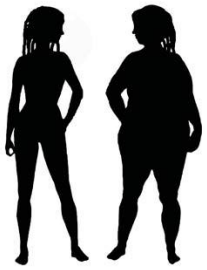
Socioeconomic status and nutritional status in Namibian women: An investigation into the relationship between socioeconomic status and nutritional status in Namibian women and other possible influences



Date: 27th August 2012

Author: Karin Limpho Vrijburg

Student number: S1655930

Master in Population Studies

Supervisor: Dr. Ir. Hinke Haisma

Rijksuniversiteit Groningen- Faculty of Spatial Sciences

Acknowledgements

This past year has been a great year for me. I have had the most amazing year doing my master and I have learned so much about myself. I would like to thank all the staff that taught me throughout this year with all their enthusiasm and passion about each subject. I thoroughly enjoyed every course, no matter how difficult it was and I am very sad that the master is already over. I would like to extend a special thanks to my supervisor, Hinke Haisma for her support, suggestions and motivation with my thesis and career. I am very grateful to her and her wonderful attitude.

I would also like to say thank you to my wonderful mom and dad, my brothers, boyfriend and friends for their encouragement and reassurance. Last but definitely not least I would like to send my love to the wonderful classmates within the Population Master. The international atmosphere was great and the support we gave each other throughout the year was incredible. I have truly had a wonderful year and I am very grateful that I chose the master Population Studies.

Abstract

The main objective was to determine where in the nutrition transition Namibian women are by looking at the relationship between SES and nutritional status and by looking at other possible influences. Various statistical analyses were carried out using the data from the 2006/07 Namibian Demographic Health Survey.

Results show that the mean BMI per wealth indices are significantly different between all wealth indices. Wealth and BMI categories are related with significant correlation coefficients of approximately 0.3. While wealth indices explain some of the variation found, other factors also influence a woman's nutritional status. An increase in a women's wealth means an increase in the chances of becoming overweight/obese. Having children increase a woman's likelihood of becoming overweigh/obese as does an increase in age. An increased education increase the chance a woman becomes overweight/obese. Being unemployed increases the chances of being underweight, but women employed in agriculture have lower chances of being obese compared to unemployed women. Women working in non-agricultural jobs have higher chances of being obese compared to unemployed women.

In conclusion, Namibia has not experienced the nutrition transition fully but it is on its way. In 2006/07 there was more over nutrition than under nutrition occurring within Namibian women. However, it is still the richer female population which suffers from overweight and obesity showing that Namibia has not reached the stages of developed countries, but will probably reach that stage with increased urbanization.

Key words: nutrition transition, BMI, overweight, obesity, nutritional status, women, socioeconomic status (SES), Namibia.

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List of abbreviations

AIDS	Acquired immune deficiency syndrome
BMI	Body Mass Index
DHS	Demographic Health Survey
GNP	Gross National Product
HIV	Human immunodeficiency virus
NCDs	Non-communicable diseases
NDHS	Namibian Demographic Health Survey
OECD countries	Organisation for Economic Co-operation and Development countries
SES	Socioeconomic Status
SPSS	Statistical Package for the Social Science
UNSD	United Nations Statistics Division
WHO	World Health Organisation

1. Introduction

1.1 Background

Countries in the developing world, particularly sub-Saharan Africa, have always had a great deal of attention focused upon the high malnutrition present among the populations there, especially amongst women and children (Monteiro et al., 2004). A lot of focus and research in these developing countries has been dedicated to infectious diseases and overcoming the nutritional deficiencies present (Ziraba et al., 2009). However, not enough attention is given to the increasing prevalence of obesity and non-communicable diseases (NCDs), even though they are also on the rise in developing countries (Monteiro et al., 2004). Already in 1997 did the World Health Organisation (WHO) warn that rising obesity levels put even developing countries at risk of developing NCDs (Prentice, 2006). This increase in overweight in populations in developing countries is resulting in a lot of these countries facing a double burden. This means there is still the presence of infectious diseases and under nutrition, but at the same time overweight NCDs are also increasing (Mendez et al., 2005). Over the past decades, due to urbanization and socioeconomic transformation, there has been increased access to energy dense foods and jobs have become less physically demanding, resulting in populations in developing countries suffering from overweight and obesity (Ziraba et al., 2009). This is referred to as the nutrition transition which Popkin called attention to in 1994. The feared outcomes of the nutrition transition are increased levels of obesity and NCDs (Martorell et al., 2000). While in developing countries there has usually been a positive relationship present between socio economic status (SES) and obesity, these dynamics seem to be changing and obesity is shifting to the poor who might not have the knowledge and financial resources to adopt healthy lifestyles (Ziraba et al, 2009). Additionally, while in most developing countries, diseases related to poverty and food insecurity continue to contribute to rising mortality rates, in those developing countries which have rising incomes, the overall *burden* of chronic and NCDs is relatively higher than in developed countries (Amuna and Zotor, 2008). Examples like this are found in middle income countries such as Brazil where it has been found that actually women of lower SES are more prone to obesity compared to women of a higher SES (Mendez et al., 2005).

Namibia is a middle income country situated in Sub-Saharan Africa, neighbouring South Africa. It gained its independence in 1990 after a century of colonial rule first by Germany and then by South Africa (NDHS, 2007). The Namibian economy is therefore still closely related to the South African economy and the Namibian dollar is pegged to the South African Rand (CIA, 2012a). Namibia's GNP per capita in 2005 was estimated at 3,558 US$ (UNSD, 2012). However, Namibia has one of the highest income inequalities in the world with a Gini coefficient of 70.7 (CIA, 2012a). Due to this high income inequality existing within Namibia, it is interesting to determine where in the nutrition transition Namibia and its subpopulations are, and additionally the relationship present between SES and nutritional status since different countries have different relationships depending upon the wealth of the country. It must not automatically be assumed that due to Namibia residing in sub-Saharan Africa there will be a positive relationship present, since the burden of obesity is also shifting

towards the poor in developing countries, depending on where in the nutrition transition the country is. This thesis shall therefore investigate whether the nutrition transition has occurred already in Namibia, and if so, whether it has occurred in all subpopulations. It will therefore determine what type of relationship is present between SES and nutritional status within Namibian women. It will also look into if there are other factors which seem to influence women's nutritional status.

It is very important to identify where and which subpopulations are experiencing which phase, since it means appropriate action can be taken to reduce the health problems associated with the various phases within the nutrition transition. In 2000, diet related diseases were the leading causes of deaths globally. Although this includes both malnutrition and over nutrition (Amuna and Zotor, 2008), it shows the importance of addressing these nutrition related problems. Particularly in low and middle income countries (like Namibia) where malnutrition and over nutrition can occur simultaneously (Amuna and Zotor, 2008), this problem needs to be identified and addressed since their medical care is less efficient than in developed countries. This means the health consequences are likely to be of greater burden than in developed countries. The Global Strategy on Diet, physical Activity and Health claims that 66% of deaths from NCDs occur in low-income countries and that this figure will continue rising (Prentice, 2006).

1.2 Objective and Research Questions

The objective of this thesis is to gain insight into the relationship between SES and nutritional status of Namibian women thereby also discovering where in the nutrition transition Namibian currently are. It will also look into what other factors could possibly influence the nutritional status of Namibian women.

Main Research Question:

Where is the female Namibian population in regard to the nutrition transition?

Sub questions:

1) Is there a difference in the nutritional statuses of women in Namibia in different Socio economic groups?
2) What does this relationship look like?
3) To what extent do wealth indices explain the nutritional status of Namibian women and are there other possible explanatory factors?

Structure

This thesis consists of six chapters, the first one being the introduction. In the second chapter, (theoretical framework), the theory that is used in this thesis shall be described. An in depth literature review will be given to gain insight into other findings from previous studies in relation to the relationship between SES and nutritional status, and the nutrition transition. Also studies which look into other factors affecting nutritional status are included in the literature review. Then the hypotheses for each sub-question shall be given and a conceptual model will serve as the basis for the analysis and give a visual expression of what the literature and theory conclude.

The third chapter is the data and methods chapter. Here the data sources and variables are explained in detail. Conceptualisation of the most important concepts used are given, and a description of how they will be operationalized. Finally for each research question a description of the statistical tests and techniques that will be used are given and explained. In the fourth chapter, the results from the research questions will be given and in the fifth chapter they shall be analysed, discussed and a conclusion shall be given. The last chapter recommends further research and gives policy recommendations.

2. Theoretical framework

2.1 Theory

Within this research the main theory that shall be used is the nutrition transition theory. The nutrition transition is basically a sequence of characteristic changes that occur in a country in relation to dietary patterns and nutrient intakes. It is associated with societal, economic and cultural changes that occur during the demographic transition of populations (Vorster et al., 2005).

The nutrition transition theory states that there are different phases countries go through as they develop which are referred to as patterns. The nutrition transition occurs simultaneously with both the demographic transition and more importantly the epidemiological transition as can be seen in figure 2.1

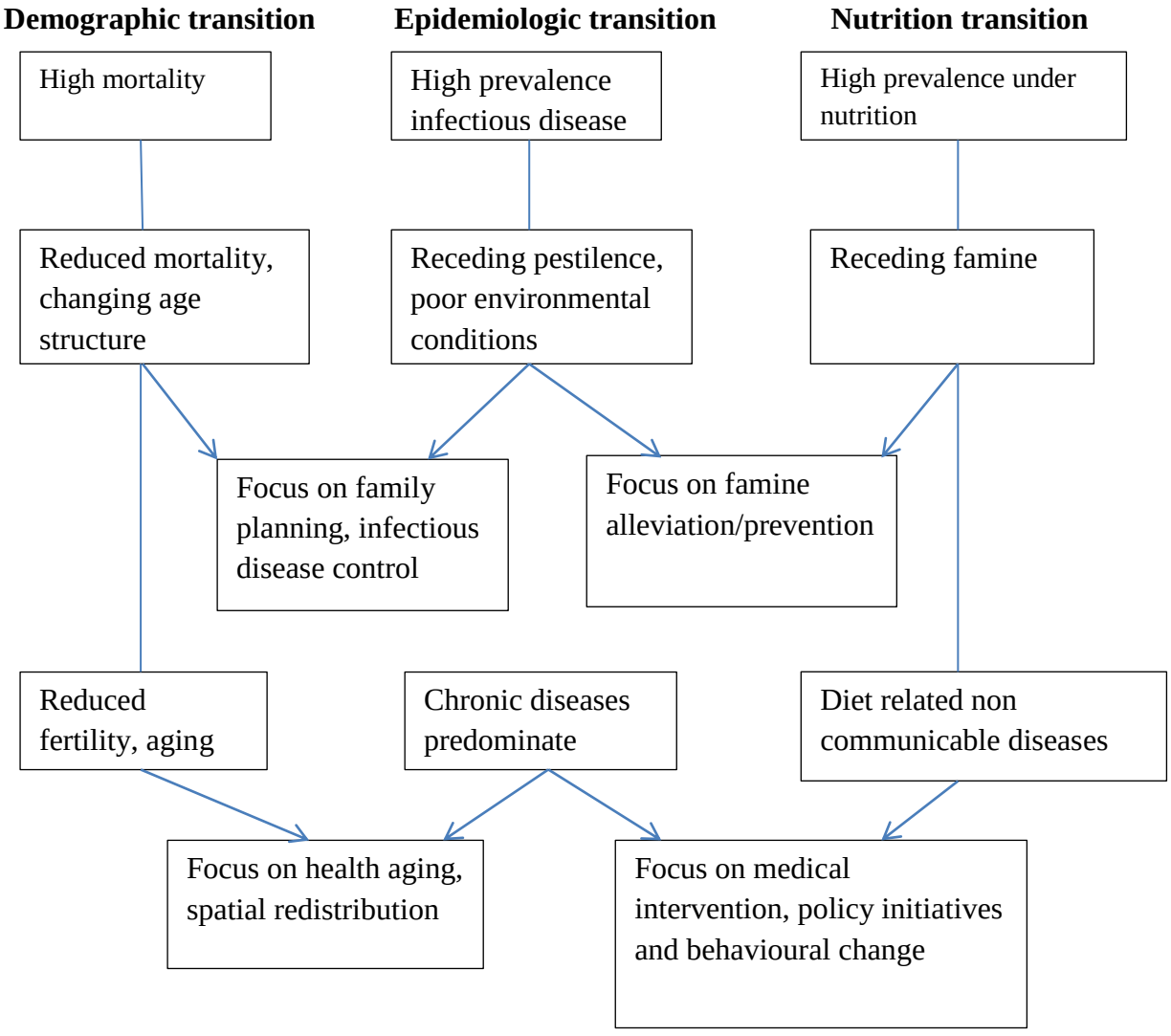

Figure 2.1 Demographic, Epidemiologic and Nutrition Transition. Source: Popkin, 2002

The nutrition transition has five different patterns which can be identified on figure 2.1 each with different characteristics. Most developing countries are in phase three while most

developed in phase four. Phases one and two are therefore past phases. A summary of the characteristics of each pattern are given below.

Pattern 1: Collecting food

Here the population was a hunter-gatherer population. The diet of this population was characterized by foods high in carbohydrates and fibre, and low in fat, especially saturated fat. The activity patterns of the population were very high. These high activity levels and diets low in saturated fat meant there was a high prevalence of under nutrition and no chronic diseases present within the populations (Popkin, 1993).

Pattern 2: Famine

In this stage, the diet of the populations became a lot less varied and there were periods of acute scarcity of food which have been hypothesized to be associated with nutritional stress and a reduction in stature. Especially women and children suffered from low fat intakes which lead to nutritional deficiency and diseases. Therefore infant and maternal mortality was high, as was the total fertility rate. Endemic diseases such as the plague and small pox caused a lot of deaths. The economy was primarily based upon agriculture. Additionally primitive technology and labour intensive household production meant the levels of physical activity remained high. All these factors lead to a nutritional status of the populations which consisted of lots of nutritional deficiencies present and a reduction in stature. However, later on in this stage, due to social stratification, diets started to vary according to gender and social status. Also food storage began to be a means of keeping foods (Popkin, 1993).

Pattern 3: Receding Famine

In this stage (currently still occurring in most developing countries) the consumption of fruit, vegetables and animal protein increases and starchy staples become less important in the diets of the populations. It started at the same time of the second agricultural revolution, which meant fertilizer started to be used, and also women joined the labour force. Also an increase in canning and processing technologies for food meant more food was available. Technological advancements meant levels of activity reduced and inactivity became more common. These improved conditions mean less nutritional stress for the populations, therefore the nutritional statuses of populations generally improve. Nutritional deficiencies decrease compared to pattern two meaning stature grows and infectious diseases decline, however they are still present. Also water systems remain primitive and there are still maternal and child health problems. Increases in both income and income disparities occur (Popkin, 1993).

Pattern 4: Nutrition-related Non-communicable Disease

Here the diets of the populations are high in fat, sugar cholesterol and other refined carbohydrates. Due to the growth of the service sector and the increase in mechanization in household production, lifestyles are usually very sedentary. Food is readily available due to food transforming technologies. All these factors result in an increased prevalence of obesity and degenerative diseases which have been identified in the Omran's epidemiologic transition

in the final stage. Infectious diseases become very uncommon. The growth in income and income inequality continues to increase. This is the stage most developed countries are in (Popkin, 1993).

Pattern 5: Behavioural Change

In this final stage, due to the people wanting to prevent or delay degenerative disease and prolong health, diets change according to what is best for prolonging life. The diets of the population include less animal fats and more fruit and vegetables. The service sector and industrial robotization are the main drivers of the economy therefore people still have very sedentary jobs. However, leisure exercise increases to offset the negative effects of the sedentary lifestyle. This therefore leads to a reduction in obesity problems of the populations. Also due to increased health promotion there is a decline in coronary heart disease and other nutrition related diseases (Popkin, 1993). Governments can play a role in achieving this transition (Popkin, 2002). Not a lot of countries are in this stage, and this is the most desired stage. An example of a country which seems to be in this stage is Japan. Japan has one of the highest life expectancies with an average life expectancy at birth of 84 (CIA, 2012b). Also Japan's obesity rates are the second lowest in the OECD countries with women having an obesity rate of 3.5% and men 4.3 (Fisher et al., 2012). Additionally in the 1990s, Japan's government had already focused policies on improving dietary habits, promoting exercise and preventing lifestyle related diseases such as diabetes (Nakamura, 2011).

The theory states that at this moment most countries are either in pattern three or four, but within a country different populations can be in different patterns. As countries gain more income they move from pattern three to pattern four which is where most developed countries are. Due to the fact that this is accompanied by a sedentary lifestyle, overweight and obesity is a public health concern in countries that are in this pattern. The transition is driven by a range of factors which include an increase in economic growth, urbanization, technical change and culture (Popkin and Gordon-Larsen, 2004).

For this thesis, the nutrition transition is most applicable. However due to the close relationship between the nutrition transition and the epidemiological transition as shown in the different patterns, both are relevant. This is especially the case for NCDs.

2.2 Literature review

Obesity and SES

In this section, a description of the findings in relation to SES and nutritional status from various studies are given. There have been various studies conducted on the relationship between SES and nutritional status (particularly obesity) throughout the world. The relationship between obesity and SES is one of great interest. Studies on this topic that were done before 1989 concluded that in developing countries there was a positive relationship present between SES and obesity (Monteiro et al., 2004b). Also it has been stated that much of the developing world still suffers from nutritional deficiencies (Martorell et al., 2000). In a lot of developing countries, diseases related to poverty and food insecurity continues to

contribute to rising mortality rates (Amuna and Zotor, 2008). Therefore obesity in developing countries has been considered to be a problem for people of higher SES. In the past people with lower SES in developing countries were protected from obesity. This was due to there being a lack of food, a lifestyle of high energy expenditure and the fact that the elite were usually the ones who would have access to large amounts of food (pattern three in nutrition transition). However, recently this view has changed. A review of studies which were conducted between 1989 and 2003 showed that obesity in the developing world is not necessarily a disease of people of higher SES. A study showed that while in low income countries there is still a low prevalence of obesity among lower socioeconomic groups, in middle income countries, having a low SES (measured by either income or education depending on what was available) is a risk factor for obesity (Monteiro et al., 2004b). Possible reasons for this are that after a certain stage of economic growth, a lifestyle of lower energy expenditure becomes the norm, and lack of access to food becomes less common (pattern four in nutrition transition). In a study conducted in Brazil (middle income country) an inverse association was found between women's SES and obesity (Monteiro et al., 2002). Similar finding were found in a study which looked specifically at women and obesity in 37 developing countries. It found that belonging to a lower SES group offers protection against obesity if the GNP per capita is below $745 per capita (low income country) but when the GNP per capita is greater than US$2995 per capita it becomes a risk factor. Within this study the cutoff point was US$ 2,500. This was also the point when lack of food and high energy expenditure lifestyle are no longer the norm in the country (Monteiro et al., 2004a). Interestingly, another study which looked in-depth into in Brazil, found that in 1997 low income women were significantly more susceptible than high income women to *both* under and overweight (Monteiro et al., 2004c). Opposite results were also found in a study which looked specifically at seven sub-Saharan African countries. It found that women of higher SES (measured by wealth) were still likely to be overweight or obese compared to their poorer counterparts. However, the study also showed that overweight and obesity increased by nearly 35% over the space of 10 years. Interesting was that the speed of increase in overweight and obesity was higher among the poorest group (50% increase) compared to the richest group (7% increase) (Ziraba et al., 2009). The fact that over time, the poorer also become at risk for overweight and obesity shows the changing relationship present between SES and BMI in developing countries and the nutrition transition coming into effect. This changing relationship is shown by other research which also looked at SES and obesity at a macro level also showed that the burden of obesity has shifted towards the poor. It concludes that only in very low income countries is being of a lower SES a protective factor against obesity, but in middle income countries, being of a lower SES was a risk factor for obesity. (Popkin and Larsen, 2004). Therefore only in very poor societies does obesity seems to be rare, especially in low socioeconomic groups. In those societies obesity has been seen as a marker of wealth. The wealth of a nation should therefore affect the prevalence of obesity as well as the relationship between obesity and SES (Popkin and Larsen, 2004).

Looking into the North West Province in South Africa, a study conducted a cross sectional analysis of adult black women and analysed the association between measures of obesity (BMI) and socioeconomic factors, dietary intake and physical activity. It concluded

that higher income is associated with higher BMI (Kruger et al., 2002). This is different to the conclusions drawn from Popkin and Larsen, (2004) and Monteiro et al (2004) which say that a lower SES is a risk factor for obesity in middle income countries. Different results were also found in other research which used the South African Demographic Health Survey of 1998 to look into South Africa and used education as a measure of SES. It found that women with lower SES had lower BMIs than women with slightly higher SES again (Puoane et al., 2002). Reasons for this were the fact that the uneducated women had more labour intensive jobs than the more educated women. Though a positive relationship seems to present, it also found that women with tertiary education (highest SES) had lower BMI than those with some schooling (middle SES). Additionally, the study also found that when looking at waist size, the highest educated had the smallest waist, followed by the lowest again (Puoane et al., 2002). Possible explanations are that the higher educated are more aware of the connection between body weight and health, or that these women were more likely to prefer the 'western' body ideal of thinness (Puoane et al., 2002).These findings show that SES (education) influences a woman's nutritional status in South Africa; however, the relationship is not straightforward.

A study which looked at women in developing countries found that the prevalence of overweight in young women (age 20-49) was higher than the prevalence of underweight, emphasising that overweight is becoming a problem, even in developing countries. This was the case in both urban and rural areas, especially countries with higher levels of socioeconomic development. Results showed that with increased urbanization, an increased percentage of overweight was present in the different countries. The study also looked at the relationship between SES (measured by education) and being overweight. A strong positive association between SES and overweight was found in the least developed countries. This relationship was reversed in the more developed countries that were studied (Mendez et al., 2005). Findings like this again show that different relationships are present between SES and BMI in different countries depending upon economic development and urbanization, even in developing countries. The study used DHS data from 1992-2000, and results also showed that prevalence of overweight have increased substantially over time (Mendez et al., 2005). This again is an example of the nutrition transition occurring in these countries. Looking at how African countries are experiencing the nutrition transition, evidence has shown that over 10 years, there has been a strong increase in obesity among women of lower SES, again indicating that the nutrition transition is occurring (Ziraba et al., 2009).

These various studies show similar trends, that there seems to be a complex relationship present between SES and the nutritional status, particularly obesity, depending on the situation of the country. It seems that in very poor societies, obesity is very rare, and if it is present it is a marker of wealth. In more affluent societies, the poor women are usually obese. Therefore, the wealth of the country affects the relationship between social class and obesity and also the prevalence of obesity within a country (Martorell et al., 2000).

Nutritional status and other possible explanatory factors.

Since other factors also seem to influence a person's nutritional status, an overview of findings from previous studies in relation to other possible influences shall be given in this section. A study which looked at BMI and nutritional status of 26 Sub-Saharan African

countries (Namibia was not included), and the differences between the rural and urban areas found that on average rural women were more at risk of *malnutrition* than urban women. These comparisons ranged from the years 2001 to 2006 (Uthman and Aremu, 2008). Research which looked at the differences between urban and rural in Bolivia, (a middle income country in South America), found that women living in urban areas were 1.2 times more likely to be *overweight* that those in rural areas (Perez-Cueto and Kolsteren, 2004). In a study conducted in India, it was found that 48% of rural women were classified as underweight, compared to only 11% of urban women (Griffiths and Bentley, 2005). This shows that for women, living in rural India means there is a higher chance of being underweight. However, another study which looked at developing countries found that although overweight was higher in urban areas; rural overweight was also substantial in half of the countries researched. It found that in countries with relatively high GNPs, a low prevalence of underweight and a high prevalence of overweight were found in *both* urban and rural areas of the country. The study also emphasized that underweight is mainly a concern for rural women in *very* poor countries (Mendez et al., 2005). Other research conducted in Africa showed that the urban African population is more at risk for obesity than the rural population. However, studies have also shown that the obesity pandemic is slowly infiltrating semi-urban and rural areas. Globalization is rapidly infiltrating traditional lifestyles in even the poorest nations in the world (Prentice, 2006). Possible reasons for this are the fact that in a lot of rural communities, people migrate to work in the urban areas and send back money to their villages which has transformed the types of foods and goods sold in the rural shops (Prentice, 2006). Also the study which looked at black women in the North West Province in South Africa found that lowest fat intake was found in subjects living in rural areas and urban areas had the highest levels of fat intake (Kruger et al., 2002). These results show that it seems that in low and middle income countries, people residing in urban areas have higher chances of being overweight. However, rural areas are also affected by overweight, although it depends on the economic situation of the country and the level of urbanization. Rural underweight seems to be mainly a concern for very poor countries while urban underweight is uncommon in general.

A woman's employment status has also been found to affect nutritional status. In seven sub-Saharan African countries, working women were more than 13% more likely to be overweight or obese compared to women who were unemployed (Ziraba et al., 2009). This was also found in Puerto Rican women where employment was related to a higher likelihood of obesity (Fitzgerald et al., 2006).

Women also seem to be differently affected than men. A study which reviewed macro-environmental trends of obesity in developing countries found that women are often more likely to suffer from obesity. In Ghana, obesity is 6 times more likely in women than in men, in Morocco four times and in South Africa three times. Furthermore, the study stated that in many developing countries the psychological desire to remain lean is absent and a larger body size is seen as desirable. In the Gambia, people were a lot more obesity tolerant compared to both white and black Americans, but especially white. Furthermore, the thinness associated with HIV/AIDS seems to increase the positive outlook towards being overweight.

The study emphasizes the worrying aspect of the fact that the emergence of non-communicable diseases are occurring while they are still battling with unfinished health problems (infectious diseases) (Prentice, 2006). In South Africa similar findings were found. It was found that being overweight in South African communities is considered a positive thing and that it reflects affluence and happiness (Puoane et al., 2002. In urban townships in South Africa, obesity and being overweight was seen as reflecting on the husbands' ability to take care of the wife (Puoane et al., 2002). The fact that Namibia is closely influenced by South Africa and also has a high HIV prevalence of 20% (NDHS, 2007), could mean that Namibian women also regard being overweight as a positive factor and associate being underweight with HIV/AIDS.

It becomes clear from the literature that certain factors seem to have an influence on the nutritional status of women. These factors include residence (urban vs. rural), ethnicity, income and education. Due to the fact that these factors all seem to have an effect but have all been studied in different countries, looking at Namibian women specifically will provide in-depth information on the situation in Namibia. To date not a lot of studies have been conducted on Namibia in relation to SES and nutritional status. One previous study done in Namibia, using the 2003/2004 Namibian Household Income and Expenditure Survey, reinforces the fact that like South Africa, there is an increase in obesity occurring. It also showed that there is a relationship present between household expenditure and BMI. Increased expenditure results in an increased BMI. However, it also stated that there is still significant malnutrition occurring (Araar et al., 2009). It is important to look at the relationship between SES and nutritional status within Namibia to be able to determine which populations are most at risk for malnutrition and which are most at risk for over nutrition. This means policies can be aimed at reducing the nutritional inequalities between women of different socioeconomic groups. Understanding where and why these differences in nutritional status exist means policies can be targeted effectively at the correct populations. Since over nutrition is related to NCDs this is very important since the Global Strategy on Diet, physical Activity and Health claims that 66% of deaths from NCDs occur in low-income countries and that this figure will continue rising (Prentice, 2006). Also in 2010 it was estimated that NCDs accounted for 38% of all deaths in Namibia (WHO, 2011). Furthermore, it is interesting to determine if other factors (besides SES) seem to influence Namibian women's nutritional status which have not been explored before since it means those factors can also be targeted. For example if unemployed women are most at risk of being overweight, policies can be aimed at unemployed women to make sure prevention strategies are effective. Namibia is especially interesting to look at due to their high inequality. They have a Ginicoefficient of 70.7 (CIA, 2012a) which suggests it is one of the most unequal societies in the world. Additionally, the high HIV prevalence means that the positive association with being overweight could also play a role there.

This study will use the DHS data from 2007 and since only anthropometric data was available for women, it will look only at the female population. This is still very relevant since female nutritional status affects children's growth and nutritional status (NDHS, 2007). It will look at socioeconomic status and other factors such as whether the woman works or

not, where she works (home or away) and what kind of job she does. An in depth analysis of the nutritional status of women shall therefore be given and what factors influence the relationship between socio economic status and nutritional status. This will give a more complete image of what socioeconomic factors are associated with the varying nutritional status of women within Namibia, thereby getting the opportunity to determine which pattern (three of four) of the nutrition transition various populations within Namibia are in so that effective measures can be taken in the future to reduce the health problems associated with pattern four of the nutrition transition.

2.3 Conceptual model

Based upon the literature and the theory, the following conceptual model has been designed to show the factors that could possibly have an influence on the nutritional status of Namibian women.

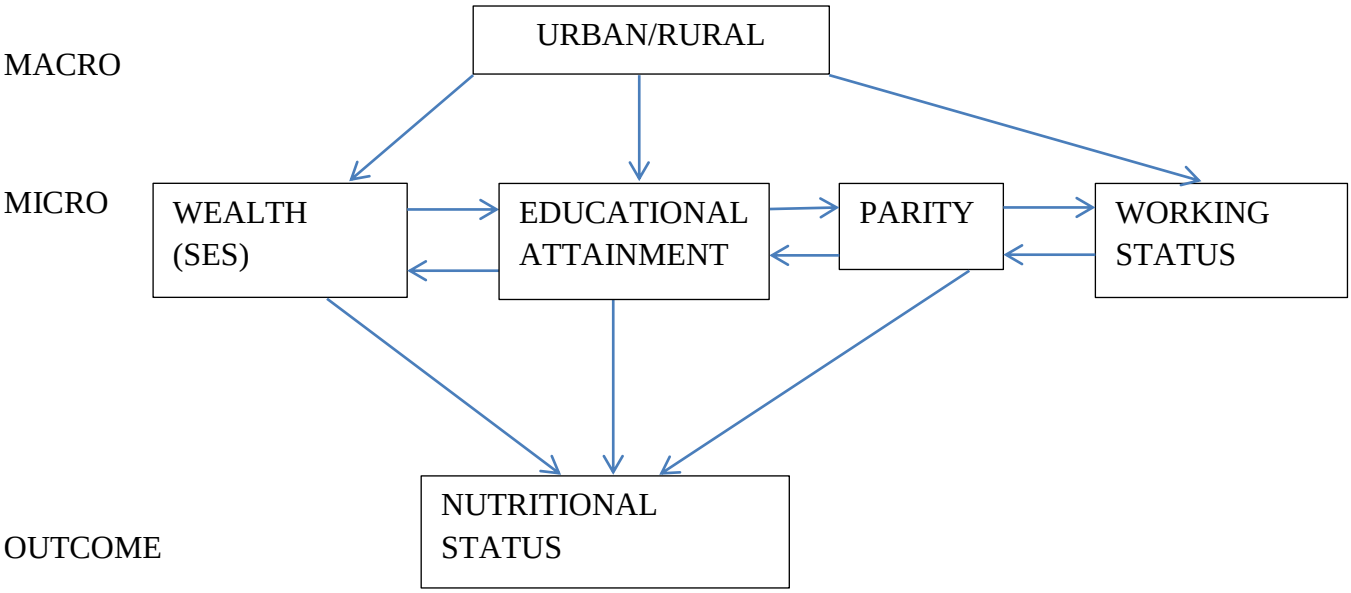

Figure 2.2: Conceptual Model

The conceptual model shows the different explanatory variables that could influence a woman's nutritional status. According to literature, at macro level, whether a woman lives in an urban or rural area is shown to have an effect on nutritional status. Wealth and educational attainment have also been shown to have an effect. If a country is early on in the nutrition transition, increased wealth and education will have a positive effect on BMI and if a country is middle income and higher, increased wealth and education will have a negative effect on BMI. Parity has also shown to increase BMI up until a certain number of children (5 to 6), according to literature and literature has also shown woman's working status could have an effect on nutritional status with employed women in sub-Saharan Africa being more likely to be overweight or obese.

2.4 Hypotheses

1. A difference in nutritional status will be present in women from different socioeconomic statuses (wealth indices).

2. Due to the fact that Namibia is a middle income country and has a GNP per capita of greater than US$ 2,500, it is expected that women with a lower socio economic status are more at risk of having higher and unhealthier BMI's therefore have a worse nutritional status than women of higher SES. A negative relationship between BMI and wealth is expected.

3. Though SES (wealth indices) will be able to explain quite a bit of variation, the expectation is that other influences also play a role such as the type of place of residence and parity. From literature it is expected women residing in urban areas have higher BMI than women in rural areas. Each child a woman has will increase her BMI and risk of becoming overweight or obese. Higher educated women will be less likely to be overweight or obese compared to lower educated women due to Namibia being a middle income country. Employed women will also be more likely to be overweight or obese.

3. Data and Methods Chapter

3.1Study design

This study will be descriptive. A descriptive study is often used in social science research to describe a certain situation or event (Babbie, 2010). In this case, the aim is first to describe the relationship present in Namibia between the SES and the nutritional status of the women within Namibia. With that description, we can determine the phase of the nutrition transition various populations within Namibia are currently in. The aim is then to find and describe other influences on the nutritional status of women in Namibia. This research is important since the findings can give policy makers insight into where most efforts and resources are required to reduce the inequalities in nutritional status between different socioeconomic groups and to improve the health of the women population in Namibia.

The study will be a cross sectional study, meaning it will look at observations of a sample of the population at a certain period in time (Babbie, 2010). A snap shot of the situation occurring in Namibia in 2006/07 will be taken. The problem with cross sectional studies is that conclusions will be based on the observations made at one time (Babbie, 2010) and since the nutrition transition in not a static subject this study will only be able to determine which populations are experiencing which phase of the nutrition transition. It will not be able to say which populations will transition into the next phase or have recently transitioned into another phase and if it is in line with the theory from the nutrition transition theory. However, if relationships are present, we can use the relationships and literature review to determine if the findings are in line with previous findings.

Additionally it will be a quantitative study, therefore using quantitative data and statistics to determine trends and relationships currently present within Namibia in relation to nutritional status and SES. For all statistical analysis the software package SPSS is used.

3.2 Description of study area

Namibia is situated in southern Africa. In 2005 Namibia's GNP per capita was estimated at 3,558 US$ therefore Namibia can be classified as a middle income country (UNSD, 2012). However, Namibia has one of the highest income inequalities in the world with a Gini coefficient of 70.7 (CIA, 2012a), therefore there are wide differences across GNP per capita. The UNDP's 2005 Human Development Report indicated that 34.9% of the population live on less than US$1 per day and 55.8% live on US$2 per day (CIA,2012a), thereby showing the great income inequality present. Additionally, Namibia has a high unemployment rate which was estimated at 51.2% in 2008 (CIA, 2012a).

Administratively Namibia is divided into 13 different regions The Namibian population is made up of about 87.5% black, 6% white and 6.5% mixed and the population in Namibia is relatively young (NDHS, 2007). Due to the relatively homogeneous ethnic composition of the Namibian population, differences in nutritional status between the different ethnicities shall not be taken into account in the analysis.

Namibia is a country, which like many southern African countries has been affected by the HIV epidemic. Namibia was estimated to have an HIV rate of 20% in the 2006/2007

period (NDHS, 2007). Besides HIV, Namibia is still suffering from other communicable diseases. However, in 2002, cerebrovascular diseases (strokes) and ischaemic heart disease were already in the top ten causes of mortality for Namibia, along with other communicable diseases (WHO, 2006). However, in 2010 it was estimated that NCDs accounted for 38% of all deaths in Namibia (WHO, 2011). Overweight is a major cause of NCDs like type 2 diabetes and cardiovascular diseases (Sassi, 2010). It is therefore very important to determine where overweight is occurring so that appropriate action can be taken to be able to reduce the prevalence of NCDs and therefore decrease the amount of deaths caused by NCDs. As emphasized, since Namibia is also still suffering from the HIV pandemic and other communicable diseases this is even more relevant since the double burden of diseases can cause great stress upon the Namibian economy and its people.

3.3 Description of data

The data that shall be used for the analysis comes from the Namibian Demographic Health survey (NDHS). The Demographic Health Surveys are nationally-representative household surveys that provide data for a wide range of monitoring and impact evaluation indicators in the areas of population, health and nutrition. They are usually conducted every five years and have large sample sizes. The latest NDHS was conducted in 2006/2007 and this is the data that shall be used. There are a variety of datasets available. The dataset that shall be used for this analysis is the 'individual women's' survey. This includes data on various important themes for the women such as a woman's anthropometric measurements, her reproductive behaviour, her marital status, her husbands' background amongst others

The sample the DHS uses is generally representative at the national, residence and regional level (MEASUREDHS, 2012a). The NDHS of 2006/07 interviews about 9,200 households in total, 9,800 women (aged 15-49) and 3,900 men (aged 15-49).

For this analysis, only certain part of the datasets will be used. Since the NDHS only has anthropometric information on women and children, only the women datasets shall be used. Additionally, since the DHS interviewed and measured women aged 15-49, for this analysis the ages 20-49 shall be used. Age 20 is a commonly used age by the WHO and CDC for making BMI relevant for adults (CDC, 2011). The reason they distinguish between BMI for adults and BMI for children and teenagers is that the bodies of children and teenagers are still changing and developing, therefore not the same guidelines for determining whether a person is overweight or not apply (CDC, 2011). Pregnant women are also filtered out from the dataset since they can give skewed results. The women's height and weight was measured by the DHS, and the BMI was computed. Height is measured using a height board and weight with a 200kg capacity scale which measures in 0.01 kg increments (MEASUREDHS, 2012b). After filtering out pregnant women and women under age 20, the number of women left which had their BMI computed is 6924 (excluding missing cases who didn't have their BMI computed). There were 7 women with BMI values of 99.9. Due to the fact that these figures were so much higher than the rest they were considered as outliers and were removed. 6917 cases were therefore left for analysis.

3.4 Conceptualisation

The most important concepts in this thesis shall be explained here. One of the most important concepts is the outcome variable, which is nutritional status. This concept refers to the state of the body in relation to the consumption and utilization of nutrients (medical dictionary, 2012). The other concepts measures in this research are important for the explanatory variables. One of the most significant ones that shall be looked at is socioeconomic status. Socioeconomic status refers to the placement of people or families with respect to the capacity to create or consume goods that are valued in our society (Shavers, 2007). A concept that might influence SES is educational attainment. It is defined as the highest grade completed within the most advanced level attended in the educational system of the country where the education was received (OECD, 2003). Other concepts that will be used in this research are the working status of the woman. The working or employment status in this thesis refers to the status of an economically active person with respect to his or her employment, that is to say, the type of explicit or implicit contract of employment with other persons or organizations that the person has in his/her job (OECD,2003). The parity of a woman in epidemiological terms refers to the classification of a woman by the number of live-born children she has delivered (medical dictionary, 2012).

These concepts that have been mentioned are all related to the individual (micro level); however, another variable which shall be tested is the type of place of residence, being urban or rural. This is at the macro level. The reason a difference is made between urban and rural is because it is believed that urban areas proved a different way of life than rural areas (UNSD, 2012). However, defining urban areas or the urban population has always been challenging. The United Nations states that because of national differences in the characteristics that distinguish urban from rural areas, the distinction between urban and rural population is not amenable to a single definition that would be applicable to all countries." (Salvatore et al., 2005).Rural areas are usually defined as what is not urban. Urban is described by the UN as a place that compromised a city or town proper and also the suburban fringe or thickly settled territory lying outside (Salvatore et al., 2005).

3.5 Operalisation

The concepts that have been explained need to be measured in an effective and context appropriate manner. To determine what a person's nutritional status is the BMI is used. This is an index of weight-for-height squared which is frequently used to classify underweight, overweight and obesity in adults. It is defined as the weight in kilograms divided by the square of the height in metres (kg/m^2) (WHO, 2011). The different values represent different categories which shall be explained below are underweight: defined as having a BMI lower than 18.5, normal between 18.5-25, overweight: is defined as having a BMI between 25-29.9 and being obese is defined as having a BMI of higher than 30. Though there are more specific subcategories that the WHO uses, in this thesis only the main categories shall be used.

SES is also measured in various methods, usually related to income and/or education. However, in this thesis SES shall be measured using wealth indices. The DHS and World Bank developed a method to measure wealth on the basis of respondent's household assets (Rutstein and Johnson, 2004). The reason wealth indices are used is because the DHS often

work in developing countries where income is not the most reliable or available measure of socioeconomic status (Rutstein and Johnson, 2004)). The reason income is not the most reliable measure is that in less developed countries people are usually less aware of their income since many families have self-employed earners and or/or home production. Also an earner often has several sources of income at one time and income might vary daily, weekly or seasonally (Rutstein and Johnson, 2004). Therefore, ownership of assets is a method the DHS and World Bank use to measure long term socioeconomic status (Rutstein and Johnson, 2004). Where relevant, country specific assets are included to better distinguish levels of wealth within that country. The DHS and WB construct five different wealth indices, ranging from the poorest 20% to the richest 20% (Rutstein and Johnson, 2004). This will be used as a measure of SES in this thesis. Separate wealth indices are not prepared for rural and urban population groups on the basis of rural or urban data, respectively (Rutstein and Johnson, 2004). Often education can also be used to measure SES; however, in this thesis education shall be a separate explanatory variable since the level of education might not be as important to socioeconomic status in developing countries like Namibia as it is in developed countries. Also to determine what is considered a high education in Namibia is difficult. Education has been measured in various forms in the DHS. In this thesis, education shall be using categories of the highest educational attainment. The categories refer to the highest education achieved in terms of primary, secondary or higher.

The working status of a Namibian woman shall be measured through the dichotomous variable 'respondent working or not' given in the dataset by the DHS to which 'yes' or 'no' can be answered (NDHS, 2007). An employed woman is a woman who says that she is currently working (has worked in the past seven days, or women who have worked during the twelve months preceding the interview). Other aspects of working status that will be measured are if the woman works in agriculture or not. This shall be measured by creating a new variable from the variable 'respondent's occupation,' which lists all the different types of employment women work in. A new variable shall be created in SPSS which groups together all the agricultural jobs as one response possibility and the non-agricultural jobs as the other response possibility. The variable has the response possibility of 'agriculture- self-employed' and 'agriculture- employee.' These two shall make up the 'working in agriculture' response and all others shall be 'not working in agriculture.'

Finally parity shall be operationalized by using the DHS variable 'total children ever born.' This means children who have died shall also be taken into account. There is the possibility of using the variable, 'total number of living children' but since it is interesting to see if the process of being having been pregnant influences nutritional status the latter shall not be used.

3.6 Methodology

3.6.1 Question 1: Is there a difference in the nutritional statuses of women in Namibia in different Socio economic groups?

To answer this question a one way analysis of variance (ANOVA) shall be used. The mean BMI of the different wealth indices shall be investigated to determine if there is a significant difference in nutritional statuses between them. The null hypothesis will be that the mean BMI for all five wealth indices are the same. In other words there is no difference in the average BMI between the five wealth indices. The reason one way is chosen is because the cases are assigned to different groups based upon one variable, the wealth index. This variable is called a factor. ANOVA has been chosen because it examines the variability of the sample values (Norusis, 2008). Using this technique we shall look into how much the observations within each group vary and how much the group means vary.

To be able to carry out the ANOVA certain assumptions need to be met. These are independence, normality and equality of variance. Independence means that there must be no relationship between the observations in the different groups and between the observations in the same group. This assumption is met.

The populations of the different wealth indices must be normally distributed. To check this, histograms of each wealth index have been made. However, though all five different groups have relatively normal distributions, there seems to be a tendency for the distributions to be skewed to the right. Still, since the sample sizes are large it is not a cause for concern. To check if the assumption of equality of variance is met, the Levene test shall be computed in SPSS. Though in practice, if the number of cases of the groups is similar the equality of variance is not important. However, in the sample there are differences between the numbers of women within the wealth indices, so this test needs to be computed. If equality of variance is violated, then the Brown-Forythe or Welsch robust F tests will be used instead. .

Test of Homogeneity of Variances
BMI to 2 decimal places

Levene Statistic	df1	df2	Sig.
97.545	4	6912	.000

Table 3.1: Tests of Homogeneity of Variances

As can be seen the Levene test for homogeneity of variances is significant meaning we cannot assume equal variances (Norusis, 2008). In the usual one-way layout, the ANOVA F statistic is known to lack robustness when dealing with nonhomogeneous variances (Roth, 1983). Therefore to avoid wrongly rejecting the null hypothesis, different tests need to be used. Robust alternatives have been proposed by Welsch (1951) and brown and Forsythe (1974). It has been shown that both these statistics are robust against heterogeneous variances (Roth, 1983). These tests shall therefore be used to determine if the mean BMI across the different wealth indices are statistically different.

If there is a significant difference between the wealth indices and their mean BMI, Post Hoc analysis shall be conducted to see where these differences are. Additionally descriptive statistics shall try to show the relationship present between wealth indices and BMI. There are different multiple comparison procedures available. Since the assumption of 'equality of variances' is violated it limits the options to fewer post hoc tests. The test that shall be used is the Games-Howell. This test assumes that sample sizes and variances are unequal (SPSS, 2011).

3.6.2 Question 2: What does this relationship look like?

Noting that there is a difference in mean BMI between the different wealth indices does not give insight into whether a statistically significant *relationship* is present, nor does it show what the relationship looks like. Additionally, the differences in mean BMI do not indicate anything about whether this difference is interesting nor if it has a significant health impact. Therefore to give the BMI more meaning in relation to nutritional status, the cases will be categorised in BMI categories classifying them as underweight, normal, overweight or obese according to the WHO standards. A new variable in SPSS will be made based upon the BMI. The following categories will be created

BMI< 18.49= underweight

BMI =18.5-24.9= normal

BMI=25-29.9= overweight

BMI> 30= obese

(WHO, 2012).

To determine if there is a relationship between the BMI categories and wealth indices, cross tabulation will be used. Cross tabulation can show if there is a relationship between categorical variables. It is a table that contains counts of the number of times various combinations of values of two different variables occur (Norusis, 2008). The independent variable in this case is wealth indices and the dependent the BMI categories. The independent variable must have the percentages sum up to 100% (Norusis, 2008). The general rule is to calculate the percentage across the dependent variable, in this case BMI categories (Norusis, 2008). If no relationship is present between the different categories, then approximately the same number of people (counts) will be present in each wealth index (Norusis, 2008).

Showing that there is variation among the different wealth indices is not sufficient to state that the variation is due to a relationship being present. The Pearson chi-square statistic shall be computed to determine if the variation between the categorical variables is significant or if it can be due to random chance. It does this by comparing observed and expected counts in each cell. The expected count is the number of cases that would be expected in each cell if there was no relation between wealth indices and BMI categories (Norusis, 2008).

To compute chi-square statistic the assumption that the cases are independent needs to be met. This means that a case cannot occupy more than one cell, (e.g. be overweight and

underweight). This assumption is met in this case so the Chi-square statistic can be computed without problems.

Depending on if the Chi-square statistic is significant or not, further test shall be computed. This is because the chi-square statistic does not say anything about how variables are related, instead it only gives information on the fact the two variables are not independent from each other (Norusis, 2008). A measure of association shall be computed to determine how strongly the variables are related. A strong association is a value close to one. Since the categorical variables are measured on an ordinal scale, the Pearson correlation coefficient and the Spearman correlation coefficient shall be used to measure association between wealth indices and BMI categories. This will give insight into the strength and direction of the relationship. The Pearson correlation coefficient is based upon actual data values while the Spearman correlation coefficient is the non-parametric alternative and replaces the actual data values with ranks. Both coefficients range from -1 to +1(Norusis, 2008).

3.6.3 Question 3: To what extent do wealth indices explain the nutritional status of Namibian women and are there other possible explanatory factors?

Since the women's BMI will be classified into categories of underweight, normal, overweight and obese, linear regression cannot be used to determine what other factors influence a woman's BMI, and therefore nutritional status. Instead multinomial logistic regression shall be used. Multinomial logistic regression is an extension of binary logistic regression. Logistic regression determines the impact of multiple independent variables simultaneously to predict membership of one of the dependent variable categories (Burns & Burns, 2008). The eventual goal of logistic regression is to correctly predict the category of outcome for individual cases using the most parsimonious model. To accomplish this, a model needs to be created that includes all predictor variables that are useful in predicting the response variable (Burns & Burns, 2008). In this case, the model will be made to try to predict whether a woman is underweight, normal, overweight or obese. Logistic regression also provides knowledge on the relationships and strengths among variables so therefore building a logistic regression model will also give insight into how the other independent variables (age, parity etc.,) influence a Namibian woman's nutritional status.

Logistic regression also has assumptions, however, less assumptions necessary than linear regression. It does not assume a linear relationship between the dependent and independent variable. The independent variables also do not need to be normally distributed, linearly related or of equal variance within each group. However, the categories must be mutually exclusive and exhaustive. This condition is satisfied since a woman can only be a member of one of the BMI categories. Also, larger samples are needed than for linear regression since maximum likelihood coefficients are large sample estimates (Burns & Burns, 2008). With a sample of size of 6917 this is not an issue in this analysis.

In logistic regression we are dealing with probabilities and not actual values. Also a mathematical transformation is needed to normalize the distribution so a log transformation is conducted. To determine best fit, a maximum likelihood method is used to maximise the probability of getting the observed results (Burns & Burns, 2008).

The multinomial response model that shall be used is the multinomial logit which is just an extension of the binary logit model to more than two response categories (Burns & Burns, 2008s). The dependent categories shall be the BMI categories underweight, normal, overweight or obese. Stepwise selection shall be conducted to see which explanatory variables will be put in the model to predict which BMI category a woman falls in. it means the first model shall contain no explanatory variables and then one by one explanatory variables shall be added to see if they improve the nagelkerke. Variables which do not show a significant improvement shall be removed. The most important explanatory variable that shall be entered into the model is wealth indices. After that the following shall be entered into the model are:

- Women's age
- Parity
- Whether she lives in urban or rural area
- Highest education in categories (no education, primary, secondary, tertiary)
- Whether she works or not
- Whether she works in agriculture or not
- Whether she works at home or away

These variables are mediating factors. Eventually, the aim is to get a model which contains all the explanatory variables which are helpful in predicting the nutritional status of the women. Thereby we are able to determine what factors influence the Namibian women's nutritional status and in what manner they influence it.

3.6.4 Possible confounding factors

Since HIV/AIDS can at times affect the nutritional status of people (Avert, 2011) HIV can be a confounding factor. HIV infection can lead to malnutrition (Avert, 2011); therefore if HIV prevalence is highest in certain socio economic groups it can lead to conclusions which are based upon wrong information. The DHS did not provide HIV information on the participants; therefore it cannot be controlled for in the analysis. However, there have been lots of studies done on the relationship between SES and HIV prevalence in Sub-Saharan African countries. A systematic review of the relationship between SES and HIV infection in women in Southern, Central and Eastern Africa showed that though results differed, it is less likely for there to be an association of *poverty* with HIV status and more likely that there is an association of increased wealth with HIV infection. However, a lot of other studies have also shown no association between SES and HIV infection (Wojcicki, 2005). In Namibia itself it has been shown that in the urban population, there is no association of HIV with SES (Aulagnier et al., 2011). These findings should be taken into account in when interpreting the results of this thesis.

4. Results

4.1: Question 1: Is there a difference in the nutritional statuses of women in Namibia in different Socio economic groups?

As can be seen from both the descriptive statistics from the one way ANOVA (table 4.1), and the graph (figure 4.1), the mean BMI per wealth index is of a different value. Additionally it can be seen that the richer wealth indices have relatively higher mean BMI. Also it is important to note that besides the richest wealth quintile, the mean BMI's fall into the 'normal' BMI range (WHO, 2012). The richest wealth index has the highest standard deviation meaning there is most variation in BMI there.

Descriptives

BMI to 2 decimal places

Wealth index	No. women in wealth index	Mean BMI	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Poorest	1055	21.3096	3.78078	.11640	21.0812	21.5380	13.12	51.34
Poorer	1173	22.3303	4.73453	.13824	22.0591	22.6015	12.80	54.17
Middle	1583	23.7553	5.42150	.13626	23.4880	24.0226	13.41	50.54
Richer	1833	25.0427	5.87549	.13723	24.7736	25.3119	13.23	52.94
Richest	1273	26.5179	6.44697	.18069	26.1634	26.8724	13.25	56.69
Total	6917	23.9902	5.70395	.06858	23.8558	24.1247	12.80	56.69

Table 4.1: Descriptives of the mean BMI per different wealth index

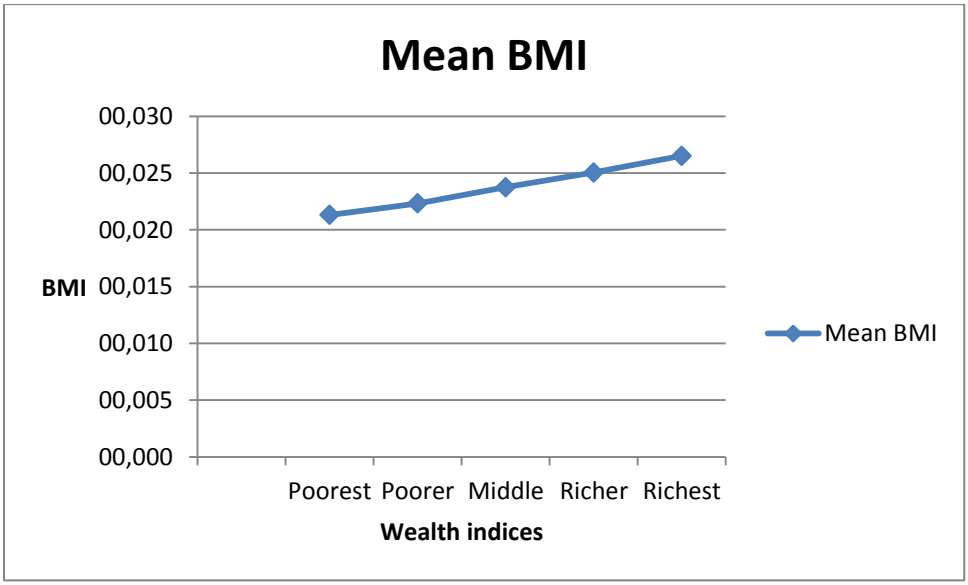

Figure 4.1: Graph showing mean BMI for each wealth index

To check if the difference in mean BMI between the wealth indices is significant, the output from the one way ANOVA needs to be looked at. Though this is significant, the assumption of equality of variance was violated, therefore the F value might not be true and there is the risk of rejecting the null hypothesis when it is should not be rejected, thereby making a type one error.

ANOVA
BMI to 2 decimal places

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	21064.135	4	5266.034	**178.471**	**.000**
Within Groups	203948.479	6912	29.506		
Total	225012.614	6916			

Table 4.2: Results from one way ANOVA

Instead the Welch and Brown-Forsythe Tests shall be computed. Both statistical tests show that the mean differences in BMI per wealth quintile are considered a significant difference at both the $P<0.05$ and $P<0.01$ criteria. Based upon these results the null hypothesis that all five wealth percentiles have equal mean BMI's can be rejected.

Robust Tests of Equality of Means
BMI to 2 decimal places

	Statistic[a]	df1	df2	Sig.
Welch	**352.181**	2	3988.136	**.000**
Brown-Forsythe	**334.713**	2	5890.720	**.000**

a. Asymptotically F distributed.

Table 4.3: Results from Welch and Brown-Forsythe tests

These results say nothing about which wealth indices have mean BMI's that are statistically different from each other, only that the mean BMI between the indices are not the same.

The Games-Howell tests reveal significant differences between all wealth indices at the $P<0.005$ level (table 4.4). The mean differences (I-J) show the mean differences in BMI between the different wealth indices. So between the *poorest* wealth index and the *poorer* wealth index, the mean difference in BMI is 1.02. From the Games-Howell test it can be seen that the biggest differences in BMI are between the richest and poorest wealth indices. The poorest have a mean BMI which is 5.21 lower than the richest mean BMI.

Multiple Comparisons

Dependent Variable: BMI to 2 decimal places

Games-Howell

Wealth index(I)	Wealth index (J)	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Poorest	Poorer	**-1,02069***	.18072	**.000**	-1.5141	-.5273
	Middle	**-2,44569***	.17921	**.000**	-2.9349	-1.9565
	Richer	**-3,73308***	.17995	**.000**	-4.2243	-3.2419
	Richest	**-5,20830***	.21494	**0.000**	-5.7951	-4.6215
Poorer	Poorest	**1,02069***	.18072	**.000**	.5273	1.5141
	Middle	**-1,42500***	.19411	**.000**	-1.9548	-.8952
	Richer	**-2,71239***	.19479	**0.000**	-3.2441	-2.1807
	Richest	**-4,18761***	.22751	**0.000**	-4.8087	-3.5665
Middle	Poorest	**2,44569***	.17921	**.000**	1.9565	2.9349
	Poorer	**1,42500***	.19411	**.000**	.8952	1.9548
	Richer	**-1,28739***	.19339	**.000**	-1.8152	-.7596
	Richest	**-2,76261***	.22631	**0.000**	-3.3804	-2.1448
Richer	Poorest	**3,73308***	.17995	**.000**	3.2419	4.2243
	Poorer	**2,71239***	.19479	**0.000**	2.1807	3.2441
	Middle	**1,28739***	.19339	**.000**	.7596	1.8152
	Richest	**-1,47522***	.22690	**.000**	-2.0946	-.8559
Richest	Poorest	**5,20830***	.21494	**0.000**	4.6215	5.7951
	Poorer	**4,18761***	.22751	**0.000**	3.5665	4.8087
	Middle	**2,76261***	.22631	**0.000**	2.1448	3.3804
	Richer	**1,47522***	.22690	**.000**	.8559	2.0946

*. The mean difference is significant at the 0.05 level.

Table 4.4: Results from the Games-Howell Post Hoc Multiple Comparisons test.

From the both the results from the Welch and Brown-Forsythe tests and the post hoc Games-Howell tests it can be concluded that the population in different wealth indices have significantly different mean BMI's and that this difference is significant between all wealth indices.

4.2: Question 2: What does this relationship look like?

The one way ANOVA showed significantly different mean BMI values for all five wealth indices. However, all of them, except the richest, fell into the normal BMI category, which is considered a good nutritional status in this thesis. Another way of looking at the association between wealth indices and BMI is by classifying BMI into underweight, normal, overweight and obese categories. This will also give insight into whether different wealth indices are at different risk for certain health problems related to the nutritional status.

BMI categories	Frequency	Per cent
underweight	835	12.1
normal	3734	54.0
overweight	1334	19.3
obese	1014	14.7
Total	6917	100.0

Table 4.5: Percentage of BMI categories present in women population

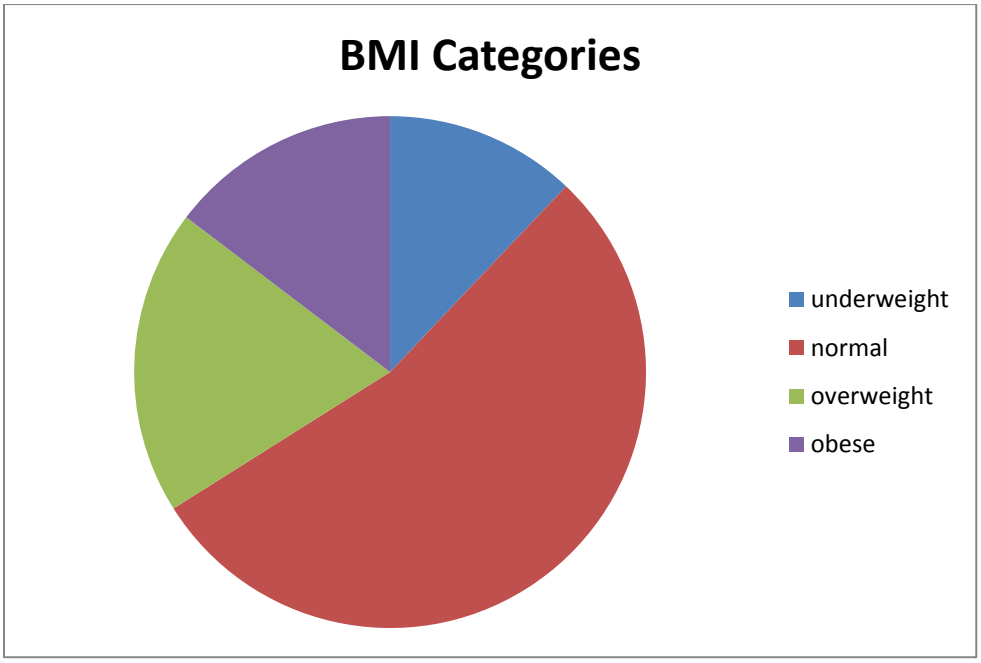

Figure 4.2: Pie chart showing distribution of BMI categories

From this pie chart, interesting findings appear immediately. As can be seen when looking at the percentages, being in the normal weight category is most common for Namibian women. 54% of women fall into this category. The next most likely category is being overweight with 19% of Namibian women in this same being overweight. The least common category for Namibian women is being underweight, with only 12% of Namibian women in this sample falling into this category.

BMI categories * Wealth index Cross tabulation								
			Wealth index					
			Poorest	Poorer	Middle	Richer	Richest	Total
BMI categories	underweight	Count	193	215	201	143	83	835
		% within Wealth index	18.3%	18.3%	12.7%	7.8%	6.5%	12.1%
	normal	Count	743	694	859	910	528	3734
		% within Wealth index	70.4%	59.2%	54.3%	49.6%	41.5%	54.0%
	overweight	Count	87	186	309	425	327	1334
		% within Wealth index	8.2%	15.9%	19.5%	23.2%	25.7%	19.3%
	obese	Count	32	78	214	355	335	1014
		% within Wealth index	3.0%	6.6%	13.5%	19.4%	26.3%	14.7%
Total		Count	1055	1173	1583	1833	1273	6917
		% within Wealth index	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table 4.6: Table showing Cross tabulation between wealth indices and BMI categories

The independent variables (wealth indices) add up to 100%. Based upon this cross tabulation, it can be seen that the probability to be underweight is highest in the poorer women with the two poorest wealth indices both having 18.3% of the women being underweight, while in the richest wealth index, only 6.5% of women are underweight. Furthermore, only 3% of the women in the poorest wealth index are obese while 26.3% of women in the richest index are classified as obese. This shows that for women in the poorest wealth index, being overweight and obese is least common, while for women in the richest wealth index being underweight is the least common. Also women in the poorest wealth index have the highest percentage (70.4%) of women who have a normal BMI category. The probability to be overweight or obese is the lowest in the poorest wealth index, and the probability to be overweight or obese increases in each richer wealth index with the richest women having the highest probability to be overweight or obese. Though an increasing mean BMI per richer wealth quintile was observed in the one way ANOVA, these findings show more specifically where most underweight and overweight women are. This is more interesting since it gives insight into possible health related problems (e.g. more NCDs in richer wealth indices) due to the nutritional statuses.

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	**645,644**[a]	**12**	**.000**
Likelihood Ratio	695.480	12	.000
Linear-by-Linear Association	606.692	1	.000
N of Valid Cases	6917		

Table 4.7 results from Chi-square test

As can be seen from the chi-square statistic, the association between wealth category and BMI category is clearly significant. Since the assumptions necessary for conducting the chi-square statics were met, it can be said that the wealth categories and weight categories (nutritional status categories) are not independent of each other. However, this does not say anything about what kind of relationship is present. Since both variables wealth and weight categories here are measured on an ordinal scale, it is possible to determine whether the relationship is linear, and if the relationship is positive or negative. Just from the data counts in the cross tabulation a positive relationship between BMI categories and wealth categories seems to be present. However, the correlation coefficients need to be calculated to determine the strength of the relationship.

Symmetric Measures					
		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Interval by Interval	Pearson's R	**.296**	.010	25.786	**.000**
Ordinal by Ordinal	Spearman Correlation	**.295**	.011	25.692	**.000**
N of Valid Cases		6917			

Table 4.8: Correlation coefficients for BMI and wealth indices

The Pearson correlation coefficient is calculated based upon actual data values and the Spearman is a nonparametric alternative to the Pearson correlation coefficient, and replaces the actual values with ranks. As can be seen from the table both correlation coefficients are significant and both are around 0.3. This means based upon the correlation coefficients there seems to be a positive relationship present between wealth categories and BMI categories.

4.3: Question 3: To what extent do wealth indices explain the nutritional status of Namibian women and are there other possible explanatory factors?

The results from the crosstabs (table 4.6) show that there seems to be a relationship between wealth indices and the BMI categories Namibian women fall under. As seen from both the Pearson correlation coefficient and the Spearman correlation coefficient, the relationship is highly significant (P<0.001). To determine what effect (significant or not) each wealth quintile has on the nutritional status of women and to see how much the wealth indices explain the variation, multinomial logistic regression shall be used. The dependent variable is BMI category and 'normal' is the reference category.

The Nagelkerke shows how much of the variation is explained by the model. A high Nagelkerke is very rare with logistic regression. Starting with an empty model results in a nagelkerke of 0.00 meaning nothing is explained. When wealth indices are added as an explanatory variable the Nagelkerke is still quite low at around 11%.

Additionally looking at the 2 log likelihood, it shows that the addition of the variable 'wealth indices' improves the model. The variable 'wealth indices' as an explanatory variable is also significant in predicting whether which BMI category a woman falls under.

Model Fitting Information

Model	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	797.461			
Final	101.981	695.480	12	.000

Table 4.9: Model fitting information: Wealth indices as explanatory variable

The degrees of freedom depend on the number of rows and columns in the cross tabulation. The reason they are important is because to determine whether a Chi-square value of 695.480 is unusual (Norusis, 2008). There are 12 degrees of freedom since it is the number of rows in the table -1 x (number of columns in table -1) = 3x4=12.

Pseudo R-Square	
Nagelkerke	.105

Table 4.10: Table showing Nagelkerke with only wealth indices as a factor

Parameter Estimates						
BMI categories			Sig.	Odds Ratio Exp(B)	95% CI for Odds Ratio	
					Lower Bound	Upper Bound
underweight		Intercept	.000			
	wealth indices	poorest	**.000**	**1.652**	1.248	2.187
		poorer	**.000**	**1.971**	1.493	2.601
		middle	**.005**	**1.489**	1.128	1.965
		richer	.998	1.000	.747	1.337
		richest				
overweight		Intercept	.000			
	wealth indices	poorest	**.000**	**.189**	.146	.246
		poorer	**.000**	**.433**	.350	.535
		middle	**.000**	**.581**	.481	.702
		richer	**.002**	**.754**	.630	.903
		richest				
obese		Intercept	.000			
	wealth indices	poorest	**.000**	**.068**	.046	.099
		poorer	**.000**	**.177**	.135	.232
		middle	**.000**	**.393**	.321	.481
		richer	**.000**	**.615**	.512	.739
		richest				

Table 4.11: Table showing parameters Estimates from multinomial logistic regression: Wealth indices as factor.

Normal BMI is the reference category and all findings are compared to the richest wealth index. The results from the table can be interpreted in the following way: The odds of being underweight for the poorest quintile compared to the richest quintile are 1.652. The odds ratio increased with being a bit richer and then decreased with being middle class. This means that when someone becomes richer, the odds of being underweight generally decrease. The odds ratio of being overweight are much smaller (0.189) for the poorest wealth quintile compared to the richest index (0.754). The same is applicable to being obese. The odds

increase with the richer wealth indices showing that the richest wealth indices have the highest chance of being overweight and obese.

However, as can be seen from the nagelkerke, there is room for improvement in the model. According to literature there are other possible factors which influence a woman's BMI. Therefore other factors (based upon literature research) which have been recorded in the DHS database will be used as explanatory variables in the model. To determine if they are significant explanatory factors, stepwise addition of these factors or covariates shall be added to the model to see how much it improves and to determine if those variables are significant or not. The following factors shall be added to the model in the hope of increasing the nagelkerke and getting a better fitting model:

- Women's age (5 year groups)
- Parity
- Whether she lives in urban or rural area
- Highest education in categories (no education, primary, secondary, tertiary)
- Whether she works or not
- Whether she works in agriculture or not
- Whether she works at home or away

Stepwise selection resulted in the following findings: The addition of women's age and parity both increased the Nagelkerke and were both found to be significant predictors, therefore they were kept in the model. Whether the woman lives in an urban or rural area made no significant improvement to the model so it was removed. The highest educational attainment of a woman also increased the nagelkerke and was a significant predictor, as was whether the woman was working or not. The variable 'working at home or away' decreased the nagelkerke and also was not significant so was removed from the model. Finally whether the woman works in agriculture or not was significant and increased the Nagelkerke. Eventually the final model had a Nagelkerke of 19.6% and all the explanatory variables were significant at the $P<0.05$ level as can be seen from the tables below.

Pseudo R-Square	
Nagelkerke	.196

Table 4.12: Table showing Nagelkerke for final model including age, parity, wealth indices, education, employment status and working in agriculture as explanatory variables

Model Fitting Information				
	Model Fitting Criteria	Likelihood Ratio Tests		
Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	8541.897			
Final	7192.570	1349.327	36	.000

Table 4.13: Table showing Model fitting information for final model including variables age, parity, wealth indices, education, employment status and working in agriculture as explanatory variables

Likelihood Ratio Tests				
	Model Fitting Criteria	Likelihood Ratio Tests		
Effect	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	7192,570[a]	0.000	0	
age (5 yr. groups)	7339.672	147.102	3	.000
Parity	7268.085	75.515	3	.000
wealth indices	7660.033	467.463	12	.000
highest educational level	7246.823	54.254	9	.000
employment status	7203.495	10.925	3	.012
works in agriculture or not	7210.391	17.821	6	.007

Table 4.14Table showing Likelihood Ratio tests for overall model

However, not all variables are significant for predicting each BMI category. Therefore only the significant results shall be interpreted. Significant values are highlighted in bold. The P value that is used to determine whether it is significant or not is 0.05.

Parameter Estimates						
BMI categories			Sig.	Odds Ratio Exp(B)	95% CI for Odds Ratio	
					Lower Bound	Upper Bound
underweight		Intercept	.000			
		age in 5 year categories	.674	.987	.929	1.049
		Parity	**.030**	**.947**	.901	.995
	Wealth indices	poorest	.352	1.162	.847	1.594
		poorer	**.016**	**1.443**	1.071	1.946
		middle	.390	1.137	.848	1.525
		richer	.393	.878	.652	1.183
		richest				
	highest education level	no education	**.000**	**2.564**	1.511	4.352
		primary	**.002**	**2.239**	1.361	3.686
		secondary	.092	1.504	.935	2.420
		Tertiary				
	employment status	not working	**.012**	**1.398**	1.077	1.816
		working				
	works in agriculture	not working in agriculture	.449	.901	.689	1.180
		works in agriculture	.782	.959	.715	1.287
		Not working				

Table 4.15: Table showing parameter estimates for underweight category

From the results from the final multinomial logistic regression model, the following interpretations about what influences a women's BMI category can be made. The reference category is 'normal BMI' and all significant values that will be interpreted are put in bold. For wealth indices and education, all findings are compared to the highest category (richest wealth index, highest education). For employment status all categories are compared to 'not working' and for checking for working in agriculture all findings are compared to 'not working.'

Underweight

Each child a woman has decreases the odds of being underweight by 0.95. The odds of being underweight for uneducated women compared to the highest educated women are 2.56. The odds ratio decreased with higher education from 2.56 to 2.23 for primary education and 1.5 for secondary education therefore lower educated women are more likely to be underweight than higher educated women. Non-working women have odds which are 1.4 times as high of being underweight compared to working women.

Parameter Estimates						
BMI categories			Sig.	Odds Ratio Exp(B)	95% CI for Odds Ratio	
					Lower Bound	Upper Bound
overweight		Intercept	.000			
		age in 5 year categories	**.000**	**1.183**	1.124	1.245
		Parity	**.000**	**1.109**	1.064	1.155
	Wealth indices	poorest	**.000**	**.174**	.129	.235
		poorer	**.000**	**.423**	.334	.536
		middle	**.000**	**.598**	.486	.735
		richer	**.003**	**.755**	.626	.911
		richest				
	highest education level	no education	**.020**	**.654**	.457	.936
		primary	.111	.789	.590	1.056
		secondary	.682	.949	.738	1.220
		Tertiary				
	employment status	not working	.112	.820	.642	1.047
		working				
	works in agriculture	not working in agriculture	.515	1.090	.841	1.414
		works in agriculture	.461	1.121	.828	1.518
		Not working				

Table 4.16: Table showing parameter estimates for overweight category.

Overweight

For each child a woman gives birth to, the odds of being overweight increase by 1.1. Also for each five year increase in age, the odds of being overweight increase by 1.18. The odds of being overweight for the women in the poorest quintile, compared to women in the richest quintile are 0.17. The odds ratio increased with increased wealth. However, all were still lower than when compared to the richest, therefore showing how the richest women have the highest risk of being overweight. When it comes to education, the odds of being overweight for the uneducated compared to the highest educated are 0.65. This shows that if a woman is uneducated she is less likely to be overweight than if a woman is highly educated. The other variables included in the model do not give significant predictions.

Parameter Estimates						
BMI categories			Sig.	Odds Ratio Exp(B)	95% CI for Odds Ratio	
					Lower Bound	Upper Bound
obese		Intercept	.000			
		age in 5 year categories	**.000**	**1.400**	1.321	1.483
		Parity	**.000**	**1.181**	1.128	1.236
	Wealth indices	poorest	**.000**	**.057**	.038	.087
		poorer	**.000**	**.155**	.114	.210
		middle	**.000**	**.383**	.304	.482
		richer	**.000**	**.619**	.507	.755
		richest				
	highest education level	no education	**.003**	**.545**	.364	.815
		primary	**.091**	**.765**	.561	1.043
		secondary	.170	.832	.641	1.081
		Tertiary				
	employment status	not working	.676	1.064	.796	1.421
		working				
	works in agriculture	not working in agriculture	.080	1.313	.968	1.780
		works in agriculture	**.063**	**.668**	.437	1.022
		Not working				

Table 4.17: Table showing parameter estimates for obese category.

Obese

Again, for every five year increase in age, the odds of becoming obese increase by 1.4. For every child a woman has her odds of becoming obese increase by 1.1. The odds of being obese for the women in the poorest wealth quintile, compared to the women in the richest are 0.057. The odds ratio of becoming obese again increase with increased wealth and again the richest women also have the highest chance of being obese compared to all other women. The odds of being obese for the non-educated women compared to the highest educated women are 0.003. This is much smaller showing how increased education, increases the risk of being overweight in Namibian women. Also, working in agriculture is *just* not significant; however in the overall model it is, therefore the interpretation shall be given. The odds of being obese for a woman who works in agriculture compared to a woman who isn't working are 0.668. The odds of being obese for a woman who is employed in a non-agricultural job compared to an unemployed woman are 1.3.

It is surprising that type of place of residence (urban vs. rural) does not affect nutritional status. A likely explanation could be that in the logistic regression model, the wealth indices took away the effect of urban rural differences.To determine if this is the case a cross tabulation of wealth indices and place of residence below (table 4.18). It shows that 96.8% of the women in the poorest wealth index reside in the rural areas. On the contrary, only 11% of women who are in the richest wealth index live in rural areas. 89 % of women who are in the richest wealth index live in urban areas while only 3.2% of women who are in the poorest wealth index live in urban areas. This clearly shows that the rural areas consist mainly of poor people while the urban area more of rich people.

Type of place of residence * Wealth index Cross tabulation

			Wealth index					
			Poorest	Poorer	Middle	Richer	Richest	Total
Type of place of residence	Urban	Count	34	167	619	1266	1133	3219
		% within Wealth index	3.2%	14.2%	39.1%	69.1%	89.0%	46.5%
	Rural	Count	1021	1006	964	567	140	3698
		% within Wealth index	96.8%	85.8%	60.9%	30.9%	11.0%	53.5%
Total		Count	1055	1173	1583	1833	1273	6917
		% within Wealth index	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table 4.18 Cross tabulation of place of residence (urban vs. rural) and wealth indices.

5. Discussion and Evaluation

5.1 Discussion

The results show some interesting findings in relation to the nutritional status of women in Namibia. As mentioned, the main aim was to gain insight into the relationship between SES (measured by wealth indices) and the nutritional status of Namibian women. It was also to discover where in the nutrition transition Namibian women currently are.

The findings show that there definitely is a difference in nutritional statuses between women of different SES. The biggest differences are found between the poorest and richest wealth indices. Classifying the women's BMI into WHO's categories showed that being classified as normal is the *most* common BMI category in Namibian women, while being underweight is *least* common. The women in the richest wealth index have over 50% suffering from overweight and obesity while women in the poorest only have approximately 11% suffering from overweight and obesity. A correlation coefficient of almost 0.3 showed a positive relationship seems to be present between women's SES (wealth indices) and their nutritional status (ranging from underweight to obese).

Wealth indices explain some of the variation found among women's nutritional status. Women in poorer wealth indices have less chance of being overweight and obese while a higher chance of being underweight. Richer women have a higher chance of being overweight or obese. Having children increase a woman's likelihood of becoming overweight or obese and so does an increase in age. Overall increased education increases the chances a woman becomes obese .Being unemployed increases the chance of being underweight, while if a woman is employed and works in agriculture she has a lower chance of being obese compared to a woman who is unemployed. If she is working in a non-agricultural (desk job) job she then has a higher chance of being obese compared to an unemployed woman. Since there does not seem to be an association between poverty and HIV (Wojcicki, 2005), the results show that the women of higher SES are suffering from the double burden since they are not only struggling with obesity and overweight but also HIV/AIDS. If the case is that women of higher SES have higher HIV prevance, as some studies have shown (Wojcicki, 2005), the double burden in women of higher socioeconomic groups is even higher.

All these findings are very interesting and add to the literature on factors that influence a woman's nutritional status, and the relationship between SES and nutritional status in middle income countries in sub-Saharan Africa. As seen from the results, wealth indices make a significant difference in BMI. This falls in line with almost all previous research which has looked into SES and BMI or nutritional status in both men and women. Though for this thesis, wealth indices was used as the official measure of SES, the fact that education has the same effect (positive effect on BMI) and is often used as a measure of SES stresses the fact that there is a positive relationship present between SES and nutritional status in Namibia.

This positive relationship is quite a surprising result since previous studies conducted in other developing countries found different results. Popkin concluded that when developing countries have a GNP per capita of lower than US$ 2,500 being of a low SES is a protective

factor against obesity, while if the country has a GNP of higher than US$ 2,500 a low SES puts women at risk of obesity. However, in 2005 Namibia has a GNP of US$ 3,558 which rose to US$ 4,650 in 2010, so according to the literature and theory a negative relationship should be present between SES and BMI, or being of low SES should put woman at a higher risk of being overweight or obese. However, from the results this is clearly not the case. Though Ziraba et al (2009) also found that there was a positive relationship present in the Sub-Saharan African countries investigated, in 2010 ,all these countries had a GNP per capita of less than US$ 2,500 (UNSD, 20120). A positive relationship is therefore expected in those countries. Namibia with a GNP per capita of at least US$ 3,558(since this was in 2005 and it rose to US$ 4,650 in 2010) is well above the US$ 2,500 cut-off point, thus the result is surprising. However, another study conducted in Namibia which looked at household expenditure and BMI and also found a positive relationship (Araar et al., 2009). Surprising results were also found in Brazil (also a middle income country) where low income women were more at risk for both under and overweight than high income women (Monteiro et al., 2004c). Brazil is a country which is rapidly undergoing the nutrition transition (Monteiro et al., 2004c), therefore this trend of both under and overweight burdening low income groups could be applicable to countries which are going through the nutrition transition rapidly. For Namibia this problem is not present (yet), as overweight and obesity is still seen as a problem of the rich but if appropriate intervention does not occur perhaps both overweight and underweight will burden the poor of Namibia.

Comparing only the effect of education on the nutritional status with other countries still supports the surprising results. In Namibia, education increased the likelihood women would become obese. Again this finding is different from other middle income countries where education and the effect on nutritional status have been researched by Monteiro et al., (2005). There it was found that in South Africa an inverse relationship between education and BMI was found for women, as was the case in other middle income countries (but not in Sub-Saharan Africa). A study conducted in Bolivia (which is one of the poorest Latin American countries) also found that education is negatively associated with overweight and obesity. Highly educated women were 1.5 times less likely to be obese that those with only primary or secondary education (Perez-Cueto and Kolsteren, 2004). Though not a country in Sub-Saharan Africa, Bolivia being one of the poorest in Latin America provides an interesting comparison with a GNP lower than Namibia's. Bolivia has a GNP per capita ofUS$1,790 in 2010 (UNSD, 20120), and there is an inverse relationship between education and BMI, while Namibia has a positive relationship with a GNP of US$4,650 in 2010 (UNSD, 2012). The effect education has on the nutritional status of Namibian women is therefore unexpected.

It was also evident that underweight was the least common category for women in Namibia with only 12.1% of Namibian women being classified as underweight. Though the other study conducted in Namibia stated that there was still significant malnutrition occurring (Araar et al., 2009), this study drew it conclusions from men and children as well, therefore the comparison is not that straight forward. When only comparing women, the findings are similar to other findings in South Africa which showed that underweight among women is very low with only 5.6% of South African women being classified as underweight (Puoane et

al., 2002). Similar conclusions were also found in the results from Mendez et al., (2005) which found that in most developing countries, overweight in women is more common than underweight, emphasizing that over rather than under nutrition seems to be the problem for women in low and middle income countries. This is in contrast with the conclusions from Martorell et al., (2000) which stated that obesity is less of a concern in Sub-Saharan Africa. However, that study used data ranging from 1991-1996 for Sub-Saharan Africa. It is very possible that the nutrition transition was not under way in Sub-Saharan Africa in those years since Sub-Saharan Africa is the region which is least far along both the demographic and epidemiologic transition. In 1991-1996 the obesity problem in sub-Saharan Africa was probably less prevalent than now, and most countries would be in phase three with no signs of phase four present. Since Ziraba et al., (2009) found a 35% increase in obesity in urban Africa between the years 1992-2005; it supports the idea that the situation in the 1990s could be very different from the situation now due to these rapid changes and that more Sub-Saharan African countries are experiencing the nutrition transition than in the 1990s.

An increase in parity increased a woman's likelihood to become overweight and obese. The number of children was also seen to affect nutritional status in a similar manner in Bolivia with each child a woman has lowering her odds of being underweight by 17% (Perez-Cueto and Kolsteren, 2004). Ziraba et al., (2009) also found that parity increased a woman's likelihood to become overweight or obese. However, for women who had more than six children, the likelihood was lower than those with four to five. This is interesting since it is often in countries in the early stages of the demographic transition who have high fertility rates and who are then also in phase three of the nutrition transition where underweight is more likely and overweight is rare. In Namibia there were hardly women who had more than six children since the total fertility rate for women in Namibia is 3.6 (NDHS, 2007). This also shows Namibia is relatively far along the demographic transition, which falls in line with the theory that underweight also becomes less of a health problem.

For Namibian women, a five year increase in age meant it was more likely that they became overweight or obese. This is also found in the countries Malawi, Ghana, Kenya, Niger, Senegal and Tanzania (Ziraba et al., 2009). In South Africa similar findings were also the case since women who were older had significantly higher BMIs than younger women. In South Africa the heaviest women fell into the 35-64 year old age group. After age 64 the BMI in women started to decline in South Africa. Since the Namibian DHS only had data on women up until age 49, these comparisons could not be made.

Employment status played a role. In Namibia the results showed that being unemployed increases the chances of being underweight. This trend is similar from the findings from Ziraba et al., (2009) which showed that working women in the investigated African countries were more than 13% more likely to be overweight or obese compared to women who weren't working. However, in the analysis done in this thesis it showed that when a woman works in agriculture she is less likely to be obese than a woman who isn't working. However, a woman who has a desk job is more likely to be obese than a woman who is unemployed. Though it was measured through education, in South Africa it was also

found that women who have low education have more agricultural jobs which are more labour intensive resulting in a lower BMI. Therefore the same is applicable to Namibia

For Namibian women, whether she lived in an urban or rural setting did not have a significant impact on her nutritional status. This is surprising when compared to the other findings from previous research where it showed that urban rural differences influence a woman's nutritional status. In Bolivia it was found that urban women were 1.2 times more likely to be overweight than rural women, and even 2.3 times more likely to be obese (Perez-Cueto and Kolsteren, 2004). Additionally in South Africa a trend towards higher levels of obesity in urban settings compared to rural settings was found by Puoane et al. No previous studies have mentioned anything about whether a woman works away from home or not as a factor influencing nutritional status. In Namibia it was also not a significant factor.

The results show that SES (both wealth indices and education) does affect the nutritional status of women in Namibia. The relationship is positive though, and so a lower SES means a lower BMI. This is not what was expected due to Namibia being classified as a middle income country and having a GNP per capita of over US$2,500. Also when compared to other countries of similar GNP per capita, the result is surprising. However, this could be due to the fact that Namibia has such a high inequality that the GNP per capita does not properly reflect the standard of living in Namibia and therefore almost becomes irrelevant. This would mean that the poor are extremely poor and therefore their struggles are to get adequate amount of food, as opposed to too much access to energy dense foods. Additionally, as has been noted, in developing countries , due to being underweight being seen as a reflection of poverty, it could be that the richer women still feel being obese reflects wealth as was still the case in the black population in South Africa. Also the association of being underweight with HIV, which is present in many African countries but especially where the HIV rate is high like in Namibia,(Bradley and Mishra, 2008), could mean being overweight is seen as admirable. Other reasons why the relationship between SES and nutritional status is not as expected could be since there are other factors driving the nutrition transition. Mendez et al., (2005) showed that whether SES and BMI were inversely or positively related does not only depended upon the GNP of the country but also the level of urbanization. Compared to the other middle income countries which were researched, Namibia has a relatively lower percentage of the population that is urban. While Bolivia has 67% of its total population living in urban areas, Namibia only has an urban population of 38% (CIA, 2012c). This gives a possible explanation why Bolivia has an inverse relationship between education and BMI while Namibia still had a positive one. South Africa also had a much higher urban population of 62% (CIA, 2012c), again explaining why an inverse associations have been found in some studies done in South Africa.

The other factors which explained the difference in nutritional status between women are as expected according to previous literature. The only other unexpected result was that urban rural differences didn't affect the nutritional status. As seen from the results, the reason for this was that in the logistic regression model, the wealth indices took away the effect of urban rural differences. It was checked which explanatory variable explained more, but

wealth indices explained more of the variation than type of place of residency therefore wealth indices was kept in the model.

5.2 Conclusion

With regard to the nutrition transition, Namibia has not experienced the nutrition transition fully, but there are signs that it is present and on its way. In 2006/07 the situation was that there was actually more over nutrition rather than under nutrition occurring within Namibian women. This is a component of pattern four of the nutrition transition which states that there will be an increase in the prevalence of obesity. However, the fact that it is still the richer part of the women population which suffers from overweight and obesity shows that Namibia has still not reached the stages of developed countries, but most likely will reach that stage if appropriate intervention doesn't occur. A woman's education level also influenced her nutritional status the same way wealth indices did. Even though in the thesis education was not specifically used as a measure of SES, but rather an explanatory variable it still shows that a higher education (which is often used as a measure of SES) increases the chances of a woman becoming obese. Therefore it can confidently be said that and there is a positive relationship between SES and BMI and that the chance that a woman becomes overweight or obese increases with increased SES (wealth and education).

The other factors which influence a woman's nutritional status are whether she employed or not. Employed women are less likely to be underweight than unemployed women. However, if a woman works in agriculture she will be more likely to be underweight compared to an unemployed women. An increase in parity and increase in age also both increase chances. These factors are in line with previous research done in other similar settings. The nutrition transition is driven by an increase in urbanization which is occurring rapidly in a lot of sub-Saharan African countries as it is in Namibia. Namibia's current urbanization rate is 3.3% annual rate of change which is higher than the world average of 1.85% rate of annual change (CIA, 2012c). Therefore it is likely that the in the future, according to the nutrition transition theory and literature, the women population of Namibia shall enter phase four. This is worrying since Namibia, as a lot of sub-Saharan African countries still suffer from communicable and infectious diseases such as HIV/AIDS and malaria. While it is good that malnutrition will not be an issue anymore, the NCDs that come with being overweight will result in the double burden increasing in Namibia which is worrying and a vast expense on the economy. Currently it seems only the richer part of the women population is at risk of suffering from the double burden since diseases like HIV/AIDS are found in both low and high socioeconomic groups (Wojcicki, 2005), but obesity and overweight are found primarily in women from higher socioeconomic groups. If the case is that there is more HIV prevalence in women of higher SES which some studies have shown (Wojcicki, 2005), the results are even more worrying. Nevertheless, with increased urbanization and economic development, more overweight and obesity will be found in lower socioeconomic groups meaning they will also suffer from the double burden if appropriate intervention does not occur.

5.3 Evaluation

This thesis used data from the DHS. The DHS is considered a good source for getting insight into population trends in developing counties where the government does not have a proper population register operating. The DHS was of the 2006/2007 situation. This is relatively recent and can therefore give an appropriate picture of the situation in Namibia. However, the DHS in Namibia only conducted anthropometric research on the Namibian women. To gain more insight into the situation in Namibia, Namibian men would also have to be researched. Additionally data was only available for women up to age 49. This means older women could not be taken into the analysis which would have been interesting to investigate since it if often at the older ages when chronic diseases occur and therefore looking at BMI at the older ages would be beneficial. Additionally, recently the use of BMI has received a lot of criticism for measuring metabolic risks and hypertension. It has been shown that waist to height ratio (WHtR) and waist to hip ratio is better than BMI for predicting risks. Various researches have shown that WHtR demonstrated statistically the strongest associations with cardiovascular diseases (Ashwell & Gibson, 2009). Additionally, research showed that people with a high WHtR and normal BMI had a higher CVD risk than those with low WHtR. This shows how there are risks associated with abdominal fat, even at a normal weight (Ashwell & Gibson, 2009). Therefore in this thesis using BMI to determine the nutritional status of women is not the most effective or reliable method for determining which women are at most at risk of the chronic diseases mentioned in the epidemiologic transition. It would have been more reliable if BMI, WHtR and WHR were used since two women with similar BMI's can still have different health risks. However, using BMI did still give great insight into the relationship between SES and nutritional status and determined the development of nutritional status as part of the nutrition transition in Namibia.

Another aspect which could have been operationalized in a different manner is SES. Although wealth indices give a good indication of the SES of women in Namibia, it might have been more interesting to have data on income as a continuous variable, and combine it with education. However, as mentioned income data is very unreliable and difficult to obtain in a lot of developing countries since earners often has several sources of income at one time and income might vary daily, weekly or seasonally (Rutstein and Johnson, 2004) and due to the fact that that in less developed countries people are usually less aware of their income since many families have self-employed earners and or/or home production. Therefore since wealth indices measure ownership of assets it is considered a good method to measure long term socioeconomic status (Rutstein and Johnson, 2004). Using wealth indices is therefore a good enough method to measure SES for this thesis.

For all statistical tests that were carried out, all necessary assumptions were met. By using the crosstabs it was possible to determine what kind of a relationship was present between SES and nutritional status (BMI). Nevertheless, it would have also been interesting to do a linear regression model for BMI and income (continuous variable) to determine the relationship present. This was not possible due to the fact that income as a continuous variable was not available. However, it was still important to classify BMI in categories since more can be said about the possible health risks relating to the nutritional status when BMI is

classified. Therefore cross tabulation of wealth indices and BMI categories was a respectable choice. Multinomial logistic regression gave insight into how wealth indices influence nutritional status and other factors which influenced a Namibian woman's nutritional status.

The nutrition transition as a theory provides an appropriate framework for analyzing the situation of the female population within Namibia. It gives clear reasons why and how the different phases of the nutrition transition are experienced by countries. Additionally the connection with the epidemiologic and demographic transition gives decent insight into the other issues which a country would be struggling with at the same time. The theory gives insight into what will most likely happen in the future if the processes of urbanization and economic development continue within Namibia. The literature review allows for appropriate comparison to other countries in relation to the nutrition transition and factors influencing the nutritional status of women. This is important since it shows how different countries can experience the nutrition transition differently and emphasizes how other factors need to be looked at besides just the GNP per capita. Additionally the literature review gave insight into similarities between other countries and trends that seem to be present (e.g. urban vs. rural difference).

6. Recommendations

6.1 Recommendation for further research

Though this thesis produced a better understanding of the effects of wealth indices on the nutritional status of women in Namibia, there is still a lot of research which needs to be done to fully understand Namibia's situation. As mentioned, men, as well as children should also be researched to gain more insight into the effects of wealth indices on the nutritional status of the Namibian population. This will also then give insight into gender issues which might be present and also at which age the nutritional problems arise so that preventative measures can be targeted effectively. More in-depth research on cultural norms and desires would also be valuable. Conducting qualitative research in relation to eating behaviour and body preferences until saturation is reached will provide information on underlying issues which cannot be found through quantitative research. Then further quantitative research can be conducted to determine how prevalent the issues and problems found through qualitative research are. An example is that as shown in previous research, in other sub-Saharan African countries, there is sometimes a preference for being overweight, and the western 'thin ideal' is not their African ideal (Prentice, 2006). However, this most likely differs per country and also within the country it probably differs per socio- economic group. Additionally with increased globalisation and therefore westernisation this is probably also changing.

Other aspects which should be researched (perhaps in the next NDHS) are waist and hip circumference. This would give more precise information on which parts of the population are most at risk for the worrying Nutrition Related Non-Communicable Diseases.

6.2 Policy Recommendations

Research focusing upon the relationship between SES and nutritional status and the other factors that influence the nutritional status is highly important for developing countries. This is because the obesity epidemic has already been proven to be difficult to tackle in the developed world. Many policies aimed at reducing obesity in for example the USA have resulted in limited improvements (Mazzocchi et al., 2009). This is in countries which have the financial resources to spend on policies. Malnutrition, obesity and overweight can furthermore create costs on the economy of the country, depending on the health systems of the country (Mazzocchi et al., 2009). Therefore in developing countries, with less financial resources, it is important to tackle this issue of a bad nutritional status to both prevent added costs on the economy, but also to improve the general health of the population which is important for economic development of the country. Currently in Namibia it is women of higher SES who are most likely to suffer from overweight, obesity and NCDs. As literature has shown it is likely that with increased urbanisation and without intervention it will soon be women of lower SES who are suffering. This is worrying since people of low SES who are most difficult to reach effectively through policies. This is because they are often most difficult to communicate health messages due to lower literacy levels and less access information pathways (Huerta and Macario, 1999). It is very important to find effective policies so that the limited resources aren't wasted on ineffective interventions and/or policies.

To make sure policies are successful, proper research into the real problems is necessary. Finding out which factors influence women (and men and children) to be underweight and which influence them to be overweight means context specific policies and interventions can be invented. It is evident that one size does not fit all when it comes to policies. Policies need to be culture specific (Mazzocchi et al., 2009). Health messages need to be communicated in a culturally appropriate and sensitive manner. Messages should not be a direct translation of health messages already being used in the mainstream (western) population (Huerta and Macario, 1999). In the case of Namibia, possible interventions need to take into account the different influences affecting the nutritional status, so that those specific influences can be targeted. The priority groups need to be defined and targeted clearly so that policies aimed at combatting under nutrition will not negatively affect the population at risk of being overweight and obese. Additionally if further research is conducted it can show whether it is poor knowledge of the people (e.g. thinking overweight is healthier than normal weight) or lack of access to healthy foods which is causing the problem. Finding out in which socioeconomic and demographic groups suffer most from the mentioned obstacles means appropriate policies(either increasing knowledge or increasing access to healthier foods) can take place in the correct groups. Preventative policies will benefit women (and possibly men) of lower SES where the problems of overweight and obesity are currently less of a problem but could very well become a big problem. For women (and men if the same problems exist) of higher SES, policies aimed at reducing the prevalence of overweight and obesity by promoting methods to reduce BMI levels in a healthy manner would be more beneficial there.

At this moment Namibia does not have an integrated or topic-specific policy programme to tackle the issues of obesity and other NCDs (WHO, 2011). Most of its resources are aimed towards HIV prevention and other communicable diseases (MOHSS, 2010). However, NCDs are estimated to account for 38% of all deaths (WHO, 2011), therefore policies and interventions are needed to address the increasing prevalence diet related diseases and other NCDs. Additionally it should not just be a case of successful policies from the developed world being transferred to Namibia since there is a high possibility it will not work and resources and efforts will be wasted. Therefore the research from this thesis shall be beneficial to give insight into the problems so that effective policies can be implemented.

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