 shows that trimester of first ANC visit is a risk factor for birth term, that is, mothers who started their ANC visit on the first trimester were 79% less likely to have preterm birth compared to mothers who started ANC visit on the third trimester ($p < 0.000$).

There was no statistical significant difference between mothers who started ANC visit on the second trimester and those who started on the third trimester ($p > 0.445$). Mothers who started visiting ANC on the second and third trimester were at the same level of risk of having preterm birth, that is, they were 1.3 times more likely to give birth to preterm babies as compared to those who started visiting ANC on the first trimester.

The odds ratios show that those who started visiting ANC on the second semester were 25% less likely to give birth to preterm babies compared to those who started

their ANC visit on the third trimester. The more the mother delayed to start ANC visits the higher were the chances of having a preterm baby.

4.3.10 Association between inter-pregnancy interval and birth term

To confirm whether there is an association between inter-pregnancy spacing interval and birth term statistical analysis was utilised, and the risk carried by each category of inter-pregnancy spacing interval was assessed using the odds ratios. The findings are shown on table 4.20, and then discussion follows below the table.

Table 4.20 Statistical analysis on the association between inter-pregnancy interval and birth term and quantification of risk associated with categories of inter-pregnancy interval on birth term

Variable	Categories	p- value	Odds ratio	95% CI	
				Lower	Upper
Inter-pregnancy interval	<6 months		1		
	6months- 1year	0.056	0.107	0.011	1.062
	18months-<2years	0.000	0.005	0.000	0.094
	2years – 4years	0.009	0.050	0.005	0.471
	First child	0.064	0.121	0.013	1.128
	≥5years	0.091	0.145	0.015	1.360

The findings presented in Table 4.20 reveal that inter-pregnancy spacing interval is a risk factor for birth term. Mothers who had an inter-pregnancy spacing interval of 18 months to less than two years were 99% less likely to give birth to preterm babies compared to mothers who spaced with less than six months ($p<0.000$). Those who

spaced with two to four years were 95% less likely to have preterm births compared to those who spaced with less than six months ($p < 0.009$).

There is no statistical significant difference in terms of birth term between mothers who had inter-pregnancy spacing interval of less than six months and those who spaced with six months to one year ($p > 0.056$), five years and above ($p > 0.091$) and giving birth for the first time (0.064). This means that children born to mothers in these categories are at the same level of risk to be born preterm, that is they are 100 times more likely to be born preterm compared to children born to mothers who have spacing of 18 months to less than two years and compared to children born to mothers who have spacing of two to four years they are 20 times more likely to be preterm.

These findings suggest that inter-pregnancy spacing interval of 18 months to four years is a protective factor against preterm birth while short spacing (less than six months) and long spacing intervals of five years and more are risk factors for preterm birth.

4.3.11 Association between intendedness of pregnancy and birth term

Statistical analysis was used to assess whether there is a significant association between intendedness of pregnancy and birth term, and the risk carried by each category of intendedness of pregnancy was quantified using the odds ratios. The results are tabulated on table 4.21, and further detailed on the discussion that follows the table.

Table 4.21 Statistical analysis on the association between intendedness of pregnancy and birth term and quantification of risk associated with categories of intendedness of pregnancy on birth term

Variable	Categories	p- value	Odds ratio	95% CI	
				Lower	Upper
Intendedness of pregnancy	Wanted		1		
	Mistimed	0.001	2.823	1.490	5.348
	Unwanted	0.001	2.823	1.490	5.348
	Unexpected	0.003	2.688	1.409	5.129

The results in Table 4.21 show that intendedness of pregnancy is a risk factor for birth term, -as mothers with mistimed or unwanted pregnancies are 2.8 times more likely to have preterm birth compared to mothers with wanted pregnancies ($p < 0.001$). Mothers with unexpected pregnancies are also at risk and almost three times more likely to give birth to preterm babies compared to those with wanted pregnancies, as indicated by (OR=2.69).

These findings seem to imply pregnancies that are unwanted, mistimed and unexpected may be risk factors for preterm birth while wanted pregnancies may be a protective factor for preterm birth.

4.3.12 Risky behaviours of partner/family and their association with birth term

To determine whether there is a significant association between high risk behaviours of partner/family members and birth term statistical analysis was used, and the risk

carried by categories of each behaviour was measured by the odds ratios. The findings are highlighted on table 4.22 below, followed by the discussion.

Table 4.22 Statistical analysis of different risk behaviours of a partner/family and their association with birth term

Variable	Categories	p- value	Odds ratio	95% CI	
				Lower	Upper
Sexually abused	Yes		1		
	No	0.800	1.133	00.431	2.979
Partner smoking	Yes		1		
	No	0.050	0.619	0.383	1.000
Stay with smokers	Yes		1		
	No	0.001	0.455	0.284	0.729
Partner drinking alcohol	Yes		1		
	No	0.065	0.646	0.407	1.027
Exposed to partner violence	Yes		1		
	No	0.291	0.721	0.393	1.324

The results detailed on Table 4.22 above reveal that staying with smokers during pregnancy is a risk factor for birth term, as proven by the fact that, -mothers who did not stay with smokers during pregnancy were 54% less likely to give birth to preterm babies compared to those who stayed with smokers when they were pregnant.

There is no significant association that was found between birth term and the following variables; sexual abuse during pregnancy ($p>0.800$), partner smoking

($p>0.050$), partner drinking alcohol ($p>0.065$) and exposure to partner violence ($p>0.291$).

The odds ratios; however, revealed that women with partners who do not smoke cigarette were 38% less likely to give birth to preterm babies compared to those with partners who smoke. Those with partners who do not drink alcohol were 35% less likely to have preterm birth compared to those whose partners drink alcohol. Mothers who were not exposed to violence by their partners were 28% less likely to have preterm birth compared to those who were exposed to violence by their partners.

4.3.13 Multivariable logistic regression results

Multiple variable analysis was used to determine whether the variables that were found to be associated with birth term when univariate analysis was performed would remain still significantly associated with birth term even after adjustment for the effects of other variables. Multivariable logistic regression results are displayed on table 4.23 below, followed by discussion.

Table 4.23 Multivariable logistic regression output

Variables	Categories	P – value	Odds ratios	95% CI	
				Lower	Upper
Inter-pregnancy spacing interval	Less than 6months		1		
	6months to 1year	.254	6.396	.264	154.947
	18mnths to <2years	.004	.155	.044	.543
	2yrs to 4years	.000	.012	.001	.137
	First child	.003	.236	.090	.621
	5 years or more	.001	.120	.033	.437
Work type	Physically demanding		1		
	Prolonged standing	.019	3.964	1.255	12.522

	shift work	.077	2.696	.898	8.097
	Long working hrs	.219	.127	.005	3.412
	None strenuous	.014	.116	.020	.652
	Not working	.016	.192	.050	.739
BMI	Underweight		1		
	Normal	.002	9.515	2.213	40.913
	Overweight	.271	.579	.219	1.533
	Obese	.894	1.079	.354	3.288
Mother age	Below 20		1		
	20 to 29	.786	1.301	.196	8.648
	30 to 34	.505	.597	.131	2.717
	35 and above	.532	.621	.140	2.768
Intendedness of pregnancy	Wanted		1		
	Mistimed	.517	.710	.252	2.003
	Unwanted	.443	1.662	.454	6.085
	Unexpected	.860	.884	.225	3.477
Supplementary tablets intake	Everyday		1		
	Sometimes	.346	.455	.088	2.346
	Rarely	.203	.358	.073	1.744
	Never	.631	.661	.122	3.584
Marital status	Single		1		
	Married	.999	1.001	.140	7.144
	Cohabiting	.449	.455	.059	3.501
	Divorced	.104	.190	.026	1.410
Highest level of education	Primary		1		
	Junior secondary	.000	.017	.002	.144
	Senior secondary	.000	.045	.009	.220
	Tertiary	.000	.041	.010	.179
trimester of first visit to antenatal clinic (ANC)	First trimester		1		
	Second trimester	.065	.231	.049	1.096
	Third trimester	.539	.643	.157	2.627
Staying with smokers	No		1		
	Yes	.001	2.198	1.372	3.521
Partner smoking	No		1		
	Yes	0.050	1.615	1.000	2.610

After all variables were assessed on their individual effects on birth term, a multivariable logistic regression model was developed to find the effects of the variables when combined with each other. Only single variables which were found to be associated ($p < 0.05$) with birth term were included in the model. Factors with p value less than 0.05 are significantly associated with birth term. Multivariable logistic regression analysis revealed that the highest level of education, inter-pregnancy spacing interval, work type, BMI, staying with smokers and partner smoking were significantly associated with birth term even after adjustment for the effects of other variables and potential confounders.

4.5 Summary

Chapter four has presented results of the study and discussion. The first section focused only on descriptive statistics. The frequency and percentage distribution of total study sample for the selected maternal socio-demographic factors and health behavioural factors, demographic factors of the babies whose mothers participated in the study and high risk behaviours of partners and family members were presented in tables. In the second section, cross tabulations of each exposure variable and the outcome variable birth term were provided in graphs and tables followed by a description and discussion of the results. The cross tabulations provided proportions of cases and controls with certain socio-demographic and behavioural factors, the results from cross tabulations suggested factors that might be associated with preterm or full term birth based on proportions. However, conclusions on the associations could not be made based on proportions only therefore the last section presents the statistical analysis results on the association between different variables and birth term. The results of the statistical analysis show the association between each

variable and birth term and further indicate the risk that is carried by each category of each variable on birth term. This led to identification of risk and protective factors for preterm birth.

The results of multivariable logistic regression analysis revealed that the highest level of education, inter-pregnancy spacing interval, work type, BMI, staying with smokers and partner smoking were significantly associated with birth term even after adjustment for the effects of other variables and potential confounders

CHAPTER 5

CONCLUSIONS, RECOMMENDATIONS AND LIMITATIONS OF THE STUDY

5.1 Introduction

In Chapter four, the results of this study were presented and discussed comparing the obtained study findings with identified literature and previous studies that were conducted in other parts of the world. This chapter provides the conclusions drawn from the study. Based on the conclusions, recommendations for future research which fit in the Namibian context are suggested and presented. Moreover this last chapter highlights the strengths and limitations this study.

5.2 Conclusions from the study

The purpose of the study was to determine behavioural and socio demographic factors associated with preterm birth among women who deliver at Windhoek Central Hospital (WCH) and Intermediate Hospital Katutura (IHK). To attain the purpose, three objectives were formulated to serve as guidelines in the whole research process. The first two objectives focused on determining and describing the health behaviours and socio-demographic profile of women with preterm births and women with full term births including behaviours or their partners and family members that may influence birth term. Objective three focused on determining the association between each identified exposure variables (socio-demographic and health behavioural factors) and the outcome variable birth term and quantification of

the risk that is carried by each category of each variable on birth term. The conclusions of this study are therefore based on the objectives.

5.2.1 Conclusion: Objective 1

Objective 1 of the study was to determine and describe the socio-demographic profile and health behaviours of women with preterm births and women with full term births at WCH and IHK.

Conclusion: Descriptive statistics were used to conclude the outcome of objective 1. Data was analysed using SPSS version 24 and cross tabulations were drawn to find the distribution of the characteristic factors among women who had preterm births and those who had full term births.

Regarding the socio-demographic factors the study findings revealed that maternal socio-demographic factors such as young and old maternal age, being underweight, having low or high level of education, being single or divorced are common factors among mothers with preterm births. In addition high proportions of preterm births were found among mothers who possessed the following characteristics - younger than 20 years, 35 years and above, BMI less than 18.5 kg/m², attained junior secondary education level and those who were single or divorced. Bigger percentages of full term births were found among mothers, who were in the middle age groups (20 to 34 years), had normal BMI, medium education level (senior secondary education level) and were either married or cohabiting.

The type of work that mothers were involved in during pregnancy also had an influence on birth term. Mothers who engaged in work that was physically demanding or that involved prolonged standing were more likely to give birth to preterm babies. This applied as well to those who were not working at all.

Behavioural factors: The following behaviours characterised women with preterm births; alcohol drinking, lack of exercise, late antenatal clinic visit, lack of supplementary tablets intake short and long inter-pregnancy spacing intervals and having unwanted pregnancies. High percentages of preterm births were found among women who - drank alcohol once or two times per week, did not engage in any form of exercise, visited ANC once or twice for the entire pregnancy duration, had inconsistencies in their supplementary tablets intake or did not take them at all, had pregnancies that were mistimed, unexpected or unwanted, had inter-pregnancy spacing interval of less than a year or 5 years and above and women who were giving birth for the first time. Most women with full term births engaged in physical exercise, drank alcohol occasional or did not drink at all, visited ANC at least three times or more during their pregnancy, took supplementary tablets every day had inter-pregnancy spacing intervals of at least 18 months up to 4 years and had wanted pregnancies.

The effect of smoking on birth term was not clear because there were few mothers who smoked cigarette during pregnancy, the same applied to use of illicit drugs, since no participants reported use of illicit drugs. It is possible that there was underreporting of these behaviours by participants because of their association with negativity.

Diet seemed to play a major role as a determinant of birth term. A greater percentage of mothers who had low intake of fruits, vegetables, meat, milk and milk products in their diet gave birth to preterm babies. Too much intake of certain foods such as very high meat and carbohydrate intake also resulted in preterm birth. Full term birth was enhanced by high vegetable intake, moderate or high meat intake, moderate and high milk and milk products intake. Very high milk and milk products intake unlike very high starch and meat intake which favoured preterm birth did not have negative effects on birth term. Low water intake of one to two glasses per day or less was common among mothers who had preterm births. A high percentage of mothers who had full term births took a lot water of about six glasses or more per day.

5.2.2 Conclusion: Objective 2

Objective 2 aimed to determine and describe high risk behaviours of partners/family members of women with preterm births and women with full term births at WCH and IHK.

Conclusion: Descriptive statistics were used to describe high risk behaviours of partners/family members of women with preterm births and women with full term births. The results seem to suggest that most of the partners/family members of participants are cigarette smokers. This was further confirmed by a high percentage of participants who stayed with smoking partners or family members. Alcohol drinking was also high among male partners; both second hand smoke and partner alcohol drinking had negative effects on birth term. The majority of participants who stayed with smokers or male partners who drink alcohol had preterm births. There were few participants who reported sexual abuse and intimate partner violence;

however, these behaviours are worthy reporting because they are serious public health issues that should not exist in communities. Exposure to intimate partner violence and emotional abuse seemed to increase the risk of preterm birth. A bigger percentage of women who were frequently abused emotionally had more preterm babies than full term ones.

5.2.3 Conclusion: Objective 3

This objective aimed at determining the socio demographic and health behavioural factors associated with preterm birth.

Conclusion: To achieve the third objective statistical analysis was utilised. This was to further analyse the results from the first and second objective in order to determine the evidence of association between each exposure variables and the outcome variable birth term. Statistical tests for significance of association were conducted at 95 percent confidence interval and results of the odds ratios, p- values and confidence intervals confirmed the associations. In addition the odds ratios showed the quantification of risk carried by each category of each variable in cases where there was a significant association between exposure variable and outcome variable birth term. Quantification of risk carried by each category of variables revealed risk factors for preterm birth and protective factors against preterm birth. Lastly, a multivariable logistic regression analysis was performed to find the exposure variable factors that continued having an association with the outcome birth term after controlling for the effects of other competing variables and potential confounders.

The exposure variables that were significantly associated with birth term include, BMI, marital status, age, highest level of education, work type, alcohol drinking number of antenatal clinic visits, trimester of first ANC visit, supplementary tablets intake, inter-pregnancy spacing interval, intendedness of pregnancy, staying with smokers and partner smoking. Categories of these mentioned variables had different effects on birth term; some were risk factors for preterm birth while others were protective factors.

The following factors were positively associated with birth term meaning that they were risk factors for preterm birth: being underweight, single or divorced, having maternal age younger than 20 years or 35 years and above, having primary, junior secondary and senior secondary levels of education, being involved in work that is physically demanding, requires prolonged standing or long working hours and shift work, alcohol drinking, taking supplementary tablets rarely or never, starting ANC visit on the second or third trimester, inter-pregnancy spacing interval of less than 1 year or 5 years and above and giving birth for the first time, having unwanted, unexpected and mistimed pregnancies and staying with smokers

The following factors were negatively associated with birth term meaning that they were protective factors against preterm birth and favoured full term birth; being married or cohabiting, maternal age of 20 to 34 years, tertiary education, none strenuous work, not working at all, taking supplementary tablets every day, starting ANC visits on the first trimester, interspacing interval of 18 months to 4 years and having a wanted pregnancy.

Multivariable logistic regression analysis revealed that highest level of education, inter-pregnancy spacing interval, work type, BMI, staying with smokers and partner smoking were significantly associated with birth term even after adjustment for the effects of other variables.

5.3 Recommendations

Some recommendations derive from the findings of this study. The recommendations focus mainly on supporting women, especially expectant mothers, and development of future research. These recommendations can be utilised by the Ministry of Health and Social Services, Ministry of Education (ME), Ministry of Gender and Child Welfare (MGCW) and other health-based organisations such as United Nations (UN) agencies and Non Governmental Organisations (NGOs) and the community at large.

5.3.1 Recommendations for the Ministry of Health and Social Services

- A policy and guideline that directs the assessment of preterm birth has to be in place. In order to reduce inclusion error in selecting preterm births, a standardised objective tool must be developed that will be used in the whole country for determining preterm births. According to the WHO preterm birth includes all babies that are born before 37 completed weeks of gestation, however, through conversing with nurses and doctors at prim-unity the researcher discovered that more attention is given to birth weight than to gestational age. This means that preterm babies who are born with normal birth weight are somehow overlooked especially if they do not have obvious signs calling for immediate medical care, but such babies still need medical attention since some of their vital organs such as lungs may be underdeveloped and can create

breathing problems and even complications later on if they are not addressed at birth. Developing guideline for assessing preterm birth could also provide the correct estimates about the burden of preterm birth in Namibia and prevention measures and research may be taken accordingly.

- There is an urgent need to employ health promotion officers to cover much ground in areas such as providing health education to pregnant women at ANC, conducting community awareness campaigns, delivering door to door services, conducting outreach programmes targeting marginalised communities that have no easy access to health care services. Preterm birth is one problem but there is a broader spectrum of problems that need services from Health Promotion Officers (HPOs) in this present day where the world is infested with lifestyle diseases. Prevention becomes more important to avoid complications caused by these diseases.
- Multi-sectoral collaboration is needed since preterm birth has many causal factors which can be addressed successfully in collaboration with other relevant sectors. For example, -the Ministry of Education can play an important role in providing reproductive health education to girls and boys at schools, the Ministry of Gender and Child Welfare may can take an active part in controlling intimate partner violence in communities and the Ministry of Agriculture can strategise to ensure food security to the population. MoHSS need to take the responsibility of planning and coordinating the programmes that are to be conducted in collaboration with other sectors.

- In practice at the antenatal clinic, health education is needed to provide pregnant women with detailed information on:
 - Importance of quitting smoking and alcohol drinking;
 - Importance of ANC visits. It seems most of the women in Windhoek do not know the importance of ANC visits as they indicated that they avoid it because they do not want to be given follow up dates;
 - Family planning and proper condom use;
 - Exercise and types of exercise suitable for pregnant women;
 - How to appropriately arrange their diet. Women's dietary habits may vary according to pre-pregnancy BMI; thus, individual advice may be necessary; - and
 - On types of work to avoid.

- Community-based intervention packages, which include educating community health workers or skilled birth attendants should be budgeted for and implemented.

- Volunteers need to be recruited across the country to assist in the implementation of maternal and child health programmes targeted at reducing preterm birth. A monthly in-service training programme could be offered to community based volunteers by the regional and district health promotion officers and nurses. The budget for these training programmes can be handled at national level.

Programmes to include:

- Involvement of men in their partners' pregnancy. Men have been ignored when it comes to pregnancy since women are the ones more connected to the baby. Men also play an important role in influencing birth outcomes. Men need to support their spouses/partners and stop risky behaviours such as smoking, alcohol drinking and domestic violence that may negatively affect birth outcomes. Male partners also play an important role in influencing the behaviour of their women during pregnancy.
- Educating women on how to take care of their pregnancies.
- Educating the entire community on the importance of supporting pregnant women
- Teenage pregnancy prevention
- Family planning and proper condom use
- Training skills in setting up income generating projects to sustain pregnant women and their families

5.3.2 Recommendations for the Ministry of Education

- Health education in schools should include reproductive health as one of the major topics. School children both girls and boys should be taught to abstain from sexual activities as this can disturb their performances at school, expose them to sexually transmitted diseases, lead to school drop outs, especially girls as this could compromise their chances of attaining higher levels of education and increase poverty in the society. Moreover, teenage girls are not yet biologically, socially and financially prepared to carry and sustain a pregnancy. This leads to

high rates of abortions and adverse birth outcomes such as preterm birth and low birth weight among teenage mothers.

- Schools should invite health professionals such as nurses, health promotion officers and counsellors on timely bases to deliver health education on teenage pregnancy prevention including demonstration of proper condom use.
- School teachers should provide support and counselling to school girls who fall pregnant and also encourage their parents to support them. Lack of social support and proper counselling forces young girls to opt for abortion, sometimes unsuccessful abortions result in adverse birth outcomes like preterm birth and structural defects.
- Training programmes should be set at schools where teachers will be educated on important health topics, especially on problems that are wide spread in the communities such as chronic diseases, HIV/AIDS and reproductive health problems so that they may teach school children in return.

5.3.3 Recommendations for the Ministry of Gender and Child Welfare

- The Ministry of Gender and Child Welfare should enforce strict laws that protect pregnant women against domestic violence. Serious correctional measures should be taken on men who beat their partners while they are pregnant.

- Advise women to report any kind of intimate partner violence. Women who do not want their partners to be imprisoned for domestic violence should be given an option of being counselled together with their partners.
- Women should be encouraged and supported to report rape and sexual abuse as such exposures may cause women to attempt abortion, give birth to preterm and low birth weight babies and exposes them to sexually transmitted diseases especially HIV/AIDS.

5.3.4 Recommendations for future research

- Large-scale studies among women with different socio-economical characteristics are needed to provide a comprehensive view of the socio-demographic profile and behaviours of pregnant women in Namibia.
- Small-scale researches on causes of preterm birth need to be carried out in each region in Namibia so that prevention strategies may be tailor made to address real causal factors that are prevailing in each region.
- Research on men's socio-demographic and behavioural factors associated with preterm birth need to be conducted since most studies only focus on women.
- A study on medical causes of preterm birth need to be carried out since preterm birth is not only influenced by maternal behavioural and socio-demographic factors but caused by multiple factors.

- Further research is needed on maternal dietary intake and its association with preterm birth looking into specific individual food items.
- A study to find out why male babies are at greater risk of being born preterm compared to female babies.

5.4 Strengths and limitations of the study

5.4.1 Strengths of the study

To the researcher's knowledge there are no studies that have focused on socio-demographic and behavioural factors associated with preterm birth in Namibia. The study provides information on socio-demographic factors and behaviours among both preterm and full term delivery mothers in Windhoek, Namibia. This study also provides the evidence from Namibian citizens for the association between socio-demographic and behavioural factors and preterm birth, which was not yet discovered in Namibia.

The information for the study was collected from public hospitals in Windhoek (WCH and IHK) because there are more women who deliver in public hospitals in Windhoek compared to those who deliver in private hospitals. The results from this study can therefore be provisionally generalised to the Windhoek maternal population before further studies which will include both public and private hospitals are carried out.

The data collection method was more effective because the researcher was the one asking questions, probing, providing clarifications to each respondent and recording their verbal responses on the questionnaire. There were no missing data after data collection since the researcher was the one responsible for recording the responses. Respondents with low literacy levels or who find it difficult to read or complete a questionnaire on their own but who understand and speak in English were also accommodated in this study.

The study participants were readily available at the postnatal wards and were interviewed while they were still admitted at the hospital, there was no hustle of making a follow up on participants.

5.4.2 *Limitations of the study*

There is no existing research on socio-demographic and behavioural factors associated with preterm births in Namibia. The research problem was formulated based on the researcher's observations and a literature review consisting of studies done in other parts of the world. More research on factors associated with preterm birth need to be done in Namibia to provide more local knowledge.

The information for the study was collected from only public hospitals in Windhoek (WCH and IHK). Although most women in Windhoek deliver in public hospital there is still a need to conduct a study that will capture participants from both public and private hospitals in Windhoek because there is a possibility that women who deliver in private hospitals might be different from those who deliver in public hospitals in terms of socioeconomic status and education level. The results therefore

cannot be generalised to the whole Windhoek maternal population since women served by private hospitals were not included in the sample.

The period of study spanned only two months which is a very short time, future research can cover a longer period of time spanning even one year or more and covering a wider population.

The other limitation is that the use of a structured interview schedule might have influenced the responses of participants due to the presence of the researcher and this could have affected the outcomes of the results. For example if participants decided to underreport behaviours such as smoking, alcohol drinking, use of illicit drugs, sexual abuse and intimate partner violence because of the negativity associated with these behaviours, the results of the study then underestimates such behaviours in the studied population.

5.5 Concluding remarks

In this study the diet and behaviours such as maternal smoking, use of illicit drugs, sexual abuse, emotional abuse and intimate partner violence were not found to be significantly associated with preterm birth. This was a remarkable discovery because some studies have confirmed an association between the above behaviours and preterm birth.

Overall the socio-demographic and other behavioural factors associated with preterm birth in Windhoek were more or less similar to those that were found by researchers in other parts of the world. Owing to the fact that population compositions differ

across the world some factors tend to overlap from country to country while some only exist in one country but not in others.

My study has shown that the aetiologies of preterm birth are complex and multi-factorial, hence require further research. Coordinated, integrated effort and significant research to address the unmet gaps, and development needs is required to identify causes and prevention strategies. It is clear that preterm birth is complex and has a significant effect on neonatal mortalities and chronic morbidities at global and country level. Therefore continued efforts to understand the aetiologies of preterm birth to develop more effective interventions that are affordable, especially preventive modalities are urgently needed.

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ANNEXURES

ANNEXURE A: UNIVERSITY OF NAMIBIA APPROVAL LETTER

University of Namibia, Private Bag 13301, Windhoek, Namibia
340 Mandume Ndemufayo Avenue, Pioneerspark
☎ +264 61 206 3111, URL <http://www.unam.edu.na>



RESEARCH PERMISSION LETTER

Date: 20/06/2016

TO WHOM IT MAY CONCERN

RE: RESEARCH PERMISSION LETTER

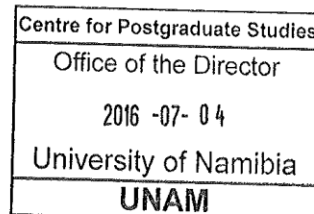
1. This letter serves to inform you that student: **KHONZANI MANDELELA** (Student number: **201201983**) is a registered student in the SCHOOL OF PUBLIC HEALTH for the MASTER IN PUBLIC HEALTH degree at the University of Namibia. His/her research proposal was reviewed and successfully met the University of Namibia requirements.
2. The purpose of this letter is to kindly notify you that the student has been granted permission to carry out postgraduate studies research. The School of Postgraduate Studies has approved the research to be carried out by the student for purposes of fulfilling the requirements of the degree being pursued.
3. The proposal adheres to ethical principles

Kind regards

Signed: *pp. Hluzentle HOD, PGS, Fac. of Health*

Name of Main Supervisor: *Dr. L. Predorius*

Signed: *M. Hedimbi*
Dr. M. Hedimbi
Director: School of Postgraduate Studies
Tel: 2063523
E-mail: mhedimbi@unam.na



ANNEXURE B: REQUEST TO THE MINISTRY OF HEALTH AND SOCIAL STUDIES TO CONDUCT A STUDY AT WCH AND IHK.



The Permanent Secretary
Ministry of Health and Social Services
P/Bag 13198
Windhoek
Namibia

Attention: The Permanent Secretary

Dear Sir

RE: REQUEST FOR PERMISSION TO CARRY OUT A RESEARCH STUDY AT WINDHOEK CENTRAL HOSPITAL AND INTERMEDIATE KATUTURA HOSPITAL FOR ACADEMIC PURPOSES.

My name is Khonzani Madlela. I am a registered student at the University of Namibia School of Public Health for Masters in Public Health degree. In order for me to finish this degree the university requires me to carry out a complete research study.

My thesis is titled "Behavioural and socio-demographic factors associated with preterm birth among women who deliver in public hospitals in Windhoek, Namibia. I therefore kindly ask for permission from your office to allow me to carry out this research study at Windhoek Central hospital and Intermediate Hospital Katutura

maternity wards. I have attached other documents for more information and my contact details are provided below.

I would like to assure you that all the information that will be obtained will be used for academic purposes only. Your assistance will be highly appreciated.

Yours

Faithfully

Khonzani Madlela. (cell: 0814950483, email: kmadlela@gmail.com)

ANNEXURE C: MINISTRY OF HEALTH AND SOCIAL SERVICE
APPROVAL LETTER



0814950483

REPUBLIC OF NAMIBIA

Ministry of Health and Social Services

Private Bag 13198
Windhoek
Namibia

Ministerial Building
Harvey Street
Windhoek

Tel: 061 - 203 2562
Fax: 061 - 222558
E-mail: hngombe@mhss.gov.na

OFFICE OF THE PERMANENT SECRETARY

Ref: 17/3/3

Enquiries: Ms. H. Nangombe

Date: 08 September 2016

Ms Khonzani Madlela
School of Public Health
University of Namibia
P.O. Box 41002
Ausspanplatz
Windhoek

Dear Ms Madlela

Re: Behavioural and socio demographic factors associated with preterm birth among women who deliver in public hospitals in Windhoek, Namibia

1. Reference is made to your application to conduct the above-mentioned study.
2. The proposal has been evaluated and found to have merit.
3. **Kindly be informed that permission to conduct the study has been granted under the following conditions:**
 - 3.1 The data to be collected must only be used for academic purpose;
 - 3.2 No other data should be collected other than the data stated in the proposal;
 - 3.3 Stipulated ethical considerations in the protocol related to the protection of Human Subjects should be observed and adhered to, any violation thereof will lead to termination of the study at any stage;

ANNEXURE D: PERMISSION LETTER FROM INTERMEDIATE HOSPITAL
KATUTURA



Republic of Namibia

Ministry of Health and Social Services

Private Bag 13215
WINDHOEK
Namibia

Intermediate Hospital Katutura
Independence Avenue
WINDHOEK

Telephone (061) 203 4004/5
Telefax (061) 222706

Enquiries: Ms. F.M. Shiweda

Date: 27 September 2016

OFFICE OF THE MEDICAL SUPERINTENDED

**Ms. Khonzani Madlela
School of Public Health
University of Namibia
P. O. Box 41002
Ausspannplatz
Windhoek**

Dear Ms. Madlela

RE: Behavioural and socio demographic factors associated with preterm birth among women who deliver Intermediate Hospital Katutura in Windhoek, Namibia.

The above mentioned subject refers:

This office hereby grants you permission to do research on behavioural and socio demographic factors associated with preterm birth among women who deliver Intermediate Hospital Katutura in the Khomas Region, Windhoek, Namibia.

Thank you

Yours in health

**DR. A. O. ALAGBE
ACTING MEDICAL SUPERINTENDENT**



27/09/16
MSR
P. Shiweda

ANNEXURE E: PERMISSION LETTER FROM WINDHOEK CENTRAL HOSPITAL

9 - 0/0001



REPUBLIC OF NAMIBIA
Ministry of Health and Social Services

Private Bag 13215 Windhoek Namibia	Harvey Street Windhoek Central Hospital	Tel. No: (061) 203 3024 Fax No: (061) 222886
Enquiries: Mrs. A.MOOTU	Ref.	Date : 21 September 2016

OFFICE OF THE MEDICAL SUPERINTENDENT
WINDHOEK CENTRAL HOSPITAL

Ms. Khonzani Madlela
School of Public Health
University of Namibia
Windhoek
0814950483

Dear Ms. Madlela

RE: PERMISSION TO CONDUCT A RESEARCH ON BEHAVIOURAL AND SOCIO DEMOGRAPHIC FACTORS ASSOCIATED WITH PRETERM BIRTH AMONG WOMEN WHO DELIVER AT WINDHOEK CENTRAL HOSPITAL.

Kindly be informed that permission has been granted for you to conduct a research on the above mentioned subject:

- 1.1 Patients /clients information should be kept confidential at all times
- 1.2 The purpose for research is only for your study purposes as you have requested and it does not include any remuneration.

Thank you for your kind gesture.

Yours sincerely

DR. S. SHALONGO
MEDICAL SUPERINTENDENT

"Health for All"

ANNEXURE F: CONSENT LETTER FOR PARTICIPATION

Consent to participate in a research study

Good afternoon.

My name is Khonzani Madlela. I am studying Masters in Public Health at the University of Namibia and I am conducting a study aimed at determining behavioural and socio demographic factors associated with preterm birth among women in Windhoek. Identifying these factors will assist the researcher to plan and conduct health education sessions with women which may create awareness among the population and ultimately contribute to reducing the high incidence of preterm births.

Participation in this study is voluntary and you are free to refuse to take part or withdraw at any stage of the study if you wish to do so without any consequences. If you agree to participate you will be asked to answer questions about your background and your health behavioral practices including those of your spouse and other family members. The information that you will provide here will assist in improving the development of future plans aimed at reducing the incidence of preterm birth, feel free to ask questions or clarity. Your identity will be kept confidential in so far as the law allows and your real name will not be used instead you will be assigned a number. This study does not involve procedures that might result in physical harm however there may be questions that might make you feel uncomfortable or even embarrassed. I want to assure you that all the information you will provide here will be kept private and confidential and will be used only for the research purposes. If you feel uncomfortable feel free to share this and we can discuss your feelings.

If you have understood the information discussed with you and you are agreeing to participate in the study may you provide your signature in spaces provided below.

I Agree to participate in this study.

Signature Date.....

ANNEXURE G: THE STRUCTURED INTERVIEW SCHEDULE

SECTION A

Demographic factors for the baby

1. What is the birth term of the baby?

Preterm

Full term

2. What is the sex of the baby?

Girl

Boy

3. What is the weight of the baby in grams?

<1500 (very low birth weight)

1500 to <2500 (low birth weight)

≥2500 (normal birth weight)

4. What is the gestational age of the baby?

Extremely preterm <28 weeks

Very preterm 28 to <32 weeks

Moderate to late preterm 32 to <37 weeks

Full term 37 to <42 weeks

5. What is the BMI of the mother?

Underweight (<18.5)

Normal (18.5 to 25)

Overweight (>25 to 30)

Obese (>30 to 40)

Socio demographic factors of postnatal mothers

Please answer the following questions.

6 What is your age in years?.....

- Below 20
- 20-29
- 30-35
- >35

7. What is your marital status?

- Single
- Married
- Cohabiting
- Divorced

8. What is your highest level of education grade?

- Primary school
- Junior Secondary
- Senior secondary
- College/University

9. State that which is applicable about your work?

- Physically demanding
- Prolonged standing >3 hrs/day
- Shift or night work
- Long working hours
- None strenuous work
- Not working

10. Where do you reside?

- Low density suburbs
- Medium density
- High density

SECTION B

Behavioural practices of women

11. Do you smoke?

Yes

No

12. How many cigarettes did you smoke per day when you were pregnant?

None

1-2

3-5

≥ 6

13. Do you drink alcohol?

Yes

No

14. How often did you drink when you were pregnant?

Never

Occasional

1-2 times per week

≥ 3 times per week

15. Did you use illicit drugs when you were pregnant?

Yes

No

16. If your answer is yes for Question 9, which ones did you use?

.....

17. Which form of exercise did you do when you were pregnant?

Gym

Housework

Walking/ climbing stairs more frequently

None

Other specify.....

18. When did you start visiting antenatal clinic when you were pregnant?

First trimester

Second trimester

Third trimester

Never

19. How many times did you visit antenatal care clinic?.....

20. How often did you take nutritional supplements tablets (iron/multivitamin tablets) when you were pregnant?

Everyday

Sometimes

Rarely

Never

Key: for Question 21 to 26

Low: – once or less than once per week

Moderate: – two to three four times per week

High: – 5 times and more per week

Very high: - everyday

Never: did not eat that kind of food at all

21. How often did you eat fruits/drink fruit juice when you were pregnant?

Everyday

5 times or more per week

Two to four times per week

Once or less than once per week

Never

22. How often did you eat vegetables/legumes when you were pregnant?

Everyday

5 times or more per week

Two to four times per week

Once or less than once per week

Never

23. How often did you eat meat, pork, fish or poultry when you were pregnant?

Everyday

5 times or more per week

Two to four times per week

Once or less than once per week

Never

24. How often did you eat pap, rice, pastas?

Everyday

5 times or more per week

Two to four times per week

Once or less than once per week

Never

25. How often did you eat meals or snacks such as burgers, pizza, chicken, or chips from places like, Hungry lion, Panarrotis, KFC, Spur, Dibonnaires or local takeaway food places?

- Everyday
- 5 times or more per week
- Two to four times per week
- Once or less than once per week
- Never

26. How often did you eat milk and milk products when you were pregnant?

- Everyday
- 5 times or more per week
- Two to four times per week
- Once or less than once per week
- Never

27. On average how many glasses of water did you drink per day?

- 1 to 2
- 3 to 5
- ≥ 6
- Don't know

28. What is the spacing interval between the birth of your previous child and conception of your newly born baby?

- Less than 6months
- 6months to 1year

18months to 2years

>2years to <5years

≥ 5years

First child

29. Did you intend to have this pregnancy?

Wanted (wanted a child now)

Mistimed (not now but at some point)

Unwanted (not at all)

Unexpected

30. Were you sexually abused when you were pregnant?

Yes

No

SECTION C

High risk behavioural practices of partners and other family members.

31. Did you stay with people who smoke when you were pregnant?

Yes

No

32. Does your partner smoke?

Yes

No

33. Does your partner drink alcohol?

Yes

No

34. Does your partner expose you to violence?

Yes

No

35. If yes, how frequent were you exposed to violence by your partner when you were pregnant?

Most of the times

Sometimes

Rarely

Never

36. How frequent were you emotionally abused by your partner, family members or your boss at work when you were pregnant?

Most of the times

Sometimes

Rarely

Never

THE END..... THANK YOU