# LEVELS, PATTERNS AND DIFFERENTIALS OF FERTILITY AMONG WOMEN OF REPRODUCTIVE AGES IN NORTHWEST NIGERIA.

BY

AKINWANDE, TAWAKALITU YETUNDE
B.Sc. DEMOGRAPHY AND SOCIAL STATISTICS (Ife)
MATRIC NUMBER: 196870

A DISSERTATION SUBMITTED TO
THE DEPARTMENT OF EPIDEMIOLOGY AND MEDICAL STATISTICS,
FACULTY OF PUBLIC HEALTH, COLLEGE OF MEDICINE,
UNIVERSITY OF IBADAN.

IN PARTIAL FULFILMENT OF
THE REQUIREMENT FOR THE AWARD OF
MASTERS OF PUBLIC HEALTH IN MEDICAL DEMOGRAPHY
OF THE
UNIVERSITY OF IBADAN,
IBADAN, NIGERIA.

MARCH, 2018

## ABSTRACT

The fertility level in Northwest Nigeria has been persistently high over the years and this level has been found to be the highest in Nigeria. High fertility has negative impact on maternal and child health particularly childhood mortality. There is dearth of information on the reasons for persistently high fertility levels in the Northwest region of Nigeria. Therefore, this study determined levels, patterns and differentials of fertility among women of reproductive ages in Northwest Nigeria.

This study utilized 2013 nation-wide survey data set on women aged 15-49years in Northwest Nigeria (n=11,877). The dependent variable was fertility measured by information on full birth history of women as reported in 2013 Nigeria demographic and health survey (NDHS). Brass relational Gompertz model, Coale and Trussel P/F ratio, analysis of variance test, Chi-square test and Generalised linear model negative binomial distribution were employed for analysis.

Respondents mean age was 28.7±9.7years, total fertility rate (TFR) for women in Northwest was using Coale and Trussel P/F ratio was 8.1 births per woman and 7.3 births per woman using Brass relational Gompertz model, TFR for Northwest rural area was 8.5 births per woman 7.6 births per woman using Brass relational Gompertz model. The fertility level using Gompertz model and Trussell P/F ratio was different. Northwest extent of child bearing was ($\alpha$=-0.0273, RMSE=1.0482), and higher in the rural ($\alpha$=0.0079, RMSE=0.343) than urban ($\alpha$=-0.1033, RMSE=0.551). Women between ages 45-49 had the highest mean CEB while women between ages 15-19 had the lowest mean CEB. Women who resides in the rural area had higher mean CEB than those who reside in the urban areas. Women who had sex preference and had more than 5 children were 40.9%, 46% of women with no education had more than 5 children. Women who had their first child below age 18 were 56% and were reported to have had more than 5 children at the time of the survey. Women in urban area who had no child yet were 32%, 17% of the women in rural area had no child while 44% and 33% of the women in rural area and urban area respectively had more than 5 children. The relative inclusive ratio of fertility was higher in the rural area (RR= 0.97 C.I = 0.90-1.05, P>0.05) than in Urban.

The major predictors of high fertility in Northwest Nigeria were; age at first birth, current age and religion of women. The level of fertility is high in Northwest Nigeria, and the burden is higher in rural area than urban areas. Improving and modifying existing programmes to reduce fertility among women in Northwest Nigeria may facilitate lower fertility in Northwest Nigeria.



Keywords: Fertility, sex-preference, North-west Nigeria, Rural, Urban

Word counts: 436

# CERTIFICATION

We certify that this project was carried out under our supervision by Akinwande, Tawakalitu Yetunde Department of Epidemiology and Medical Statistics, Faculty of Public Health, College of Medicine, University of Ibadan, Ibadan.

**Dr. S.A. Adebowale**

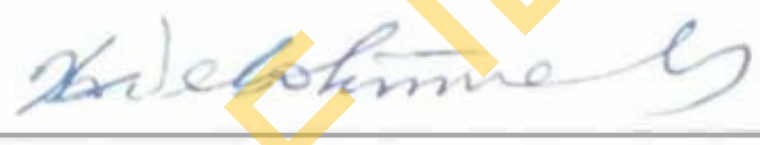
B.Sc. (Ado), P.G.D, M.Sc.( Lagos), MSc. Ph.D RES. Fellow (South Africa)

Department of Epidemiology and Medical Statistics,

Faculty of Public Health,

College of Medicine, University of Ibadan

Ibadan Nigeria.



**Dr. Gbadebo Babatunde M. (Co-Supervisor)**

B.Sc. M.Sc. Ph.D Ife

Department of Epidemiology and Medical Statistics,

Faculty of Public Health,

College of Medicine, University of Ibadan

Ibadan Nigeria.

## DEDICATION

This work is dedicated to Almighty Allah (SWT) the most Beneficent, the most Merciful.

# ACKNOWLEDGEMENTS

All thanks to Almighty Allah the most beneficent the most merciful for the making me complete my programme, despite the challenges I encountered during the programme. Indeed I cannot deny his mercies and favours upon me, I give thanks and praise to his holy name, the helper of the helpless.

I thank Allah for giving me a wonder family and wonderful parents Alhaji A.L.A Akinwande and Alhaja A.B Akinwande who supported me with everything they have, their time, their words of encouragement, sacrifices especially their financial and moral support. I could not have asked for more, may Almighty Allah bless them.

I am most grateful to my supervisor Dr. S.A Adebowale for his encouragement, assistance and professional guidance throughout the conduct of this project. I am also grateful to my co-supervisor Dr. B.M Gbadebo for his professional guidance and thankful to all other lecturers in the Department of Epidemiology and Medical Statistics in general for their knowledge impacted on me during my programme. I am also grateful to all My siblings Mrs Kehinde Adesoye, Mrs Taiwo Owolabi, Tunde Akinwande, Quadri Akinwande, Quyyum Akinwande, Olayemi Adesoye and other family members who supported me during my programme. My special thanks to Management and staffs of IsonBpo MTN process especially my supervisors and my colleagues who made sacrifices for me during my course of programme. Special thanks goes to Mr Saliu Ogunmola for his sacrifices to assist me during the study.

I am grateful to Mr Tubosun Olowolafe, Mr Omotosho Uthman, Mr Peter Adeyeye for their mentorship during my programme and also to all my colleagues in the master programme Lateefat Akinwale Sanusi, Awoyelu Ifeoluwa Emmanuel, Bukola Enitilo, Bridget Afam, Peter Okafor, Rasheed Adebiyi and Izzatulai Bolajoke for their motivations and encoragements.

Many thanks to my friends who supported and believed in me, am grateful to Abisoye Ottun, Adekola Olabisi, Raji Bukola, Kunle Ologbenla and Folake Oguntuga I thank them for their encouragements and motivations.

# TABLE CONTENTS

# LIST OF TABLES

## LIST OF FIGURES

## LIST OF FIGURES

## List of Abbreviations

**CEB:** Children Ever Born

**TFR**: Total Fertility Rate

**ASFR:** Age Specific Fertility Rate

**NDHS:** Nigeria Demographic and Health Survey

**NPC:** National Population Commission

**FGN**: Federal Government of Nigeria

## List of Abbreviations

**CEB:** Children Ever Born

**TFR**: Total Fertility Rate

**ASFR:** Age Specific Fertility Rate

**NDHS:** Nigeria Demographic and Health Survey

**NPC:** National Population Commission

**FGN**: Federal Government of Nigeria

# CHAPTER ONE

## 1.0 INTRODUCTION

### 1.1 Background of the Study

Fertility level is among the commonly used indicators of the social and economic development of a nation. Fertility can be said to be the natural capability to produce offspring while the fertility rate is the number of offspring born per woman. Growth in population can be curbed by identifying fertility level and key factors influencing fertility preference and desires. There will be difficulty in determining suitable population policies if there is lack of knowledge and information about factors influencing fertility (Beyeza-Kashesy et al., 2010). Fertility level of a population does not only determine the population current size but also has a positive or negative effect on the future economic growth of a population and demographic dividend.

Over the years, there have been changes in fertility pattern throughout the world. The world fertility pattern has reached an extraordinary low level, although there had been deviation in world fertility pattern (United Nations, 2015). The world total fertility rate was 2.5 birth per woman, the developed country had TFR of 1.7 births per woman, Europe had the lowest total fertility rate of 1.6 births per woman, Oceania had TFR of 2.4 births per woman, the less developed countries had TFR of 2.6, Africa had the highest TFR of 4.7 births per woman, sub-Sahara Africa countries had 5.0 births per woman, Northern African countries had TFR of 3.4 birth per woman, west Africa countries had TFR of 5.7 birth per woman and Nigeria had TFR of 5.5 birth per woman (Population Reference Bureau, 2016).

Developing countries are faced with problems of uncontrollable increase in their population which is ascribed to bearing of many children by women especially in the rural areas because of lack of education, awareness and poverty as well as marriage at earlier age (Asaduzzaman & Khan, 2009). In sub-Sahara Africa, fertility was constant at 5.1 births per woman between

2005 and 2010, the persistent high fertility was associated with the reduction in mortality (United Nations, 2011). In Nigeria fertility level has experienced a reduction over the three decades, from 5.9 births per woman in 1991 to 5.7 births per woman in 2008 and dropped more to 5.5 births per woman in 2013, the slow pace of reduction of TFR was associated with unequal distribution of TFR across regions in Nigeria (NPC & ICF, 2014). Many factors have been responsible for Nigeria fertility situation this factors include early marriage especially in the northern regions and low education. The age distribution of are as follows, 23% of women age 15-19 have already started child bearing, 32% of those age 20-49 have had given birth by 18years, the highest concentration is in the Northwest part of Nigeria which 78% of the girls are married by age 18years due to early married practises in the Region (NPC & ICF, 2014).

The Northwest Zone TFR was estimated at 6.7 births per woman which means that each woman in the region is expected to have an average of 7 children, this is higher than the four children to a woman proposed in National Population Policy (NPC & ICF, 2014). This is associated to the early marriage practises in the region, women who marry early are expected to have more children than those that delay marriages (Ozumba, 2012).

Early studies identified regional differentials in fertility level across Nigeria with some regions pertaining to high fertility (Northern region) while others seemingly had low fertility (Southern regions) levels. North East and North West were identified to have higher TFR as compared to the southern regions (Reed & Mberu, 2014). A study on fertility in Nigeria found that the three southern regions, on average, had considerably lower fertility levels (4.5 children ever born) than the northern regions with an average fertility level of 6.7 (Joseph, 2006). A report by the World Economic Forum further stated that fertility was higher in the Northern regions than in the Southern regions (World Economic Forum, 2014). In a similar study, Rampedi (2014) discovered that there exists a relationship between region of residence and fertility in Nigeria. It was observed that of the six regions in Nigeria, fertility is highest in the North West region

2005 and 2010, the persistent high fertility was associated with the reduction in mortality (United Nations, 2011). In Nigeria fertility level has experienced a reduction over the three decades, from 5.9 births per woman in 1991 to 5.7 births per woman in 2008 and dropped more to 5.5 births per woman in 2013, the slow pace of reduction of TFR was associated with unequal distribution of TFR across regions in Nigeria (NPC & ICF, 2014). Many factors have been responsible for Nigeria fertility situation this factors include early marriage especially in the northern regions and low education. The age distribution of are as follows, 23% of women age 15-19 have already started child bearing, 32% of those age 20-49 have had given birth by 18years, the highest concentration is in the Northwest part of Nigeria which 78% of the girls are married by age 18years due to early married practises in the Region (NPC & ICF, 2014).

The Northwest Zone TFR was estimated at 6.7 births per woman which means that each woman in the region is expected to have an average of 7 children, this is higher than the four children to a woman proposed in National Population Policy (NPC & ICF, 2014). This is associated to the early marriage practises in the region, women who marry early are expected to have more children than those that delay marriages (Ozumba, 2012).

Early studies identified regional differentials in fertility level across Nigeria with some regions pertaining to high fertility (Northern region) while others seemingly had low fertility (Southern regions) levels. North East and North West were identified to have higher TFR as compared to the southern regions (Reed & Mberu, 2014). A study on fertility in Nigeria found that the three southern regions, on average, had considerably lower fertility levels (4.5 children ever born) than the northern regions with an average fertility level of 6.7 (Joseph, 2006). A report by the World Economic Forum further stated that fertility was higher in the Northern regions than in the Southern regions (World Economic Forum, 2014). In a similar study, Rampedi (2014) discovered that there exists a relationship between region of residence and fertility in Nigeria. It was observed that of the six regions in Nigeria, fertility is highest in the North West region

and lowest in the South East region. He later concluded that, region of residence alone cannot be used to explain the prevalence of high fertility in the North West region and the low fertility in the South East region. However, evidence is sparse on the factors that had contributed to high fertility level in the North West Nigeria. Thus, this study aimed to investigate the levels, patterns and differentials of fertility among women of reproductive age in North West Nigeria.

## 1.2 Statement of Research Problem

Nigeria's population is one of the fastest growing in the World. The country's population grew from 56 million in 1963 to 88 million in 1991, and almost more than doubled the 1963 figure in just 38 years reaching 119 million in 2001 (FGN, 2004). Within just a span of another five years, in 2006, the country's population reached 140 million (NPC, 2006). Current estimates suggest that the total national population has exceeded 180 million (PRB, 2015). It is expected that the figure will double its size in the next two decades if the prevailing fertility rate persists.

The country's rapid population growth is accentuated by the persistent high national fertility average that stood at a pre-transitional level of 5.5 children per women (NPC & ICF, 2014). The overall national fertility decline remains a mirage in Nigeria since only a marginal reduction of 0.2 child per woman was recorded between 2008 and 2013. Evidences have suggested that wide variations in total fertility rates exist among the six geo-political zones of the country. Fertility is much higher among the northern zones than it is in the southern zones. The highest TFR of 6.7 is found in the Northwest zone, while the lowest of 4.3 is found in the South South zone (NPC & &CF, 2014). This is indicative that Nigeria's high fertility is largely driven by the TFR of the northern zones. It could therefore be argued that the slow overall national fertility decline is mitigated by the persistently high fertility regimes of the northern zones.

The consequences of high fertility and its attendant rapid population growth varies from economic, human development, environmental and health issues. It should be noted that high fertility and rapid population growth are hindrance to economic growth and development. Which means that rapid population growth can result to a persistent poverty cycle in a society or a country as a whole (Chowdhury, 2010). High fertility has negative implication on maternal child health (Adebowale & Palamuleni, 2015). Aside that, it also determinants a nation's economic growth and development it also reduces as well as demographic dividend and some environmental factors such as congestion directly affecting the health of the population in the long run.(Chowdhury, 2010).

The 2006 Census indicated that over 60 % of the population is made up of persons younger than age 25. The preponderance of youths in the population and the strong population momentum that has been built into Nigeria's population suggest that population will continue to grow in the next 40 – 50 years even if fertility is drastically reduced to replacement level. It is even striking to observe that the current ideal number of children are 6.5 and 7.1 for all women and currently married women respectively (NPC & ICF, 2014). These figures are higher than the national TFR (5.5), which means Nigerians have desire for more children.

Northwest Nigeria has the highest level of high fertility as well as highest mortality in Nigeria with TFR of 6.7 children per women, Neonatal mortality of 44 death per 1,000 live birth, post natal mortality of 46 death per 1,000 live birth, infant mortality of 89 death per 1,000 live birth and under five mortality of 185 death per 1,000 live birth compared to other regions of the country (NPC & ICF, 2014). This may cause more problems such as outbreak of disease natural resources and infrastructural scarcity (Adiri et al., 2010).

## 1.3 Justification of the Study

Since the adoption of National Policy on Population for Sustainable Development to improve the quality of life and standard of living of Nigerians (NPC, 2004), interest on some targets of the document has attracted many researchers, and this has led to different findings that seek to explain various factors responsible for the existing high fertility level in Nigeria. Nigeria has at one point or the other executed various programmes to keep fertility level low. While high fertility has been strongly related to mothers in terms of their level of education, age at marriage, age at first birth, place of residence and employment status. Studies on fertility level, especially in North West Nigeria has not been prominent. It is important to centre research efforts on contributing factors to high fertility level in North West Nigeria where it is rampant in order to achieve the targets set in the Nigeria National Policy on Population. There is lack of studies that explore reason for high fertility in Northwest Nigeria considering the places of residence differences. However, this study intends to extend the frontier of knowledge by examining the factors contributing to high fertility level in North West Nigeria with respect to rural and urban places of residence.

## 1.4 Research Questions

1. What is the fertility level among women of reproductive age in North West Nigeria?

2. Is there a rural-urban differentials in fertility among women of reproductive ages in North West Nigeria?

3. Is sex preference associated with fertility among women of reproductive age in North West Nigeria?

4. What are the factors influencing fertility among women of reproductive age in North West Nigeria?

## 1.5 Objectives of the Study

The general objective of the study is to examine the levels, patterns and differentials of fertility among women of reproductive age in North West Nigeria.

The specific objectives are to:

1. Determine the fertility level among women of reproductive age in North West Nigeria.
2. Examine rural-urban differentials in fertility among women of reproductive ages in North West Nigeria.
3. Examine the relationship between sex preference and fertility among women of reproductive ages in North West Nigeria.
4. Identify factors influencing fertility among women of reproductive age in North West Nigeria.

## 1.6 Operational Definition of Terms

**Number of Children Ever Born:** Total number of children born to a woman during her childbearing years.

**Total Fertility Rate:** The average number of children that would be born to a woman by the time she ended childbearing if she were to pass through all her childbearing years conforming to the age-specific fertility rates of a given period.

**Age Specific Fertility Rate:** This is the number of live births per 1000 women in a specific age group for a specified geographic area and for a specific point in time, usually a calendar year.

# CHAPTER TWO

## 2.0 LITERATURE REVIEW

### 2.1.1 Review of Relevant Literature

Global fertility rates currently stand at 2.5 children per woman whereas in the late 1960s, fertility rates were on average 6.0 children per woman (Ramos, 2014). The rate is expected to fall from 2.5 TFR in 2015 to 2.1 by 2100 (World Population Prospects, 2015). There has been an identifiably and considerable shift in global fertility levels from high fertility to low fertility. The world population which was 7.3 billion in 2015 is expected to be 9.7 billion in 2050 and 11.2 billion after the following 50 years.(World Population Prospects, 2017). Fertility has declined in some other part of the world especially in the developed countries and will continue to decline in the next decade (Kohler et al., 2006). While sub-Saharan African countries are still having high fertility. (UN, 2015). Even so, over the past decades Africa has had the highest fertility rates in the World with a TFR of between 6.0 and 6.5 births per woman (Ushie, et al., 2011).

In 2016 Africa was Africa had TFR of 4.6 birth per woman, sub-Saharan Africa had TFR of 5.0, West Africa had TFR of 5.3 and Nigeria was reported to have a TFR of 5.5 this made Nigeria among countries with very high TFR (World Population Prospect, 2017). Fertility studies showed that fertility varies widely by region and socio-demographic characteristics in Nigeria (Adebowale et al., 2017; Akintunde et al., 2013; Imoh et al.,2015; Olatoregun, et al., 2014). In Nigeria the highest TFR was found in the Northwest Region of the country with TFR of 6.3 birth per women (NPC & ICF, 2014).

## 2.2 Fertility Levels in Africa

Although with interventions there has been decline in mortality among African countries, however the countries are yet to experience decline in fertility rate. In recent times, DHS data collected in African countries showed that fertility has begun to decline, the factors attributed to this were postponement in marriage, increase in the use of contraceptives and also lower fertility preference. Some countries which have experienced decline in fertility include Kenya, Botswana, Zimbabwe, some parts of Nigeria and also Senegal (Lesthaeghe, 2014).

There has been slight fall in fertility of sub-Saharan African countries from 6.5 births per woman between 1950 and 1955 to 5.4 birth per woman in 2005 and 5.0 births per woman in 2016. This can be said to be average of figure for Sub-Sahara Africa. Some countries such as Democratic Republic of Congo and Niger still have high fertility at 6.4 and 7.3 TFR respectively (Canning, Raja, & Yazbeck, 2015). Some other countries in Africa such as the East Africa and the South Africa countries started their fertility transition as early as the first decades of the 21st century, some other countries in the West Africa and Central Africa are yet to experience fertility change, this can be attributed to the changes in contraceptive use in the later countries and lack of use in the former countries. The West and Central Africa countries are immune to fertility control as a result of the poor utilization in the use of fertility control measures particularly in the rural part of the countries which in turns increases the overall Total fertility rate (Lesthaeghe, 2014).

## 2.3 Fertility in Nigeria

There has been a continuous and relatively high fertility in Nigeria over the time, estimates of TFR for Nigeria in 1965, 1970, 1971 and 1975 were 6.6, 6.5, 7.3 and 7.0 birth per woman respectively (Feyisetan & Bankole, 2002). Presently the TFR of Nigeria has dropped from what it was in the past decades to 5.5 birth per women.(World Population Prospect, 2017). The declined in fertility rate can be associated with intervention programs been advocated in Nigeria, such as promotion of female education, female participate, awareness of and promotion of contraceptive use and other factors. (Reproductive & Initiative, 2011).

Nigeria fertility varies across six geopolitical zones in the countries. The Northern part of the country was characterised by high fertility rate while the southern part was characterised by a relatively lower fertility rate (NPC & ICF, 2014). The lowest TFR in Nigeria was seen in South south part of the country with TFR of 4.3 births per woman while the highest TFR was seen in Northwest with 6.7 births per woman (NPC & ICF, 2014).

Other determinants of fertility in Nigeria includes factors such as age at first birth, place of residence, contraceptive use, educational background of women, wealth status, religion and type of marriage union (Adebowale et al., 2017; Akpa, 2012). In Nigeria, age at first birth is a determinant of fertility level regardless of the woman's socio-economic or demographic factors. The timing of the first birth of a women will determine the number of birth she will have in the long run (Oyefara, 2012). The trend in contraceptive use in Nigeria has increased overtime from 6.0 %, 12.6 % and 14.6 % in the year 1990, 2003 and 2008 respectively to its current level of 15.1 in 2013 (NPC & ICF, 2014). Although despite the increase in the trend of fertility in Nigeria, there is still very low prevalence of contraceptives usage in Nigeria (Igbodekwe et al., 2014). There are clear variations in regional usage of fertility in Nigeria some other factors associated with low contraceptive usage in Nigeria include educational

background, religion, wealth status and place of residence (Odewale, Oladosun, & Amoo, 2016).

### 2.4.1 Fertility in Northern Nigeria and Northwest Nigeria

The Northern part of Nigeria consist of three geopolitical zones from which includes Northwest, Northeast and North central with present levels of fertility TFR of 6.7, 6.3 and 5.3 births per woman (NPC & ICF, 2014). The fertility level in Northern part of Nigeria in the years 2003 reported TFR of Northwest, Northeast and Northcentral to be 6.7, 7.0 and 5.7 births per woman respectively (NPC & ICF, 2004) while in 2008 TFR of the Northwest and Northeast region increased 7.3 and 7.2 births per woman respectively while that Northcentral dropped to 5.4 births per woman (NPC & ICF, 2009).

One of the consequences of high fertility in Northern part of the country is insurgency as displayed by the boko haram sect which is a threat to lives and property of the residence in the region (Lubeck & Program-sais, 2014). Aside that other high fertility in Northern Nigeria is a threat to maternal and child health causing high maternal mortality and childhood mortality in the region (Adebowale & Palamuleni, 2015).

### 2.5.1 Fertility Determinants

In general view fertility is determined by factors such as marriage, contraception, lactation, induced abortions are said to be major or primary causes of fertility differentials in any population. This may affect the population by increasing the population size or reducing the size and structure (Council & Review, 2012). Countries where induced abortion is legalized and there is high use of contraceptive such country will experience low fertility as seen in developed counties of the world (Frejka, 1985). The determinants of fertility in Sub-Sahara African countries are a are lactational amenorrhea due to breastfeeding, decreased exposure to

conception due to postpartum sexual abstinence, and pathological, involuntary infertility due to gonorrhoea (Frank, 1983). Other factors that determines the fertility in Sub-Saharan African countries includes education, place of residence, exposure to mass media, contraceptive use, age at first intercourse, age at first birth, number of children ever born breastfeeding and intercourse patter among others factors.(Bongaarts, Frank, & Lesthaeghe, 1984). The reason for the urban and rural differentials in fertility is associated with concentration of women with higher education and longer year of schooling in the urban areas. Women who spent longer years in schooling are expected to enter child bearing later and this will make their fertility reduced, therefore the number of the number of years of female schooling is significant and negatively related to cumulative fertility in thirteen of the countries, despite their different levels of female schooling and economic characteristics. (Frejka, 1985).

### 2.5.1 Fertility and Place of Residence

Persistently high fertility levels have led to many investigations on the proximate determinants of fertility in Africa. However, little attention has been given to the implications of region of residence on fertility, especially in high fertility countries such as Nigeria. Considerable amount of research has found that while region of residence is not a proximate determinant of fertility, it has an effect on the number of children given birth by a woman. For example, a study conducted in Pakistan found that fertility varied among the different geographical areas in Pakistan. Fertility was highest in the Balochistan region with a TFR of 4.72 and lowest in the North West Frontier Province (NWFP) with a TFR of 4.17 (Hakim, 1994). Although there is only a slight difference between the total fertility rates among the different regions in Pakistan, it is evident that the women in the different regions of Pakistan on average do not have the same number of children.

### 2.5.2 Fertility and Religion

Another study conducted in Ethiopia using the 2005 Demographic and Health Survey found that fertility varied greatly among the different religions in Ethiopia. The regions with high proportions of Muslims (Afar, Somali and Harar) had higher fertility levels as compared to the regions with high a dominance of Christians (Addis Ababa, Amhara and Gambela) (Teller and Gebresselassie, 2009). Identifiably, religion has an effect on the number of children born to a woman. However, the study on Ethiopia is evidence to that women affiliated to specific religions i.e. Islam and Christianity are found in certain regions of the country. In regions where the dominant religion is Islam, fertility was found to be high because Muslims favour large family sizes as compared to regions where the dominant religion is Christianity. Rampedi (2014) revealed that a significant relationship has been found between religion and number of CEB, the study also found that in Nigeria the expected number of CEB was 0.05 lower among Muslim women as compared to Catholic women (Rampedi, 2015). Even so, fertility among Muslim women is less than fertility among Catholic women by only a small percentage. It has been said that the regions with high proportions of Muslims often have higher fertility levels as compared to the regions with high dominance of Christians, (Teller and Gebresselassie, 2009).

### 2.5.3 Fertility and Education

The spread of education and literacy among women is believed to be fundamental to changes in reproductive behaviour. A comparative study has shown that higher education of women is consistently associated with lower fertility (Ehrhardt, 2015) He explained that, the mechanisms through which education affect fertility include postponement of age at marriage, reduction of family size preference and rise in contraceptive use. Martin (1995) also argues that education enhances women's ability to make reproductive choices. Rampedi (2015) also found the

relationship between level of education and CEB to be statistically significant. The expected number of CEB is 0.45 times lower for women with tertiary education as compared to women with no education. Women with tertiary education, identifiably, spend more time pursuing their education and thus delay their age at first marriage. Moreover, women with tertiary education are better able to make responsible reproductive choices than women with no education. Kwarai has indicated that in Nigeria the majority of uneducated women are found in the Northern regions (Kwarai, 2011). The high fertility observed in the Northern regions could be because most women remain uneducated.

### 2.5.4 Fertility and Age at First Birth

Postponement of first marriage and marital dissolution through divorce or widowhood accompanied by low remarriage rates are associated with low levels of fertility. There is some evidence that the age at first birth in sub-Sahara Africa is increasing as the education of women becomes widespread. This is likely to reduce fertility. For example in Sudan, postponement of first marriage has been outlined as the main determinant of fertility decline observed (Cleland et al., 1994).

In a similar vein, Odimegwu and Zerai have indicated that early age at first marriage is a key determinant of fertility (Odimegwu & Zerai, 1996). Ozumba went on to find that it is women of specific regions, predominantly, the Northern region which are more prone to early marriage as compared to other regions (Ozumba, 2012). After examining Bongaarts fertility framework which has identified, among others, age at first sex, contraception use and abortion as proximate determinants of fertility (Bongaarts, 1978), research has found that these characteristics of women also vary by region. In Nigeria, sex usually occurs in the context of marriage. However, young girls in Nigeria get married, between the ages of 15-24. As a result, these adolescents become exposed to sex at an early age (Erulkar & Bello,

2007). Even so, not all regions have its teenage girls exposed to sex at an early age because not all regions have women who marry early. For example a study using the 2003 NDHS found that the median age at first sex for the North West region was 15.8 while it was 20.4 for the South East region (Eruklar & Bello, 2007).

### 2.5.5 Fertility and Contraceptive Use

Nigeria has one of the lowest prevalence of contraceptive use (11-13% in 2010) in the sub-Saharan region (Monjok, et al., 2010), the prevalence is even lower in the Northern regions as compared to the Southern regions. In 2001, Akinyoade conducted a study in Nigeria which showed that on average 6.9% of women in North West Nigeria were on contraception while in the South West region the proportion of women on contraception was 16.3%. Rampedi (2014), a study on the effect of region of residence on fertility level study found that the expected number of CEB was 0.23 times higher among women who use modern contraceptive methods as compared to women who use no method of contraception. The use of modern contraceptive can at times be expensive. Often women who are educated and employed can afford them. However, research has found that educated women at times have children at a faster rate to make up for the time they had spent on their education or careers (Rampedi, 2014). Therefore, even amongst educated women who can afford and use contraception, fertility will remain high.

### 2.5.6 Fertility and Sex Preference

In spite of the significant campaign for the equality and desirability of both sexes of children, empirical evidence and reality indicate that the practice of child-sex preference is still rampant in Nigeria (Eguavoen, et al. 2007), especially in the rural areas.

In an another study, Arnold and Kuo (1984) observed that cultural traditions and random biological process, rather than the general levels of development determine sex preferences. Oreland (1983) observed the effect of sex preference in fertility behaviour and found that preference for a particular sex sustains higher level of childbearing than would be the case if parents were indifferent to the sex of their children. He also observed that couples continue to bear children beyond their overall desired family size in order to achieve some favoured sex.

It has been argued that the reason why parents prefer sons to daughters is that they are typically supported in their old age by son(s), whereas girls usually move away from their families. Hence, a son is more desirable as an investment and "the traditional idea that a boy belongs to us and a daughter to someone else" has become widespread in Nigeria (Eguavoen, et al., 2007; Odimegwu, et al., 2001).

The other explanation is that sons are needed to maintain the family line. This definitely has implication for fertility. If families desire one or more sons, then they may have larger families than would otherwise have been the case, and this would create (Lyager, 2010), "a significant barriers to further fertility decline" in many countries.

## 2.6 Conceptual Framework

The conceptual framework used was adapted from a similar study conducted by John Bongaarts, 1978. The independent variables consist of Maternal age at first birth, age at marriage, sex preference, place of residence, maternal education, maternal occupational status, wealth index, religion, marital status and marriage type and contraceptive use, while the outcome variable is fertility level which as hy Number of Children Ever Born (CEB). The independent variables influences the outcome variable directly or indirectly.

### 2.6.1 Age at First Birth

The relationship between age at first birth and fertility has to do with time of entry into parenthood, the earlier one enters into parenthood the higher the fertility woman is likely to have and the later one enter into parenthood the lesser the fertility one is likely to have ( Kohler, Skytthe, & Christensen, 2001). The increase in the education of women contributes to their greater empowerment and results in postponement of marriage which in turns reduces family size (Ferré, 2009).

### 2.6.2 Sex Preference

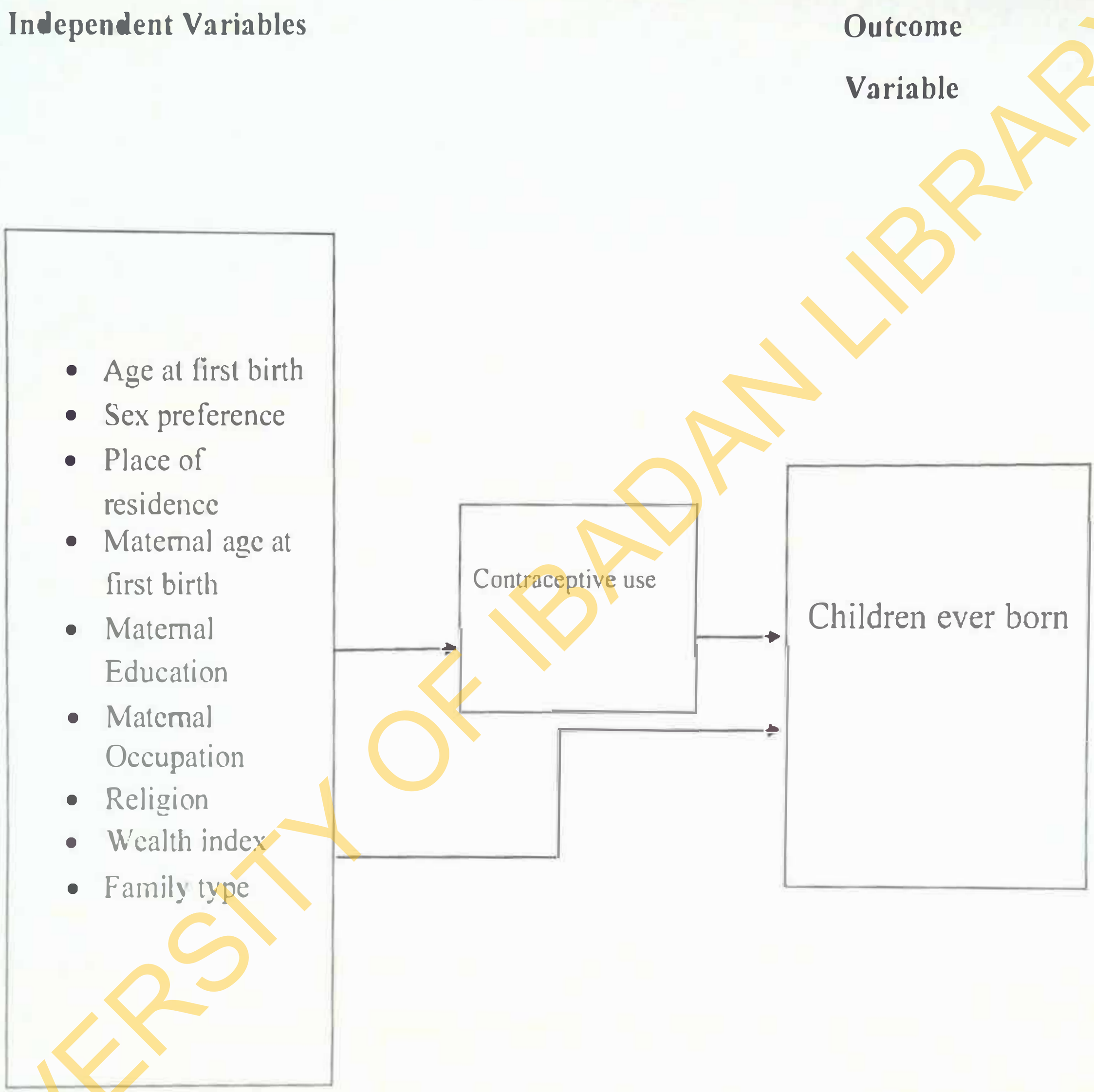
African countries are dominated patriarchal society which sees importance in having a male child for inheritance purpose and other factors, much more importance is being added to having a male child. Regardless of socio-economic or demographic characteristics of individual they still have sex preference for male child (Eguavoen et al., 2007). Another study done in Malawi shows that there is high prevalence for female child in the society, families who had already decided their ideal number of women might decide to have more, if they have not had the gender they intended to have. this practice increases fertility (Adebowale & Palamuleni, 2015). India countries which is also a high fertility country also has high male preference especially among the Muslims in the country which also contribute to the reason of high fertility (Asghar et al., 2014).

### 2.6.3 Place of Residence

A study done in India among the Suvanese women showed that women who reside in the Urban area have higher fertility than those who reside in rural area (Rodriguez, 2007). Increase in Urbanization reduces the risk of high fertility (Martine et al., 2013). Women in the rural area

has higher fertility because lack of education and awareness, poverty, marriage at early ages (Asaduzzaman & Khan, 2009). Another study done among women in Jesse kingdom of Ethiope West Local Government Area of Delta State, Nigeria stated that women in who resides in rural areas are characterized with low or no education which in turns results to higher fertility than the urban residents (Etukudo & Effiong, 2016).

# CONCEPTUAL FRAMEWORK




Source: John Bongaarts (1978)

# CHAPTER THREE

# RESEARCH METHODOLOGY

## 3.0 Introduction

This chapter presents the background information on the study area, data source and data description, sample size and sampling procedure, and the instrument of data collection. It also presents study design, study population, data processing and management, variables operational definition and measurement, approach to achieving study objectives, data analysis as well as study limitation.

## 3.1 Background Information on Northwest Nigeria

The Northwest region of Nigeria was formed from the parts of the old Northern Region. This area of the country covers seven states; Jigawa, Kaduna, Kano, Kastina, Kebbi, Sokoto and Zamfara (Nigerian National Population Commission, 2010). It consists of Hausas and Fulanis and the religion in the region is Islam. About 69% of women in the North West have no education, the literacy level in the region is 26% and median age at first birth was 17.9years in North West. North West has the largest proportion of teenagers who have started child bearing 36% of the girls that started child bearing are seen in the North West. The TFR was 6.7 in Northwest (NPC & ICF, 2014). The postpartum ameonorrhea and abstinence is 15.5 months in North West (NPC & ICF, 2014). In terms of education, 62.8% of the population had no education, while 5.4% had at least secondary education.

## 3.2 Data Description

The sample for the 2013 NDHS was nationally representative and covered the entire population residing in non-institutional dwelling units in the country. The survey used as a sampling frame the list of enumeration areas (EAs) prepared for the 2006 Population Census of the Federal Republic of Nigeria, provided by the National Population Commission. The sample was designed to provide population and health indicator estimates at the national, zonal, and state levels. The analysis for the present study was restricted to North West Nigeria (Jigawa, Kaduna, Kano, Kastina, Kebbi, Sokoto and Zamfara).

## 3.3 Study Population

The study focused on women of reproductive age 15-49 years in Northwest Nigeria. The extracted sample was weighted by applying the weighting factor (iw = v005/1000000) in the analysis.

## 3.4 Study Design

This study was an analytical cross-sectional study and involves the analysis of secondary datasets that is the 2013 Nigerian Demographic and Health Survey.

## 3.5 Variables and Variable Measurements

### 3.5.1 Outcome variable

The outcome variable was fertility. However, the number of children ever born (CEB) is used to assess fertility. The focus of this study is the number of children ever born to women aged 15-49 given that these ages represent the reproductive age of a woman.

### 3.5.2 The Independent Variables

These include some selected socio-economic and demographic variables (Maternal age at first birth, age at marriage, birth interval, sex preference, place of residence, maternal education, maternal occupational status, wealth index, religion, ethnicity, marital status and family type, contraceptive use and media exposure

## 3.6 How study objectives were addressed

**Objective one:** To determine the fertility level among women of reproductive age in North West Nigeria. This was achieved by finding the adjusted TFR of women in Northern Nigeria as a whole using Coale and Trussel P/F ratio and Gompertz model.

**Objective two:** To determine rural-urban differentials in fertility among women of reproductive ages in North West Nigeria. The TFR for the two residence was compared that is rural and urban.

**Objective three:** To examine an association between sex preference and fertility among women of reproductive age in North West Nigeria. Another variable was generated and named Sex Preference, analysis of variance test was carried out to know the means CEB across each variable and chi square test was carried out to know the significance of socio-economic factors and sex preference as it affects fertility among women in Northwest Nigeria.

**Objective four:** To identify factors influencing fertility among women of reproductive age in North West Nigeria. Generalised linear model of Negative Binomial test was carried out using the significant factors in the Chi-square test.

## 3.7 Data Analysis

Stata 12.0 software version, Ms Excel and Population analysis spreadsheet were used for the management and analysis of the data sets. The data was weighted to remove the effect of cluster design, to ensure a suitably representative sample for subgroup analysis. Three approaches were used in the analysis.

Univariate analysis such as the frequency distributions of the variables, Trussel P/F ratio and Brass Gompertz model were used to determine the fertility level and pattern. Bivariate analysis was performed using Chi-square test to examine the association between the independent variables and fertility. Multivariate analysis was carried out using Generalised linear model of Negative Binomial model. This was to examine the relationship between the outcome variable which was fertility and a set of selected independent.

### 3.7.1 P/F ratio technique.

An estimate probable estimate of fertility has been provided by P/F ratio technique which employs data on children ever born and birth in the last one year by age of women and correction factor is worked out for the number of children born last year. $P_i$ stands for average parity of women in a particular age group and $F_i$ stands for average parity equivalent obtain from period fertility rate population analysis spreadsheet was used to achieve this.

The technique was based on the following assumptions:

I. The reference period error is independent of age. It means that the reported age of fertility is correct but not up to the level.
II. The reported children ever born by the younger women is accurate.
III. Fertility has remained constant in the past.

Procedure for calculating P/F ratio

1. Calculation of reported average parity of women in age group (i) denoted by

$$P(i) = \frac{total\ number\ of\ children\ ever\ born\ (ceb)\ to\ women\ in\ age\ group\ (i)}{total\ number\ of\ women\ in\ that\ age\ group\ (TW)}$$

2. Calculation of fertility schedule from the information of birth in last one year ASFR for age group (i) denoted by

$$f(i) \frac{totalbirthtowomeninlastoneyearinagegroup\ (i)}{totalnumberofwomen}$$

3. Calculation of cumulated fertility schedule for the period, denoted by $\phi_i$

$\phi_i = 5f(0) + f(1) + \ldots\ldots\ldots\ldots\ldots + f(i)$

Estimation of average parity equivalent for a period.

Average parity equivalent $F_{i\ are}$ estimated by interpolation using period fertility rate $f_i$ using the period fertility rate $f_i$ and the cumulated fertility rate $\phi_i$

Fi is obtained as

$F(i) = \phi(i-1) + a * f(i) + b * f(i+1) \ldots\ldots\ldots$

Where a, b and c are constants.

### 3.7.2 Relational Gompertz Fertility Model

The relational Gompertz is a modification of the Brass P/F ratio method which estimates age specific and total fertility by determining the shape of the fertility schedule from data collected on recent birth while determining its level from reported parities of younger women. In producing estimates of age-specific and total

fertility, the method seeks to remedy the errors commonly found in fertility data associated with too few or too many births being reported in the reference period, and the under-reporting of lifetime fertility and errors of age reporting among older women. The relational Gompertz is an improved and more versatile version of the Brass P/F ratio method with the same input data.

The basic equation of the relational model is

$$G(x)=\exp(a.\exp(bx))$$

which is sigmoidal (i.e. S-shaped), but also has an associated hazard function that is right-skewed and which therefore captures fairly well both the pattern of average parities of women by age and their cumulated fertility. The form of $G(x)$ implies that a double-negative log transform of proportional cumulated fertilities or average parities approximates a straight line for most of the age range. The double-log transform

$$Y(x)=-\ln(-\ln(G(x)))$$

is termed a *gompit* and has a close analogue in the *logit* transform frequently used in mortality analysis. Brass, however, found that a much closer linear fit could be obtained by a relational

model that expresses the gompits of an observed series of fertility data as a linear function of the gompits of a defined standard fertility schedule. In other words,

$Y(x)=\alpha+\beta Y_s(x)$

where

$Y_s(x)$ is the gompit of the standard fertility schedule. Evidently, if $\alpha = 0$ and $\beta = 1$, the fertility schedule will be identical to the standard fertility schedule. Alpha ($\alpha$) represents the extent to which the age location of childbearing in the population differs from that of the standard (negative values imply an older distribution of ages at childbearing than in the standard), while beta ($\beta$) is a measure the spread of the fertility distribution (values greater than 1 imply a narrower distribution).

The data used for the estimation of relational Gompertz fertility schedule are-
The fertility rates for the first, two or three years before the survey, classified by age of mother at survey; average parities of women classified by five year or single age group of mother.

**Assumptions:**

1. The standard fertility schedule chosen for use in the fitting procedure appropriately reflects the shape of fertility distribution in the population
2. Any changes in fertility have been smooth and gradual and have affected all age groups in a broadly similar way
3. Errors in pre-adjustment fertility rates are proportionately the same among women in the central age group (20-29), so that the age pattern of fertility described by reported recent births is reasonably accurate
4. Parities reported by younger women (20-29) arc accurate

**Steps to Calculation:**

1. Calculate reported average parities ( $5Px$ of women in each age group [x,x+5), for $x$ =[15, 20...45])
2. Determine classification of mothers (Depending on the data available, the fertility rates may be classified either by age of mother at the survey date, or by age of mother at birth of her child)

3. Calculate implied age specific fertility rate and parity (Age-specific fertility rates are derived by dividing the births reported in the period of investigation (e.g. the year, two years or three years) before the survey date by the number of women in each age group)
4. Choose fertility standard to be applied and model variant to be fitted (The standard $Y_s(x)$ values are determined by taking the gompits of the schedule and the standard parity values, $Y_s(i)$, are the gompits of the parities associated with the standard fertility schedule. The choice of standard determines the values of $g(x)$ and $e(x)$ used in the regression fitting procedures which are derived algebraically from the $Y^s()$.
5. Evaluate plot of p point and f point
6. Fit model by selecting point to be used
7. Assess fitted parameter
8. Fitted ASFRs and Total fertility

### 3.7.3 Multivariable Analysis

The multivariate analysis involved generalised linear model of Negative binomial was used to identify the factors influencing fertility among the women of reproductive age in Northwest Nigeria. Where the dependent variable (DV) was Children Ever Born which was categorised into high fertility that CEB of 5 and above or normal fertility of CEB less than 5 to have binomial function. The independent variables are qualitative they include: age group, age at first birth, place of residence, education, religion, wealth index, type of union and sex preference.

- General class of linear models that are made up of 3 components: Random, Systematic, and Link Function

- Random component: Identifies dependent variable ($Y$) and its probability distribution

- Systematic Component: Identifies the set of explanatory variables ($X_1,...,X_k$)

- Link Function: Identifies a function of the mean that is a linear function of the explanatory variables.

$$g(\mu) = \alpha + \beta_1 X_1 + \cdots + \beta_k X_k$$

**Negative Binomial Regression**

- Continuous data with skewed distribution and variation that increases with the mean can be modeled with a *Gamma* distribution

- Identity link (form used in *normal* and *gamma* regression models):

- $g(\mu) = \mu$

- Log link (used when $m$ cannot be negative as when data are *Poisson* counts):

$g(\mu) = \log(\mu)$

- Logit link (used when $m$ is bounded between 0 and 1 as when data are binary):

$$g(\mu) = \log\left(\frac{\mu}{1-\mu}\right)$$

Distribution of Responses: Binomial

Link Function: $g(\mu) = \log\left(\frac{\mu}{1-\mu}\right)$

The third component of a GLM is the link between the random and systematic components. It says how the mean $\mu = E(Y)$ relates to the explanatory variables in the linear predictor through specifying a function $g(\mu)$:

$$g(\mu) = \beta 0 + \beta 1\, x1 + \beta 2\, x2 + \cdots + \beta k\, xk.$$

where $g(\mu)$ is called the link function.

## Ethical Clearance

The approval to carry out the study was obtained by the federal ministry of education. Before the commencement of the study. Informed consent was received from the respondents at the point of data collection and respondents were assured of their confidentiality.

# CHAPTER FOUR

# DATA PRESENTATION, ANALYSIS AND INTERPRETATION

This chapter presents the percentage distribution of the characteristics of the study population according to some selected background characteristics and indirect estimation techniques of analysis. Results from bivariate and multivariate analyses were also presented in this chapter.

## 4.1 Univariate Analysis

The distribution of the study population by background characteristics is presented in Table 4.1. It showed the description of respondents interviewed in the survey. The result showed that 11,877 women in the reproductive ages between 15-49 were interviewed with the mean age of 28.7years and standard deviation of 9.7 years. With respect to the respondent age one in five respondents (20.5) were within ages 15-24years 17.8% were within 25-29years of age, 18.1% of them were within 30-34years of age while 9% of respondents were within ages 40-44years. The rural area had the highest number of respondent with 74.4%. The respondents with no education were 72.78% while 2.52% of the respondent had tertiary education. On the religion of the respondents, 89.3% of them were Muslim

A consideration of ethnicity, 86.6% of the respondents are either Hausa or Fulani while the rest among them were Igbo, Yoruba and other ethnic group which were 11.4% of the total respondent. Almost 95.3 % all of the respondents had never used any contraceptive while the remaining had one method of contraceptive, 74% of the respondents had no preference for any sex while the remaining had preference, 56.1% of the respondent were in monogamous union while the remaining were in polygamous union.

Table 4.1 Frequency Distribution of Respondents by Background Characteristics (n=11877)

| Background Characteristics | Frequency | Percentage |
|---|---|---|
| **Age** | | |
| 15-19 | 2428 | 20.5 |
| 20-24 | 2042 | 17.2 |
| 25-29 | 2151 | 18.1 |
| 30-34 | 1623 | 13.7 |
| 35-39 | 1399 | 11.8 |
| 40-44 | 1069 | 9.0 |
| 45-49 | 1164 | 9.8 |
| Mean±σ | 28.7±9.7 | |
| **Residence** | | |
| Urban | 3402 | 28.6 |
| Rural | 8474 | 71.4 |
| **Education** | | |
| No education | 8643 | 72.8 |
| Primary | 2021 | 17.0 |
| Secondary | 913 | 7.7 |
| Higher | 299 | 2.5 |
| **Religion** | | |
| Christian | 1132 | 9.5 |
| Islam | 10605 | 89.3 |
| Others | 139 | 1.2 |
| **Wealth Index** | | |
| Poorest | 4036 | 34.0 |
| Poorer | 3488 | 29.4 |
| Middle | 1867 | 15.7 |
| Richer | 1462 | 12.3 |
| Richest | 1024 | 8.6 |
| **Ethnicity** | | |
| Hausa/Fulani | 10288 | 86.6 |
| Igbo | 130 | 1.1 |
| Yoruba | 105 | 0.9 |
| Others | 1354 | 11.4 |
| **Contraceptive Use** | | |
| Yes | 552 | 4.7 |
| No | 11324 | 95.3 |
| **Marital Status** | | |
| Never married | 1476 | 12.4 |
| Currently in union/living with a man | 10035 | 84.5 |
| Formerly in union/living with a man | 366 | 3.1 |
| **Type of Union** | | |
| Monogamy | 5617 | 56.1 |
| Polygamy | 4385 | 43.9 |
| **Sex Preference** | | |
| No gender preference | 8787 | 74.0 |
| Preference | 3089 | 26.0 |

Table 4.2 shows the calculated average parity of Northwest in total for both rural and urban residence, the reported total fertility rate (TFR) is 7.5, this means an average woman in Northwest will have 8 children at the end of her child bearing.

Table 4.2 Calculation of ASFR and Average Parity

| AGE GROUP | NO OF WOMEN | CHILDREN EVER BORN | BIRTH IN LAST YEAR | ASFR f(i) | AVERAGE CEB P(i) |
|---|---|---|---|---|---|
| Northwest | | | | | |
| 15-19 | 2428 | 792 | 331 | 0.1364 | 0.3260 |
| 20-24 | 2042 | 3417 | 630 | 0.3086 | 1.6732 |
| 25-29 | 2151 | 7517 | 695 | 0.3233 | 3.4949 |
| 30-34 | 1623 | 8103 | 489 | 0.3011 | 4.9929 |
| 35-39 | 1399 | 9330 | 327 | 0.2335 | 6.6674 |
| 40-44 | 1069 | 7419 | 154 | 0.1436 | 6.9367 |
| 45-49 | 1164 | 9565 | 69 | 0.059 | 8.2202 |
| Total | 11877 | 46142 | 2694 | 1.5054 | 3.8850 |
| Northwest rural | | | | | |
| 15-19 | 1,635 | 706 | 287 | 0.1756 | 0.4316 |
| 20-24 | 1,500 | 2765 | 493 | 0.3287 | 1.8440 |
| 25-29 | 1,590 | 5897 | 531 | 0.3341 | 3.7091 |
| 30-34 | 1,135 | 6021 | 374 | 0.3298 | 5.3054 |
| 35-39 | 999 | 6960 | 250 | 0.2503 | 6.9643 |
| 40-44 | 783 | 5690 | 124 | 0.158 | 7.2647 |
| 45-49 | 832 | 6957 | 51 | 0.061 | 8.3615 |
| Total | 8,474 | 34996 | 2110 | 1.6375 | 4.1297 |
| Northwest urban | | | | | |
| 15-19 | 793 | 86 | 44 | 0.0558 | 0.1084 |
| 20-24 | 543 | 652 | 137 | 0.2528 | 1.2012 |
| 25-29 | 561 | 1620 | 164 | 0.2925 | 2.8877 |
| 30-34 | 488 | 2081 | 114 | 0.2342 | 4.2659 |
| 35-39 | 400 | 2370 | 77 | 0.1917 | 5.9254 |
| 40-44 | 286 | 1729 | 30 | 0.1041 | 6.0394 |
| 45-49 | 332 | 2609 | 18 | 0.0538 | 7.8658 |
| Total | 3402 | 11146 | 584 | 1.1849 | 3.2762 |

In table 4.3 is the Trussell technique was used to calculate the TFR of the women in Northwest, the adjusted TFR was 8.1 this implies that a woman in northwest will have an average of 8 children using Trussell technique of calculating TFR.

Table 4.3 Trussell Technique for Adjusted TFR

| Age | Reported ASFR f(i) | Average CEB P(i) | Cumulative Fertility Phi(i) | F(i) | P/F ratio | | P2/F2 | P3/F3 | P4/F4 | Avg(P3/F3, P4/F4) |
|---|---|---|---|---|---|---|---|---|---|---|
| Northwest | | | | | | | | | | |
| | | | | | | ASFR | 1.0561 | 1.0918 | 1.0472 | 1.06951 |
| 15-19 | 0.136 | 0.326 | 0.682 | 0.305 | 1.068 | 0.1602 | 0.1692 | 0.1750 | 0.1678 | 0.1714 |
| 20-24 | 0.309 | 1.673 | 2.225 | 1.584 | 1.056 | 0.3167 | 0.3345 | 0.3459 | 0.3317 | 0.3388 |
| 25-29 | 0.323 | 3.495 | 3.841 | 3.201 | 1.092 | 0.3236 | 0.3417 | 0.3533 | 0.3388 | 0.3461 |
| 30-34 | 0.301 | 4.993 | 5.347 | 4.768 | 1.047 | 0.2964 | 0.3130 | 0.3234 | 0.3103 | 0.3170 |
| 35-39 | 0.234 | 6.667 | 6.514 | 6.063 | 1.100 | 0.2271 | 0.2399 | 0.2480 | 0.2379 | 0.2429 |
| 40-44 | 0.144 | 6.937 | 7.232 | 6.922 | 1.002 | 0.1322 | 0.1400 | 0.1444 | 0.1385 | 0.1415 |
| 45-49 | 0.059 | 8.220 | 7.527 | 7.459 | 1.102 | 0.04911 | 0.0518 | 0.0535 | 0.0514 | 0.0525 |
| TFR | 7.5270 | | | | | 7.5270 | 7.9490 | 8.2186 | 7.882 | 8.0503 |
| Northwest rural | | | | | | | | | | |
| | | | | | | ASFR | 0.997 | 1.052 | 1.018 | 1.035 |
| 15-19 | 0.176 | 0.432 | 0.878 | 0.402 | 1.073 | 0.2034 | 0.2028 | 0.2140 | 0.2071 | 0.2106 |
| 20-24 | 0.329 | 1.844 | 2.522 | 1.850 | 0.997 | 0.3339 | 0.3329 | 0.3514 | 0.3400 | 0.3457 |
| 25-29 | 0.334 | 3.709 | 4.192 | 3.524 | 1.052 | 0.3356 | 0.3346 | 0.3532 | 0.3417 | 0.3475 |
| 30-34 | 0.330 | 5.305 | 5.841 | 5.210 | 1.018 | 0.3252 | 0.3242 | 0.3422 | 0.3311 | 0.3367 |
| 35-39 | 0.250 | 6.964 | 7.093 | 6.606 | 1.054 | 0.2435 | 0.2428 | 0.2563 | 0.2480 | 0.2521 |
| 40-44 | 0.158 | 7.265 | 7.883 | 7.551 | 0.962 | 0.1457 | 0.1453 | 0.1533 | 0.1484 | 0.1509 |
| 45-49 | 0.061 | 8.361 | 8.188 | 8.117 | 1.030 | 0.0502 | 0.0501 | 0.0529 | 0.0511 | 0.0520 |
| TFR | 8.1876 | | | | | 8.1876 | 8.1633 | 8.6167 | 8.3370 | 8.4768 |
| Northwest urban | | | | | | | | | | |
| | | | | | | ASFR | 1.210 | 1.185 | 1.147 | 1.166 |
| 15-19 | 0.056 | 0.108 | 0.279 | 0.108 | 1.005 | 0.0703 | 0.0850 | 0.0833 | 0.0806 | 0.0819 |
| 20-24 | 0.253 | 1.201 | 1.543 | 0.993 | 1.210 | 0.2673 | 0.3233 | 0.3167 | 0.3064 | 0.3116 |
| 25-29 | 0.292 | 2.888 | 3.005 | 2.437 | 1.185 | 0.2906 | 0.3514 | 0.3443 | 0.3331 | 0.3387 |
| 30-34 | 0.234 | 4.266 | 4.176 | 3.721 | 1.147 | 0.2293 | 0.2774 | 0.2718 | 0.2629 | 0.2673 |
| 35-39 | 0.192 | 5.925 | 5.135 | 4.775 | 1.241 | 0.1857 | 0.2246 | 0.2201 | 0.2130 | 0.2165 |
| 40-44 | 0.104 | 6.039 | 5.655 | 5.403 | 1.118 | 0.0952 | 0.1151 | 0.1128 | 0.1092 | 0.1110 |
| 45-49 | 0.054 | 7.866 | 5.924 | 5.862 | 1.342 | 0.0466 | 0.0563 | 0.0552 | 0.0534 | 0.0543 |
| TFR | 5.9244 | | | | | 5.9244 | 7.1658 | 7.0211 | 6.7929 | 6.9070 |

Figure 4.1.1, Figure 4.1.2 and Figure 4.1.3 are graphical illustration showing the differences between the reported ASFR and P/F ratio for Northwest Nigeria, Northwest Rural, and Northwest Urban respectively. For Northwest, at first the reported ASFR and P/F ratio ASFR are separated from age 15-39, at above age 39 the figures for ASFR and P/F ratio were getting similar. The figure 4.1.2 representing Northwest Rural residence shows similar trend with Northwest total ASFR it was observed that ASFR was increasing at age 15-19, was constant at age 20-34 and began to fall at above age 34. The reported and the P/F ratio were slightly different at the beginning, P/F ratio ASFR was higher, however at age 35 both P/F ratio ASFR and reported ASFR were equal till 40 where there was a very slight difference noticed in the ASFR.

Figure 4.1.3 shows that there was difference in ASFR reported and P/F ratio ASFR although both of them took the same trend. The P/F ratio has higher ASFR at age 15-19 the ASFR increased and increased higher at age 20-24 at age 25-29 there was a fall in the two ASFRs and slight shift in the curve. At age 40-49, the two ASFRS were equal.

Figure 4.1.1, Figure 4.1.2 and Figure 4.1.3 are graphical illustration showing the differences between the reported ASFR and P/F ratio for Northwest Nigeria, Northwest Rural, and Northwest Urban respectively. For Northwest, at first the reported ASFR and P/F ratio ASFR are separated from age 15-39, at above age 39 the figures for ASFR and P/F ratio were getting similar. The figure 4.1.2 representing Northwest Rural residence shows similar trend with Northwest total ASFR it was observed that ASFR was increasing at age 15-19, was constant at age 20-34 and began to fall at above age 34. The reported and the P/F ratio were slightly different at the beginning, P/F ratio ASFR was higher, however at age 35 both P/F ratio ASFR and reported ASFR were equal till 40 where there was a very slight difference noticed in the ASFR.

Figure 4.1.3 shows that there was difference in ASFR reported and P/F ratio ASFR although both of them took the same trend. The P/F ratio has higher ASFR at age 15-19 the ASFR increased and increased higher at age 20-24 at age 25-29 there was a fall in the two ASFRs and slight shift in the curve. At age 40-49, the two ASFRS were equal.

ASFR reported and P/F ratio adjusted ASFR.

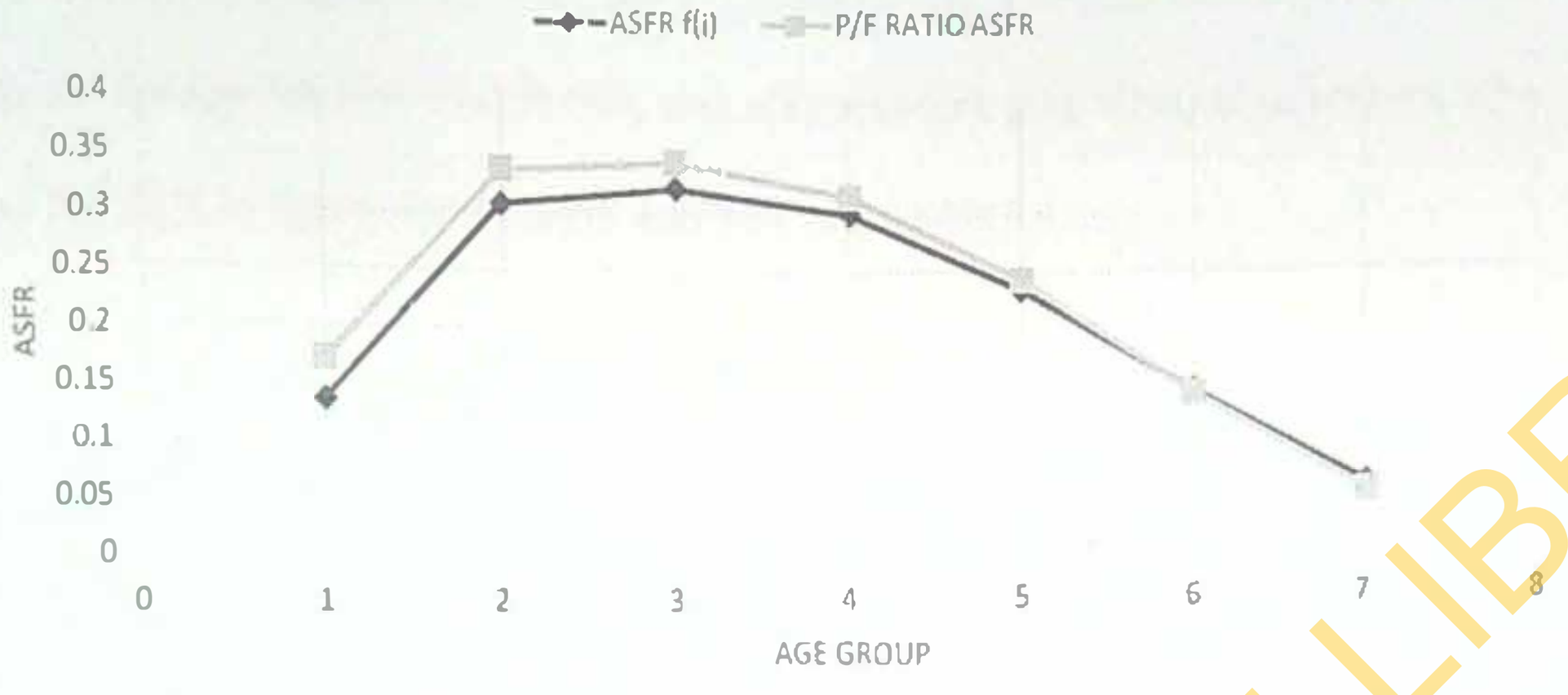



Figure 4.1.1 Northwest


Figure 4.1.2 Northwest Rural

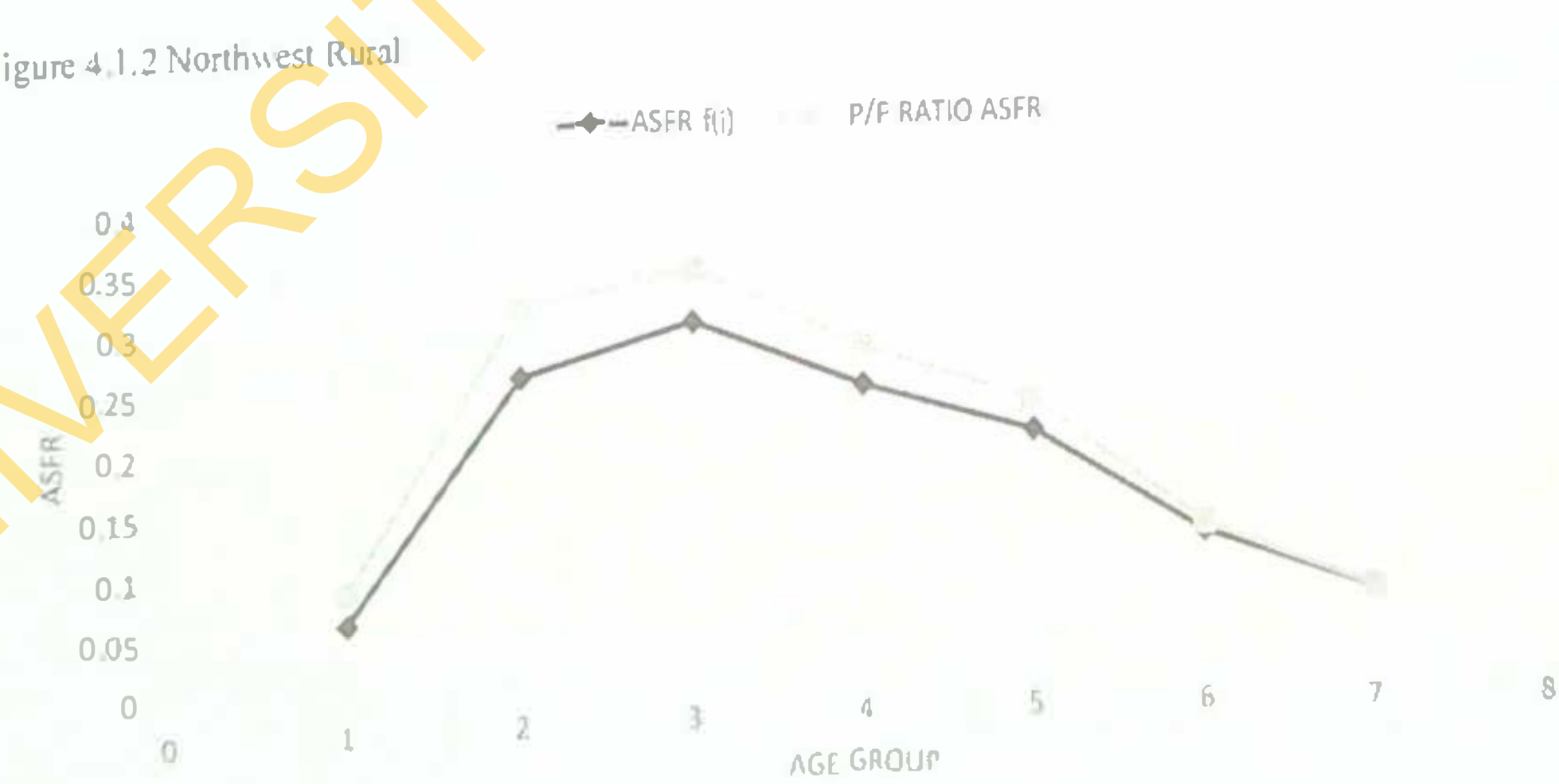



Figure 4.1.3 Northwest Urban ASFR

Table 4.4 shows the F-point of Gompertz relation in Northwest Nigeria, Northwest rural and Northwest urban. In table 4.4.1, 4.4.2 and 4.4.3 respectively. The table shows the distribution of figures for Age (x), F(x), F(x)/F(x+5), z(x), e(x), z(x)-e(x), g(x), z()-e(),g(),z()-e() – y, g() – x and RMSE. The figures for the result were seen in the table 4.4.

Table 4.4 Relational Gompertz model F-Points

| Age (x) | F(x) | F(x)/F(x+5) | z(x) | e(x) | z(x)-e(x) | g(x) | Graph points z()-e() | Graph points g() | Regression points z()-e() -- y | Regression points g() -- x | RMSE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Table 4.4.1 Northwest | | | | | | | | | | | |
| 14.5 | 0.000 | 0.000 | | 0.936 | | -2.438 | | | 0.000 | 0.000 | 0.000 |
| 19.5 | 0.682 | 0.307 | -0.167 | 1.331 | -1.499 | -1.453 | -1.499 | -1.453 | -1.499 | -1.453 | 0.003 |
| 24.5 | 2.225 | 0.579 | 0.605 | 1.417 | -0.812 | -0.743 | -0.812 | -0.743 | -0.812 | -0.743 | 0.000 |
| 29.5 | 3.841 | 0.718 | 1.107 | 1.296 | -0.189 | -0.036 | -0.189 | -0.036 | -0.189 | -0.036 | 0.016 |
| 34.5 | 5.347 | 0.821 | 1.622 | 0.962 | 0.660 | 0.841 | 0.660 | 0.841 | 0.660 | 0.841 | 0.038 |
| 39.5 | 6.514 | 0.901 | 2.258 | 0.441 | 1.817 | 2.180 | 1.817 | 2.180 | 1.817 | 2.180 | 0.195 |
| 44.5 | 7.232 | 0.961 | 3.220 | 0.001 | 3.219 | 4.531 | | | 0.000 | 0.000 | 0.000 |
| 49.5 | 7.527 | 1.000 | | 0.000 | | | | | 0.000 | 0.000 | 0.000 |
| Table 4.4.2 Northwest Rural | | | | | | | | | | | |
| 14.5 | 0 | 0 | | 0.936 | | -2.438 | | | 0 | 0 | 0 |
| 19.5 | 0.878 | 0.348 | -0.054 | 1.331 | -1.385 | -1.453 | -1.385 | -1.453 | -1.385 | -1.453 | 0.006 |
| 24.5 | 2.522 | 0.601 | 0.677 | 1.417 | -0.740 | -0.743 | -0.740 | -0.743 | -0.740 | -0.743 | 0.000 |
| 29.5 | 4.192 | 0.718 | 1.103 | 1.296 | -0.192 | -0.036 | -0.192 | -0.036 | -0.192 | -0.036 | 0.027 |
| 34.5 | 5.841 | 0.824 | 1.639 | 0.962 | 0.678 | 0.841 | 0.678 | 0.841 | 0.678 | 0.841 | 0.033 |
| 39.5 | 7.093 | 0.900 | 2.248 | 0.441 | 1.807 | 2.180 | 1.807 | 2.180 | 1.807 | 2.180 | 0.165 |
| 44.5 | 7.883 | 0.963 | 3.271 | 0.001 | 3.270 | 4.531 | | | 0 | 0 | 0 |
| 49.5 | 8.188 | 1.000 | | 0.000 | | | | | 0 | 0 | 0 |
| Table 4.4.3 Northwest urban | | | | | | | | | | | |
| 14.5 | 0 | 0 | | 0.936 | | -2.438 | | | 0 | 0 | 0 |
| 19.5 | 0.279 | 0.181 | -0.537 | 1.331 | -1.868 | -1.453 | -1.868 | -1.453 | -1.868 | -1.453 | 0.000 |
| 24.5 | 1.543 | 0.513 | 0.405 | 1.417 | -1.011 | -0.743 | -1.011 | -0.743 | -1.011 | -0.743 | 0.000 |
| 29.5 | 3.005 | 0.720 | 1.111 | 1.296 | -0.184 | -0.036 | -0.184 | -0.036 | -0.184 | -0.036 | 0.004 |
| 34.5 | 4.176 | 0.813 | 1.577 | 0.962 | 0.615 | 0.841 | 0.615 | 0.841 | 0.615 | 0.841 | 0.118 |
| 39.5 | 5.135 | 0.908 | 2.338 | 0.441 | 1.897 | 2.180 | 1.897 | 2.180 | 1.897 | 2.180 | 0.509 |
| 44.5 | 5.655 | 0.955 | 3.068 | 0.001 | 3.067 | 4.531 | | | 0.000 | 0.000 | 0.000 |
| 49.5 | 5.924 | 1.000 | | 0.000 | | | | | 0.000 | 0.000 | 0.000 |

Table 4.5 shows the P-point of Gompertz relation in Northwest Nigeria, Northwest Rural and Northwest Urban. In table 4.5.1, 4.5.2 and 4.5.3 respectively. The table shows the distribution of figures for P(i)/P(i+1), z(i), e(i), z(i)-e(i) and g(i). The final result shows that Northwest recorded 0.361, urban reported 0.343 and rural reported 0.551. The urban figure was also difference from that of rural and Northwest, which were similar.

Table 4.5 Relational Gompertz model P-Points

| Group (i) | P(i)/P(i+1) | z(i) | e(i) | z(i)-e(i) | g(i) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 4.5.1 Northwest | | | | | | | | | | |
| 0 | 0.000 | | 1.047 | | -2.661 | | | 0.000 | 0.000 | 0.000 |
| 1 | 0.195 | -0.492 | 1.285 | -1.777 | -1.747 | -1.777 | -1.747 | -1.777 | -1.747 | 0.006 |
| 2 | 0.479 | 0.306 | 1.424 | -1.118 | -1.016 | -1.118 | -1.016 | -1.118 | -1.016 | 0.001 |
| 3 | 0.700 | 1.031 | 1.372 | -0.341 | -0.335 | -0.341 | -0.335 | -0.341 | -0.335 | 0.001 |
| 4 | 0.749 | 1.241 | 1.140 | 0.100 | 0.441 | 0.100 | 0.441 | 0.100 | 0.441 | 0.113 |
| 5 | 0.961 | 3.229 | 0.702 | 2.527 | 1.516 | 2.527 | 1.516 | 2.527 | 1.516 | 0.929 |
| 6 | 0.844 | 1.773 | 0.270 | 1.503 | 3.224 | | | 0.000 | 0.000 | 0.000 |
| 7 | | | 0.000 | | 6.092 | | | 0.000 | 0.000 | 0.000 |
| | | | | | | | | | | 0.361 |
| 4.5.2 Northwest rural | | | | | | | | | | |
| 0 | 0.000 | | 1.047 | | -2.661 | | | 0.000 | 0.000 | 0.000 |
| 1 | 0.234 | -0.373 | 1.285 | -1.658 | -1.747 | -1.658 | -1.747 | -1.658 | -1.747 | 0.010 |
| 2 | 0.497 | 0.358 | 1.424 | -1.066 | -1.016 | -1.066 | -1.016 | -1.066 | -1.016 | 0.002 |
| 3 | 0.699 | 1.027 | 1.372 | -0.344 | -0.335 | -0.344 | -0.335 | -0.344 | -0.335 | 0.000 |
| 4 | 0.762 | 1.302 | 1.140 | 0.161 | 0.441 | 0.161 | 0.441 | 0.161 | 0.441 | 0.085 |
| 5 | 0.959 | 3.165 | 0.702 | 2.463 | 1.516 | 2.463 | 1.516 | 2.463 | 1.516 | 0.848 |
| 6 | 0.869 | 1.962 | 0.270 | 1.691 | 3.224 | | | 0.000 | 0.000 | 0.000 |
| 7 | | | 0.000 | | 6.092 | | | 0.000 | 0.000 | 0.000 |
| | | | | | | | | | | 0.343 |
| 4.5.3 Northwest urban | | | | | | | | | | |
| 0 | 0.000 | | 1.047 | | -2.661 | | | 0.000 | 0.000 | 0.000 |
| 1 | 0.090 | -0.878 | 1.285 | -2.163 | -1.747 | -2.163 | -1.747 | -2.163 | -1.747 | 0.005 |
| 2 | 0.416 | 0.131 | 1.424 | -1.293 | -1.016 | -1.293 | -1.016 | -1.293 | -1.016 | 0.001 |
| 3 | 0.677 | 0.941 | 1.372 | -0.431 | -0.335 | -0.431 | -0.335 | -0.431 | -0.335 | 0.004 |
| 4 | 0.720 | 1.113 | 1.140 | -0.027 | 0.441 | -0.027 | 0.441 | -0.027 | 0.441 | 0.244 |
| 5 | 0.981 | 3.961 | 0.702 | 3.259 | 1.516 | 3.259 | 1.516 | 3.259 | 1.516 | 2.150 |
| 6 | 0.768 | 1.331 | 0.270 | 1.060 | 3.224 | | | 0.000 | 0.000 | 0.000 |
| 7 | | | 0.000 | | 6.092 | | | 0.000 | 0.000 | 0.000 |
| | | | | | | | | | | 0.551 |

Table 4.6 shows the F-model of Gompertz relation in Northwest Nigeria, Northwest Rural and Northwest Urban. In table 4.6.1, 4.6.2 and 4.6.3 respectively. The first columns in the tables show the age distribution of mother ranging from 0-7. The second column is the standard for the Y(i) while the third column shows Y(i). The fourth column is the exponential of the exponential of –Y(i). The next columns were FM(x) and the last column was that of actual cumulant. The F-level results were 6.84, 7.5 and 5.2 for Northwest, Rural and Urban respectively.

Table 4.6 Relational Gompertz model F-model

| Age (x) | Ys(x) | Fitted Y(x) | exp(-exp(-Y(x)) | FM(x) | fm(x) | Actual cumulant |
|---|---|---|---|---|---|---|
| Table 4.6.1 Northwest | | | | | | |
| 14.5 | -1.896 | -2.015 | 0.001 | 0.004 | 0.001 | |
| 19.5 | -0.775 | -0.840 | 0.099 | 0.720 | 0.143 | 6.915 |
| 24.5 | -0.041 | -0.070 | 0.342 | 2.497 | 0.355 | 6.505 |
| 29.5 | 0.631 | 0.634 | 0.588 | 4.294 | 0.359 | 6.530 |
| 34.5 | 1.392 | 1.432 | 0.788 | 5.749 | 0.291 | 6.789 |
| 39.5 | 2.483 | 2.575 | 0.927 | 6.765 | 0.203 | 7.030 |
| 44.5 | 4.532 | 4.724 | 0.991 | 7.235 | 0.094 | 7.297 |
| 49.5 | 13.816 | 14.454 | 1.000 | 7.300 | 0.013 | |
| | | | | | | 6.844 F-LEVEL |
| Table 4.6.2 Northwest rural | | | | | | |
| 14.5 | -1.896 | -1.910 | 0.001 | 0.009 | 0.002 | |
| 19.5 | -0.775 | -0.776 | 0.114 | 0.871 | 0.172 | 7.714 |
| 24.5 | -0.041 | -0.034 | 0.355 | 2.722 | 0.370 | 7.093 |
| 29.5 | 0.631 | 0.646 | 0.592 | 4.532 | 0.362 | 7.082 |
| 34.5 | 1.392 | 1.416 | 0.785 | 6.007 | 0.295 | 7.445 |
| 39.5 | 2.483 | 2.519 | 0.923 | 7.063 | 0.211 | 7.687 |
| 44.5 | 4.532 | 4.592 | 0.990 | 7.578 | 0.103 | 7.963 |
| 49.5 | 13.816 | 13.982 | 1.000 | 7.656 | 0.015 | |
| | | | | | | 7.497 F-LEVEL |
| Table 4.6.3 Northwest Urban | | | | | | |
| 14.5 | -1.896 | -2.442 | 0.000 | 0.000 | 0.000 | |
| 19.5 | -0.775 | -1.059 | 0.056 | 0.352 | 0.070 | 4.987 |
| 24.5 | -0.041 | -0.154 | 0.311 | 1.963 | 0.322 | 4.953 |
| 29.5 | 0.631 | 0.674 | 0.601 | 3.787 | 0.365 | 5.002 |
| 34.5 | 1.392 | 1.614 | 0.819 | 5.165 | 0.276 | 5.097 |
| 39.5 | 2.483 | 2.958 | 0.949 | 5.985 | 0.164 | 5.408 |
| 44.5 | 4.532 | 5.485 | 0.996 | 6.277 | 0.059 | 5.679 |
| 49.5 | 13.816 | 16.932 | 1.000 | 6.304 | 0.005 | |
| | | | | | | 5.188 F-LEVEL |

Table 4.7 shows the P-model of Gompertz relation in Northwest Nigeria, Northwest Rural and Northwest Urban. In table 4.7.1, 4.7.2 and 4.7.3 respectively. The first column in the tables show the age distribution of mother ranging from 0-7. The second column is the standard for the Y(i) while the third column shows Y(i). The fourth column is the exponential of the exponential of –Y(i). the next columns was FM(x) and the last column was that of actual cumulant. The result for Northwest is almost similar to that of Rural and there is difference in the result for p-model and p-level of Urban.

Table 4.7 Relational Gompertz model P-model

| Age (i) | Ys(i) | Fitted Y(i) | exp(-exp(-Y(I)) | FM(x) | Actual Cumulant |
|---|---|---|---|---|---|
| 4.7.1 Northwest | | | | | |
| 0 | -2.076 | -2.204 | 0.000 | 0.001 | |
| 1 | -1.083 | -1.162 | 0.041 | 0.298 | 7.979 |
| 2 | -0.312 | -0.355 | 0.240 | 1.754 | 6.963 |
| 3 | 0.354 | 0.344 | 0.492 | 3.592 | 7.101 |
| 4 | 1.058 | 1.082 | 0.712 | 5.201 | 7.008 |
| 5 | 1.956 | 2.023 | 0.876 | 6.395 | 7.610 |
| 6 | 3.423 | 3.560 | 0.972 | 7.095 | 7.137 |
| 7 | 6.092 | 6.359 | 0.998 | 7.287 | |
| | | | | | 7.300 P-LEVEL |
| 4.7.2 Northwest rural | | | | | |
| 0 | -2.076 | -2.092 | 0.000 | 0.002 | |
| 1 | -1.083 | -1.087 | 0.051 | 0.394 | 8.384 |
| 2 | -0.312 | -0.308 | 0.256 | 1.963 | 7.190 |
| 3 | 0.354 | 0.366 | 0.500 | 3.827 | 7.420 |
| 4 | 1.058 | 1.078 | 0.712 | 5.447 | 7.456 |
| 5 | 1.956 | 1.986 | 0.872 | 6.674 | 7.988 |
| 6 | 3.423 | 3.470 | 0.969 | 7.421 | 7.494 |
| 7 | 6.092 | 6.170 | 0.998 | 7.640 | |
| | | | | | 7.656 P-LEVEL |
| 4.7.3 Northwest urban | | | | | |
| 0 | -2.076 | -2.663 | 0.000 | 0.000 | |
| 1 | -1.083 | -1.439 | 0.015 | 0.093 | 7.333 |
| 2 | -0.312 | -0.488 | 0.196 | 1.235 | 6.130 |
| 3 | 0.354 | 0.333 | 0.488 | 3.079 | 5.912 |
| 4 | 1.058 | 1.201 | 0.740 | 4.666 | 5.763 |
| 5 | 1.956 | 2.309 | 0.905 | 5.707 | 6.545 |
| 6 | 3.423 | 4.117 | 0.984 | 6.202 | 6.139 |
| 7 | 6.092 | 7.409 | 0.999 | 6.300 | |
| | | | | | 6.304 P-LEVEL |

Table 4.8 shows the graphical illustration of Gompertz relational model of plot P-point and F-points, plot of z()-e() with F- and P-point associated with 45-49 age group removed and plot of z()-e() against g() with P-data point associated with the 40-44 group removed shown in figure 4.2, 4.3 and 4.4 respectively for Northwest, Northwest urban and Northwest rural respectively.

Figure 4.2 shows the plot P-point and F-point for Northwest, Northwest urban and Northwest rural in figure 4.2.1, 4.2.2 and 4.2.3 respectively the plot for the three locations are similar, the lines fitted to the P-point and the F-points lie almost on top of each other neither fits their underlining data series particularly well.

The F-point curve download markedly at older at older ages, suggesting some degree of age exaggeration in the data. While the fact that the points lie just below the F-point is an indication that a slight decline in fertility is underway.

Figure 4.3 shows the plot of z()-e() with F-and P-point associated with 45-49 age group removed for Northwest, Northwest urban and Northwest rural respectively shown in figure 4.3.1, 4.3.2 and 4.3.3 respectively. Like figure 4.2, the region and place of residence were similar. The plot suggests a better fit to both lines might be achieved if the P- and F-points for last age group were omitted. These points are omitted and resulting revised plot is being examined.

Figure 4.4 shows that the lines no longer lie as close together and do not remain parallel, visual inspection suggests that removal of the next oldest P-point might cause all the remaining points to lie on a single line.

The points regarding as falling on a single line, implying that the average parities and fertility rates underlying these points are consistent with each other. In this case, we can accept the fitting of the relational Gompertz model

Table 4.8 shows the graphical illustration of Gompertz relational model of plot P-point and F-points, plot of z()-e() with F- and P-point associated with 45-49 age group removed and plot of z()-e() against g() with P-data point associated with the 40-44 group removed shown in figure 4.2, 4.3 and 4.4 respectively for Northwest, Northwest urban and Northwest rural respectively.

Figure 4.2 shows the plot P-point and F-point for Northwest, Northwest urban and Northwest rural in figure 4.2.1, 4.2.2 and 4.2.3 respectively the plot for the three locations are similar, the lines fitted to the P-point and the F-points lie almost on top of each other neither fits their underlining data series particularly well.

The F-point curve download markedly at older at older ages, suggesting some degree of age exaggeration in the data. While the fact that the points lie just below the F-point is an indication that a slight decline in fertility is underway.

Figure 4.3 shows the plot of z()-e() with F-and P-point associated with 45-49 age group removed for Northwest, Northwest urban and Northwest rural respectively shown in figure 4.3.1, 4.3.2 and 4.3.3 respectively. Like figure 4.2, the region and place of residence were similar. The plot suggests a better fit to both lines might be achieved if the P- and F-points for last age group were omitted. These points are omitted and resulting revised plot is being examined.

Figure 4.4 shows that the lines no longer lie as close together and do not remain parallel, visual inspection suggests that removal of the next oldest P-point might cause all the remaining points to lie on a single line.

The points regarding as falling on a single line, implying that the average parities and fertility rates underlying these points are consistent with each other. In this case, we can accept the fitting of the relational Gompertz model

Table 4.8 shows the graphical illustration of Gompertz relational model of plot P-point and F-points, plot of z()-e() with F- and P-point associated with 4 5-49 age group removed and plot of z()-e() against g() with P-data point associated with the 40-44 group removed shown in figure 4.2, 4.3 and 4.4 respectively for Northwest, Northwest urban and Northwest rural respectively.

Figure 4.2 shows the plot P-point and F-point for Northwest, Northwest urban and Northwest rural in figure 4.2.1, 4.2.2 and 4.2.3 respectively the plot for the three locations are similar, the lines fitted to the P-point and the F-points lie almost on top of each other neither fits their underlining data series particularly well.

The F-point curve download markedly at older at older ages, suggesting some degree of age exaggeration in the data. While the fact that the points lie just below the F-point is an indication that a slight decline in fertility is underway.

Figure 4.3 shows the plot of z()-e() with F-and P-point associated with 45-49 age group removed for Northwest, Northwest urban and Northwest rural respectively shown in figure 4.3.1, 4.3.2 and 4.3.3 respectively. Like figure 4.2, the region and place of residence were similar. The plot suggests a better fit to both lines might be achieved if the P- and F-points for last age group were omitted. These points are omitted and resulting revised plot is being examined.

Figure 4.4 shows that the lines no longer lie as close together and do not remain parallel, visual inspection suggests that removal of the next oldest P-point might cause all the remaining points to lie on a single line.

The points regarding as falling on a single line, implying that the average parities and fertility rates underlying these points are consistent with each other. In this case, we can accept the fitting of the relational Gompertz model.

## Table 4.8 Graph of fitting Gompertz relational model

FIGURE 4.2 plot of P-point and F-point

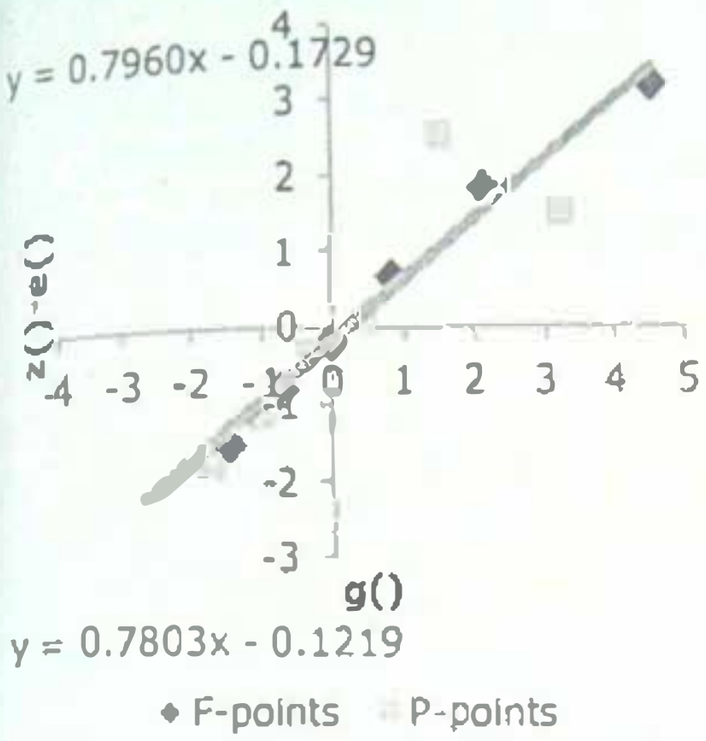



Figure 4.2.1 Northwest Nigeria

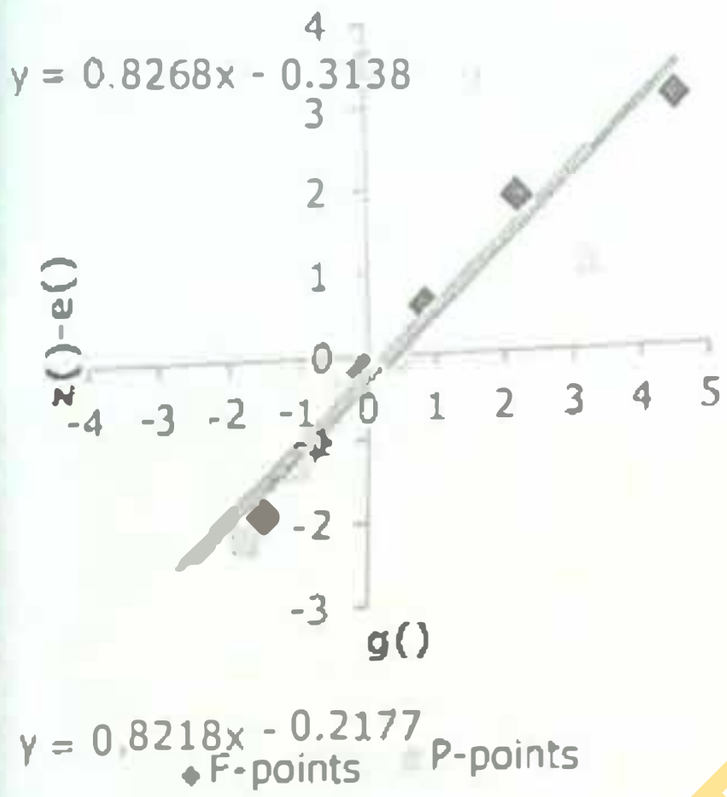



Figure 4.2.2 Northwest Urban Nigeria

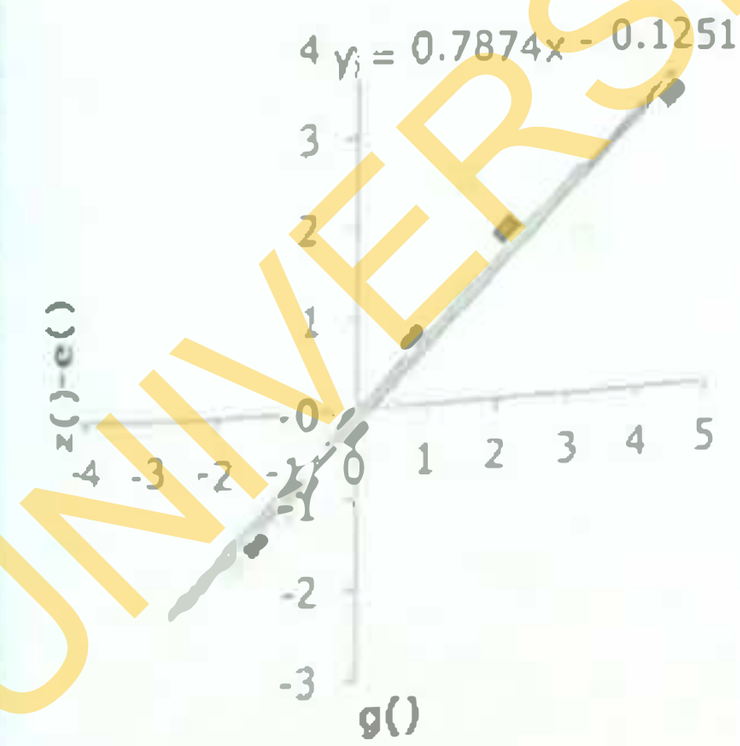



Figure 4.2.3 Northwest Rural Nigeria

FIGURE 4..3 plot of z()-e() with F- and P-point associated with 45-49 age group removed

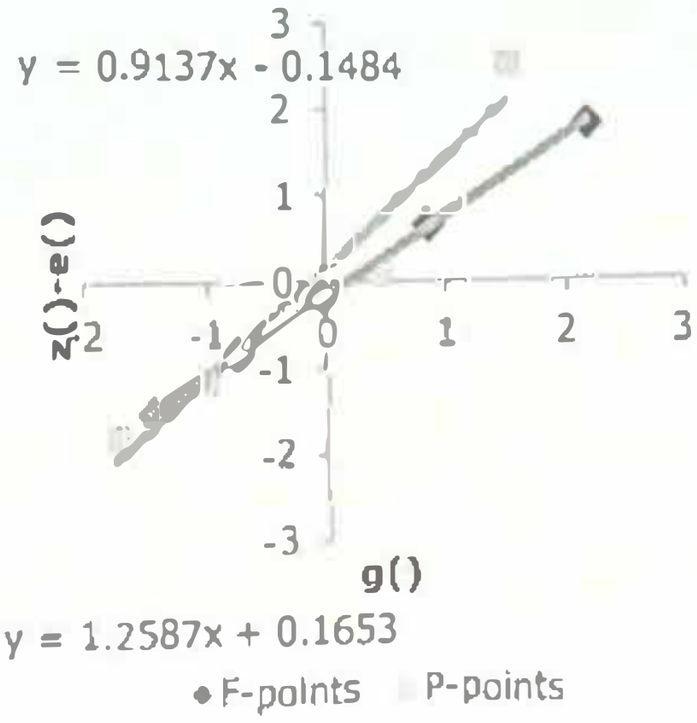



Figure 4.3.1

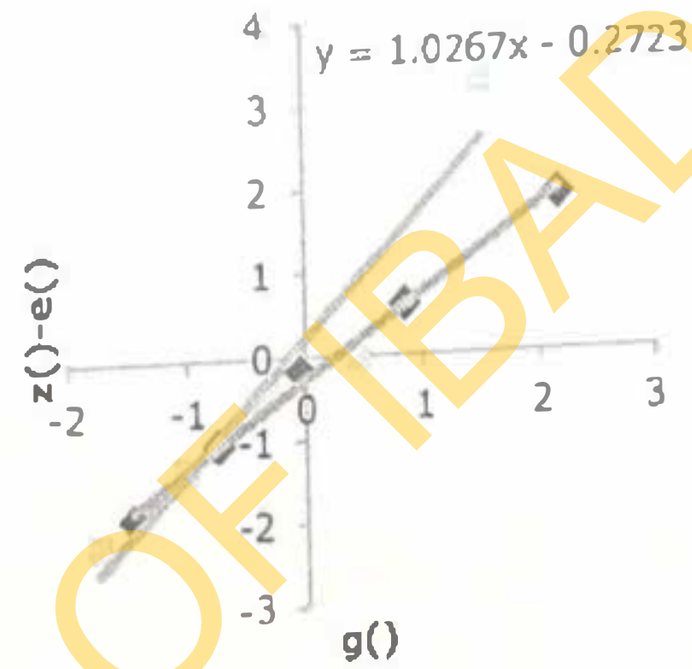



Figure 4.3.2

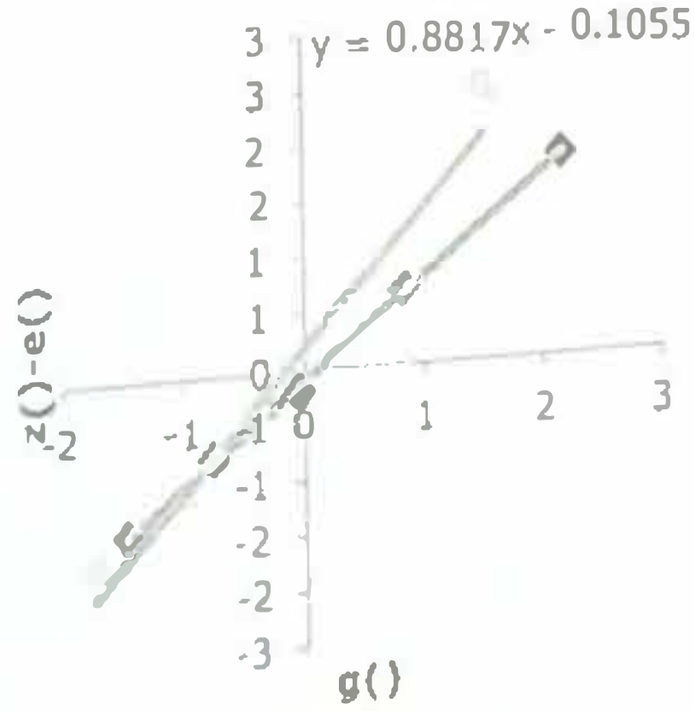



Figure 4.3.3

FIGURE 4.4 Plot of z()–e() against g() with P-data point associated with the 40–44 age group removed

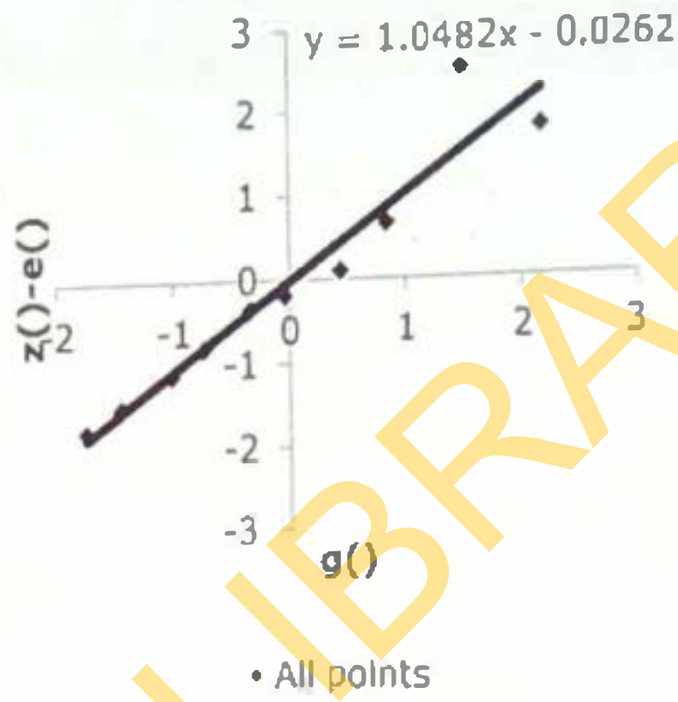



Figure 4.4.1

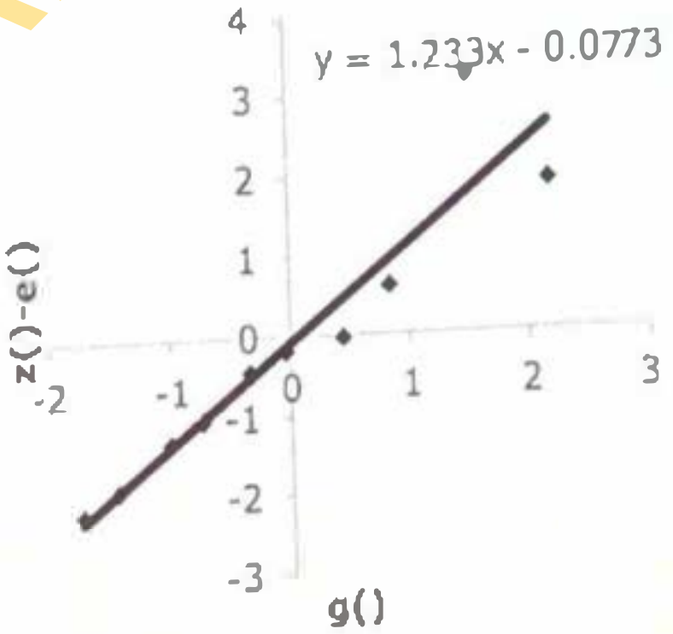



Figure 4.4.2

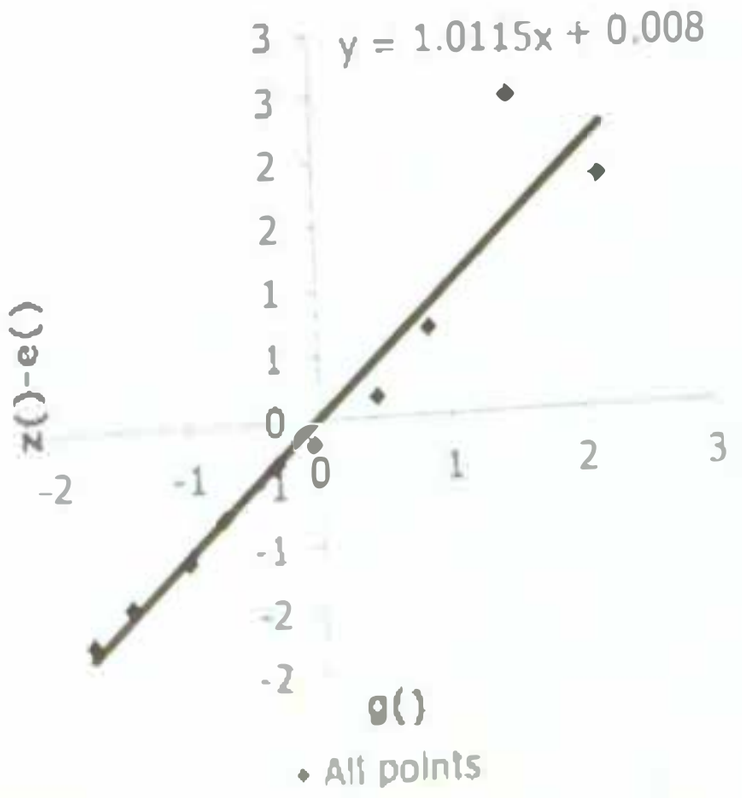



Figure 4.4.3

Fig 4.5.1, 4.5.2 and 4.5.3 showed the graphical illustration of Northwest Nigeria, Northwest urban and Northwest rural Nigeria observed and Adjusted Gompertz ASFR respectively. The horizontal axis consists of the age group of women between 15-49 while the vertical axis consist of the women ASFR. The similarities in the figures were at the starting point, for the three graphs at first, the ASFR observed was lower than the adjusted ASFR for Gompertz. In figure 4a, between ages 20-29 ASFR became constant and started falling after age 30 for both adjusted ASFR and observed ASFR. This can be related to the fact that in Northwest Nigeria, fertility reaches its peak at 20-24 and began to decline afterward. Similarly, figure 4.5.2 which represents Northwest Urban shows that at age 29, fertility reached its peak and began to decline after that point. This was similar for adjusted and reported figures. For figure 4.5.3 which represented Northwest rural ASFR reached its maximum between 20-24 with ASFR of 0.375.

Graphical illustration of Observed and corrected Gompertz ASFR

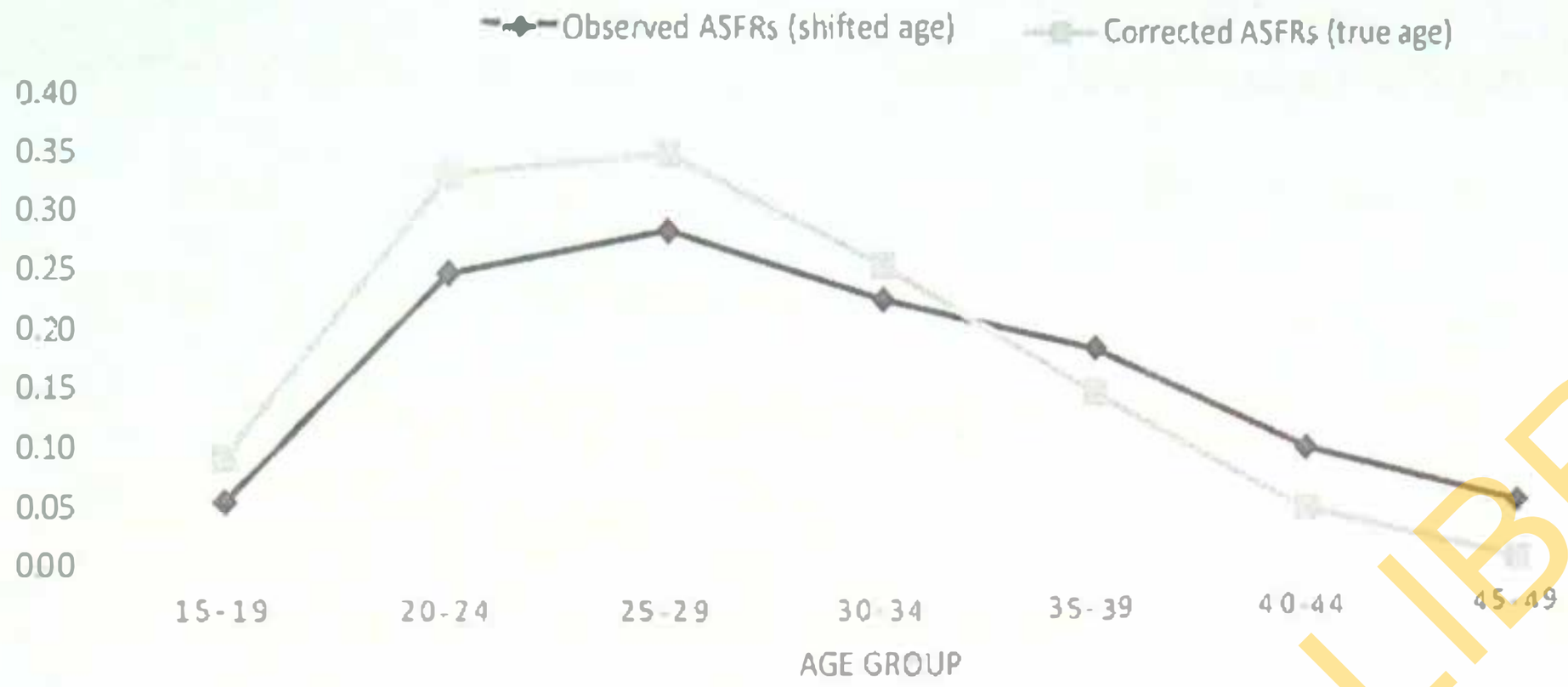



Fig 4.5.1 Northwest Nigeria 2013

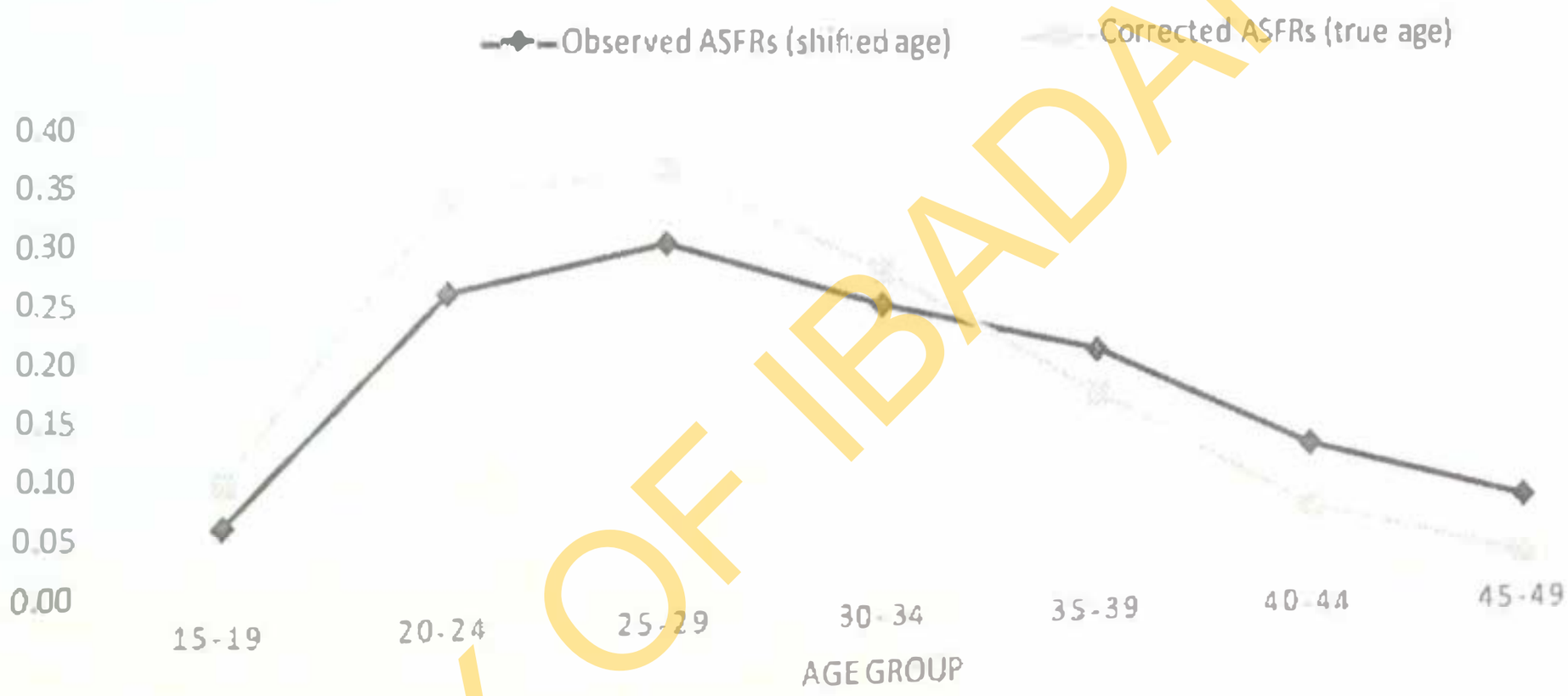



Fig 4.5.2 Northwest Urban 2013

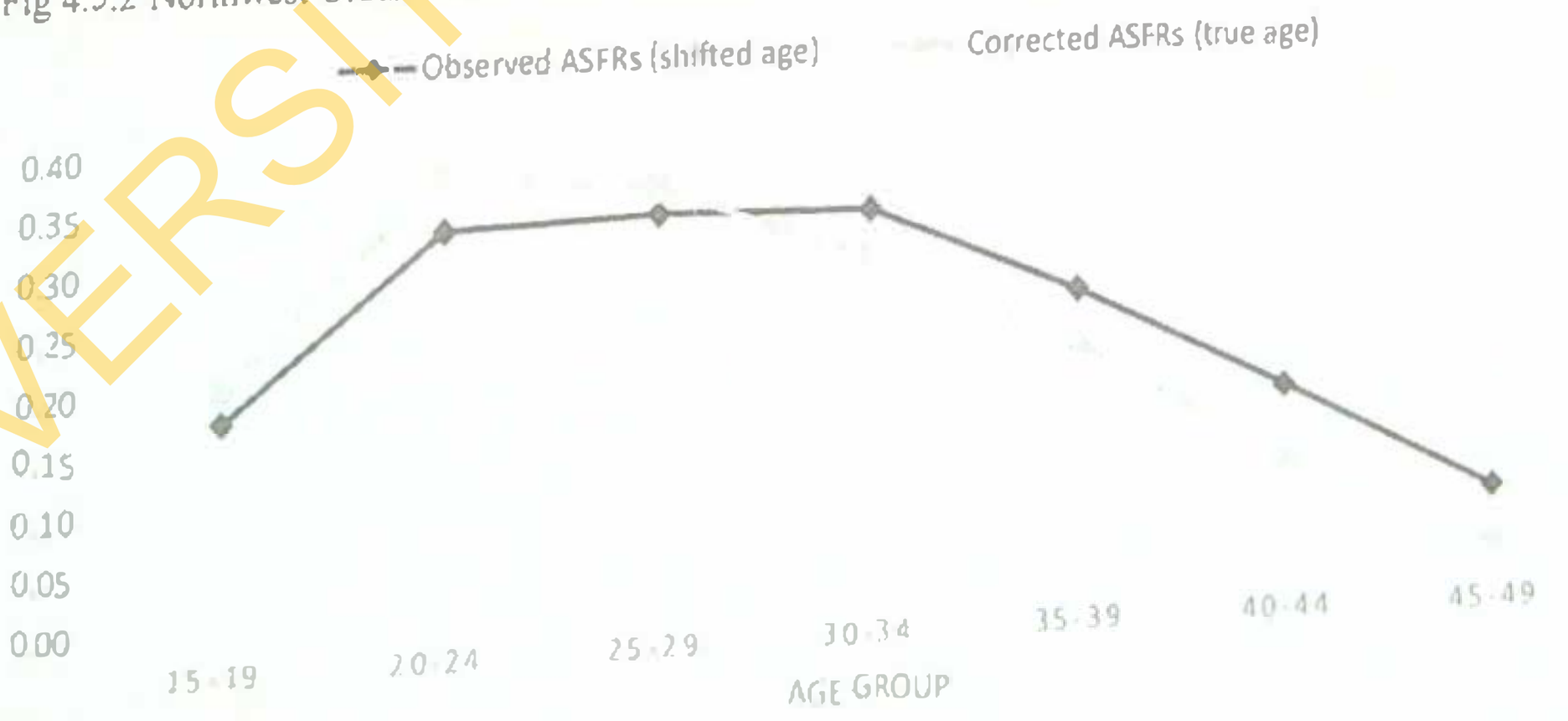



Fig 4.5.3 Northwest Rural 2013

Table 4.10 shows Gompertz model of Total Fertility, parameters α and β this table shows the Gompertz parities as well as the age specific fertility rate in 5years age group between 15-49 for women in Northwest, Northwest Rural and Northwest Urban. Gompertz TFR was 7.29, 7.63 and 6.30 for women in Northwest, Northwest Rural and Northwest Urban respectively. This implies that a woman in Northwest Nigeria will have an average of 7 children at the end of her child bearing ages while those in Rural and Urban areas in the region will an average of 8 children and 6 children respectively.

The Alpha values for the Northwest, Northwest Rural and Northwest Urban are -0.0273, 0.0079 and -0.103 respectively. The Beta values for the Northwest, Northwest Rural and Northwest Urban are 1.0482, 1.0115 and 1.233 respectively. If the alpha lies between $-0.3 < \alpha < 0.3$ and beta lies between $0.8 < \beta < 1.25$. All the alpha and beta values fell within this range, which means there is a good fit in the line joining the P- Point and F-points together and if otherwise one or two of the data series are problematic.

Negative alpha for both Northwest data and Northwest Rural data shows that the observed fertility distributions are slightly older than the standard value and Beta greater than 1 for all the parameters suggest a wide spread of fertility distribution.

The root mean squared error (RMSE), for Northwest, Northwest rural and Northwest urban are 0.361, 0.343 and 0.551 respectively. While the T-hat gotten from implied fertility is 7.30, 7.66 and 6.33 for Northwest, Northwest rural and Northwest urban respectively.

Table 4.9 Gompertz model of Total Fertility in age group, parameters α and β

| AGE GROUP | $\eta ASFR_{NW}$ | $PARITIES_{NW}$ | $\eta ASFR_{NWR}$ | $PARITIES_{NWR}$ | $\eta ASFR_{NWU}$ | $PARITIES_{NWU}$ |
|---|---|---|---|---|---|---|
| 15-19 | 0.173 | 0.298 | 0.204 | 0.394 | 0.094 | 0.093 |
| 20-24 | 0.362 | 1.754 | 0.374 | 1.963 | 0.337 | 1.235 |
| 25-29 | 0.355 | 3.592 | 0.357 | 3.827 | 0.359 | 3.079 |
| 30-34 | 0.282 | 5.201 | 0.287 | 5.447 | 0.264 | 4.666 |
| 35-39 | 0.194 | 6.395 | 0.202 | 6.674 | 0.153 | 5.707 |
| 40-44 | 0.083 | 7.095 | 0.091 | 7.421 | 0.050 | 6.202 |
| 45-49 | 0.010 | 7.287 | 0.012 | 7.640 | 0.004 | 6.300 |
| TFR | 7.29 | | 7.63 | | 6.30 | |
| A | -0.0273 | | 0.0079 | | -0.1033 | |
| B | 1.0482 | | 1.0115 | | 1.2330 | |
| RMSE | 0.361 | | 0.343 | | 0.551 | |
| T-Hat | 7.30 | | 7.66 | | 6.30 | |

NW=Northwest, NWR= Northwest Rural NWU= Northwest Urban

Figure 4.6 showed the Gompertz ASFR of Northwest Nigeria, Northwest Rural and Northwest Urban. The graph showed rural Gompertz ASFR was the highest at point 0.37 followed by was that of Northwest at point 0.36, the Northwest urban lowest ASFR at point 0.33 all between age 20-24. For rural area and Northwest, the ASFR reached its peak at age 20-24 and began to fall. While for urban area fertility reached bat age group 25-29.

Figure 4.6 showed the Gompertz ASFR of Northwest Nigeria, Northwest Rural and Northwest Urban. The graph showed rural Gompertz ASFR was the highest at point 0.37 followed by was that of Northwest at point 0.36, the Northwest urban lowest ASFR at point 0.33 all between age 20-24. For rural area and Northwest, the ASFR reached its peak at age 20-24 and began to fall. While for urban area fertility reached bat age group 25-29.

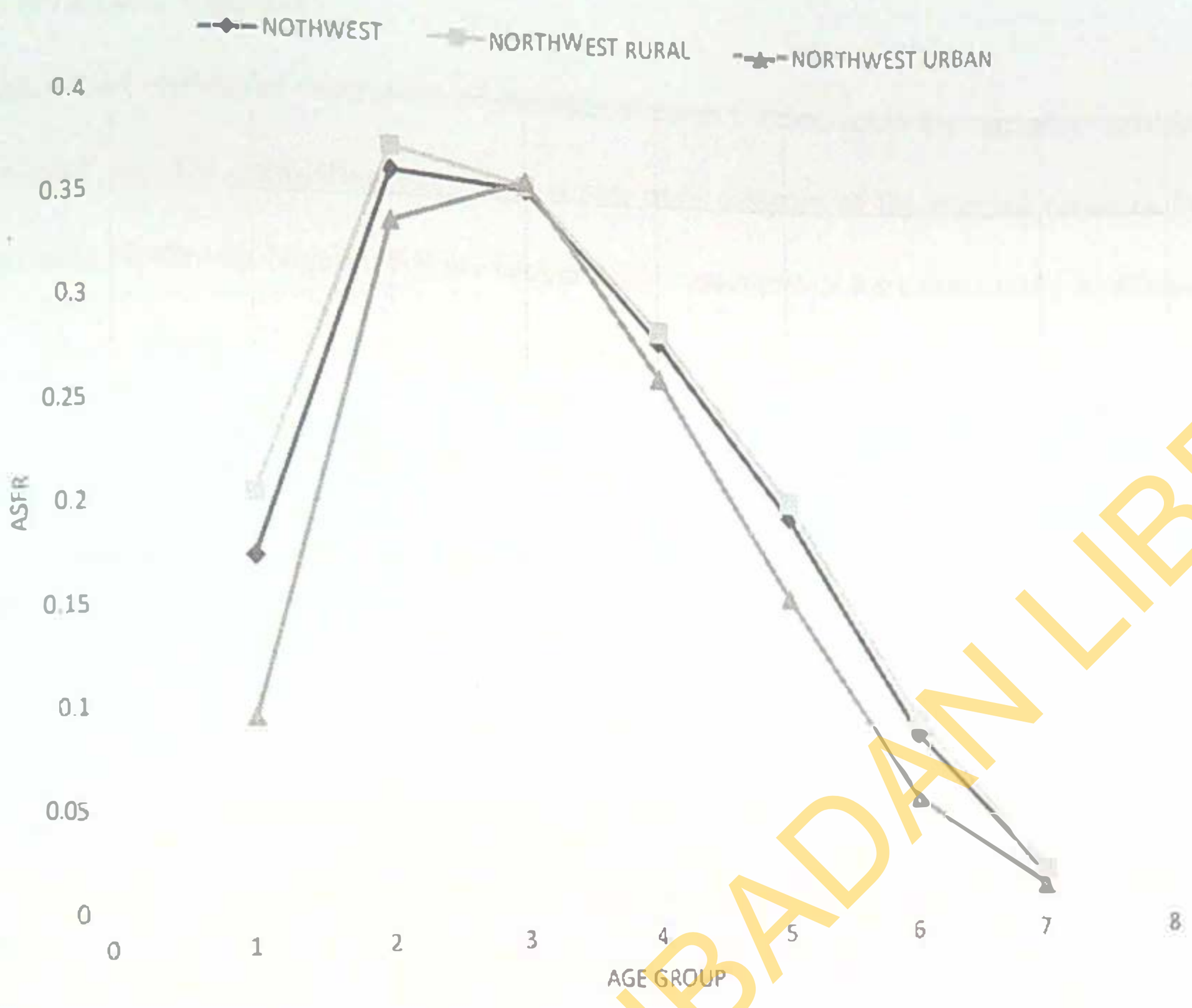



Figure 4.6 Gompertz ASFR of Northwest, Northwest Rural and Northwest Urban in age group

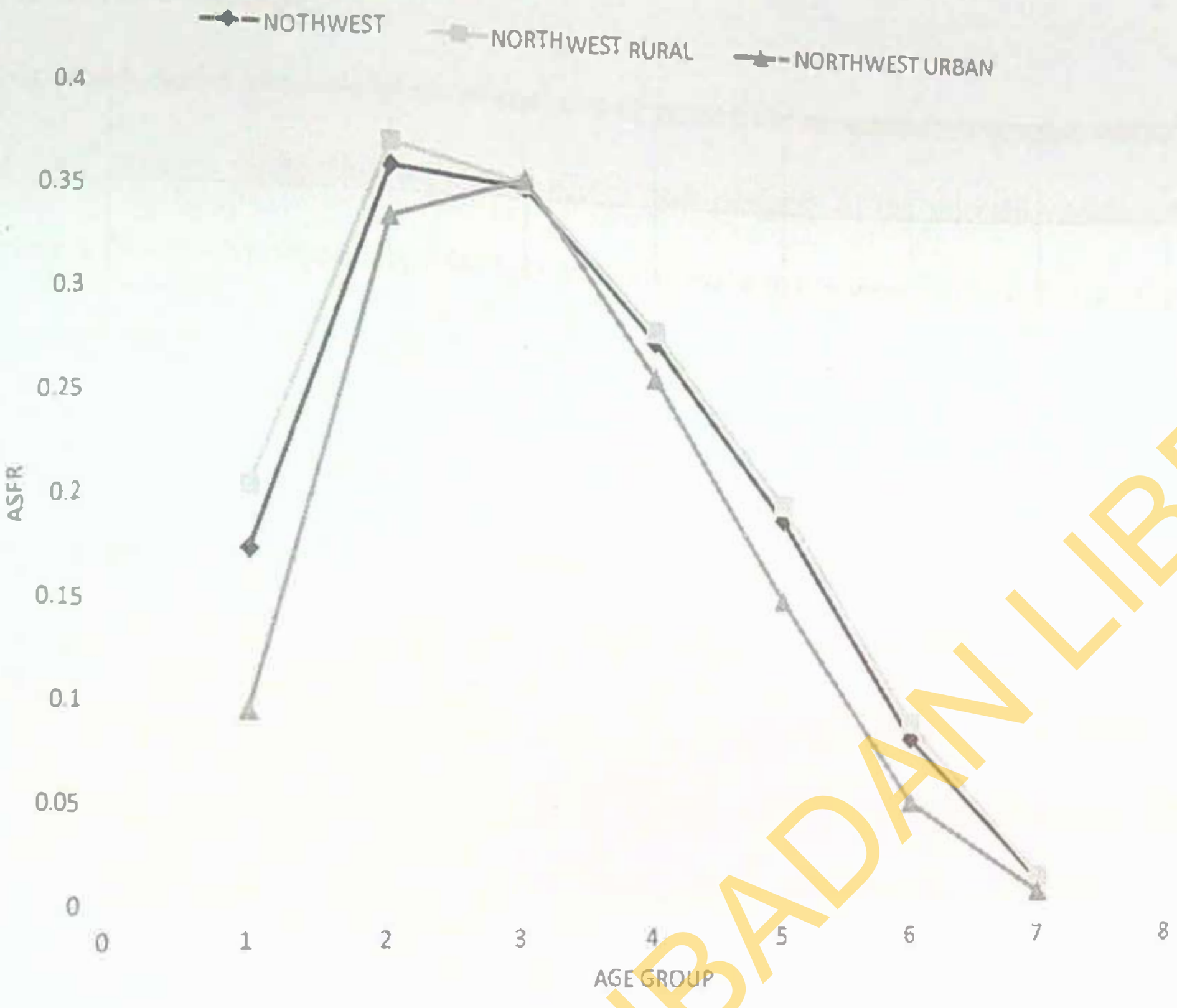



Figure 4.6 Gompertz ASFR of Northwest, Northwest Rural and Northwest Urban in age group

## 4.2 Bivariable Analysis

Table 4.10.1 shows the description of statistics of mean CEB on socio demographic variables and the F statistic comparing the means across each category of the selected variables for women in Northwest Nigeria. All the background characteristics were statistically significant at p-value less than 0.001 except for contraceptive use which was significant at 0.01.

The mean CEB among women aged 45-49 was the highest while age 15-19 women had the lowest mean CEB. Women who resides in the rural area had higher mean CEB than those who reside in the urban areas. Those who practice other religion had the highest mean CEB. Also the poorest women had the highest mean CEB in the wealth index category. Women who had never used any contraceptive method had higher mean CEB than women are using or have used any method. Likewise women with no education had the highest mean CEB while women with secondary education had the least mean CEB.

Table 4.10.1 Description of background characteristics of respondents by mean Children Ever Born for Northwest

| Background Characteristics | Total women | Mean CEB±σ | χ2-value | F-value |
|---|---|---|---|---|
| Total | 11877 | 3.89±3.36 | | |
| **Age** | | | 4500*** | 2861.3*** |
| 15-19 | 2428 | 0.33±0.6 | | |
| 20-24 | 2042 | 1.67±1.23 | | |
| 25-29 | 2151 | 3.49±1.75 | | |
| 30-34 | 1623 | 4.99±2.19 | | |
| 35-39 | 1399 | 6.67±2.51 | | |
| 40-44 | 1069 | 6.94±2.97 | | |
| 45-49 | 1164 | 8.22±3.17 | | |
| **Age at first birth** | | | 20.9*** | 217.8*** |
| Below18 | 5262 | 5.38±3.1 | | |
| 18Above | 4088 | 4.37±2.82 | | |
| **Residence** | | | 22.2*** | 129.4*** |
| Urban | 3402 | 3.28±3.28 | | |
| Rural | 8474 | 4.13±3.36 | | |
| **Religion** | | | 15.8*** | 104.1*** |
| Christian | 1132 | 2.38±2.45 | | |
| Islam | 10605 | 4.04±3.4 | | |
| Others | 88 | 4.37±3.97 | | |
| **Education** | | | 100.9*** | 362*** |
| No education | 8240 | 4.51±3.36 | | |
| Primary | 1382 | 3.67±3.17 | | |
| Secondary | 1956 | 1.71±2.43 | | |
| Higher | 299 | 2.03±2.48 | | |
| **Working status** | | | 5.5** | 795*** |
| No | 5012 | 2.81±3.16 | | |
| Yes | 6799 | 4.69±3.28 | | |
| **Wealth index** | | | 9.6* | 85.6*** |
| Poorest | 4036 | 4.55±3.45 | | |
| Poorer | 3488 | 3.94±3.29 | | |
| Middle | 1867 | 3.59±3.3 | | |
| Richer | 1462 | 3.27±3.24 | | |
| Richest | 1024 | 2.47±2.79 | | |
| **Sex Preference** | | | 34.0*** | 69.0*** |
| No preference | 8787 | 4.05±3.42 | | |
| Preference | 3089 | 3.41±3.14 | | |
| **Type of Union** | | | 0.01 | 164.5*** |
| Monogamy | 5617 | 4.04±3.18 | | |
| Polygamy | 4385 | 4.95±3.24 | | |
| **Contraceptive Use** | | | | |
| Ever Used | 552 | 3.43±2.63 | 5.6273* | 8.72** |
| Never Used | 11324 | 3.89±3.35 | | |

*p<0.05, **p 0.0, ***p<0.001

Table 4.10.2 shows the description of statistics of mean CEB on socio demographic variables and the F statistic comparing the means across each category of the selected variables for women in Northwest Nigeria rural places of residence and urban places of residence. The total number of women in rural area was 8,474 while the number of women in urban was 3402.

Similar to Northwest, the mean CEB pattern across the variable were similar. However, there is a difference in the mean CEB for education category. It is important to note that there is a wide difference between mean CEB of rural area and urban, the mean CEB for rural is higher than urban for each of the variables.

Table 4.10.2 Description of background characteristics of respondents by mean Children Ever Born for Northwest Rural and Urban

| Background Characteristics | NORTHWEST RURAL | | | | NORTHWEST URBAN | | | |
|---|---|---|---|---|---|---|---|---|
| | Total women | Mean CEB±σ | χ2-value | F-value | Total women | Mean CEB±σ | χ2-value | F-value |
| Total | 8474 | 4.13±3.36 | | | 3402 | 3.28±3.28 | | |
| **Age** | | | 3100*** | 2304*** | | | 1700*** | 660.13*** |
| 15-19 | 1635 | 0.43±0.67 | | | 793 | 0.11±0.37 | | |
| 20-24 | 1500 | 1.84±1.2 | | | 543 | 1.2±1.2 | | |
| 25-29 | 1590 | 3.71±1.66 | | | 561 | 2.89±1.88 | | |
| 30-34 | 1135 | 5.31±2.1 | | | 488 | 4.27±2.23 | | |
| 35-39 | 999 | 6.96±2.44 | | | 400 | 5.93±2.52 | | |
| 40-44 | 783 | 7.26±2.91 | | | 286 | 6.04±2.94 | | |
| 45-49 | 832 | 8.36±3.14 | | | 332 | 7.87±3.23 | | |
| **Age at first birth** | | | 16.09*** | 105.82*** | | | 5.5768* | 130.87*** |
| Below18 | 4203 | 5.3±3.13 | | | 1059 | 5.67±2.98 | | |
| 18Above | 2835 | 4.48±2.9 | | | 1253 | 4.1±2.6 | | |
| **Religion** | | | 3.2 | 27.22*** | | | 35.48*** | 45.23*** |
| Christian | 459 | 2.92±2.86 | | | 673 | 2.02±2.06 | | |
| Islam | 7896 | 4.19±3.37 | | | 2709 | 3.59±3.44 | | |
| Others | 85 | 4.47±3.98 | | | 3 | 1.99±3 | | |
| **Education** | | | 19.55*** | 101.07*** | | | 94.41*** | 242.92*** |
| No education | 6975 | 4.4±3.35 | | | 1265 | 5.09±3.38 | | |
| Primary | 829 | 3.58±3.18 | | | 553 | 3.81±3.16 | | |
| Secondary | 625 | 1.94±2.78 | | | 1331 | 1.6±2.23 | | |
| Higher | 46 | 3±2.92 | | | 253 | 1.85±2.36 | | |
| **Working status** | | | 2.51*** | 462.66*** | | | 13.7*** | 347.67*** |
| No | 3546 | 3.17±3.2 | | | 1467 | 1.94±2.9 | | |
| Yes | 4885 | 4.84±3.3 | | | 1913 | 4.31±3.18 | | |
| **Wealth index** | | | 13.68** | 28*** | | | 17.11*** | 25.61*** |
| Poorest | 3863 | 4.55±3.44 | | | 173 | 4.7±3.77 | | |
| Poorer | 3195 | 3.91±3.27 | | | 293 | 4.32±3.45 | | |
| Middle | 1114 | 3.48±3.13 | | | 753 | 3.76±3.53 | | |
| Richer | 242 | 3.7±3.53 | | | 1220 | 3.18±3.18 | | |
| Richest | 61 | 2.81±2.96 | | | 963 | 2.45±2.78 | | |
| **Sex Preference** | | | 15.47*** | 51.34*** | | | 23.68*** | 15.81*** |
| No preference | 6306 | 4.29±3.41 | | | 2481 | 3.44±3.37 | | |
| Preference | 2168 | 3.65±3.18 | | | 921 | 2.84±2.98 | | |
| **Type of Union** | | | 0.0104 | 104.94*** | | | 2.87 | 56.79*** |
| Monogamy | 4011 | 4.05±3.26 | | | 1102 | 4.07±3.0 | | |
| Polygamy | 3669 | 4.87±3.25 | | | 568 | 5.26±3.2 | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Contraceptive Use** | | | 2.5062 | 462.66*** | | | 17.04*** | 4.61* |
| Ever Used | 187 | 4.54±2.82 | | | 366 | 2.86±2.35 | | |
| Never Used | 8288 | 4.12±3.37 | | | 3037 | 3.33±3.37 | | |

*P<0.05, **P<0.01, ***P<0.001

Table 4.11 shows the description of selected background characteristics of respondents by Children Ever Born (CEB) and chi-square value showing statistical relationship between CEB and each variable. Children ever born (CEB) was recoded and regrouped into quantitative variable, which ranges from 0 to 17 which as the highest number of children a woman could have in the data set. The categories include 0, 1-2, 3-4 and 5 plus.

Almost three-fourth (74%) of the women in age group 15-19years had no children yet. This can be associated with the fact that women in this age group were just started child bearing. Four-fifth 80% and 86% of women in age group 40-44 and 45-49 respectively had more than 5 children. Women in these age groups were said to have ended child bearing especially in Northwest, where women started child bearing earlier and ended Child-bearing earlier than their counterparts in other region. The p-value<0.001 this indicated that there is a significant association between age of mother and fertility in Northwest Nigeria. More than half 56% of women who had their first child below age 18 were reported to have had more than 5 children at the time of the survey. The p-value between the age of mother at first birth and child ever born was <0.001 this means that there is significant relationship between age of mother at first birth and the women fertility in Northwest Nigeria.

With respect to place of residence, 32% of the women in urban area had no child yet, 17% of the women in rural area had no child. 44% and 33% of the women in rural area and urban area respectively had more than 5 children ($p<0.05$), which implies that, there is a significant relationship between the women place of residence and fertility in Northwest Nigeria. Another variable, which was considered is the religion of the mother. This was categorized into Christianity, Islam and other practices. While 19% of Christians had more than 5 children 43% of those that practice other faith and 40% of women who are Muslims have more than 5

children. ($p<0.05$), which implies that this mean there is a significant relationship between religion of mother and fertility in Northwest Nigeria.

The education of the women was examined. 46%, 37%, 13% and 32% of women with no education, primary education, secondary education and tertiary education had more than 5 children respectively. The chi square p-value <0.001, this indicates there is an association between the education of women and their fertility. Subsequently, working status of the women, wealth index, type of union, sex preference, and contraceptives use p-value were less than 0.005. We conclude that there is an association between listed characteristics and the fertility of the women in Northwest Nigeria.

Table 4.11 Description of selected background characteristics of respondents by Children Ever Born (CEB) and chi-square.

| Background Characteristics | Children Ever Born | | | | Total women | Chi square |
|---|---|---|---|---|---|---|
| | NONE | 1-2 | 3-4 | 5+ | | |
| Total | 21.3 | 20.4 | 19.5 | 38.8 | 11877 | |
| **Age** | | | | | | 8929.9*** |
| 15-19 | 73.5 | 25.4 | 1.1 | 0 | 2428 | |
| 20-24 | 20.5 | 53.5 | 25 | 1 | 2042 | |
| 25-29 | 6.6 | 20.6 | 44.7 | 28.1 | 2151 | |
| 30-34 | 5.1 | 7.5 | 25.7 | 61.7 | 1623 | |
| 35-39 | 2.0 | 4.3 | 13.0 | 80.6 | 1399 | |
| 40-44 | 3.7 | 4.3 | 11.7 | 80.4 | 1069 | |
| 45-49 | 1.7 | 3.4 | 8.8 | 86.1 | 1164 | |
| **Age at first birth** | | | | | | 176.6*** |
| Below 18 | - | 21.2 | 23.1 | 55.7 | 5262 | |
| 18 Above | - | 31.9 | 26.9 | 41.2 | 4088 | |
| **Residence** | | | | | | 273.9*** |
| Urban | 32.1 | 17.0 | 18.0 | 32.9 | 3402 | |
| Rural | 16.9 | 21.7 | 20.1 | 41.3 | 8474 | |
| **Religion** | | | | | | 205.1*** |
| Christianity | 35.3 | 21.1 | 24.1 | 19.5 | 1132 | |
| Islam | 19.8 | 20.3 | 19.0 | 40.9 | 10605 | |
| Others | 23.5 | 15.3 | 18.1 | 43.1 | 88.0 | |
| **Education** | | | | | | 1369.2*** |
| No education | 13.1 | 20.3 | 20.6 | 46.0 | 8240 | |
| Primary | 21.6 | 21.7 | 20.0 | 36.7 | 1382 | |
| Secondary | 51.4 | 20.2 | 15.34 | 13.1 | 1956 | |
| Higher | 46.8 | 18.6 | 12.9 | 21.7 | 299 | |
| **Working status** | | | | | | 976.3*** |
| Not working | 34.5 | 23.2 | 16.7 | 25.6 | 5012 | |
| Currently working | 11.4 | 18.2 | 21.5 | 48.8 | 6799 | |
| **Wealth index** | | | | | | 425.1*** |
| Poorest | 13.7 | 20.6 | 19.3 | 46.4 | 4036 | |
| Poorer | 18.5 | 21.7 | 20.7 | 39.1 | 3488 | |
| Middle | 25.4 | 19.8 | 19.0 | 35.8 | 1867 | |
| Richer | 31.4 | 17.8 | 17.2 | 33.7 | 1462 | |
| Richest | 38.8 | 19.7 | 19.9 | 21.6 | 1024 | |
| **Sex Preference** | | | | | | 51.0*** |
| No Preference | 20.4 | 19.5 | 19.1 | 40.9 | 8787 | |
| Preference | 23.8 | 22.8 | 20.4 | 33.0 | 3089 | |
| **Type of Union** | | | | | | 176.9*** |
| Monogamy | 11.8 | 27.0 | 22.7 | 38.5 | 5617 | |
| Polygamy | 8.2 | 18.2 | 21.9 | 51.7 | 4385 | |
| **Contraceptive** | | | | | | 47.4*** |
| Using | 19.6 | 17.6 | 31.9 | 30.9 | 552 | |
| Not Using | 21.4 | 20.5 | 18.8 | 39.3 | 11325 | |

*p<0.05, **P<0.01, ***p<0.001

Percentage CEB and place of residence of women in Northwest urban and Northwest rural

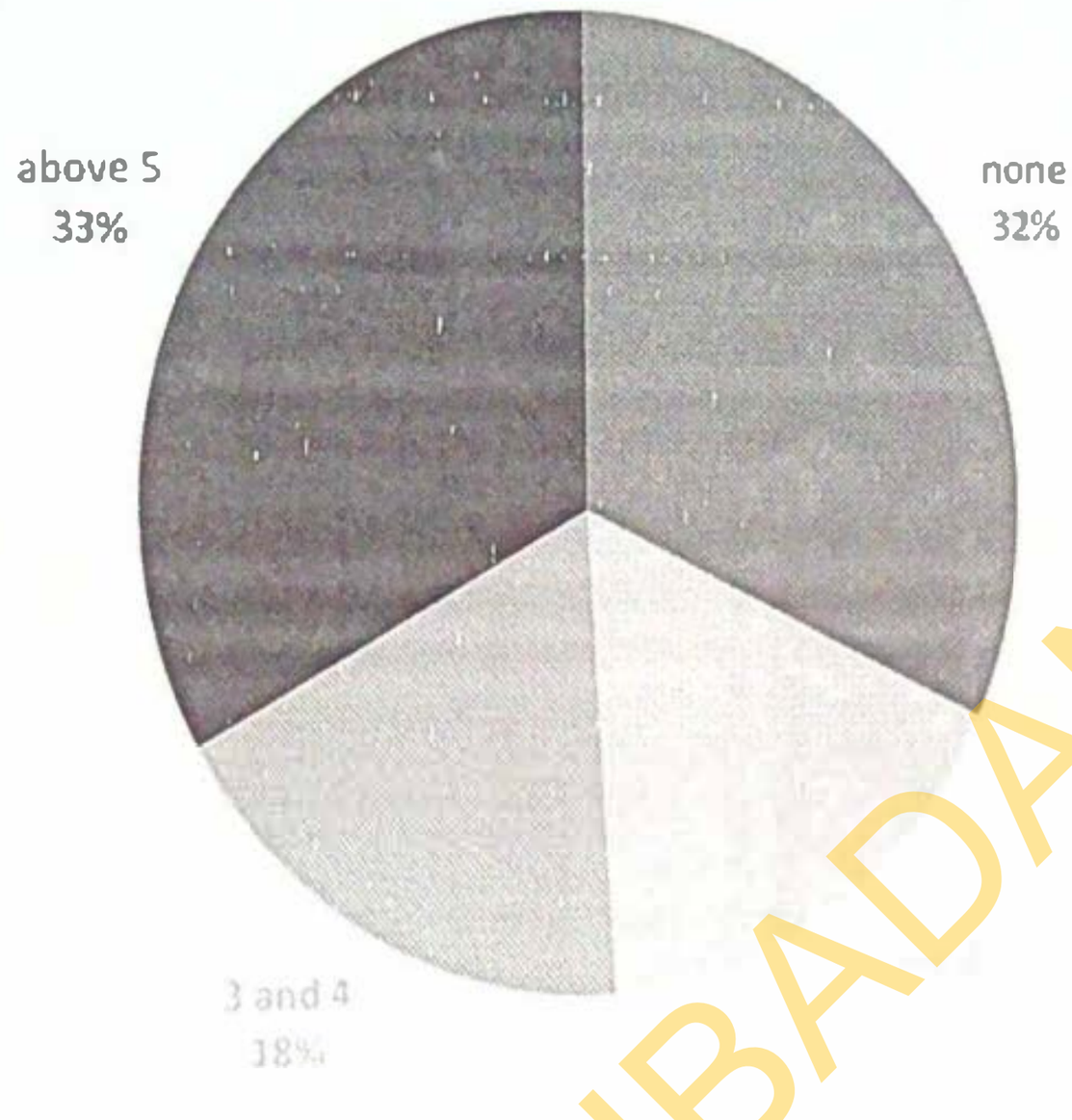



Figure 4.7 CEB of women in Northwest urban

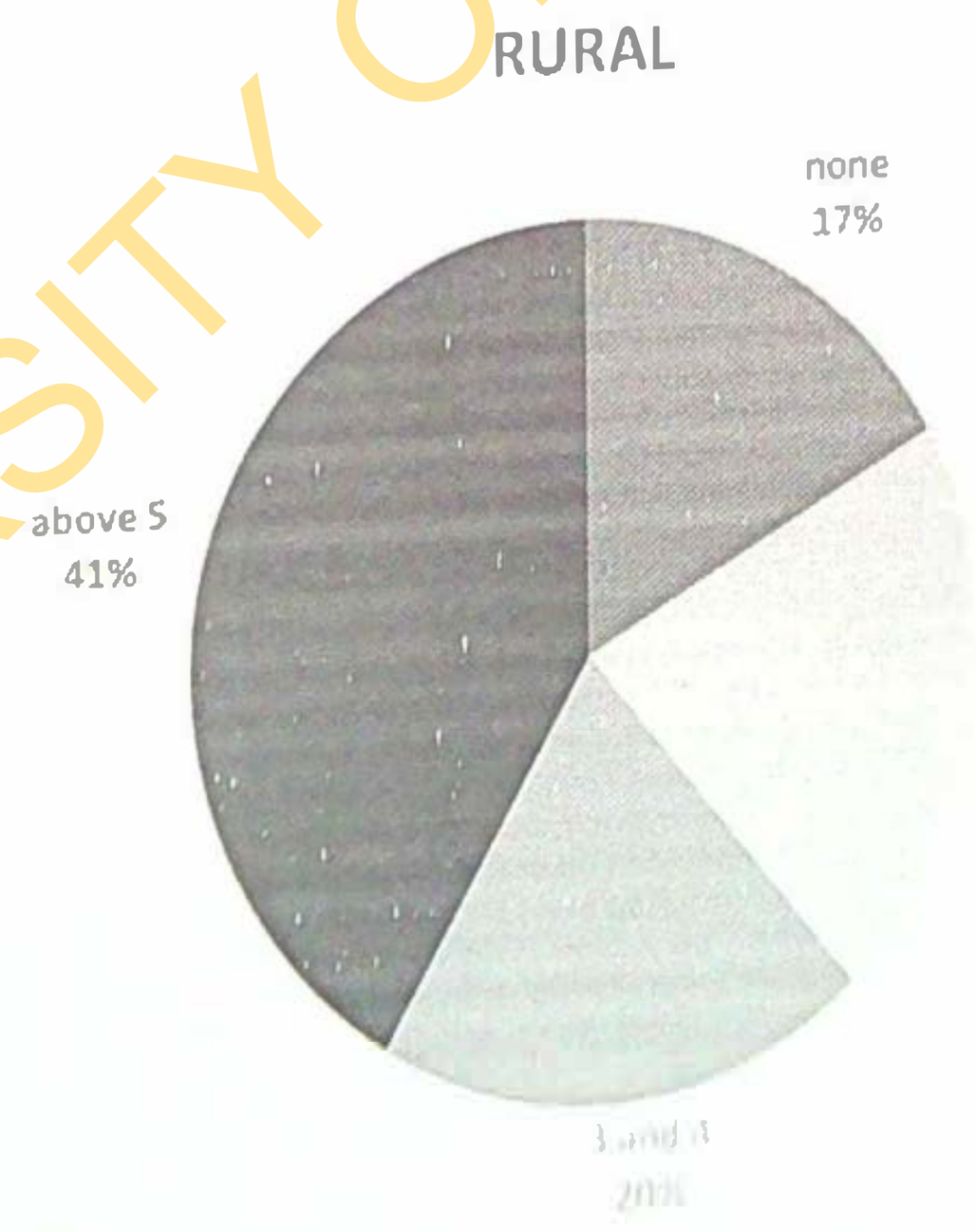



Figure 4.8 CEB of women in Northwest urban

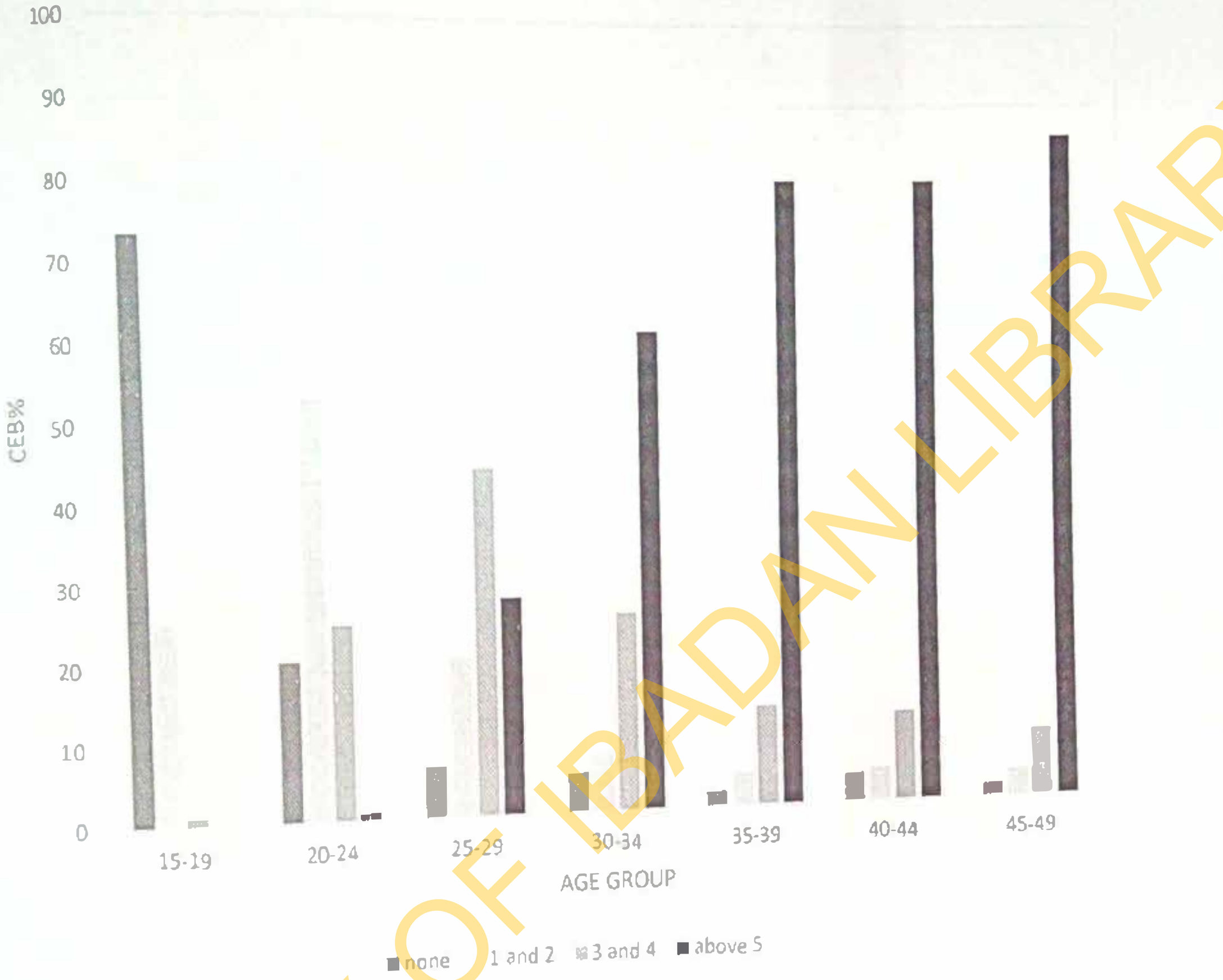



Fig 4.9 Bar chart of age of women and their CEB in Percentage

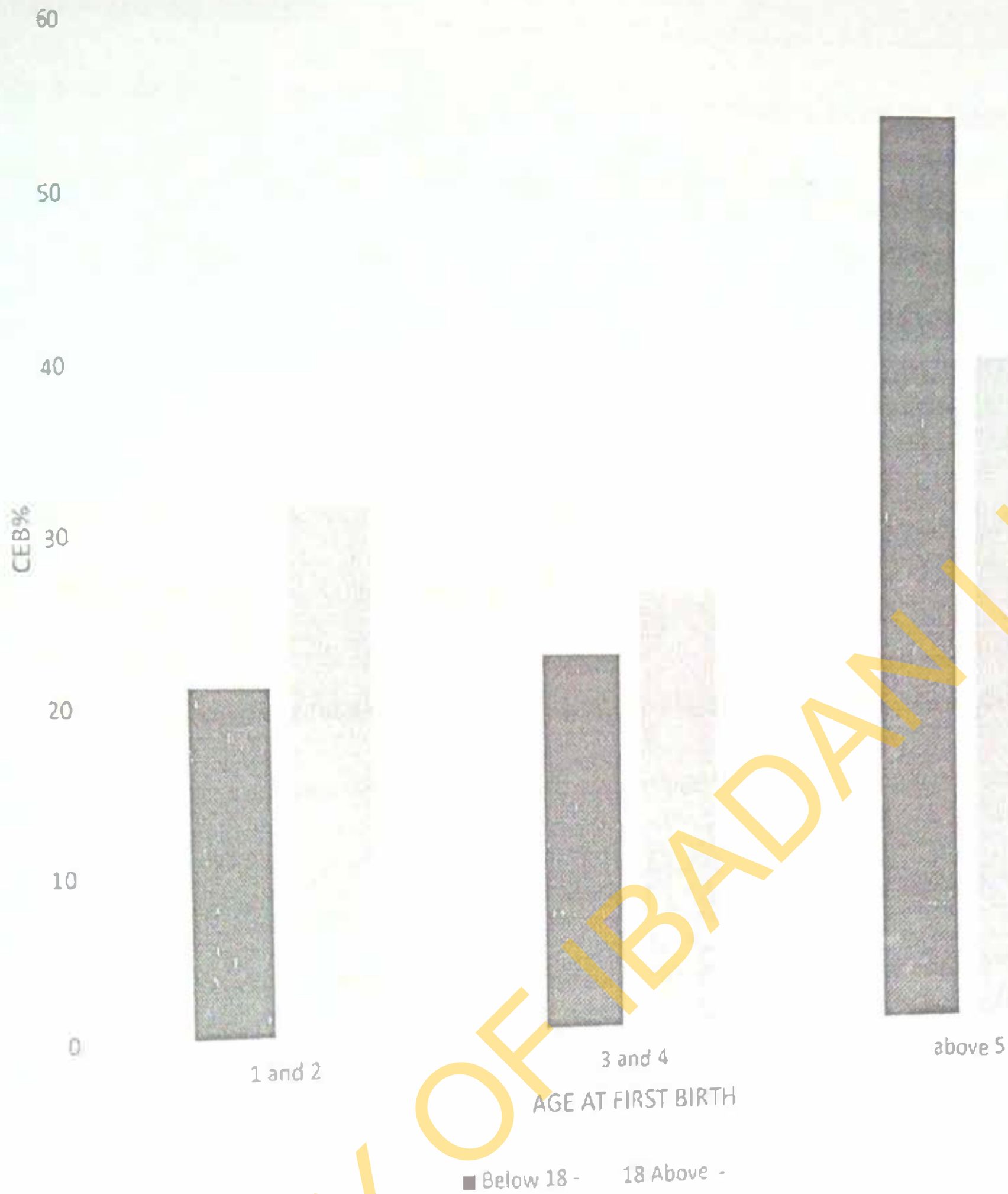



Fig 4.10 Bar chart illustration of age at first birth and their CEB in Percentage

## 4.3 Multivariable Analysis

Table 4.12 shows the results for the generalized linear model negative binomial of the respondents background characteristics and the response variable which was Children Ever Born (CEB) in Northwest Nigeria which was presented in Incidence Rate Ratio (IRR) to identify factors influencing fertility among women of reproductive ages. The dependent variable CEB was categorized into high fertility and normal fertility women who had less than 5 children were regarded as women with Normal fertility while women with 5 children and above were regarded as women with high fertility.

Model 1 was formed as a result of putting each of the variables individually into the model, all the variables were statistically significant at p-value less than 0.001 except for contraceptive use and sex preference which were significant at p-value less than 0.01.

Women who were between ages 20-24, 25-29 and 45-49 were 99%, 72% and 14% respectively less likely to have lower fertility than women who were between 15-19, these were significant at p-value less than 0.001. On the other hand, women who had primary education, secondary education and tertiary education were 1.2times, 1.6times and 1.5times respectively more likely to have normal fertility than their counterpart with no education, this is significant at p–value less than 0.001. Women who resides in the rural areas are 88% less likely to have normal fertility than their counterparts who resides in urban areas.

Model 2 shows the full model, all the explanatory variables were inputted into the model with the response variable which was CEB. It is interesting to know that the variables which were statistically significant in model 1 were not significant in model 2 except for Current age of women, age at first birth and religion. This variables were significant at p-value less than 0.001.

Table 4.12 Generalized linear Model negative binomial of background characteristics of the respondents and their fertility in Northwest Nigeria.

| | CHILDREN EVER BORN (CEB) | |
|---|---|---|
| | Model 1 | Model 2 |
| | Adjusted IRR (95% CI) | Adjusted IRR (95% CI) |
| **Background** | | |
| **Age group** | | |
| 15-19 | Ref | Ref |
| 20-24 | 0.99(0.98-0.99)*** | 0.95(0.92-0.97)*** |
| 25-29 | 0.72(0.70-0.74)*** | 0.64(0.61-0.67)*** |
| 30-34 | 0.38(0.35-0.41)*** | 0.29(0.26-0.32)*** |
| 35-39 | 0.19(0.17-0.22)*** | 0.13(0.11-0.15)*** |
| 40-44 | 0.20(0.17-0.23)*** | 0.12(0.10-0.14)*** |
| 45-49 | 0.14(0.11-0.17)*** | 0.09(0.07-0.11)*** |
| **Education** | | |
| No education | Ref | Ref |
| Primary | 1.17(1.11-1.24)*** | 0.98(0.91-1.05) |
| Secondary | 1.61(1.56-1.66)*** | 0.99(0.91-1.09) |
| Tertiary | 1.45(1.33-1.58)*** | 0.92(0.72-1.18) |
| **Wealth Index** | | |
| Poorest | Ref | Ref |
| Poorer | 1.14(1.09-1.19)*** | 1.00(0.95-1.06) |
| Middle | 1.20(1.13-1.26)*** | 1.02(0.95-1.09) |
| Richer | 1.24(1.17-1.31)*** | 1.03(0.92-1.16) |
| Richest | 1.46(1.38-1.55)*** | 1.25(1.08-1.46)* |
| **Place of Residence** | | |
| Urban | Ref | Ref |
| Rural | 0.88(0.84-0.91)*** | 0.97(0.90-1.05) |
| **Religion** | | |
| Christianity | Ref | Ref |
| Islam | 0.73(0.70-0.77)*** | 0.60(0.53-0.69)*** |
| Others | 0.71(0.58-0.86)*** | 0.50(0.39-0.64)*** |
| **Type of Union** | | |
| Monogamy | Ref | Ref |
| Polygamy | 0.7837(0.75-0.82)*** | 1.01(0.97-1.06) |
| **Age at first birth** | | |
| Below 18 | Ref | Ref |
| 18+ | 1.33(1.27-1.39)*** | 1.7283(1.64-1.82)*** |
| **Sex Preference** | | |
| No | Ref | Ref |
| Yes | 1.13(1.09-1.18)*** | 1.0198(0.97-1.07) |
| **Contraceptive use** | | |
| Yes | Ref | Ref |
| No | 0.88(0.81-0.95)** | 0.995(01(0.86-1.15) |
| **Working Status** | | |
| No | Ref | |
| Yes | 0.6874(0.66-0.71)** | |

IRR- Incidence Rate Ratio; CI- Confidence Interval; *P<0.05, **P<0.01, ***P<0.001; Ref = I

# CHAPTER FIVE

# DISCUSSION, CONCLUSION AND RECOMMENDATION

## 5.1 Discussion

Fertility is one of the component of population dynamics that determines the structure, size and composition of the population in any country. This study examined levels, patterns and differentials of fertility among women of reproductive ages in Northwest Nigeria, the study examined four specific objectives. First, it determined the fertility levels among women of reproductive ages in Northwest Nigeria. Second, it examined the rural-urban differentials in fertility among women of reproductive ages in Northwest Nigeria. Third, it examined the relationship between sex preference and fertility in Nigeria and other social demographic characteristics. And lastly identified factors influencing fertility among women of reproductive age in Nigeria Northwest Nigeria.

Over the years there has been persistently high fertility in Northwest Nigeria than other regions in the country. The Northwest Nigeria is highly dominated by the Hausa/Fulani which most of the population practice Islam. Because of the error attributed to the use conventional TFR this study used the Trussell P/F ratio and Brass relational Gompertz model to determine the fertility level in Northwest Nigeria. The reason for using two methods was to identify the most appropriate technique for estimating fertility level comparing the TFR results with the result for Northwest in NPC & ICF, 2014. The TFR result from the two techniques provided different results. Brass relational Gompertz model TFR was similar to the TFR reported in NDHS 2013 for Northwest Nigeria than Trussel P/F ratio, this is because the Brass relational Gompertz model was introduced as a result of the flaws of using Trussell P/F ratio. It is important to note that Brass relational Gompertz model has it bases in Trusel P/F ratio.

The fertility level in Northwest Nigeria is high, the result showed in the study was similar to result shown in NPC & ICF, 2014 with a slight difference, this is possible because of the method used in estimating TFR. Study by Adebowale et al., 2017 using NDHS data set in Nigeria also showed that the fertility in Northwest Nigeria is still high compared to other regions in Nigeria (Adebowale et al., 2017).

Despite the high fertility in Northwest Nigeria, the fertility level in the rural area was higher than urban area. This is contratry to the study done in India among Suvanese women (Rodriguez, 2007) whichstated that fertility level in Urban area is higher that Rural. This can be due to differences in location and other factors such as religion, educational attainments, type of union and so on. Also similar study in Nigeria by Etukudo in 2016 among women in Jesse kingdom of Ethiope West Local Government Area of Delta State, showed that fertility is higher in rural than urban in developing countries (Etukudo & Effiong, 2016).

Fertility was measured by CEB in this study, the bivariate analysis showed predictors of high fertility in Northwest Nigeria were current age of mother, age at first birth, contraceptive use, wealth index, level of education and religion. Sex preference in Northwest Nigeria is still high, there is a significant association between sex preference and fertility level among the women in Northwest Nigeria (Asghar et al., 2014). Respondent age was a significant determinant of fertility level, older women had higher fertility than younger women, this findings is in accordance with study done in Nigeria (Fagbamigbe & Adebowale, 2014). The study also showed that there is low prevalence in the use of contraceptive use among women in Northwest Nigeria and there is a significant relationship between contraceptive use and fertility, women who were not using contraceptive had higher fertility than women who are not using (Imoh et al., 2015). Age at first birth is also a determinant of fertility, women who has their first birth earlier below age 18 years had higher fertility than their counterpart who had birth at 18 years

and above (Kohler, Skytthe, & Christensen, 2001). Fertility was higher among those who practice other Religion and Islam than those who practice Christianity.

Predictors such as education, wealth index, type of union, work status, sex preference and contraceptive use which had significant bivariate effects on fertility were not significant determinants of high fertility among women in Northwest Nigeria using the multivariate analysis of generalised linear model of negative binomial. However, the major determinants of high fertility among women in Northwest Nigeria were age at first birth, current age of women and religion of the women, Generalised linear model fitted into CEB showed clearly this relationship.

## 5.2 Limitation of study

The study draws on a cross-sectional secondary datasets NDHS 2013; as a result, there is tendency for children ever born to be underreported or over reported. Also the survey was not designed for this study, important variables that could have been used in the analysis were not available in the study instrument. The study made use of recoding and generating new variables to suite the study. A recall bias may occur, in African context, dead children are often omitted by women when required to recount the number of children they have given birth to. This will result in underreported CEB.

## 5.3 Conclusion

The fertility level in Northwest Nigeria is still very high compared to other regions in the country. The fertility levels in rural area is higher than that of urban area, place of residence is a determinants of fertility. The sex preference is still very high in Northwest Nigeria and contraceptive use is still low in the region, although the low prevalence in contraceptive use and sex preference are not the determinants for high fertility in Northwest Nigeria. The major

predictors of high fertility in Northwest Nigeria were age at first birth, current age and religion of women.

## 5.4 Recommendations

- The Brass relational Gompertz model should be used to measure fertility level in lieu of P/F ratio.
- Health education should be improved for women in Northwest Nigeria especially for women who resides in the rural area.
- Government and non-governmental organizations should take conscience efforts at encouraging women to reduce number of children they would have in their life time through use of modern contraceptives and family planning methods, existing programmes to increase awareness and use of modern contraceptive should be modified and improved in Northwest Nigeria, more attention should be given to women in rural areas than urban areas, sensitizing them the need and benefits to have fewer children.
- Intervention programmes on promotion of gender equality should be created to discourage sex preference in Northwest Nigeria. Early marriage should be discouraged in Northwest Nigeria, girl child and their parents should be motivated, encouraged and supported to have good education up to higher levels. This will automatically raise age at first birth of the women.

predictors of high fertility in Northwest Nigeria were age at first birth, current age and religion of women.

## 5.4 Recommendations

- The Brass relational Gompertz model should be used to measure fertility level in lieu of P/F ratio.
- Health education should be improved for women in Northwest Nigeria especially for women who resides in the rural area.
- Government and non-governmental organizations should take conscience efforts at encouraging women to reduce number of children they would have in their life time through use of modern contraceptives and family planning methods, existing programmes to increase awarencss and use of modern contraceptive should be modified and improved in Northwest Nigeria, more attention should be given to women in rural areas than urban areas, sensitizing them the need and benefits to have fewer children.
- Intervention programmes on promotion of gender equality should be created to discourage sex preference in Northwest Nigeria. Early marriage should be discouraged in Northwest Nigeria, girl child and their parents should be motivated, encouraged and supported to have good education up to higher levels. This will automatically raise age at first birth of the women.

# REFERENCES


Adebowale, S. A., & Palamuleni, M. E. (2015). Influence of gender preference and sex composition of surviving children on childbearing intention among high fertility married women in stable union in Malawi. African Health Sciences, 15(1), 150–160.

Adebowale, S., Yusuf, O., Gbadebo, B., & Tukur, D. (2017). Level and detenninants of high fertility in two contracting populations in Nigeria. Africa Population Studies, 31(1).

Adiri, F., Ibrahim, H. I., Ajayi, V., Sulayman, H. U., Yafeh, A. M., & Ejembi, C. L. (2010). Fertility Behaviour of Men and Women in Three Communities in Kaduna State , Nigeria. African Journal of Reproductive Health, 14(3), 97–106.

Akintunde, M., Lawal, M., & Simeon, O. (2013). Religious Roles in Fertility Behaviour among the Residents of Akinyele Local Government, Oyo State, Nigeria. International Journal of Economy, Management and Social Sciences, 2(June), 455–462.

Akinyoade, A. (2001). A Comparative Analysis of Contraceptive Use in North West and South West Nigeria. Ife Psychologia, 9(1), 148-172.

Akpa, O. M. (2012). Modeling the Deterninants of Fertility among Women of Childbearing Age in Nigeria : Analysis Using Generalized Linear Modeling Approach, 2(18), 7–11.

Asaduzzaman, M., & Khan, M. H. R. (2009). Identifying Potential Factors of Childbearing in Bangladesh. Asian Social Science, 5, 147–154.

Asghar, M , Murry, B., & Saraswathy, K. N. (2014). Fertility Behaviour and Effect of Son Preference among the Muslims of Manipur, India. Journal of Anthropology, 2014, 1–5.

Avidime, S., Aku-akai, L., Mohammed, A. Z., Adaji, S., & Ejembi, S. C. (2010). Fertility Intentions , Contraceptive Awareness and Contraceptive Use among Women in Three Communities in Northern Nigeria, 2010(3), 65–70.

Bongaarts, J., (1978). A Framework for Analyzing the Proximate Determinants of Fertility. Population and Development Review, 4(1), pp. 105-132.

Bongaarts, J., Frank, O., & Lesthaeghe, R. (1984). The Proximate Determinants of Fertility in Sub-Saharan Africa. Population and Development Review, 10(3), 511.

Bongaarts, J., Frank, O., & Lesthaeghe, R. (1984). The Proximate Determinants of Fertility in Sub-Saharan Africa. Population and Development Review, 10(3), 511.

Canning, D., Raja, S., & Yazbeck, A. S. (2015). Africa ' s Demographic Transition -

Chowdhury, S. (2010). Determinants and Consequences of High Fertility: A Synopsis of the Evidence. *World Bank*, (June), 5.

Cleland, W. W., & Kreevoy, M. M. (1994). Low-barrier hydrogen bonds and enzymic catalysis. Science-New York Then Washington-, 1887-1887.

Council, P., & Review, D. (2012). for Analyzing the Proximate Determinants of Fertility, 4(1), 105–132.

Eguavoen, A. N. T., Odiagbe, S. O., & Obetoh, G. I. (2007). The Status of Women, Sex Preference, Decision-Making and Fertility Control in Ekpoma Community of Nigeria. Journal of Social Science, 15(1), 43-49.

Ehrhardt, J. (2015). Demographic Research Explaining fertility : The potential for integrative approaches Johannes Huinink Martin Kohli Table of Contents, *33*(July).

Eruklar, A. S. & Bello, M., (2007). The Experience of Married Adolescent Girls in Northern Nigeria, Abuja: Population Council.

Etukudo, I. W., & Effiong, B. V. (2016). Fertility Behaviour in a Rural Nigerian Community: Determinants and Implications. Journal of Scientific Research and Reports, 10(5), 1–12.

Fagbamigbe, A. F., & Adebowale, A. S. (2014). Current and predicted fertility using Poisson regression model: evidence from 2008 Nigerian Demographic Health Survey. African Journal of Reproductive Health, 18(1), 71–83.

Federal Government of Nigeria. (2004). National policy on Population for Sustainable Development.

Ferré, C. (2009). Age at first child: does education delay fertility timing? The case of Kenya. World Bank Policy Research Working Paper No. 4833, (February). 1–45.

Feyisetan, B. J. & Bankole, A. (2002). Fertility Transition in Nigeria: Trends and Prospect. Population Bulletin of the United Nations. 48(49), 461–478.

Frejka. T. (1985). Induced abortion and fertility. Family Planning Perspectives, 11(4), 230–234. Journal of Social Sciences, 15(1), 43-49.

Hakim, A., (1994). Factors Affecting Fertility in Pakistan. The Pakistan Development Review, 33(4), pp. 685-709.

Igbodekwe, F. C., Oladimeji, O., Oladimeji, K. E., Adeoye, I. A., Akpa, O. M., & Lawson, L. (2014). Utilisation of Modern Contraceptive among Women of Childbearing Age in Resource Constraint Setting : Evidence from 2008 National Demographic and Health Survey in Nigeria, 4(3), 72–78.

Imoh, J. A., Adebowale, A. S., & Imoh, L. C. (2015). Contraceptive use and adjusted total fertility rate among women of reproductive age in nothern Nigeria. Jos Journal of Medicine, 9(1).

Joseph, S., (2006). Encyclopedia of Women & Islamic Cultures. Leiden: Koninklijke Brill

Kohler, H., Billari, F. C., & Ortega, J. A. (2006). Low Fertility in Europe: Causes, Implications and Policy Options. The Baby Bust: Who Will Do the Work? Who Will Pay the Taxes, (2004), 48–109.

Kohler, H., Skytthe, a, & Christensen, K. (2001). The Age at First Birth and Completed Fertility Reconsidered: Findings from a Sample of Identical Twins, *49*(0), 1–47.

Kwarai, M., (2011). Insights into Early Marriage and Girls' Education in Northern Nigeria, Lagos: Action Health Incorporated.

Lesthaeghe, R. (2014). The fertility transition in sub-Saharan Africa into the 21st century. PSC Resaerch Report 14-823, 25.

Lubeck, P. M., & Program-sais, A. S. (2014). Explaining the Revolt of boko Haram : Demography , Governance & Crisis in Northern Nigeria.

Lyager, M. (2010). Fertility Decline and Its Causes. An Interactive Analysis of the Cases of Uganda and Thailand. Approaches to Development, 1–23.

Martin Teresa Castro. (1995). Women's Education and Fertility: Results from 26 Demographic and Health Surveys. Studies in Family Planning, 26(4), 187-202.

Martine, G., Alves, J. E., & Cavcnaghi, S. (2013). Urbanization and fertility decline: cashing in on structural change.

Mberu, B. U. & Reed, H. E., (2014). Understanding Sub-group Fertility in Nigeria. Population Review, 53(2), pp. 23-46.

McDonald, P., (2008). Very Low fertility consequences, causes and policy approaches. The Japanese Journal of Population, 6(1), pp. 19-23.

Monjok, E., Smesny, A., Ekabua, J. E. & Essien, J. E., (2010). Contraceptive Prevalence in Nigeria: Literature Review and recommendation for future policy decisions. Open Access Journal of Contraception, Volume I, pp. 9-22.

Nigeria Demographic and health Survey 2004, 1–630.

National Demographic and Health Survey. Nigerian Demographic Health Survey 2009, 187–196..

Nigeria Demographic and Health Survey 2014. National Population Commission.

National Population Commission (NPC) [Nigeria] and ICF Macro. (2008).

National Population Commission. (2010). 2006 Population and Housing Census, Priority Table Volume IV: Population Distribution by Age and Sex (State and Local Government Area), IV, 1–371.

Odewale, B. J., Oladosun, M., & Amoo, E. O. (2016). Fertility Desire and Contraceptive Use among Women in Nigeria, 577–581.

Odimegwu, C. & Zerai , A., (1996). Understanding the Proximate Determinants of Fertility of a Nigerian ethnic group. Genus, 52(3), pp. 67-86.

Odimegwu, C. O. (2001, July). Couple formation and domestic violence among the Tiv of Benue State, Nigeria. In International Colloquium Gender, Population and Development in Africa organised by UAPS, INED, ENSEA, IFORD (pp. 4-8).

Odimegwu, C., (1998). Application of Demographic estimation models to a Nigerian Ethnic group: implications for population growth and family planning programmes. Development and Society, 27(2).

Odu, O., Jadunola, K., & Parakoyi, D. (2005). Reproductive behaviour and determinants of fertility among men in a semi-urban Nigerian community. Journal of Community Medicine and Primary Health Care, 17(1), 13–19.

Okonofua, F. & Binagwaho, A., (2014). Current and Predicted Fertility using Poisson Regression Model: Evidence from 2008 Nigerian Demographic and Helath Survey. African Journal of Reproductive Health, 8(1), pp. 72-100.

Olatoregun, O., Fagbamigbe, A. F., Akinyemi, O. J., Yusuf, ●. B., & Bamgboye, E. A. (2014). A comparative analysis of fertility differentials in Ghana and Nigeria. Afr J Reprod Health, 18(3), 36-47

Osuafor, G. N. & Mturi, A. J., (2013). Do Regious beliefs influence Use of Contraception among currently married women in Nigeria. Journal of Social Development in Africa, 28(1).

Oyefara, J. L. (2012). Age At First Birth and Fertility Differentials Among Women in Osun State , Nigeria. Researchgate, 8(16), 139–163.

Oyefara, J. L. (2015). Oyefara: Maternal Age at First Birth and Fertility Differentials 20. Ife Journal of the Humanities and Social Studies, 2(2), 20–39.

Population Reference Bureau. (2016). 2016 World Population Data Sheet. 2015 World Population Data Sheet, 23.

Reproductive, U., & Initiative, H. (2011). Fertility and Family Planning trends in urban Nigeria : A Research brief how high is fertility in Nigerian, 1–8.

Rodriguez, G. (2007). Chapter 4. Poisson Models for Count Data. Bernoulli, (September 2007), 1–50.

UN. (2015). World Fertility Patterns 2015. Data Booklet, 1–30.

World Population Prospects. (2015).

World Population Prospect. (2017). World Population Prospects.

# APPENDIX I

You have been authorized to download data from the Demographic and Health Surveys (DHS) Program. This authorization is for unrestricted countries requested on your application, and the data should only be used for the registered research or study. To use the data for another purpose, a new research project should be submitted using the "Create a new Project" link in your user account.

All DHS data should be treated as confidential, and no effort should be made to identify any household or individual respondent interviewed in the survey. The data sets must not be passed on to other researchers without the written consent of DHS. Users are required to submit a copy of any reports/publications resulting from using the DHS data files to:https://mg.mail.yahoo.com/compose?to=archive@dhsprogram.com.

To begin downloading datasets, please login at: http://www.dhsprogram.com/data/dataset_admin/login_main.cfm. Once you are logged in, you may also edit your contact information, change your email/password, request additional countries or Edit/Modify an existing Research Project.
The files you will download are in zipped format and must be unzipped before analysis. Following are some guidelines:

After unzipping, please print the file with the .DOC extension (found in the Individual/Male Recode Zips). This file contains useful information on country specific variables and differences in the Standard Recode definition. You will also need the DHS Recode Manual: http://dhsprogram.com/publications/publication-dhsg4-dhs-questionnaires-and-manuals.cfm.
This manual contains a general description of the recode data file, including the rationale for recoding; a description of coding standards and recode variables, and a listing of the standard dictionary, with basic information relating to each variable.

It is essential that you consult the questionnaire for a country, when using the data files. Questionnaires are in the appendices of each survey's final report: http://dhsprogram.com/publications/publications-by-type.cfm. We also recommend that you make use of the Data Tools and Manuals at: http://www.dhsprogram.com/accesssurveys/technical_assistance.cfm.

For problems with your user account, please email https://mg.mail.yahoo.com/compose?to=archive@dhsprogram.com. For data questions, please register to participate in the DHS Program User Forum at: http://userforum.dhsprogram.com/.
The Demographic and Health Surveys (DHS) Program
ICF INTERNATIONAL
530 Gaither Road
Suite 500
Rockville, MD 20850
USA
LOGIN INFORMATION:
Login Email: https://mg.mail.yahoo.com/compose?to=yilahun@yahoo.com
Password: (use the password you entered when you registered)