A STUDY TO DETERMINE THE CAUSES OF HIGH PREVALENCE OF TYPE-II DIABETES MELLITUS AMONGST MILITARY PERSONNEL AT THE KENYA DEFENCE FORCES DESPITE THEIR PHYSICAL FITNESS TRAINING AND DIET

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Abstract: Diabetes remains a major challenge to both civilian and combat populations. Serving in the Kenya defense forces military requires a certain level of physical fitness and freedom from any disability and disease. When civilians apply to join the military they are required to pass a medical exam. While not all medical conditions disqualify a person from joining the military, diabetes is one of those conditions that disqualify one from joining the military, others include asthma, hypertension and HIV infection and any obvious disability of the upper and lower limbs which may be attributed to among other conditions diabetes especially diabetic foot. In the recent years there has been unprecedented increase in the numbers of military members developing diabetes in the course of their service to KDF. Yet when they joined the service they were free from diabetes. Strenuous and regular exercises amongst this group are expected to protect them from this developing diabetes and other lifestyle disease. Developing diabetes while already serving in the military, however, is not automatic grounds for dismissal from the military. Because active service members have mandatory medical examinations and free access to health care, it is thought that there are few undiagnosed cases of diabetes among military personnel. Service members who develop diabetes and cannot be well controlled are referred to a medical evaluation board, which assesses their medical fitness and makes recommendations about follow-up care. The objective of this study was to establish various military exposures as a result of deployment can contribute to the development of diabetes on work performance and productivity and economic burden on the military medical scheme. To achieve this, a case study was done at defense forces memorial hospital involving diabetic patients who regularly attend diabetic clinic every week. Questionnaires touching on the risk factors of developing diabetes were used amongst patients attending the clinic every week. This work would be used to inform Kenya defense forces policy makers on the best way to prevent her personnel from developing type II diabetes. The results indicated that the Type II diabetes soldiers were involved in physical activities like a morning run, mountain climbing, weight lifting, judo and seat ups more than three times per week which decreases their likelihood of having obesity, which leads to diabetes. With regard to financial implication, the study established that given that at the time of the interview most of the Type II diabetes soldiers were under treatment or medication, the costs of treatment was a burden to them. The study therefore concludes that the high alcohol intake exacerbates the situation for diabetes type II patients. This study recommends that the barracks should come up with measures that will ensure that exercises are being undertaken in the field. The study also recommends that the Ministry of Health in conjunction with the Ministry of defense aligns the cost of treatment in accordance with their monthly pay. This study recommends further that the management at the barracks offers dinner to the soldiers with special
diet for those with diabetes. In addition, the management at the barracks should extend their help to those who would like to curb alcohol addiction by establishing free counseling services.

**Key Words:** Diabetes Mellitus, Military Personnel, Hypoglycemia, Hyperglycemia

**Introduction**

Type II diabetes mellitus, which constitutes more than 90% of all cases of diabetes typically affects individuals over 40 years old although young adults and paediatric cases are rapidly increasing. Obesity in the single most important rise factor and more than 80% of type II diabetes patients are obese. The disorder typically develops gradually without obvious symptoms at the onset. It is frequently diagnosed either by elevated blood glucose in routine screening tests or as the introductory case, after the disease has become severe enough to cause polyuria and polydipsia (Astrup, 2001).

Progression of type II diabetes of them begins with a state of insulin resistance. With increasing age and added weight tissues that were once normally insulin responsive become relatively refractory to insulin action. Diabetes mellitus, type I accounts for 5-10% of cases results from auto immune destruction of pancreatic B- cells. In absence of B-cells, insulin is neither produced nor released and the circulating insulin concentration is near zero. Both diabetes types I and II are associated with long term vascular pathology. This chronic complication includes premature atherosclerosis, retinopathy, nephropathy and neuropathy (Delavari et al., 2009).

**Problem Statement**

Diabetes is still a major problem in the world at large and continues to pose a significant morbidity in both civilian and military populations and also it continues to impact on the economy because of cost implication and impact on productivity of soldiers both in the war front and at peace time location. Obesity is the single most important risk factor and more than 80% of type II diabetes patients are obese (Duarte et al., 2003). Other factors include: Sedentary lifestyle, unhealthy diet, increasing age i.e. above 40 years, high blood pressure, family history, ethnicity and impaired glucose tolerance (IGT). In the recent years there has been unprecedented increase in the numbers of military personnel developing type II diabetes in the course of their service to KDF, yet when they joined the service they were free from diabetes. Strenuous and regular exercises amongst this group are expected to protect them from this developing diabetes and other lifestyle disease (Sun Jung et al., 2014). The objective of this study is to determine the causes of high prevalence of diabetes type-II amongst the members of the Kenya defense forces despite their physical fitness training and diet.

The specific objectives of the study were:

- To determine frequency of physical exercises in military personnel who have developed type II diabetes prior to diagnosis of the disease.
- To compare military personnel base diet and the diet they are provided during field deployment to the development of type II diabetes mellitus.
- To establish the contribution of consumption of alcohol and cigarette smoking to development of type II diabetes mellitus.
To establish the financial implication of diabetes on the Kenya military medical scheme

**Literature Review**

**Risk Factors for Developing Diabetes**

The risk factors for type I diabetes are still being researched. However, having a family member with type I diabetes slightly increases the risk of developing the disease (Morandi et al., 2014). Environmental factors and exposure to some viral infections have also been linked to the risk of developing type I diabetes. Several risk factors have been associated with type II diabetes and include family history of diabetes, overweight, unhealthy diet, physical inactivity, increasing age, high blood pressure, ethnicity, Impaired Glucose Tolerance (IGT), history of gestational diabetes as well as poor nutrition during pregnancy (Jing et al., 2014). Impaired Glucose Tolerance (IGT) is a category of higher than normal blood glucose, but below the threshold for diagnosing diabetes. Changes in diet and physical activity related to rapid development and urbanization have led to sharp increases in the numbers of people developing diabetes (Rashid et al., 2013).

**Complications of Diabetes**

People with diabetes have an increased risk of developing a number of serious health problems. Consistently high blood glucose levels can lead to serious diseases affecting the heart and blood vessels, eyes, kidneys, nerves and teeth. In addition, people with diabetes also have a higher risk of developing infections. In almost all high-income countries, diabetes is a leading cause of cardiovascular disease, blindness, kidney failure, and lower limb amputation. Maintaining blood glucose levels, blood pressure, and cholesterol at or close to normal can help delay or prevent diabetes complications. Therefore people with diabetes need regular monitoring.

Cardiovascular disease affects the heart and blood vessels and may cause fatal complications such as coronary artery disease (leading to heart attack) and stroke. Cardiovascular disease is the most common cause of death in people with diabetes. High blood pressure, high cholesterol, high blood glucose and other risk factors contribute to increasing the risk of cardiovascular complications.

Kidney disease (diabetic nephropathy) disease caused by damage to small blood vessels in the kidneys leading to the kidneys becoming less efficient or to fail altogether. Kidney disease is much more common in people with diabetes than in those without diabetes. Maintaining near normal levels of blood glucose and blood pressure can greatly reduce the risk of kidney disease.

Diabetes can cause damage to the nerves throughout the body when blood glucose and blood pressure are too high. This can lead to problems with digestion, erectile dysfunction, and many other functions. Among the most commonly affected areas are the extremities, in particular the feet. Nerve damage in these areas is called peripheral neuropathy, and can lead to pain, tingling, and loss of feeling. Loss of feeling is particularly important because it can allow injuries to go unnoticed, leading to serious infections and possible amputations. People with diabetes carry a risk of amputation that may be more than 25 times greater than that of people without diabetes. However, with comprehensive management, a large proportion of amputations related to diabetes can be prevented. Even when amputation takes place, the remaining leg and the
person’s life can be saved by good follow-up care from a multidisciplinary foot team. People with diabetes should regularly examine their feet.

Most people with diabetes will develop some form of eye disease (retinopathy) causing reduced vision or blindness. Consistently high levels of blood glucose, together with high blood pressure and high cholesterol, are the main causes of retinopathy. It can be managed through regular eye checks and keeping glucose and lipid levels at or close to normal.

Women with any type of diabetes during pregnancy risk a number of complications if they do not carefully monitor and manage their condition. To prevent possible organ damage to the fetus, women with diabetes type 1 or diabetes type 2 should achieve target glucose levels before conception. All women with diabetes during pregnancy, type 1, type 2 or gestational should strive for target blood glucose levels throughout to minimize complications. High blood glucose during pregnancy can lead to the fetus putting on excess weight. This can lead to problems in delivery, trauma to the child and mother, and a sudden drop in blood glucose for the child after birth. Children who are exposed for a long time to high blood glucose in the womb are at higher risk of developing diabetes in the future.

Such complications include, eye complications (glaucoma, cataracts, diabetic retinopathy), foot complications (neuropathy, ulcers, and sometimes gangrene which may require that the foot be amputated), skin complications (people with diabetes are more susceptible to skin infections and skin disorders), heart problems (such as ischemic heart disease, when the blood supply to the heart muscle is diminished), hypertension (common in people with diabetes, which can raise the risk of kidney disease, eye problems, heart attack and stroke), mental health (uncontrolled diabetes raises the risk of suffering from depression, anxiety and some other mental disorders) and hearing loss (diabetes patients have a higher risk of developing hearing problems). Additionally, other complications include, gum disease (there is a much higher prevalence of gum disease among diabetes patients), gastro paresis (the muscles of the stomach stop working properly), ketoacidosis (a combination of ketosis and acidosis; accumulation of ketone bodies and acidity in the blood), neuropathy (diabetic neuropathy is a type of nerve damage which can lead to several different problems) and Hyperosmolar Hyperglycemic Nonketotic Syndrome (blood glucose levels shoot up too high, and there are no ketone present in the blood or urine. It is an emergency condition), Nephropathy (uncontrolled blood pressure can lead to kidney disease), and peripheral arterial disease (symptoms may include pain in the leg, tingling and sometimes problems walking properly) and stroke (if blood pressure, cholesterol levels, and blood glucose levels are not controlled, the risk of stroke increases significantly). Further, erectile dysfunction - male impotence infections (people with badly controlled diabetes are much more susceptible to infections) and healing of wounds cuts and lesions take much longer to heal.

**Observations in the United States Military**

Individuals with type II diabetes in the U.S. military have risk factors similar to the general U.S. population. Because diabetes is a preventable disease, it is of concern that it is occurring in this population of younger and presumably fit individuals. This has significant implications for the prevention of diabetes in both military and civilian populations.

There has been growing concern over recent increases in the prevalence of diabetes and obesity in the U.S. and the impact this may have on morbidity, mortality, and health care expenditure.
Furthermore, accumulating evidence shows that this epidemic is effecting young adults in the U.S., with similar increases in type II diabetes and obesity. These trends may directly affect the military in terms of recruitment, retention, and military readiness. Diabetes of any type is cause for rejection into military service, in accordance with Department of Defense directive. Members of the military who develop diabetes during active duty are referred for possible medical discharge or retirement. However, not all personnel with diabetes are discharged; in one unpublished study, 83 soldiers with diabetes were retained in the U.S. Army during an 18-month period. Few data exist regarding the prevalence and incidence of diabetes in the military, particularly type II diabetes. A study of the incidence of type 1 diabetes, among U.S. Navy enlisted personnel, reported an incidence of 21.3 per 100,000 person-years (Murrock, Taylor & Marino, 2013).

**Diabetes in Kenya**

The estimated diabetes prevalence in Kenya ranges between 2.7% (rural) and 10.7% (urban). The prevalence of impaired glucose tolerance is 8.8% (rural) and 14.4% (urban). The real numbers of people living with diabetes is unknown: data for most of the regions is not available. In 2003, non-communicable diseases (diabetes, cardiovascular diseases, chronic lung diseases and cancer) contributed 53% of hospital admissions in Kenya. Diabetes accounted for 27% of these hospital admissions (Mbanya et al., 2010).

There is very little information available about the prevalence, incidence and risk factors for the development of diabetes at the Kenya defense forces since to date there is no study that has been carried out to get the facts about the prevalence of diabetes in the Kenya defense force therefore it is against this fact that this study shall be carried out to ascertain the burden of diabetes at the Kenya defense forces on the productivity of the soldiers, the findings shall be used to institute diabetes preventive measures and control amongst the members of the Kenya defense forces since its of pram Management Challenges (Sobngwi et al., 2012).

The Army is retaining an increasing number of personnel with diabetes, and, despite directives to the contrary, these soldiers may be deployed to active war zones where typically recommended methods for managing the disease might create more problems than they solve (Graue et al., 2013). The boards generally recommend that those on medications that potentially can cause hypoglycemia or those that might put a soldier at risk if dehydrated not be deployed to active war zones. Many commanders will override that recommendation and take that soldier into theater with their unit (Murrock, Taylor & Marino, 2013). While many diabetics who are deployed will have supportive roles in fixed facilities with access to ongoing medical care, others will be in riskier situations.

For them, managing diabetes might involve challenges unknown to stateside service members. Meters for monitoring blood sugar are not validated in extreme conditions, such as desert summers, and insulin might become denatured and inactivated in high heat. In addition, soldiers on extended patrol or performing certain hazardous duties might not have access to food on the regular intervals most conducive to control of blood-glucose levels (Chesla, Chun & Kwan, 2009). In these situations, a diabetic soldier cannot obtain food to counteract hypoglycemia if it develops and might develop “cognitive impairment, behavioral changes or go into a coma and
die (Horton, 2010). Advice soldiers about these issues and what precautions to take to ameliorate them are of paramount importance that this special population remains fit all the time.

**Materials and Methods**

This study employed a cross-sectional descriptive study design i.e. the current KDF diabetic patients currently attending DFMH diabetic clinic (cases). The study was conducted in a hospital set up. To achieve this, the case study was done at defense forces memorial hospital involving diabetic patients who regularly attend diabetic clinic every week. The study population was members of the Kenya defense forces who are diabetics attending clinic at DFMH in a period of 3 months. The study also included individuals who are at pre-diabetic stage referred to this clinic. According to DFMH, there have been 912 diabetes type II patients in the last 3 months. Probability proportional to sampling was used to determine the number of diabetic patients to be interviewed and to take the questionnaires since the population is less than or equal ten thousand.

The sample size was arrived at using the formula as used by Fisher et al., (1998).

\[
    n = \frac{z^2 pq}{d^2}
\]

Where;
- \( n \) = desired sample size
- \( z \) = standard deviation of the required confidence level, usually set at 1.96 which is at 95% confidence level.
- \( P \) = prevalence of type 2 diabetes in Kenya is 0.06.
- \( q = 1 - p \) therefore, \( q = 1 - 0.06 = 0.94 \)
- \( d \) = desired level of statistical significance (0.05).

Hence \( n = \frac{(1.96)^2 \times 0.06 \times 0.94}{(0.05)^2} = 86 \)

The sample size of this study was 86 respondents.

Questionnaires touching on the risk factors of developing diabetes were administered amongst patients attending the clinic every week. Data was also obtained from the hospital records to determine the disease burden to KDF. Anthropometric measures were also taken from the patients including BMI. Data was collected from the hospital drug store and pharmacy on total numbers of all those on diabetic drugs to determine the burden of the disease.

The study collected both qualitative and quantitative data. Qualitative data was obtained from the open ended questions while the quantitative data was obtained from closed ended questions. Quantitative data collected was analyzed by use of descriptive statistics like percentages and frequencies which qualitative data was analyzed through content analysis. Quantitative data was analyzed through computer software, Statistical Package for Social Sciences (SPSS version 20) and presented in form of frequency distribution tables, bar graphs, and pie charts.

**Results and Discussions**

This study had a sample of 86 patients in DFMH out of which 82 responses were obtained. This represented a 95.35% response rate. According to Babbie (2002) any response of 50% and above is adequate for analysis thus 95.35% is even better. The study established that most soldiers were
participating in physical exercises. Further, the study established that the physical exercise involved in include a morning run, mountain climbing, weight lifting, judo and seat ups. Increasing levels of physical activity should be the first step in the prevention of diabetes mellitus type II (Thongsai, Watanabenjasopa & Youjaiyen, 2013).

Also, the study established that most soldiers exercised more than three times per week. The duration of the last exercise that most soldiers had had was one hour. Gestational diabetes patients can control their diabetes with exercise (Sun Jung et al., 2014). In addition, the study established that most soldiers exercised in the barracks but were not exercising in the field deployment. The study further established that most soldiers were infantry persons.

It was also established that most soldiers were not regularly exercising after being diagnosed with diabetes. The study further found out that for most soldiers, their current body weight was between 66 and 80 Kgs. Mueller et al. (2013) reported that scientists believe that the impact of sugary soft drinks on diabetes risk may be a direct one, rather than simply an influence on body weight.

**Table 1: Current Body Weight**

<table>
<thead>
<tr>
<th>Weight</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>(50-65)</td>
<td>12</td>
<td>14.63</td>
</tr>
<tr>
<td>(66-80)</td>
<td>43</td>
<td>52.44</td>
</tr>
<tr>
<td>(81-95)</td>
<td>21</td>
<td>25.61</td>
</tr>
<tr>
<td>(96-110)</td>
<td>4</td>
<td>4.88</td>
</tr>
<tr>
<td>(More than 110)</td>
<td>2</td>
<td>2.44</td>
</tr>
</tbody>
</table>

**Financial Implication**

The study revealed that oral medication was the method of treatment used by many soldiers. The age at which most soldiers were diagnosed with diabetes, as the study established, was between 26 and 30 years of age. The study also established that at the time of the interview, most of the soldiers were under treatment or medication. Diabetes is likely to be a major health problem, competing for limited health resources with infectious diseases (Burgess, Msukwa & Beare, 2013). With regard to the time when the soldiers were diagnosed with diabetes, the study established that majority were diagnosed with diabetes 2 years ago.

The study also established that most soldiers had complications due to diabetes. In addition, the study revealed that the organs that were involved in the complications caused by diabetes were the kidneys. Further, the study established that most of the soldiers were receiving treatment for another disease other than diabetes. The study found out that the soldiers’ deployment after being diagnosed with diabetes was peace time location for most soldiers. Diabetes continues to impact on the economy because of cost implication and impact on productivity of soldiers both in the war front and at peace time location (Duarte et al., 2003).

The study also found out that the average cost of medication per month was between Kes 1,000 and 5,000 for most soldiers. It was also established that the frequency in which the most soldiers visited the hospital to see the doctor was three months. Estimates for the Africa Region indicate
that at least USD 2.8 billion was spent on healthcare due to diabetes in 2011 (Flinders, Alexander & Patel, 2013).

Table 4.1: Average Cost of Medication per Month

<table>
<thead>
<tr>
<th>Average Cost</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000-5000</td>
<td>52</td>
<td>63.41</td>
</tr>
<tr>
<td>5001-10000</td>
<td>8</td>
<td>9.76</td>
</tr>
<tr>
<td>10001-15000</td>
<td>14</td>
<td>17.07</td>
</tr>
<tr>
<td>More than 15001</td>
<td>8</td>
<td>9.76</td>
</tr>
</tbody>
</table>

Military Personnel Base Diet

Regarding comparison of military personnel base diet and the diet provided during field deployment at the barracks, the study established that eggs, sausages, bread, tea, coffee were taken for breakfast, while lunch consisted of potato, beans, meat cabbage, and rice. However, there was no dinner being served. Changes in diet related to rapid development and urbanization have led to sharp increases in the numbers of people developing diabetes (Rashid et al., 2013).

During field deployment, the study established that biscuits were for breakfast, potato, beans/canned meat, meat cabbage, rice and biscuits were for lunch and potato, beans/canned meat, meat cabbage, rice and biscuits were for dinner. Patients with type I diabetes will need to take insulin injections for the rest of their life. They also must ensure that proper blood-glucose levels are attained by carrying out regular blood tests and following a special diet (Yong et al., 2014).

In this connection, the study established that majority of the soldiers had been deployed to a mission/conflict/war zone. When in mission/conflict/war zone, the established that at breakfast, sausages, eggs, milk, coffee, tea and bread were served. At lunch canned meat/beans, spaghetti, rice and Ugali were served. At dinner, canned meat/beans, spaghetti, rice and Ugali were served. The study further established that a plate model with the bulk being vegetables was preferred by most soldiers. Chesla, Chun and Kwan (2009) established that soldiers on extended patrol or performing certain hazardous duties might not have access to food on the regular intervals most conducive to control of blood-glucose levels thus exacerbating their situation.

Contribution of Consumption of Alcohol and Cigarette Smoking

The study further established that most soldiers did not smoke. Also, it was established that most soldiers were taking alcohol. The study established further that most of the soldiers took 4 bottles a day. Smoking and alcohol intake are well-established risk factors for many chronic diseases, including diabetes and its complications. As well as other harmful effects, smoking and alcohol intake increases abdominal fat accumulation and insulin resistance. All drug users should be encouraged to quit the behavior (Haregot et al., 2013).

Conclusion

This study concludes that the soldiers were involved in physical activities like a morning run, mountain climbing, weight lifting, judo and seat ups. The soldiers were involved in exercises more than three times per week which decreases their likelihood of having obesity-induced diabetes. The study further concludes that the soldiers were not regularly exercising after being
diagnosed with diabetes. This puts them in a vulnerable position for developing diabetes complications. The study also concludes that the lack of exercise for the soldiers when in field deployment increases their vulnerability and prevalence of diabetes type II.

With regard to financial implication, the study concludes that given that at the time of the interview most of the soldiers were under treatment or medication, the costs of treatment was a burden to them. The study also found out that the average cost of medication per month was between Kes 1,000 and 5,000 for most soldiers. It is therefore concluded that diabetes continues to impact on the economy because of cost implication and impact on productivity of soldiers both in the war front and at peace time location.

In connection to military personnel base diet, the study concludes that the diet provided during field deployment at the barracks, which included eggs, sausages, bread, tea, coffee for breakfast, potato, beans, meat cabbage, and rice for lunch was good for diabetes patients in the barracks.

Further, the study established that most soldiers were taking alcohol. Most of the soldiers took 4 bottles a day. The study therefore concludes that the high alcohol intake exacerbates the situation for diabetes type II patients.

**Recommendations**

The study established that most soldiers exercised in the barracks but were not exercising in the field deployment. This study therefore recommends that the barrack should come up with measures that will ensure that exercises are being undertaken in the field. This will reduce the probability of patients developing complications due to excess body weight.

The study found out that the average cost of medication per month was between Kes 1,000 and 5,000 for most so. It is therefore recommended that the Ministry of Health in conjunction with the Ministry of defense aligns the cost of treatment in accordance with their monthly pay. This will ensure that they afford the treatment without having to forego some of their financial conveniences.

The study established that at the barrack, breakfast and lunch were served with the exception of dinner. This is not ideal for diabetes patients who need to have a balanced to boost their fight against the disease. This study recommends that the management at the barrack offers dinner to the soldiers with special diet for those with diabetes. This will help them recover and fight the disease.

The study established that most soldiers were taking alcohol. Smoking and alcohol intake are well-established risk factors for many chronic diseases, including diabetes and its complications. This study recommends that alcohol intake regulated in the barracks especially for those diagnosed with diabetes. In addition, the management at the barracks should also extend their help to those who would like to curb alcohol addiction by establishing free counseling services.

**5.5 Areas for Further Research**

This study was carried out at the medical diabetic clinic at DFMH. It covered adults both male and female members of the Kenya Defense forces that are currently cases of diabetes attending
diabetes clinic at DFMH. This study therefore recommends that further studies should be conducted in broader perceptive which will include other security forces such as the navy and the air force bases. This will help in making more generalized conclusions that can form the basis of a change implementation in such institutions.

References


