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PREVALENCE AND FACTORS ASSOCIATED WITH OBESITY AMONGST EMPLOYEES OF OPEN-CAST DIAMOND MINE IN NAMIBIA.

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Minithesis submitted in partial fulfillment of the requirement for the degree of Masters in Public Health in the School of Community and Health Science,

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KEY WORDS

Obesity

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ABSTRACT

PREVALENCE AND FACTORS ASSOCIATED WITH OBESITY AMONGST EMPLOYEES OF OPEN-CAST DIAMOND MINE IN NAMIBIA

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Background: NAMDEB is a Namibian alluvial diamond mining company, owned in equal shares by the government of republic of Namibia and De Beers. It is mining in the open-cast mines along the southern coast of Namibia, using various methods and equipments such as bowl scrapers, bulldozers, trackdozers and excavators. NAMDEB have got different mining site, where employees are residing in hostels near the mine. One of those mines is the Pocket Beaches mine where this study took place. The study investigated the prevalence and factors associated with obesity amongst employees of Pocket Beaches mine. Obesity rates are increasing at an alarming rate worldwide; 1.2 billion people worldwide are overweight of which 300 million are clinically obese. Of concern is that obesity is a risk factor for many diseases including hypertension, diabetes and other forms of cancers. Although there are several mine workers who on reporting to occupational health services for minor ailment are found to be overweight or obese, we are not certain of the extent of the problem. The health risk associated with obesity could cause a big loss to NAMDEB in terms of care cost, low productivity and absenteeism**.**

Aim: The aim of this study was to investigate the prevalence and determinants of obesity amongst NAMDEB employees working at Pocket Beaches diamond mine

Study design: a descriptive, cross-sectional study measured the prevalence of obesity and describes the factors that are associated with obesity and overweight.

Study population: NAMDEB employees who were working at Pocket Beaches mine. A simple random sampling technique was used to select participants. 87 employees were selected from 188 total NAMDEB employees working at Pocket Beaches mine.

Data collection: Data was collected through interviews. Anthropometric measurements namely weight, height and abdominal circumference were collected using a standard protocol.

Analysis: Data was analyzed using Epi Info 2002. Body Mass Index (BMI) was calculated as kg/m^2. Overweight was defined as BMI = 25 to 29.9 kg/m^2 and obesity as BMI $\geq$ 30 kg/m^2. Waist Circumference $\geq$80 cm was used to identify central obesity in women and $\geq$90 cm in men. The frequency of participation in physical activity, barriers to physical activity and food consumption is reported in percent and means.

Result: The study found prevalence 42% overweight and 32% obesity among employees of NAMDEB. A significant number of participants 48% never participate in moderate exercise per week. 71% of participants reported lack of motivation to exercise and too tired after work as the major barriers to physical activity. The consumption of fatty foods such as fried chicken and fried meat was common among study subjects. A large number of respondents 79% eat fried chicken regularly while 74% eat fried meat regularly. 79% of participants consumed inadequate fruits and vegetable (1 fruit and vegetable per day). The two most mentioned reasons for low fruits and vegetables consumption were lack of fruits and vegetables in hostel food menu and 14% don't like fruits.

Conclusion: This study results revealed a high prevalence of overweight and obesity among employees. There is also low participation in physical activity and inadequate intake of fruits and vegetables among employees. Lack of motivation to exercise and unavailability of fruits and vegetable contributed to unhealthy lifestyles. Appropriate interventions are necessary in order to reduce the high obesity prevalence.

Recommendations: wellness program to promote physical activity should be introduced at Pocket Beaches mine. Management should engage Sodexho (catering company) to increase fruits and vegetables in the employees' menu.

DECLARATION

I declare that *Prevalence and Factors Associated with Obesity Amongst Employees of Open-Cast Diamond Mine in Namibia* is my own work, that this work has not been submitted for any degree or examination in any university, and that all the sources I have used or quoted have been indicated and acknowledged by complete references.

Desderius Haufiku November 2008

Signed……

DEDICATION

This work is dedicated to my beloved parents, my late father Mr. Erastus Hidinua Haufiku and Mrs. Klaudia Hafyenanye (Mukwahepo) who laid the foundation of my education. I would also like to dedicate my work to my son, Erastus Hidinua Junior Haufiku, who endure my absence and missed my love and support during my study.

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GOD BLESS YOU ALL!

LIST OF ABBREVIATIONS

AIDS/HIV	- Acquired Immunodeficiency Virus
BMI	- Body Mass Index
CDC	- Center for Diseases Control
CVD	- Cardio-vascular Diseases
FAO	- Food and Agricultural Organization
MOHSS	- Ministry of Health and Social Services
NAMDEB	- Namibia De Beers
NCDs	- Non-communicable Diseases
SADHS	- South Africa Demography and Health Survey
SD	- Standard Deviation
WHR	- World Health Report
WHO	- World Health Organization
VCL	- Value Center Leader

Definition of terms

Exercise: any form of physical exertion of the body with the aim to achieve a beneficial level of fitness and health both physically and mentally.

Moderate exercise: exercise that make you feel slightly out of breath. You should feel slightly worn out, but not to the point where it is unbearable. Example of moderate exercise are going to a brisk walk or walking up a hill.

Leisure time: time or opportunity for relaxation free from duties or responsibilities.

Lifestyles: refers to the way a person (a group) lives. This includes patterns of social relations, food consumption, behaviours, and interests. Lifestyles typically also reflect an individual's attitudes.

Diet: patterns of eating. The quality, quantity and times of the day a person eat.

Scope of work: the degree of physical labour specific to the occupation.

Low birthweight: birthweight below 2, 500 grams.

Stunting: the process of failure to reach linear growth potential as a result of inadequate nutrition and or poor health. This implies long-term malnutrition and poor health, measured as height for age 2 Z- scores below a standard.

Overnutrition: excess energy imbalance caused by energy intake exceeding energy expenditure.

Dredge: is the boat floated in an initial pond and then moved into the mining block where its cutter suction head excavates down to the diamondiferous material. The technology is used to remove overburden sand and in areas with very wet ground conditions.

Patterson band: is the salary grading system used by NAMDEB whereby the A band is the lowest paid and E band the highest paid.

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CHAPTER 1

1.1 INTRODUCTION

In the past four decades, obesity has been recognized as the most common risk factor for a number of chronic diseases such as heart diseases, hypertension, stroke, high cholesterol, adult onset type II diabetes and certain forms of cancers (WHO, 2002; Asfaw, 2006). The World Health Organization (WHO) lists overweight in the top 10 devastating risk factors for high mortality in both developing and developed countries (WHO, 2002). The health consequences range from increased risk of premature death among the affected, to serious chronic diseases that can significantly reduce the quality of life.

Of concern is that obesity rates are increasing at an alarming rate worldwide. Overweight affects 1.2 billion worldwide of which 300 million are clinically obese (WHO, 2003). In developed countries like the USA, the prevalence of overweight is as high as 60% (Worley, 2006). Meanwhile more than 30% of the population in Latin America, the Caribbean, Middle East and Northern Africa are overweight (WHO, 2002).

In Southern Africa, obesity is also a major public health problem along with HIV/AIDS and malnutrition. It is also apparent that in developing countries obesity and malnutrition co-exist (Puoane *et al*, 2002). The South African Demographic and Health Survey (1998) reported a 29% and 56% prevalence of overweight in men and women respectively and 9% and 29% prevalence of obesity in men and women respectively (Puoane *et al*, 2002). In addition, a 17% prevalence of overweight including obesity have been reported among

young people aged 13-19 years, with higher prevalence in girls 25% than in boys 7% (Kara, 2004).

Although there are no statistics on obesity in Namibia, obesity is now increasing the risk and development NCDs especially type 2 diabetes and hypertension (New Era, 27 March 2007; WHO, 2002). Based on statistics from WHO country and regional data (2006) Namibia had 25 000 diabetic patients in 2003. It is projected that the number would increase to 60 000 by the year 2030.

WHO worldwide report (2002) suggests that about 60% of diabetes globally can be attributed to overweight and obesity. Meanwhile hypertension, which is highly associated with obesity, was reported in Ministry of Health and Social Services (MOHSS) health report of 2003 as one of the most common non-communicable disease in Namibia. During the first nine months of 2002 alone over 10 000 new cases of hypertension were diagnosed, of which 4000 patients were admitted to hospitals due to hypertension (MOHSS, 2003).

Obesity is now recognized to be partly a consequence of individual lifestyle, in part the result of poor diet (over-nutrition) and lack of physical activity (Opie, 1995). Most Namibians are known for their love of red meat and fatty foods compared to healthier alternatives such as chicken, fish and vegetables (O'Keefe, Rund, Marot, Symmonds & Berger, 1988). Factors associated with overweight and obesity includes unhealthy lifestyle such as eating the foods rich in animal fats and low in fibre and lack of exercise (Balk, K., Owen, N., Salmon, J., Bauman, A & Gore, C.J, 2001). These factors are

consequences of economic development, modernization, urbanization and globalization (Vorster, Bourne, Venter & Oosthuizen, 1999; WHO, 2003). Namibia has seen high rates of urban population growth after it attained independence in 1990. At the current rate of urban population growth, it is estimated that 43% of the population of Namibia would be urbanized, with about 1 million people living in urban places by year 2006, and 50% by 2010 (Office of the President, 2004).

High prevalence of obesity was also found among employees at one of the South Africa diamond mine (Standler, 2006). The prevalence was 45% and 32% among females and males respectively. Obese individuals were found to have low productivity, more susceptible to injuries at work with increased absenteeism (Soteriades et al., 2005; Dias et al., 2003). All these factors had a significant cost to the organization.

However, it has been recognized that several factors played an important role in the increased prevalence of obesity in the workforce. These factors include changes in dietary habits, lack of physical activity in leisure time and certain working condition such as work that require less labour (Dias, Wolmarans, Laubscher & Schutte, 2003). It is also worth noting that certain occupations such as machine operators, clerical work and any other job that require someone to work seated can put employees at risk of gaining more weight. Popkin (2001) pointed out that the use of machinery, office bound work and automation together with the phasing out of physically demanding tasks have contributed significantly to the increase in body weight among the working class due to low energy expenditure. This however, has negative health and employment outcomes in the workforce, including lower productivity and poor job performance.

1.2 PROBLEM STATEMENT

Records from NAMDEB occupational health services indicate that a large proportion of mineworkers who seek medical assistance are overweight and obese. There has been no formal screening to obtain the exact extent of the problem. The health consequences of obesity could cause great losses to the organization in terms of care cost, low productivity and absenteeism. This study therefore aims to assess the prevalence of obesity as well as factors associated with obesity among employees of Pocket Beaches mine, Namibia. The results of the study will be used by wellness programme to develop intervention strategies for primary prevention of obesity.

CHAPTER 2

2. LITERATURE REVIEW

2.1 Health consequences of obesity

Obesity and overweight lead to adverse metabolic changes in the body with effects on blood pressure, cholesterol and insulin. Those changes could result in development of non-communicable diseases such as hypertension, diabetes and CVDs (Meyer at el, 2008).

The World Health Organization's (2002) report on obesity and overweight illustrates that the risk of developing type 2 diabetes, hypertension, CVD and certain types of cancer rises substantially with increasing body fatness. It also states that out of 85% cases of type 2 diabetes worldwide, 90% are due to obesity or overweight (WHO, 2002; Asfaw, 2006).

The WHO Health Report (2000) stated that non-communicable diseases (NCDs) are the leading causes of death and disability worldwide. The report estimates that these disorders collectively contributed to almost 60% of global mortality and 43% of the global burden of diseases in 1999. In 1998 alone, 77% of the total number of non-communicable deaths occurred in developing countries and 85% of the NCD burden was borne by low and middle-income countries. This dismissed the widespread misconception that the problem of NCD is not relevant for developing world (MOHSS, 2003).The above statement is supported by WHO health report which stated that, contrary to common perception that chronic diseases are a problem in developed

countries, this epidemic is worse in low and middle income countries, where 80% of all chronic diseases death occur (WHO, 2005).

Boutayeb and Boutayeb (2005) analyzed the burden of NCDs in developing countries and found that cardiovascular diseases (CVDs) contributed to a third of global deaths with 78% in low and middle-income countries. The study also revealed that diabetes in the world is expected to increase from 194 million in 2003 to 330 million in 2030. This projected increase in the prevalence of diabetes has negative impact especially in developing countries because diabetes affects middle-aged people between 35 and 64 years while in developed countries, the most affected are people above the age of retirement (Boutayeb and Boutayeb, 2005). In Namibia, diabetes is also one of the chronic diseases affecting more people in their youth (Onandjokwe HISK, 2000).

Data from WHO health report on diabetes figures indicated that this condition is a public health problem in Namibia. The report shows that in 2000 there were 25,000 people with diabetes and it is projected that by the year 2030 the figure will almost triple to 60,000 (WHO, 2005). This is an indication of a need to prioritize strategies for prevention of risk factors for NCDs in this country. However, obesity is not only responsible for the above mentioned life threatening problems, it also associated with non fatal but debilitating illness such as respiratory diseases, chronic musculoskeletal problems and infertility (WHO, 2003).

In light of the above it is a concern that, data on obesity and overweight suggest that these risk factors have increased at an alarming rate; worldwide overweight affects 1.2 billion of which 300 million are clinically obese. In developed countries such as the USA, the prevalence of overweight reaches 60% (Worley, 2006).

However, according to the WHO (2005) report, two out of three overweight and obese people now live in developing countries. The report further projected that by 2010 more obese people will live in the developing countries as opposed to developed world.

There is no available national data on obesity in Namibia. Nevertheless, data from neighbouring countries such as South Africa show a high prevalence of obesity among women 29% and much lower prevalence among men 9% (SADHS, 1998).

2.2 The determinants of obesity

Determinants or risk factors of obesity are diverse in origin. These risk factors are generally classified as modifiable and non modifiable (Sobngwi *et al.,* 2002). Modifiable determinants mostly involve factors that are within the control of human beings. With such factors, the individual, community or government can intervene to prevent or reduce them. Examples of modifiable determinants of obesity are cultural beliefs, poor diet and physical inactivity. Non modifiable determinants include those factors that are beyond the control of human beings such as genetic factors and gender (Stockmyer, Kuester, Ramsey, & Dietz, 2001).

2.3.1 Lifestyles Factors

2.3.1.1 Nutrition transition

Nutrition transition is described by WHO/FAO Expert Consultants (2003:13) as "a sequence of characteristic changes in dietary patterns and nutrient intakes associated with social, cultural and economic changes during the demographic transition". The nutrition transition itself is characterized by a shift away from indigenous diets of different nutritional quality based on staple grains and fruits and vegetables. Those nutritious diets are replaced by more food of animal origin, preprocessed food, fat and more added sugar (Popkin, Horton & Kim, 2001). Higher fat and sugar intake can lead to increased energy intake and leads to the development of obesity (Gibney & Voster, 2001).

There is enough evidence in literatures, which suggest that diets rich in fruits, vegetables and fibers have great benefit to the general health of persons particularly to cardio-vascular health and prevention of obesity (Bjaras et al., 1997; WHO, 2002; Wildschutt, 2005). Fruits and vegetables are low in energy density because of their high water and fibre content and low fat content. This helps people to feel full and yet consume fewer calories and reduce energy intake (Bourne & Searger, 2001). However, the current nutrition transition characterized by high consumption of sugar dense foods and saturated fats has resulted in high prevalence obesity and other risk factors of chronic diseases such as high cholesterol and high blood pressure (Hester *et al*, 1999).

2.3.1.2 Physical inactivity

Regular physical activity is regarded as an important component of healthy lifestyles (Lambert et al, 2001; WHO, 2002). There is encouraging evidence that moderate to higher level of physical activity may provide protection and lower the risk of developing chronic diseases of lifestyles and obesity (WHO, 2002). Physical activity increase energy expenditure by the body which may result in the elevation of metabolic rates and prevent development of obesity (Armstrong & Welshman, 1997). The Centers for Diseases Control (CDC) and the American College of Sport Medicine suggested that children and adults are recommended to accumulate 30 minutes of moderate intensity physical activity on most all days of the weeks preferably (Pate *et al*, 1995). Regular physical activity has a variety of benefits, which among others include a decrease risk of cardiovascular diseases, obesity, non-insulin-depended diabetes mellitus and hypertension (Sobngwi *et al.*, 2002). There are four situations for people to be physical active in their daily lives such as at work, for transport, in domestic duties or in leisure time. However, the current trends of high level of physical inactivity which is becoming common in developing world is viewed as a prominent risk factor favouring weight gain (Boutayeb and Boutayeb, 2005). In 2005, the World Health Organization estimated that physical inactivity causes almost 2 million deaths worldwide annually. Globally, physical inactivity is estimated to cause 10-16% of all cases of breast cancer, colon cancer, obesity and diabetes and, about 22% of all ischemic heart diseases incidents (WHO, 2005).

According to the World Health Report (WHR) of 2002, a global estimate for prevalence of physical activity among adults is 17%. The report further states that estimates for prevalence of some, but insufficient activity (<2.5 hours per week of moderate activity) range from 31% to 51%, and the global average are estimated to be 41% across sub-regions (WHO, 2005). There are no studies done in Namibia on the prevalence of physical activity. However, various cross-sectional studies done in South Africa revealed that the majority of South Africans are not meeting the recommended minimum physical activity standards (Lambert, Bohlmann & Kolbe-Alexander, 2001). Large-scale studies in urban black communities in the Western Cape Province reported some low levels of physical activity ranging between 30-40% during their work and leisure time (Levitt, Katzenellenbogen, Bradshaw, Hoffman & Bonnici, 1993; Levitt, Steyn, Lambert, Fourie, Rossouw, 1999). The low level of physical activity is believed to be driven by shifts in physical activity patterns. These shifts include, shift in occupational structure (more people doing sedentary jobs) as result energy expenditure in many occupations has decreased and inactivity during leisure has increased (Popkin, Horton & Kim, 2001). In addition television watching has increased rapidly (Allison, Dweyer & Makin, 1999). Meyer at el (2008) investigated the influence of televisions on physical activity and found that, those with high television exposure were more likely to be less physical active and have poor dietary intake. High television exposure was associated with less walking and biking during leisure.

The association between physical activity and weight has been reported in a cross-sectional epidemiological study done by DiPietro (1995). The study reported that the

lower body weight or more favorable distribution of body fat is associated with high level of self reported physical activity. However, this study used a one-time assessment of physical activity, which is inadequate to describe the relation of physical activity and weight gain. The author recommended a longitudinal population based studies focusing on multiple assessments of physical activity patterns over long periods as more appropriate to determine the relationship between physical activity and body weight.

2.3.2 Environmental Factors

2.3.2.1 Globalization and Urbanization

Worldwide social and economic integration has accelerated in the past decade because of globalization. However, this has had direct and indirect consequences on health (Popkin, Horton & Kim, 2001). The most identified negative health-related effects of globalization include among others nutrition transition. This means people in low and middle-income countries are now consuming diets high in total energy, fats, salt and sugar than before. Other determinants which are associated with globalization include increased production, promotion and widely marketing of processed foods and those that are high in fat and sugar which affect weight gain (Raja, 2005).

It has been reported that increased exposure to the global market economy and freed movement of the population in developing countries due to globalization not only resulted in economic growth in developing countries but led to diets and lifestyles changes and ‘’globalization of risk factors’’ (Raja, 2005 & Kruger, Puoane, Senekal & van der Merwe, 2005). These risk factors have potentials to reverse the economic growth

in developing countries due to the high cost of controlling and management of health problems associated with globalization such as obesity.

Increasing urbanization creates conditions in which people are exposed to new products, technology and marketing strategies (Kaja, 2005). This has brought a lot of economic benefits such as creation of employment. However, urbanization has also increased health risks that contribute to obesity and overweight. According to the WHO and FAO (2003) high rates of urbanization are accompanied by nutrition transition. People changed from traditional high-fiber, low-fat diet to a more western type of diet, rich in animal fats and low in dietary fiber. In addition, these dietary patterns are combined with a decline in physical activity in urban areas due to availability of transport, replaced walking and cycling. All these lifestyles factors favour weight gain and development of obesity (Stander, 2006). This was confirmed by Food and Nutrition report of 2001, which suggested that "… increased urbanization and technology change lead to a shift from physical active to sedentary occupations, less walking and cycling, more use of cars and television, increased use of labour saving devices at work and home, and changes in income profile (Popkin, Horton & Kim, 2001:9).

A study conducted by Steyn *et al.,* (1997), assessed urbanization as risk factor of chronic diseases. The study revealed that, people who spent large proportions of their lives in an urban setting tended to have unhealthy lifestyles and were at higher risks of developing chronic diseases of lifestyles and obesity compared to their rural counterparts. The above

observations should necessitate drastic measures to be taken in urban settings to educate people on the dangers of urban life.

2.3.2.2 Obesogenic factors

It is believed that there are some factors in the environment that are driving the obesity epidemic. These factors are known to influence negative habits and practices in the population such as poor food choice and preventing people from participating in physical activity (Popkin, 2001). Puoane (2005) argued that the environment has major influences on people who moved from rural areas to urban settings as they are forced by situations to eat what is available. It is also identified that advertisements of fast food on television and other media commenting their nutritional values and ease of preparation has influence people's food choice. People tend to follow what is being advertised and regard their traditional food as of poor nutritional value (Stockmeyer, Kuester, Ramsey & Dietz, 2001).

Some of the structural environment in which population lives is poorly planned and as a result acts as a barrier to engaging in physical activity. Due to economic condition of developing countries, a number of urban towns in developing countries lack adequate exercise facilities (Kruger *at el*., 2005). Furthermore, an increase in the rates of crime and violence hinder people from exercising, especially outdoor exercise (Bourne, Lambert & Steyn, 2002).

2.3.2.3 Socio-economic status

The socio-economic status of a population has great influence on what the people can afford to eat as well on their physical activity patterns. Thus obesity and socio-economic status of a population tend to be related in developing countries. Due to poverty and unemployment in developing countries, people tend to eat cheap fatty meat and fatty snacks that are mostly available from street vendors and this contributed to high prevalence of obesity among poor population (Puoane, 2004).

According to more recent studies on socio-economic status and women obesity in developing countries, there seems to be progressive increase in women obesity toward the lower-income groups (Monteiro, Conde, Lu & Popkin, 2004). The lower the level of education or social status the higher the prevalence of obesity (Kamadjeu, Edwards, Atanga, Kiawi, Unwin & Mbanya, 2006; Molarius, 2002). However, different findings had been found in the study done among black South African women. The study revealed that women with no education were found to have a lower mean BMI than those with some form of education (Puoane *et al.,* 2002). The study further revealed that women with no education tend to do more manual labour and in the process use more energy than their better educated counterparts (Bourne, Lambert & Steyn, 2002).

2.3.3 Beliefs and Attitudes

In many African cultures, being overweight is associated with good health, happiness and even wealth (Mvo, Dick, & Steyn, 1999; Faber & Kruger, 2005). This belief is now

widespread as being slim can be linked with HIV/AIDS; hence so many people eat as much as possible in order to seem healthy (Puoane *et al*., 2005) In some African cultures social gatherings such as weddings and funerals encourage overeating due to the availability of free food that is often served in large quantity leading to over nutrition and obesity. Certain foods such as fried meat and chicken in some culture are also associated with social status and those foods are mostly that rich in animal fat (Kruger, Puoane, Senekal & van der Merwe, 2005; WHO, 2003). However, these beliefs become a barrier to maintaining normal body weight resulting in the development of obesity in some individuals (Puoane, Brandley & Hughes, 2005).

Women are more vulnerable when it comes to traditional perception of body image. According to the studies done on South African black women, a larger body size is positively associated with attractiveness, good health and happiness (Puoane *et al.,* 2005).Therefore with such beliefs it would be difficult for women to attempt any weight reduction measures.

2.3.4 Biological Factors

2.3.4.1 Genetics

Genetic influences on the determination of human obesity are profound and powerful. Genetic influences are likely to be powerful especially in people with severe and early-onset obesity (Farooqi *et al*, 2000). Recent studies have provided evidence linking childhoood obesity to particular genetic constitution (Barsh, Farooqi & O'Rally, 2000). There appears to be two types of genetic causes of obesity: monogenic and polygenic. Monogenic obesity is caused by mutation of a single gene while polygenic obesity is

brought about by multiple genes interaction with one another (O'Rahilly, Farooqi, Yeo & Challis, 2003).

Due to the hereditary factors, some people tend to gain weight easily while others seem to maintain the same weight for long period of time without conscious effort. It has been identified that some people have genes that either increase or decrease appetite (Centers for Diseases Control and Prevention CDC, 2004). This means that some people become hungry often and tend to eat more food; this however, increases the chances of overeating and gaining of more weight.

2.3.4.2 Early life hypothesis

A number of studies suggest that fetal and infant nutrition deficiency has a tendency of contributing to diet -related chronic diseases especially obesity, hypertension, CVD and adult onset diabetes later in life (Popkin, Horton & Kim, 2001). However, the mechanism of early life fetal and infant (low birthweight and stunted children) nutrition deprivation and development of obesity and non-communicable diseases later in childhood or adulthood is still unclear (Popkin, Horton & Kim, 2001; Voster *et al*., 1999).

1. **Low birth weight (LWB)**

It appears that babies with low birth weight their growth rate tends to influence the chance of becoming obese and developing associated diseases (Barker, 1997). The argument on this stated that fetal growth retardation results in metabolic adjustments to cope with nutritionally deficiency in utero. However, as the child grows the metabolic adjustment that were necessary to cope with nutrition deficiency in utero become maladaptive to subsequent overnutrition resulting in development of obesity and other non-communicable diseases (Barker, 1997).

2. Stunted children

Stunting, which is described as underweight for age, is an indication of lack of nutrients required for growth and development (Kruger *et al*., 2005). It has been proven that stunting is a risk factor for subsequent development of obesity later in childhood or adulthood (Voster *et al*., 1999). Stunted children are likely to have increased abdominal fat that can be aggravated by poor diet and reduced physical activity during childhood or adulthood (Popkin, Horton & Kim, 2001; Kruger et al, 2005).

2.4 The Impact of Obesity in the Workplace

Large body frame had been a significant determinant of fitness for duty especially in the mining industry; however, a large body is mainly as a result of obesity or overweight (Dias *et al*., 2003). Obesity can have considerable impact on work capacity and fitness for duty among employees (Soteriades *et al.*, 2005). Several studies have investigated the consequences and determinants of obesity in the workplace. These studies have shown that employees with excessive body mass are at risk of chronic diseases of lifestyle and high occupational injury and this has great economic consequences in the organization (Pollack *et al*., 2007; Soteriades *et al,* 2005; Kartikeyan, Nagaonkar, 2002; Tucker & Clegg, 2002).

According to a study conducted in the USA among aluminum manufacturing employees, the odds of injury among obese employees were high (2.21) compared to those with ideal body mass index (Pollack *et al*., 2007). In that study, approximately 85% of injured employees were either overweight or obese. A cross sectional, analytical and

observational study conducted by Standler (2006) investigated the dietary intake, physical activity and risks for lifestyle diseases among employees at a South African open cast diamond mine. The study showed that eight out of ten participants that have been diagnosed with diabetes were overweight (BMI >25), seven out of ten participants with hypertension were overweight while nine out of ten had hypercholesterolemia. This presents strong evidence on the relationship between overweight and chronic diseases of lifestyle. However, obesity could have a significant cost to the organization in the form of high absenteeism, loss of productivity and accidents at work (Finkelstein, Fiebelkorn & Wang, 2005; Pollack *et al*., 2007). Standler (2006) concluded that, automation and mechanization combined with high fat and low fiber intake, as well as lack of exercise facility at the workplace were major contributors of excess body mass among employees.

2.5 Economic cost of obesity/non-communicable diseases

Obesity and its associated health problems have economic consequences not only to the individual concerned but also to their employers as well as health care system. Different costs of treating the diseases are borne by individuals, sectors of society, family and health care system (Finkelstein, Fiebelkorn & Wang, 2005). The economic consequences due to obese employees can cause a big loss to the organization and employees, in terms of direct cost and indirect cost. Direct costs refer to preventive, diagnostic and treatment services related to obesity and non-communicable diseases associated with obesity. Indirect costs involve the values of wages lost by employees unable to work because of illness as well as the future earnings lost by premature death or disability (Wolf & Colditz, 1998). The above-mentioned economic consequence of obesity and non-

communicable diseases was confirmed by a study done in one of South Africa's diamond mines. The study found that there was a strong link between chronic medication expenditure and unhealthy lifestyle. The study further reported that in 2004 alone De Beers medical expenditure used in treatment of employees with chronic disease of lifestyles was R22 million (Standler, 2006).

The cost involved in the treatment of obesity and non-communicable diseases puts much strain on the already under resourced health care system in developing countries. However, there are no studies done in developing countries to quantify the total cost of obesity and non-communicable diseases at country level. Evidence from developed countries such as USA, Canada and Australia indicated huge amounts of money being spent on obesity. For example in 1995, the total (direct and indirect) cost attributable to obesity in USA was estimated to $99 billion (Thompson, Edelsberg, Kensey & Oster, 1998). This signifies the importance of investing in prevention measures based on theory that it cost less to prevent than to pay for the cost of ill health.

2.6 Interventions to reduce obesity

There is a lot of evidence that prevention of obesity is possible when sustained action directed both at individuals, families, as well as the social, economic and cultural determinants of obesity (Kruger et al, 2005; WHO, 2003; Bjaras et al, 1997). It is recommended that any weight management programme for individual and groups at risk should be comprehensive, multi-sectoral and involve long term strategies in order to become successful (Fu, Shao & van Ommeren, 2003). These strategies should include

prevention, promotion, weight maintenance and treatment of co-morbidity. It is on the above background that WHO (2003) recommended that the implementation of effective obesity prevention strategies should be based on the following elements:

- Interventions should focus on population-based environmental factors through public policies that promote the availability and accessibility of variety of low-fat, high fibre foods and provide opportunities for physical activity.
- Promoting healthy behaviours to encourage, motivate and enable individuals to lose weight by:
  - eating more fruits and vegetables, as well as nuts and whole grains
  - engaging in daily moderate physical activity for at least 30 minutes
  - cutting the mount of fatty, sugary foods in the diet
  - moving from saturated animal-based fats to unsaturated vegetable-oil based fats
- Mounting a clinical response to the existing burden of obesity and associated conditions through clinical programmes and staff training to ensure effective support for those affected to lose weight or avoid further weight gain.

CHAPTER 3

This chapter discusses the methods used to collect and analyze data for this study.

3.0 RESEARCH DESIGN AND METHODOLOGY

3.1 Aim of the study

To investigate the prevalence and determinants of obesity amongst NAMDEB employees working at Pocket Beaches diamond mine.

3.2 Objectives of the study

- To assess the prevalence of overweight and obesity amongst Pocket Beaches mine employees.
- To describe the socio-demographic factors associated with obesity among mine employees.
- To determine the level of participation in physical activity among mine employees.
- To assess the barriers to the participation in physical activity among mine employees.
- To assess employee's consumption of fruits and vegetables, fat food and sweetened drinks.

3.3 Methods

3.3.1 Study Design

This is a descriptive, cross-sectional study design, measuring the prevalence of obesity and describing factors that are associated with obesity and overweight.

3.3.2 Study Population

The study population consists of total number of 188 NAMDEB and contractors' employees who are working at Pocket Beaches diamond mine.

3.3.3 Sampling

Simple random sampling procedure was used in order to give every employee an equal chance of participating in the study. The researcher obtained a complete list of all employees from the Value Center Leader (VCL) office. All employees were then allocated a number. To select those who were to be included in the sample, numbers were randomly drawn from a small box; those whose numbers were chosen were required to voluntary participate in the study. In the case of selected employees who declined to participate in the study, another randomly selected employees complying with the sample criteria replaced them. The same procedure was followed if selected employees resigned, transferred or were fired during the study period.

3.3.4 Sample size

The study expected the obesity prevalence to be 35% (thus expected proportion p = 0.35) required precision q = 1- 0.35 = 0.65, d = 0.1 (i.e. 95% CI). Calculations were as follow: n = 1.96 x 1.96 x0.35 x 0.65 / 0.1 x 0.1 = 87. Therefore 87 participants (i.e. 95% statistical precision) were randomly selected from total number of 188 total permanent employees of Pocket Beaches Mine.

3.3.4.1 Exclusion Criteria

All employees employed by NAMDEB or contractors working at Pocket Beaches for less than six months, temporary employees and pregnant women were excluded from the sample.

3.3.5 Data collection tools

The questionnaires consisted of some structured questions developed by Stadler (2006) that had been previously used in an analytical, cross-sectional study which investigated dietary intake, physical activity and risk for chronic disease of lifestyle among employees at a South African open-cast diamond mine. Some modifications on questionnaire were made to fit this study. The questionnaires were in English; however the investigator translated it in Oshiwambo to make sure the questions were clearly understood by the participants who did not understand English.

3.3.6. Data collection

3.3.6.1 Interviews

This study used interviewer-administered questionnaires to collect data. The researcher himself was responsible for individual employee interviews and thus avoided interviewer variation, which could affect data reliability. Data collected includes:

3.3.6.2 Socio-demographic

The socio-demographic questionnaire collected basic socio-demographic information such as age, gender, race, marital status, highest education level, occupational category, department and salary grading.

3.3.6.3 Anthropometry

Weight was determined to the nearest 0.1 kg by using a standard clinic scale (Sunbeam) with maximum weight of 130 kg. Each participant was weighed wearing light clothing without shoes. The scale was calibrated regularly between measurements.

Height was measured using metal measuring tape, secured against flat wall and flat headboard positioned at right angle to the wall for collect reading.. Each participant was requested to stand barefooted with back and legs straight and back of the head placed against the wall. Measurements were then taken in centimeters to the nearest 0.1 cm.

A flexible tape measure was used to take measurements of waist circumference. Waist circumference was measured to the nearest 0.1 cm at the smallest area below the rib cage and above the umbilicus. All measurements were taken twice per participant, and the average reading was recorded.

3.3.6.4 Physical activity and dietary patterns

To examine physical activity level and dietary patterns of the study participants, face-to face interviews were conducted using structured questionnaires. Participants were required in the questionnaire to provide information on three components of physical activity such as exercise, occupational physical activity and leisure time physical activity. The number of days and duration of exercises per week and barriers of physical activity were asked. Participants were asked to state the frequency with which they consume the following: fruits and vegetables, fatty foods and sweetened drinks. In addition participants were asked to state the amounts of sugar used in tea/ coffee.

3.3.7 Validity

To ensure validity of data collected, a pilot test was done on random sample of seven participants with similar characteristics to the sample population. One representative from each occupational category was included in the pilot study. All ambiguous questions identified during the pilot study were subsequently rephrased and clarified according to the responses and suggestions received by the pilot study participants. The measurements of weight, height and waist circumference were repeated twice on each participant and the average reading was recorded. This process was done to eliminate inconsistencies. The random sampling method used in this study minimizes any form of bias such as selection bias that can influence the validity of the study. In this study every employee was given an equal chance to be selected for participation in the study.

3.3.8 Data analysis

Weight and height were used to calculate the body mass index (BMI) of participants according to WHO formula as follow, Body mass index = weight (kg) divided by square of height in (m).The subject were then classified according to the WHO classification as having underweight (BMI <18.5 kg/m^2), normal weight (BMI 18.5 – 24.9 kg/m^2), overweight (BMI 25 –29.9 kg/m^2) and obese (BMI ≥30 kg/m^2). A waist circumference measurements equal to or above 94 cm (action level 1) and 102 cm (action level 2) for men and equal to or above 80 cm (action level 1) and 88 cm (action level 2) for women, was used as cut-off points to determine abdominal obesity as adopted by WHO (2000). According to WHO (2000) a waist circumference at action level 1 means abdominal overweight while action level 2 means abdominal obesity.

Socio-demographic, anthropometric, physical activity and dietary patterns data was captured electronically with Microsoft Excel and data was analyzed by the researcher using Epi Info Version 3.3.2 (a database and statistics software program). Means and standard deviation (SD) were calculated for all continuous variables. The association between obesity and socio-demographic variables were analyzed via the ANOVA test. The level of significance for all statistical tests was set at p-value <0.05.

The frequency distribution of physical activity, barriers to physical activity and dietary patterns were analysed and reported in percentage.

3.4 Ethical consideration

This study was approved by members of Pocket Beaches mine management. The UWC Faculty Research and Ethics Committee approved the research protocol. All participants were given information sheets explaining the purpose of the study, that participation in the study was voluntary and that participants could withdraw at any stage. No identification information was required on questionnaires to ensure participants confidentiality. Participants were ensured that data collected from the study would only be used for research purposes and that only the researcher would have access to the data. Participants were requested to sign informed consent forms before data collection.

CHAPTER 4

4.0 RESULTS

4.1 SAMPLE CHARACTERISTICS

4.1.1 Socio-demographics

The sample included 80 males (92%) and 7 females (8%) subjects, Table 1 displays socio-demographic characteristics of the sample. Sixty eight (78%) of the participants were blacks, while sixteen (18%) of the participants were coloured and three (3%) were whites. Majority of participants were of the age group of 30-39, 35 (40%), 25 (29%) were of age group of 40-49 and 20 (23%) were of age group of 20-29, whereas 5 (6%) were of age 50-59 and relatively small number fall under age group of 18-29, 2 (2%). Forty six (53%) were unmarried and thirty nine (45%) were married.

Twenty one (24%) had tertiary education, 44 (51%) had grade 11 to 12 while 1 (1%) had no schooling.

4.1.2 Occupational data

The sample comprised of 32 (37%) participants from the mining department, 22 (25%) from metallurgy, 16 (18%) of participants were from engineering, Barlows 6 (7%) while 5 (6%) and 3 (3%) participants were from Dredge and Security departments respectively. The largest number of participants were NAMDEB employees 80 (92%) and 7 (8%) were contractors. The occupational categories representing the sample population included mostly operators 48 (55%) comprising of machines and metallurgy operators with a smaller representation from the other occupational categories. With regards to salary grading, according to Patterson band, the majority of the participants 48 (55%) were from the B-band with a significant number from C-band 24 (27%), which is the highest salary level for the participants (Table 2).

Table 1 Socio-demographic characteristics of the sample population (n = 87)

Demographic variable	Gender Male n (%)	Female n (%)
Race		
Black	61 (70%)	7 (8%)
Coloured	16 (18%)	0 (0%)
White	3 (4%)	0 (0%)
Age		
18-29	19 (22%)	3 (4%)
30-39	32 (37%)	3 (4%)
40-49	24 (28%)	1 (1%)
50-59	5 (6%)	0 (0%)
Marital status		
Unmarried	42 (48%)	4 (6%)
Married	36 (41%)	3 (3%)
Divorced	1 (1%)	0 (0%)
Separated	0 (0%)	0 (0%)
Living together	1 (1%)	0 (0%)
Education		
Tertiary education	19 (22%)	2 (2%)
Grade 11 to 12	41 (47%)	3 (3%)
Grade 8 to 10	11 (13%)	2 (2%)
Grade 7 and below	8 (9%)	0 (0%)
No Schooling	1 (1%)	0 (0%)

Table 2 Occupational categories, departments and salary classification of the sample population (n = 87)

Occupational variable	Number of subjects (n)	Percentage (%)
Occupational category		
Management/ Foremen	11	12
Artisan/ Technician	9	10
Security/Clerical	4	4
Machine operator	23	26
Metallurgy operator	17	20
Operator (other)	11	13
Operative	12	14
Department		
Management	3	3
Engineering	16	18
Metallurgy	22	25
Mining	32	37
Security	3	3
Dredge	5	6
Barlows	6	7
Salary Band		
A (N$ 3700 –N$5200 /m)	8	9
B (N$4500 – N$12500/m	48	55
C (N$ 8500 – N$20500/m	24	28
Other (using other system of salary grading than Patterson)	7	8

4.2 Anthropometry

The age specific means and standard deviation (SD) of four anthropometric variables shows the following trends: generally study had shown that the total study population was overweight (mean BMI 27.6, SD 5.23), the mean BMI was higher for age group of 50-59 years old than other age groups (mean BMI 33.2 kg/m^2). There was no significant differences in height of participants among the age groups (p=0.52). Results also show that age group of 50-59 years old had increased abdominal obesity (mean WC 113.6 cm) while the younger age group 18-29 years old had normal waist circumference (mean WC 87.5 cm). Those in the age group of 50-59 were heavier than the rest of age groups (mean weight 105.40 kg), as indicated in table 3.

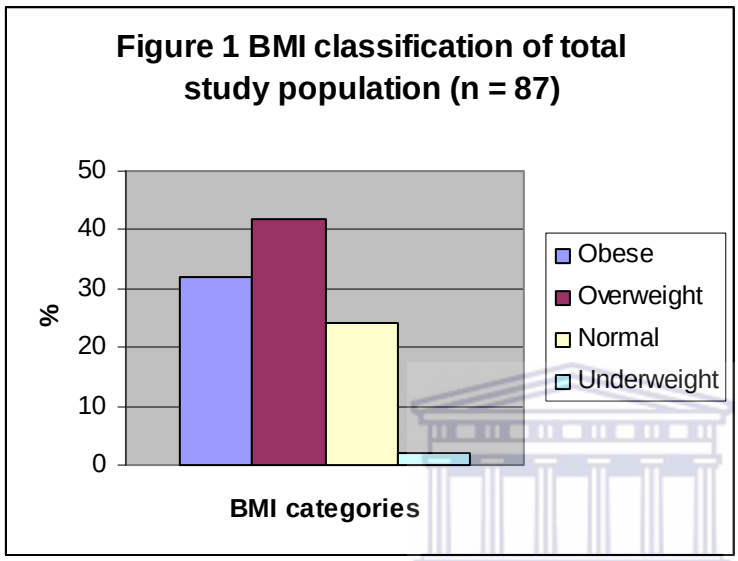
Table 3. Anthropometric value by total study population and by age (n = 87)

Variable	Total population Mean (SD)	18-29 (n=22) Mean (SD)	30-39 (n=35) Mean (SD)	40-49 (n=25) Mean (SD)	50-59 (n=5) Mean (SD)	P-Value
BMI	27.6 (5.23)	25.59 (4.81)	26.6 (4.82)	29.80 (4.55)	33.20 (6.76)	0.00
Height	1.74 (.07)	1.73 (.07)	1.75 (.08)	1.73 (.05)	1.77 (.06)	0.52
Waist circumference	95.9 (14.02)	87.5 (10.50)	93.7 (12.00)	102.8 912.02)	113.6 (20.80)	0.00
Weight	85.2 (16.56)	77.8 (15.06)	83 (15.22)	90.7 (15.30)	105.40 (17.09)	0.00

4.2.1 BMI classification of total study population

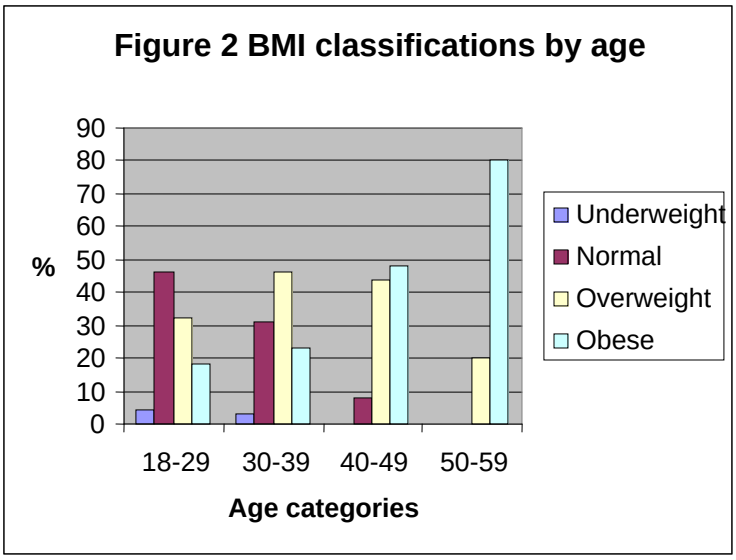
Height, weight and waist circumference were indicators used to determine whether population was obese, overweight, underweight or had normal weight. The BMI of the respondents ranged between 18 and 45 kg/m^2. The mean BMI of the respondents was 27.6 kg/m^2 with a SD of 5.23. Of the total study population, twenty eight (32%) of the

study participants were classified as obese (BMI ≥30 kg/m^2), thirty six (42%) as overweight (BMI>24.9 - <30 kg/m^2), twenty one (24%) as normal weight (BMI 18.6 – 24.9 kg/m^2), while three (3%) as morbidity obese (BMI ≥40 kg/m^2) and two (2%) were classified as underweight (BMI<18.6 kg/m^2 (Figure 1).



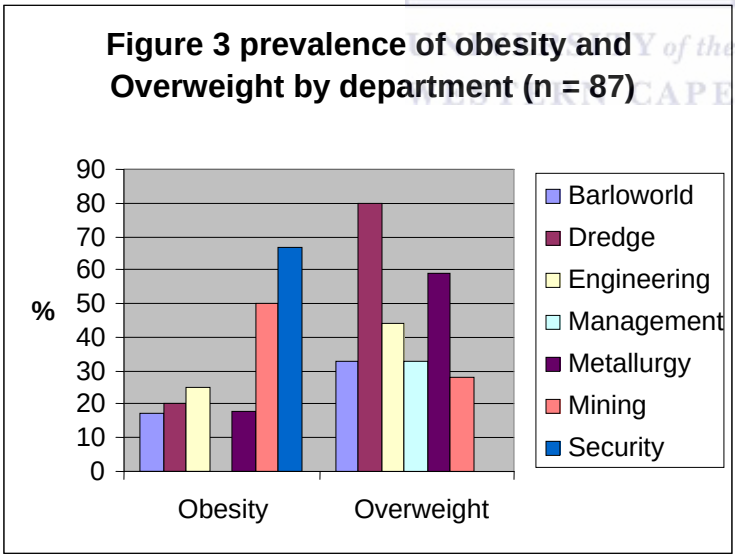
4.2.2 BMI classification by age

Obesity was more prevalent (80%) in the 50-59 age group while overweight was more prevalent (46%) in the age group of 30-39, meanwhile underweight was (4%) in the age group of 18-29. A significant difference was found between the mean BMI of the four age groups (p-value 0.00).



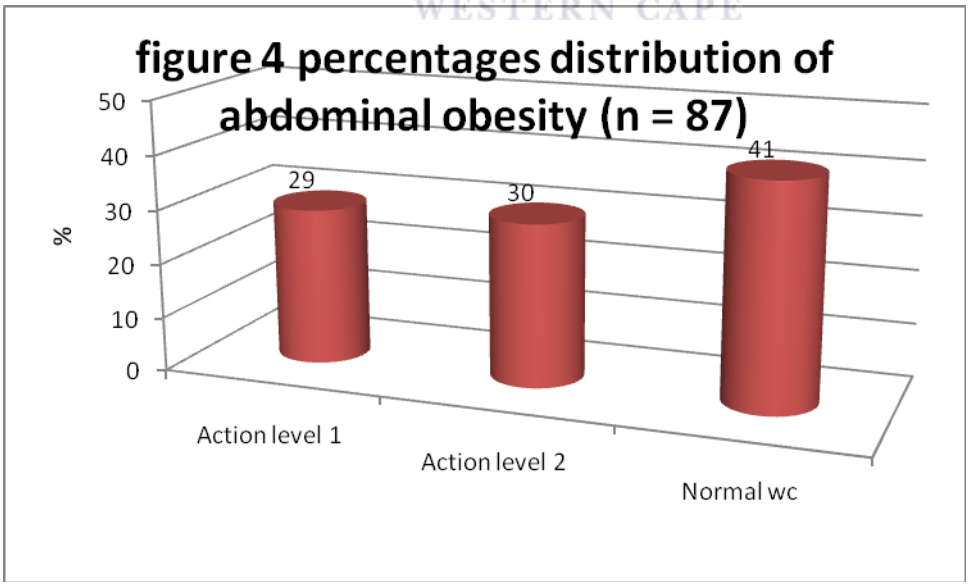
4.2.3 Prevalence of obesity and overweight by departments.

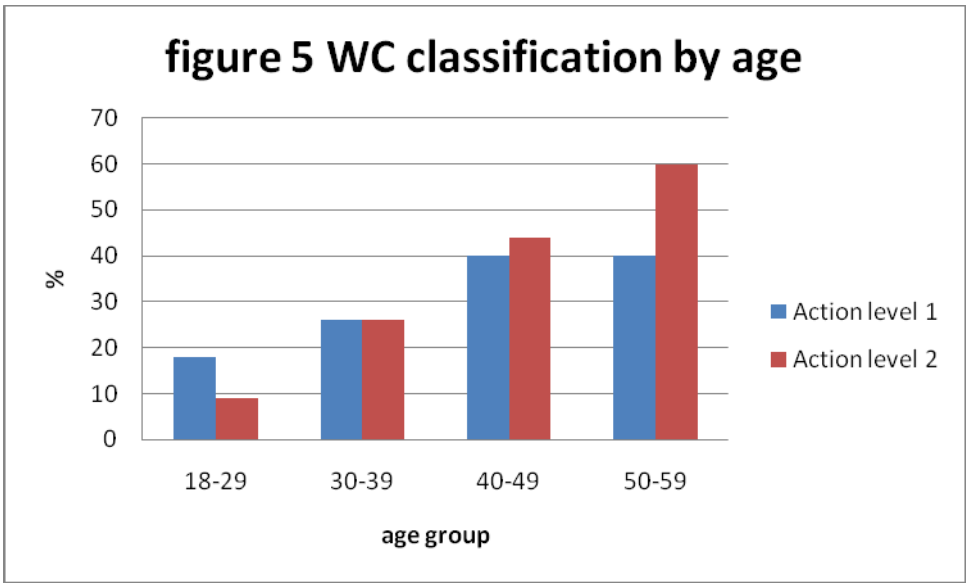
Obesity was most prevalent (67%) among the security department while overweight was most prevalent (80%) among dredge employees (Figure 4)



4.2.4 Prevalence of abdominal obesity of the total study population and by age

A waist circumference measurement equal to or above 94 cm (action level 1) and 102 cm (action level 2) for men and equal to or above 80 cm (action level 1) and 88 cm (action level 2) for women, as adopted by the WHO (1995), was used as cut-off points to determine abdominal overweight and abdominal obesity among the participants. A waist circumference of ≥102 cm in men and ≥88 cm in women exhibit a high risk to chronic diseases of lifestyles. The waist circumference of study population ranged between 66 cm and 150 cm, the mean waist circumference was 95.93 with a SD of 14.02. Twenty six 30% of participants had waist circumference equal to or above 102 cm (action level 2), while 29% had abdominal overweight (WC >94 cm action level 2), as indicated in figure 4. The age group of 50-59 had increased prevalence of central obesity 60% compared to much lower prevalence 9% in the age group of 18-29. Figure 5 illustrates the waist circumference classification by age group.





4.3 Physical Activity

The habitual physical activity referred to three components of physical activity which includes daily exercise, occupational physical activity and leisure time physical activity.

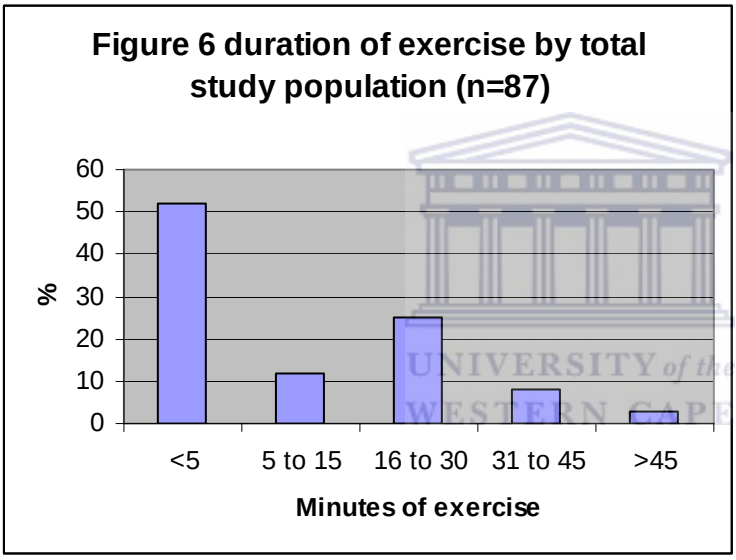
4.3.1 Levels of participation in daily exercises by participants

Participants were asked to report frequency of participation in moderate exercises per week (exercises in which they find themselves running out of breath and sweating). Forty two (48%) of participants never exercise per week, nineteen (22%) exercise 2-3 times a week while fourteen (16%) exercise once a week and only six (7%) exercise more than 5 times a week (Table 4). Those who exercise for more than 5 times a week had low mean BMI (25.3 kg/m^2) compared to those who never exercise per week (mean 28.7 kg/m^2) and there was significant differences p-0.04.

Forty five (52%) of participants had less than five minutes of moderate exercise, twenty two (25%) exercise 15-30 minutes, ten (12%) exercises for 5-15 minutes meanwhile three (3%) exercise for more than 45 minutes (Figure 6).

Table 4 Participation in moderate daily exercise per week by total study population

Number of exercise per week	Frequency	Percentage (%)
Never	42	48.3
Once a week	14	16.1
2-3 times a week	19	21.8
4-5 times a week	6	6.9
More than 5 times a week	6	6.9



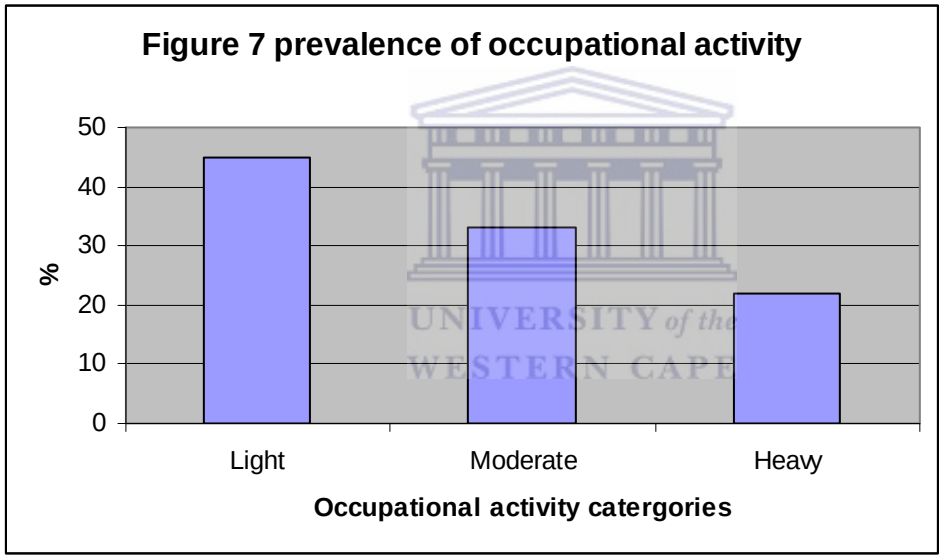
4.3.2 Scope of physical work

Participants were asked to describe the degree of physical labour related to their occupation by selecting one of three possible options, as per the classification of the Centre for Diseases Control (Takao, Kawakami & Ohtsu, 2003).

Occupational physical activity was classified into three categories such as light, moderate and heavy. A light degree of physical labour was classified as no hard physical labour, a moderate degree of physical labour was classified as 1-4 hours of physical labour and

heavy degree of physical labour was classified as more than 5 hours of physical labour per day. Thirty nine (45%) had light, twenty nine (33%) had moderate and nineteen (22%) had a heavy occupational physical labour, as indicated in Figure 7. There were slight BMI mean differences (0.9 kg/m^2) of those with heavy degree of physical labour and those with light degree of physical labour.

Respondents were asked to indicate the number of hours they spend sitting at work. Forty (46%) spend more than four hours sitting, twenty five (29%) spend 1-2 hours, whereas eight (9%) spend less than 1 hour sitting at work.

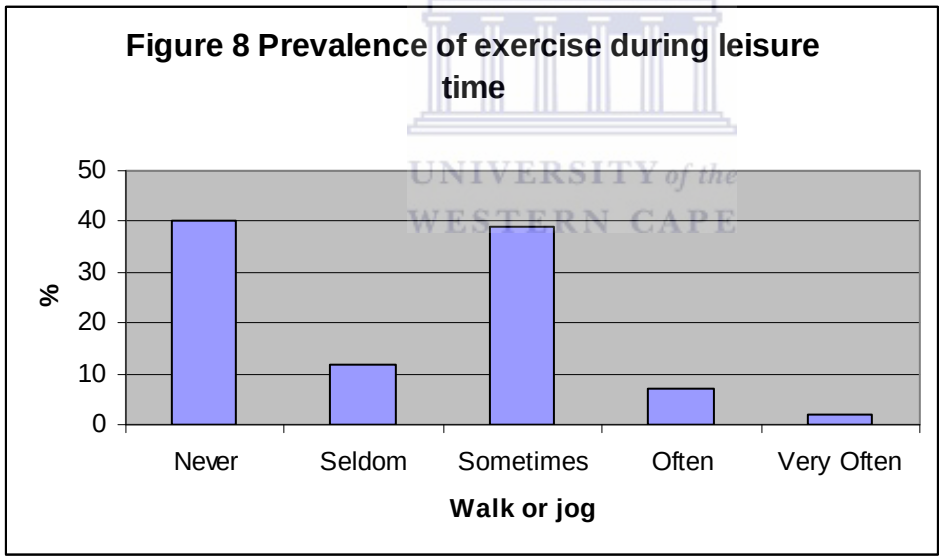


4.3.3 Leisure Physical activity

Forty four (51%) respondents watch television only sometimes (three days per week) on their leisure time, twenty (23%) watch television often (more than three days per week) during leisure time, eleven (13%) watch television very often whereas two (2%) never watch television during leisure time.

Respondents were asked to indicate the number of hours they spend watching television. Thirty seven (43%) spend 1-2 hours watching television, twenty two (25%) spend less than 1 hour, whereas seventeen spend 2-3 hours in front of television during leisure time.

Six (7%) respondents walk or jog often during leisure time while thirty five (43%) never exercise during their leisure time (Figure 8). Those who walk or jog during leisure time were forty eight (55%) for only less than five minute, twenty (23%) walk or jog for 5-15 minutes, while thirteen (15%) walk or jog for 15-30 minutes. Those walk or jog regularly during leisure time had low mean BMI (25.1 kg/m^2) compared to those who never participated in physical activity during leisure time (mean BMI 28.8 kg/m^2).

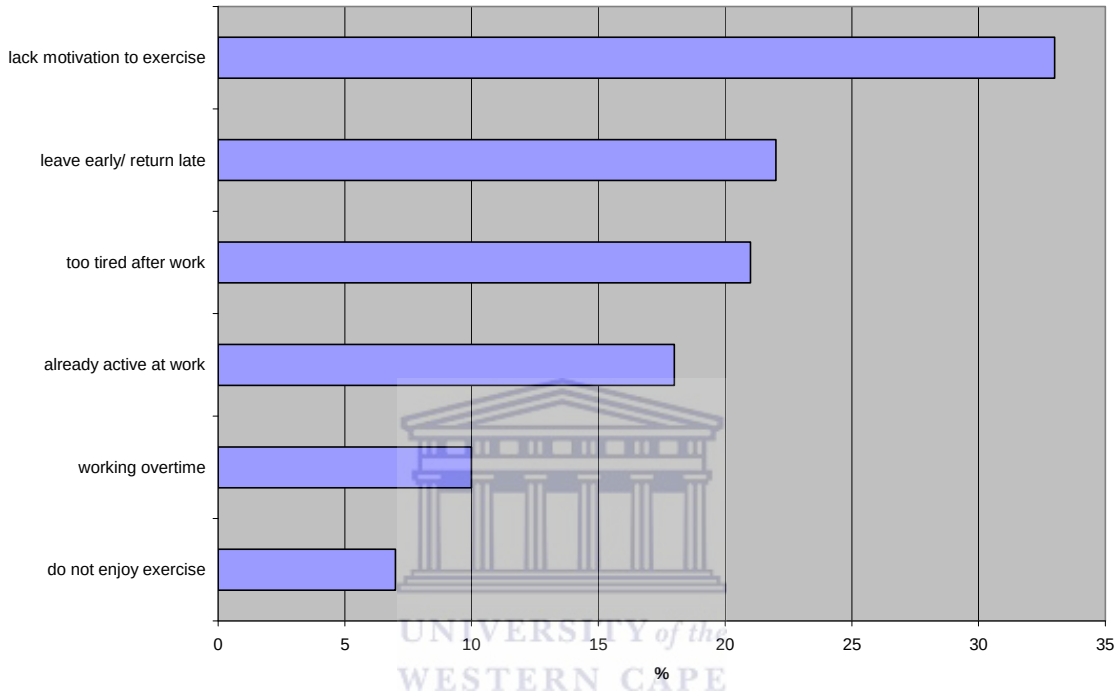


4.3.4 Barriers to physical activity participation

The three most frequently reported barriers to physical activity by the sample population were lack motivation to exercise / too lazy/ cannot get started by 33%, leave too early for work/ get home too late by 22% and too tired after work/ haven't got the energy by 21% (Figure 9). Too tired after work/ haven't got energy was reported as barrier to

participation in physical activity by (71%) women and 13 (16%) men. Lack time due to work demand was reported by 16 (20%) men.

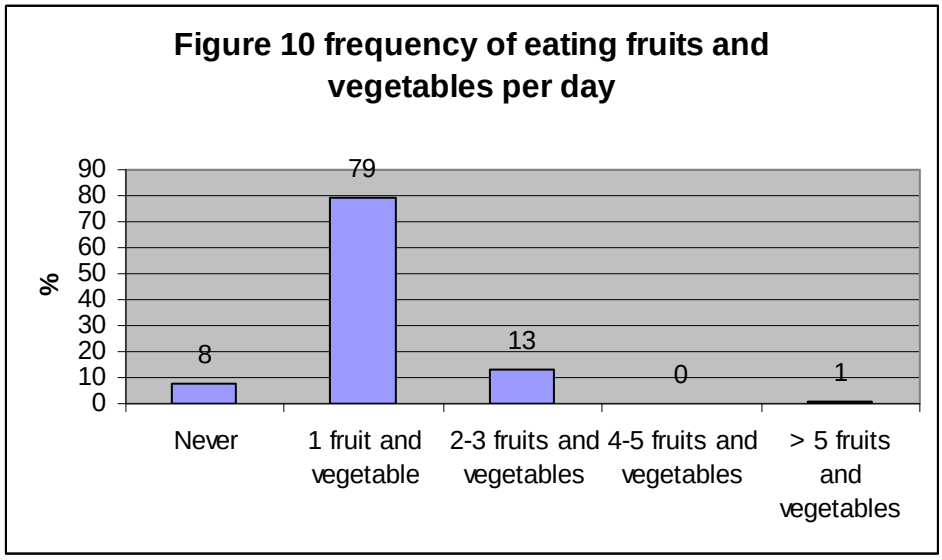
Figure 9 barriers to physical activity



4.4 Dietary intake

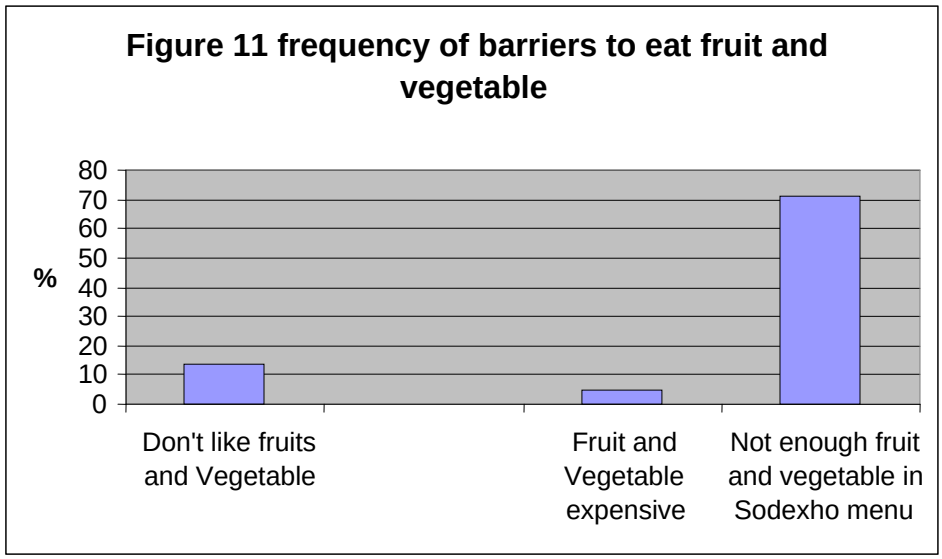
4.4.1 Frequency of eating fruits and vegetables per day

When respondents were asked the number of fruits and vegetables they eat per day, sixty nine (79%) ate 1 fruit and vegetable per day, ten (12%) of respondents ate 2-3 fruits and vegetables per day whereas seven (8%) never eat fruits and vegetables (Figure 10). No significant differences were found between mean BMI of participants and fruits and vegetables consumption per day (p-value 0.93).



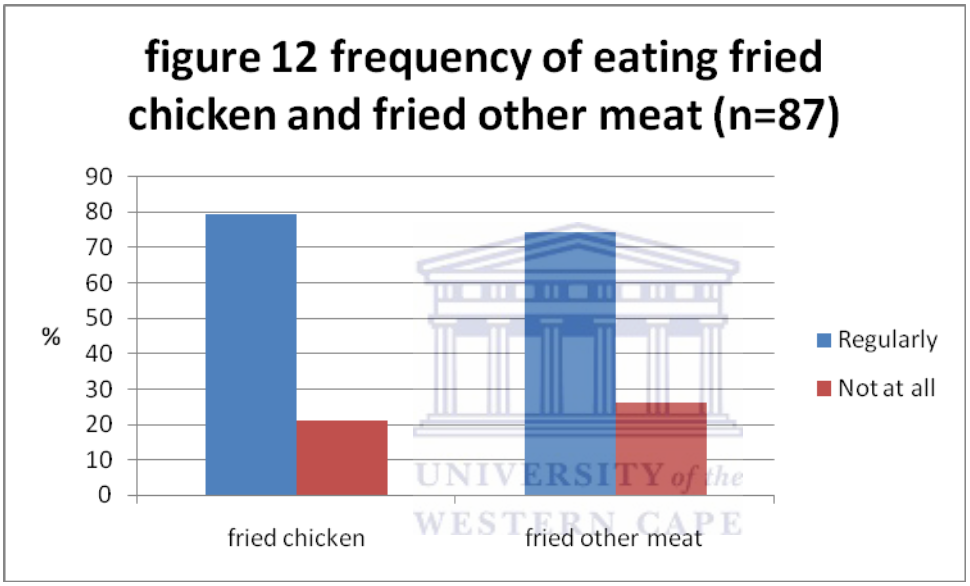
4.4.2 Main reasons for low consumptions of fruits and vegetables

The two most frequently mentioned reasons that prevent respondents from eating enough fruits and vegetables were, not enough fruits and vegetables in Sodexho menu (the company catering for employees at Pocket Beaches mine) by 71% and do not like fruit and vegetable by 14% (Figure 11).



4.4.3 Frequency of eating fried chicken/ other meat

A Significant number of respondents 69 (79%) ate fried chicken regularly, while 8 (9%) never have chicken. Meanwhile 69 (74%) ate other fried meat regularly, while 8 (9%) don't ate other fried meat, as indicated in figure 12. This had indicated that high number of employees consumed fatty food.

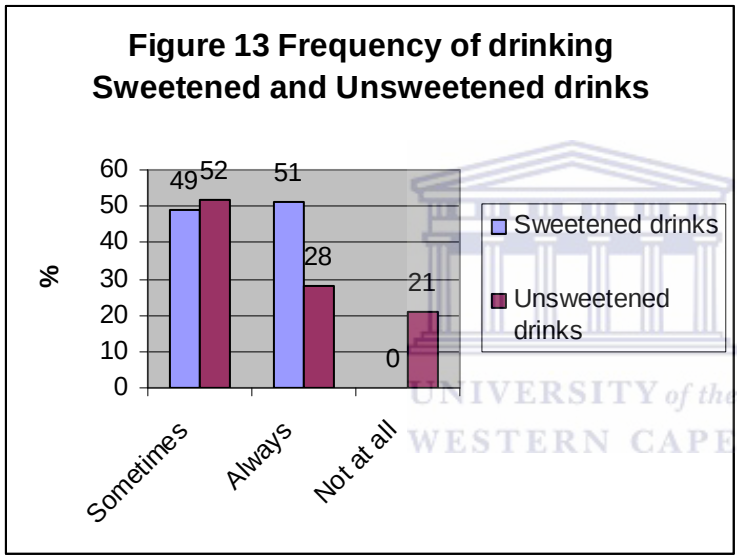


4.4.4 Frequency of trimming fat from meat before cooking

The majority of respondents 36 (41%) do not trim fat from meat before cooking, while 20 (23%) always trimmed fat from meat before cooking, whereas 31 (36%) trimmed fat from meat before cooking only sometimes.

4.4.5 Frequency of drinking sweetened drinks/ unsweetened drinks

Respondents were asked the frequency of drinking sweetened drinks such as cool drinks and fruits juices, 44 (51%) drank sweetened drinks always when thirsty. Again respondents were asked to report the frequency of drinking unsweetened drinks such as water, 45 (52%) drink unsweetened drinks sometimes (not regularly), 24 (28%) always (every day) drink unsweetened drinks, whereas 18 (21%) don't drink unsweetened drinks at all (Figure 13).



4.4.6 Number of teaspoons used in tea or coffee

Majority of respondents 50 (58%) used 2-3 teaspoon of sugar in tea or coffee, while a significant number 24 (28%) used 4 and above teaspoon in tea or coffee.

CHAPTER 5

5.1 Discussion

This study investigated the prevalence and factors associated with overweight and obesity among NAMDEB employees working at Pocket Beaches mine in Oranjemund-Namibia.

This study has found prevalence 42% overweight and 32% obesity among employees of NAMDEB. The prevalence of overweight in this study was higher than the prevalence reported by Stander (2006) among mineworkers at a South African open-cast diamond mine which was 40%. However, obesity prevalence in this study was marginally low 30% compared to 34% reported by Standler. The high prevalence of overweight and obesity in this study reflect that obesity is becoming a major health problem in developing countries. South African Demographic and Health Survey (1998) reported a 56% prevalence of obesity among women and 29% in men (Puoane *et al* 2002). It had been suggested that increasing urbanization and rise in socio-economic status in developing population would increase their proneness to obesity (Bourne, Lambert & Steyn, 2002).

The earlier beliefs that obesity is a disease of rich countries need be denounced and appropriate interventions need to be implemented in developing countries as a matter of urgency. Obesity can have considerable impact on work capacity and fitness for duty among employees (Soteriades *et al.,* 2005). This study used BMI to measure obesity, therefore not investigated if the high prevalence of overweight and obesity was linked to high muscular mass or high body fat mass. In this study 33% of employees were involved in manual labour which would influence their muscularity.

Despite being shown to be a reliable indicator of obesity and overweight, BMI does not make a clear differences between overweight resulting from fat mass and that resulting from muscular mass (Lee & Nieman, 2003).

The prevalence of obesity in this study was found to increase with age. For example, 80% of the 50-59 year old age group was obese compared to 18% in 18-29 year old age group. This result is consistent with previous findings that obesity in adults increases up to the age of 65 after which it decrease (Grujic, Martinov-Cvejin, Ac-Nikolic & Niciforovic-Surkovic, 2005). Increased obesity rate in adults appears to result from decreased physical activity and resting metabolic rate in adulthood. Adult experience 20% decrease in energy expenditure compared to younger people (Beers, 2000). The age-related reductions in resting metabolic rate result from several changes in the body during adulthood. Those changes include reduced muscle tone and strength of muscle contraction, and certain hormones (Beers & Jones, 2000).

Furthermore, 60% of the age group of 50-59 years old had an increased waist circumference (action level 2) compared to 9% in age group of 18-29 years old, indicating a high prevalence of central obesity among adult employees. This is a worrying situation because central obesity is highly associated with risk of chronic diseases of lifestyle than peripheral obesity. Individuals with abdominal obesity are more likely to develop chronic diseases such as CVD, type 2 diabetes, hypertension and stroke (Donahue et al., 1987; WHO, 2003).

Results for daily physical activity showed that most (48%) of the Pocket Beaches mine employees never exercise per week with only a small proportion (7%) exercising more

than 5 times a week. Furthermore, less time is spent on exercises. In this study, 52% of the participants exercised for less than 5 minutes, this being far below 30 minutes exercises regime that is recommended by WHO (2003). These findings showed a low level of exercise thereby indicating that physical inactivity is a problem and employees need to be encouraged to exercise at least for more than three days per week as recommended by WHO. Physical inactivity in the mine employees was associated with obesity in this study. Study shown that employees who participated in physical activity during leisure had low mean BMI (25.1 kg/m^2) compared to those who never exercised on leisure (mean BMI 28.8 kg/m^2). Regular physical activity is necessary not only to prevent obesity but also to maintain good emotional and physical health (Centers for Disease Control and Prevention, 2000; WHO, 2003). With regard to occupational physical activity there was a higher prevalence of low active occupation with 45% of the participants having low degree of physical activity at work. The possible explanation to low physical labour is possibly caused by the use of labour-saving mechanical devices. Many employees such as machine operators, metallurgy operators and dredge operators are using automated machines. This means employees work required them to spend much time sitting and involved less physical labour. This could be explained by the majority of respondents in this study being employed in sedentary occupation. For example, 56% of participants worked as security officers, machine operators, management/foremen and clerical. The study findings have shown a significantly low leisure time physical activity with only 7% of employees participating in physical activity during leisure time by walking or jogging. This study showed that employees mostly watch television on their leisure time rather than participating in physical activity. For example, 87% participants

reported watching television regularly during leisure time for more than two hours. Watching television is known to be the most inactive behavior next to sleeping; people tend to be totally still and even lie down and tend to snack frequently while watching television (Dietz, 1996) All these has effect on weight gain.

The three most frequently reported barriers to physical activity by participants were lack of motivation to exercise/too lazy/cannot get started (33%), leave too early for work/ get home too late (22%) and too tired after work haven't got energy (21%). The above mentioned barriers to physical activity are in agreement with the findings of the Canadian Fitness and Lifestyles Research Institute (1996). The Canadian Fitness and Lifestyle Research Institute reported lack of energy, lack of motivation and lack of time as the most important barriers to physical activity participation. South African diamond mineworkers reported that they leave too early for work/ get home too late, lack of time due to family commitments and too tired to exercise after work as the most important barriers to physical activity participation (Standler, 2006). In this study 32% of participants reported lack of motivation/too lazy/ cannot get started as barrier to physical activity participation. The above mentioned barriers demonstrated that lack of motivation and too much work prevent employees from engaging in physical activity during leisure time. Booth et al (1997) has also found lack of interest/ motivation and lack of time and working shifts to be barrier to physical activity participation among blue collar workers. However, in one study done in South Africa, perceptions that loss of weight meant that person was infected with HIV; lack of exercise and relaxation facilities was identified as barriers to physical activity participation (Puoane & Tsolekile, 2008).

Increased consumption of fruits and vegetables ensure an adequate intake of dietary fibre which can help to displace fats and sugar in the body (Popkin, Horton & Kim, 2001). WHO (2003) recommends intake of minimum 5 potions of fruits and vegetables per day.

The current study revealed generally low consumption of fruits and vegetable at Pocket Beaches mine. Majority of respondents (79%) reported that they eat only 1 fruit and vegetable per day. The low consumption of fruits and vegetables were also reported in a study done in South Africa, which assessed the nutrition and occupational health of employees of the mining industry (Dias *et al* 2003). According to World Health Report (2003), low fruits and vegetables intake is responsible for high prevalence of obesity and non-communicable diseases worldwide. There is convincing evidence in literature that high consumption of fruits and vegetable can decrease obesity (Gibney & Voster, 2001). However, in this study there was lack of association between BMI status and fruit and vegetables consumption. A possible explanation for inability to show association would be that the majority of participants only consumed 1 fruit and vegetable per day, limiting the variance to detect an effect. The most frequently mentioned barrier to more consumption of fruits and vegetables was lack of fruits and vegetables in the hostel food menu (71%) and 14% did not like fruits and vegetables. Similar barriers to the consumption of vegetables and fruits have been reported elsewhere (Gibney & Voster, 2001; Stockmyer, Kuester, Ramsey & Dietz, 2000). The South African Food-Based Dietary Guidelines Consumer study highlighted the following barriers: lack of availability of fruits and vegetables, taste preferences and affordability. The result showed that Sodexho, the company catering food for NAMDEB mineworkers does not

have enough fruits and vegetables in its menu. This is a worrying situation because there is no canteen at Pocket Beaches mine where employees can buy fruits and vegetable when they did not get enough from hostel kitchen. Therefore availability of fruits and vegetable is a major problem need urgent intervention.

South African Food Based Dietary Guidelines (2001) recommended a moderate fat diet providing less than 30% of total energy. Increased fat intake especially fat from animal sources is positively associated with obesity, cardiovascular diseases and certain form of cancers such as breast, colon and prostate cancers (Wolmarans & Oosthuizen, 2001).

The consumption of fatty foods such as fried chicken and fried meat was common among study participants. A large number of respondents (79%) eat fried chicken while (74%) eat fried meat regularly. Fried food was also found to be a preferred method of preparation in urban black South Africans (Puoane & Tsolekile, 2008). People associated fried food with civilization and regard those who are using traditional method of boiling food as backward (Chopra & Puoane, 2003). Chopra and Puoane (2003) reported reasons for fat consumptions as due to people preferred to fry food because it is quick and fried meat is tastier than boiled meat. Previous survey has established that the amount of fat consumed by mineworkers living in hostel is more than adequate, if not excessive (Dias *et a*l, 2003). Bourne et al, (2002) reported that fat intake among urban blacks have increased from 16.4% to 26.2% of total energy and at the same time carbohydrate intake decreased. Unfortunately this study has not investigated the total fat intake of employees in order to establish if it was at the recommended level.

Furthermore, this study results have indicated that 51% of employees always drink sweetened drinks when they are feeling thirsty compared to 28% who always drink unsweetened drinks such as water. The increased intake of sugary drinks can lead to excessive energy intake than the body can use which then be converted into fat (Perbellini, 2004). Drinking unsweetened drinks such as water have been reported to help people to feel fuller and prevent overeating. It is recommended that water intake for men should be 2.9 l/day and 2.2 l/day for women (Bourne & Searger, 2001).

The most important findings of this study are the high prevalence of overweight and obesity among employees at Pocket Beaches. The high prevalence of overweight and obesity can be attributed to low physical activity both at work and during leisure time, and low consumption of fruits and vegetables. The population also has a high consumption of refined carbohydrate and fat in the form sweetened drinks and fried food. This can predispose them not only at high risk of developing obesity but some other non-communicable diseases such as diabetes, CVDs and some cancers. Of concern is high prevalence of obesity among older employees 50-59 years old and low physical activity participation of this age group.

5.2 Limitations

The sample size may be too small for the findings to be generalized to the entire NAMDEB operations rather than Pocket Beaches mine only. The high prevalence of overweight and obesity in the sample population might be overestimated due to the predominantly male participants whose high BMI values could have been attributed to a high muscle mass rather than a high body fat. In this study the body fat percentage was not determined in order to differentiate between a high body weights due to muscle mass or due to a high body fat mass. Another limitation in this study is that the total fat intake of employees was not investigated in order to determine if fat content of employees' diet is at the accepted level or it is too high. The other dietary parameters were not quantified such as the study asses only number of teaspoons used per cup not per day. Further limitations of the study are: No direct measure of physical activity or energy expenditure rather based on general questionnaires. No attempt has been made in this study to assess employees knowledge and beliefs about body weight, and knowledge of risk factors for NCDs.

CHAPTER 6

6.0 CONCLUSION AND RECOMMENDATION

6.1 Conclusions

The study investigated the prevalence and factors associated with obesity amongst employees at Namibia open-cast diamond mine.

The results revealed a high prevalence of overweight and obesity among employees, older employees have high obesity and overweight rate than the younger counterparts. Obesity and overweight in this study associated with age and occupation. It was found that the physical activity of employees is generally low during work time and on leisure time. The diet of employees is characterized by high intake of fat and low consumption of fruits and vegetables increasing their risk for developing obesity and other non-communicable diseases. Study identified some barriers to physical activity such as lack of motivation and work related factors such leave too early and come back too late and tired after work. Meanwhile barriers to high consumption of fruits and vegetable identified by this study include lack of fruits and vegetables in food served to employees at mine hostel and dislike of fruits and vegetables.

There is urgent need for Pocket Beaches mine to develop intervention strategies in order to promote healthy lifestyles and reduce the high prevalence of overweight and obesity among employees.

This study recognized its limitation due to small sample size; therefore the findings cannot extrapolated to other NAMDEB mine populations.

6.2 Recommendations

All employees should be measured BMI during the pre-employment and routinely annual medical examinations. Those with above normal BMI should be treated accordingly and those with normal BMI should be counseled to avoid gaining weight. Namdeb wellness programe should engage in educating employees on healthy lifestyles such as increased physical activity, increased intake of fruits and vegetables and reduced intake of saturated fats and sweetened drinks. To promote physical activity among employees, the Namdeb inter-departmental sport events (7-A- sides) should be held quarterly instead of annually as it now. Although a Namdeb inter-departmental sport event well known as (7-A- sides) was established as a safety campaign, it has a potential to promote physical activity among employees if it is held regularly. Employees should be encouraged to make use of physical activity centre (gym) which is available at Pocket Beaches hostel.

With regard to diet, there is a need to establish a food committee at Pocket Beaches in order to oversee the food preparation and engage Sodexho in addressing the problem of high fat content in diet and low fruits and vegetables provided to employees. Employees meals should have low fat, low sugar and high in fibre in order to prevent and reduce obesity and other chronic diseases of lifestyles among employees.

It is recommended that further studies with big sample representing all Namdeb mines should be performed in order to have representative findings of the whole company. In the proposed studies BMI should be used to determine obesity together with skin fold measurements to distinguish between subjects with a high body muscle mass and high

body fat mass. Another research need to be undertaken to examine other determinants of obesity, such as total dietary intake, as well as more direct measures of energy expenditure (heart rate and accelerometers) in order to characterize domain and intensity of exercise more accurately. Attempt should also be made to quantify the cost of obesity and other non-communicable diseases to the organization in order to plan and budget for intervention strategies.

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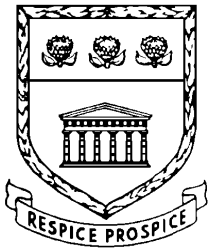

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APPENDIX 1.1: INFORMATION SHEET

PREVALENCE AND FACTORS ASSOCIATED WITH OBESITY AMONGST EMPLOYEES OF OPEN-CAST DIAMOND MINE IN NAMIBIA

Dear……

I am a student at the University of the Western Cape. I am trying to gather information related to the prevalence and factors contribute to obesity and overweight among employees of Pocket Beaches Mine. This study is part of partial fulfillment of masters in public health.

What is this survey about?
The aim of this study is to collect information about body size, eating and exercise including barriers to health lifestyles in order to determine the appropriate primary prevention strategy in the workplace.

Who will participate in this study?

87 employees representing all the departments and job categories on mine will be randomly selected to participate in this study.

What do we expect from the participants in the study?
You will have to answer questions to provide the following information: sex, age, gender, job categories; Physical activity patterns; and eating patterns

You will also have your weight taken by standing on a weighing scale while wearing light clothing. Your height will also be measured while standing bare footed on a firm board. Your waist circumference will be measured using a flexible tape measure.
The above measurements and questionnaires will take approximately 25- 30 minutes.

How will you benefit from taking part in this study?
You will benefit from this study by providing essential information to improve the future health of employees by introducing appropriate intervention at Pocket Beaches Mine, based on the result of this study.

Can you withdraw from the study?
Definitely you may withdraw from the study at any time, without having to give a reason. You may refuse to be measured weight, height and waist circumference or to answer question should you wish to. The study is completely voluntary and your employment will not be influenced by your decision.

Any further questions?
More information may be obtained from **Mr. Desderius Haufiku** at **tel: 063 236363/ cell**: **0812453388** or my supervisor **Prof. Thandi Puoane** at University of the Western Cape tel: **+27 21 959 3084/ cell: +27 21 827075881**. If you are willing to participate in the study, please read and sign the consent form.

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APPENDIX 1.2

Translated information sheet (Oshiwambo)

Omufimanekwa……

Ame omulihongi mo universiti ya Western Cape, ohandi ningi omakonaakono enasha nokwoondoka movanailonga apa po Pocket Beaches. Eshi oshinasha nokuwanifapo shimwe shomoinakuwanifwa yo masta moundjlowele wakeshe umwe.

Ekonaakono eli olinasha nashike?
Elalakano okukonga ouyelele shinasha nokwoondoka, noinima oyo ta yeeta oku kala waondoka, ngaashi oikulya, nomadeulo olutu nosho tuu.

Olye takakufa ombinga?
Oanailonga veli 87 okudja koikandjo yayooloka apa pomina yetu ova hoololwa nopehena katongo opo vakufe ombinga.

Oshike twateelela kombinga yoye?
Otokapulwa uyadeke omapulo kombinga yoinima tayishikula:
Oukwatya woye ngaashi, eedula doye, okategoli moilonga noshotu
Okuninga omadeulo olutu ngaashi, ohoningi omadeulo olutu lungapi moshivike, noshotuu.
Okulya ngaashi oholi oyiimati noikwambidi ingapi mefiku
Oto kametwa yoo oshivixa shoye, oule noshiya shoye, aishe eyi otakakwata efimbo lominute 30-40.

Mekonaakono eli ounamo ouwa washike?
Ouyelele ou toyandje otau kakwafela okutulapo oporograma yokukelela oinima oyo tayeeta okwoondoka.

Oto dulu okulikufamo mekonaakono eli?
Ouna oufamba okukala ino nyamukula omapulo oo taapulwa nopuhena nande oshilanduli shasha, hano aishe eyi otayi ningwa ashike pehalo loye.
Ngee owapumbwa ouyelele wawedwapo
Oto dulu okuninnga ekwatafano na Mr Desderius Haufiku kongodi eyi 063 236363 ile 0812453388.

APPENDIX 2.1: CONSENT FORM

Title of Research Project: Prevalence and Factors Associated with obesity amongst employees of Open-cast mine in Namibia.

The study has been described to me in language that I understand and I freely and voluntarily agree to participate. My questions about the study have been answered. I understand that my identity will not be disclosed and that I may withdraw from the study without giving a reason at any time and this will not negatively affect me in any way.

Participant's name……..

Participant's signature……

Date……

Should you have any questions regarding this study or wish to report any problems you have experienced related to the study, please contact the study coordinator:

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APPENDIX 2.2

Ombapila yedimino

Oshipalanyolo shekonaakono: Ouhapu noinima yo tayetifa okwoondoka pomina ya Pocket Beacheas.

Ekonaakono eli ondelifatululilwa nawa kutya olili kombinga ashike melaka eli handuudu nondakufa etokolo lange mwene opo ndikufe ombinga. Nomapulo aa ndina shinasha nekonaakono taliningwa okwanyamukulwa. Ondishudako nawa kutya oukwatya wange itukahololwa mekonaakono omu, nondina oufemba okulikufamo ngeenge inandihala vali okuya komesho nopehena nande oshilanduli shasha.

Edina.....

Eshaino loye.....

Efiku.....

Ngeenge ouna epulo lasha kombinga yekonaakono ile wahala okupopya oupyakadi washa unasha nekonaakono eli otodulu okumona:

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APPENDIX 3:
RESEACH
QUESTIONNAIRE

1. ANTROPOMENTRIC QUESTIONNAIRE

Date of interview……

SUBJECT NUMBER		

WEIGHT | | | | | kg

HEIGHT | | | | | cm

WAIST CIRCUMFERENCE

				cm

AVERAGE WEIGHT	**kg**
AVERAGE HEIGHT	**cm**
AVERAGE WAIST CIRCUMFERENCE	**cm**
BMI=weight / (height x height)	

2. SOCIO- DEMOGRAPHIC QUESTIONNAIRE

DATE OF BIRTH

D	D	M	M	Y	Y	Y	Y

Please mark the appropriate box with x in the grey area

AGE	1	2	3	4	5
	18-29	30-39	40-49	50-59	60-69

GENDER	1	2
	Female	Male

RACE

1	2	3	4	5
Black	White	Coloured	Indian	Other specify

Marital Status	1	2	3	4	5	6	7
	Unmarried	Married	Divorced	Separated	Widowed	Living Together	Other Specify

HIGHEST EDUCATIONAL LEVEL

1	2	3	4	5
No Schooling	Grade 7 and Below	Grade 8 up to Grade 10	Grade 11 up to Grade 12	Tertiary Education/

Occupational Category **X**

Management & Forman	**1**	
Artisan/ Technician	**2**	
Clerical / Admin / Security	**3**	
Machine operator	**4**	
Metallurgy operator	**5**	
Operator (other)	**6**	
Operative	**7**	

EMPLOYER

1	2
NAMDEB	CONTRACTOR

DEPARTMENT		X
Engineering	**1**	
Metallurgy	**2**	
Mining	**3**	
Dredge	**4**	
Security	**5**	
Management	**6**	
Barlows	**7**	
MBS	**8**	
Sodexho	**9**	

PATTERSON BAND (GRADING)

		X
A	1	
B	2	
C	3	
D	4	
E	5	
Other	6	

3. PHYSICAL ACTIVITY

3.1. How may times per week do you take part in exercises (in which you find yourself running out of breath and sweating)?

1	2	3	4	5
Never	Once a week	2 - 3 times a week	4 - 5 times a week	More than 5 Times a week

3.2 How many minutes do you exercises per day?

1	2	3	4	5
Less than 5 minute	5 – 15 minutes	15 – 30 minutes	30 – 45 minutes	More than 45 minutes

SCOPE OF PHYSICAL WORK			X
3.3. What is the degree of physical labour related to your job (e.g. work that will leave you	No physical labour	1	
	1-4 hours of physical labour	2	

breathless)?			
	More than 5 hours	3	

3.4. How many hours do you spend sitting at work per day?

1	2	3	4	5
Less than 1 hour	1-2 hours	2-3 hours	3-4 hours	More than 4 hours

4.WORK INDEX			**X**
1. What is your main occupation	Manager, foreman, security, supervisor. tertiary qualification	1	
	artisan, operator, operative	2	
2. At work I sit	Never	1	
	Seldom	2	
	Sometimes	3	
	Often	4	
	Always	5	
3. At work I stand	Never	1	
	Seldom	2	
	Sometimes	3	
	Often	4	
	Always	5	
4. At work I walk	Never	1	
	Seldom	2	
	Sometimes	3	
	Often	4	
	Always	5	
5. At work I lift heavy load	Never	1	
	Seldom	2	
	Sometimes	3	
	Often	4	
	Always	5	
6. After work I am tired (physically)	Very often	1	
	Often	2	
	Sometimes	3	
	Seldom	4	
	Never	5	
7. At work I sweat	Never	1	
	Seldom	2	
	Sometimes	3	
	Often	4	
	Always	5	

5. LEISURE INDEX **X**

1. During leisure time I watch television	Never	1	
	Seldom	2	
	Sometimes	3	
	Often	4	
	Very often	5	
2. How many hours do you spend watching television after work?	Less than 1 hour	1	
	1-2 hours	2	
	2-3 hours	3	
	3-4 hours	4	
	More than 4 hours	5	
3. During leisure time I walk or jog	Never	1	
	Seldom	2	
	Sometimes	3	
	Often	4	
	Very Often	5	
4. How many minutes do you walk/jog per day	Less than 5 minutes	1	
	5-15 minutes	2	
	15-30 minutes	3	
	30-45 minutes	4	
	More than 45 minutes	5	

6 BARRIER TO PHYSICAL ACTIVITY

If you are not physical active during leisure time indicate the three most appropriate reason that prevent you from engaging in physical activity during Leisure time. Mark with a cross in the block next to your choice.

X

1. Already physical active at work / prefer not being physical active during leisure	1	
2.Lack of time due to work demand	2	
3.Lack of time due to some other commitments	3	
4.Regularly working overtime	4	
5.Working shift	5	
6.Leave too early for work/get home too late	6	
7.Too tired after work/haven't got the energy	7	
8.Do not enjoy exercise/too inconvenient to exercise	8	
9.Too self-conscious/too fat to exercise	9	
10.Lack motivation to exercise/ too lazy/cant get started	10	
11.Don't have the right clothes/facilities to exercise	11	
12.Cant exercise because of poor health/ an injury	12	
13.Has nobody to exercise with	13	
14.Too old to exercise	14	
15.Others specify……	15	

5.DIETARY INTAKE

5.1 How many fruits and vegetables do you eat per day?		**X**
1. Never	1	
2. 1 Fruit and vegetable per day	2	
3. 2-3 Fruit and vegetable per day	3	
4. 4-5 Fruit and vegetables per day	4	
5. More than 5 fruit and vegetables per day	5	

5.2 What are some of the things that prevent you from eating fruit and vegetables?		
1. Don't like fruit and vegetables	1	
2. Lack of fruit and vegetable in my town/village	2	

3. Fruits and vegetables are expensive	3	
4.Not enough fruits and vegetables in Sodexho menu	4	

5.3 When you have chicken, is it fried?		
1. Sometimes	1	
2. Always	2	
3. Not at all	3	
4. I never have chicken	4	

5.4 When you have other meat, is it fried?		
1. Sometimes	1	
2. Always	2	
3. Not always	3	
4. I never have other meats	4	

5.5 Do you trim fat from meat before cooking?		**X**
1. Sometimes	1	
2. Always	2	
3. Not at all	3	

5.6 How often do you use Sweetened drinks per day? (e.g. cool drink, fruit juice)		**X**
1. Sometimes	1	
2. Always	2	
3. Not at all	3	

5.7. How often do you use unsweetened drinks per day?		**X**
1. Sometimes	1	

2. Always	2	
3. Not at all	3	

5.8. How many teaspoons of sugar do you use in tea/coffee		**X**
1. 0-1 teaspoon	1	
2. 2 - 3 teaspoon	2	
3. 4 and above teaspoons	3	