"A CROSS SECTIONAL STUDY OF PREVALENCE OF DIABETES MELLITUS AMONG ARMY PERSONNEL IN BELGAUM CANTONMENT"

By

Maj (Dr). MADHUSUDHANA M.V.

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K.L.E. University, Karnataka, Belgaum

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In

COMMUNITY MEDICINE

Guide

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DECLARATION BY THE CANDIDATE

I hereby declare that this dissertation entitled **" A CROSS SECTIONAL STUDY OF PREVALENCE OF DIABETES MELLITUS AMONG ARMY PERSONNEL IN BELGAUM CANTONMENT"** *is a bonafide and genuine research work carried out by me under the guidance of* **Dr. A.S. WANTAMUTTE** **MD, (BHU),** *Professor and Head, Department of Community Medicine, Jawaharlal Nehru Medical College, Nehru Nagar, Belgaum-590010.*

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LIST OF ABBREVIATIONS USED

BMI	-	Body Mass Index
DM	-	Diabetes Mellitus
DBP	-	Diastolic Blood Pressure
FBS	-	Fasting Blood Sugar
GDM	-	Gestational Diabetes Mellitus
IDDM	-	Insulin Dependent Diabetes Mellitus
IFG	-	Impaired Fasting Glucose
IGT	-	Impaired Glucose Tolerance
JCO	-	Junior Commissioned Officers
NIDDM	-	Non Insulin Dependent Diabetes Mellitus
OGTT	-	Oral Glucose Tolerance Test
OR	-	Other Ranks
PPBS	-	Post Prandial Blood Sugar
SBP	-	Systolic Blood Pressure
SES	-	Socio Economic Status
WHO	-	World Health Organisation
WHR	-	Waist Hip Ratio

ABSTRACT

Background:

Diabetes is rapidly emerging as a major public health problem in India; and India has the maximum number of diabetics in the world. Diabetes assumes special importance in context of Indian army, where Diabetes is one of the leading causes of hospital admission, disability and invalidment from service. The present study was undertaken to find out the prevalence of Diabetes Mellitus among Army personnel in Belgaum Cantonment. No study of this kind has been carried out in this place, so far.

Objectives:

The objectives of the present study were to find out the prevalence of Diabetes Mellitus and its distribution and determinants amongst the armed force personnel in Belgaum Cantonment.

Methodology:

A one year cross sectional study with a sample size of 600 participants, carried out by a structured interview using questionnaire, physical examination, anthropometry, and fasting blood sugar estimation.

Results:

The overall prevalence of Diabetes Mellitus among army personnel in Belgaum Cantonment was 6.67%. Out of 40 diabetics identified, 17(42.5%) of them were newly detected cases of diabetes.

The various risk factors found to be significantly associated with Diabetes in the present study are increasing age, higher army ranks and higher educational status, lack of physical exercise, alcohol intake, increased Body Mass Index (BMI), increased Waist Hip Ratio (WHR), extra fat intake in the diet, long duration of field service and prolonged mental stress. Diabetes was also positively associated with Hypertension and family history of Diabetes.

Interpretation and Conclusion:

To conclude, we observed a modest prevalence of Diabetes Mellitus i.e. 6.67% amongst army personnel in Belgaum Cantonment. Urgent actions need to be taken to prevent Diabetes becoming a major health problem in this organization.

Key words:

Prevalence; Diabetes Mellitus; Army Personnel; Belgaum Cantonment.

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INTRODUCTION

Diabetes is one of the most pervasive and worsening health problems facing the world today. Diabetes mellitus is a major health problem in all nations, and the disease afflicts a broad swath of people, young and old.

Diabetes is not new to the medical world as it is known since antiquity (1500 BC), but now with its epidemic claws, diabetes has become a major health threat to the whole world. This medical disorder is characterized by hyperglycemia and impaired metabolism of carbohydrates, fat and proteins and accompanied by absolute or relative insulin deficiency. Diabetes has diverse geographical distribution. The highest incidences have been reported from India, China, and the USA.[1]

Diabetes is the single, most important metabolic disease widely recognised as one of the leading causes of death and disability worldwide.[2] A recent WHO estimate shows 180 million people worldwide have diabetes. This number is likely to double by 2030, and hence Diabetes has been titled The 'Epidemic of New Millennium'.[3]

Diabetes is a devastating disease as it can affect nearly every organ and system in the body. It can cause blindness, lead to end stage renal disease, and increases the risk for stroke, ischemic heart disease, peripheral vascular disease, and neuropathy.[4] The diabetes epidemic is accelerating in the developing world, with an increasing proportion of affected people in younger age groups. Recent reports describe type 2 diabetes being diagnosed in children and adolescents.[5] This is likely to increase further the burden of chronic diabetic complications worldwide.

Diabetes incurs substantial cost to society and its citizens in terms of medical expenditure and loss of productivity resulting from diabetes related morbidity and premature mortality. People with diabetes require at least 2-3 times more health care

resources than the people who do not have diabetes. In developed countries Diabetes care accounts for up to 15% of national healthcare budget. [6]

Diabetes in India

Diabetes is rapidly emerging as a major public health problem in India. As the Prevalence of diabetes has increased globally, now India has the maximum number of diabetics in the world and hence India has a distinction of being called, "the diabetic capital of the world".[7]

An estimation done in 2004 shows that, India has over 30 million individuals who were affected by this disease which is likely to go up to 57.2 million by the year 2025.[8] Type 2 diabetes mellitus is the commonest form of diabetes in India and recent studies shows that the prevalence of type 2 diabetes mellitus is 2.4% in rural population and 11.6% in urban population.[9]

The increase in prevalence is due to rapid urbanization, changes in lifestyles and genetic predisposition. The fact remains that the incidence of diabetes can be reduced by adopting healthy Lifestyle. [10]

Diabetes in Indian army

Diabetes assumes special importance in context of Indian army, where Diabetes along with Hypertension is the leading cause of disability, hospital stay and invalidment from service.[11]

The armed forces personnel are a good representative sample from the whole country as the armed forces forms one of the largest groups, employing personnel of different caste and creed of people from the length and breadth of our country and they form a distinct group, as majority of them are young, predominantly males and are subjected to severe stress, strain and extremes of climate. The implications of developing a chronic disorder with such far reaching consequences for a person

serving in an establishment where fitness takes priority over every thing else is worth considering.

Very few studies are available in the community setting of Indian army, which have assessed the prevalence of diabetes mellitus. In community based studies undertaken amongst armed force personnel, Varma et al[12] at Delhi and Mumbai cantonment and Datta[13] at Lucknow cantonment observed a prevalence of 2.19% and 1.5% respectively.

No other recent study on prevalence of diabetes mellitus among armed force personnel (apart from the above mentioned studies) could be traced despite search on Medline or Pubmed and extensive literature search. Even these studies were not conducted specifically on diabetes mellitus but were undertaken on other risk factors in general, and covering diabetes mellitus as a part there of. Hence there is a need to enquire in to the prevalence, distribution and determinants of diabetes mellitus in the community setting of Indian Army.

It was against this background the present study has been undertaken to know the prevalence of diabetes mellitus and its distribution and determinants amongst the armed force personnel in Belgaum Cantonment.

OBJECTIVES

1. To Study the prevalence of Diabetes Mellitus amongst Army personnel in Belgaum Cantonment.

2. To study the distribution and determinants of the disease among the Army personnel.

3. To recommend the measures to be undertaken.

REVIEW OF LITERATURE

Diabetes is a chronic disease that occurs when the pancreas does not produce enough insulin or alternatively, when the body cannot effectively use the insulin it produces. Insulin is a hormone that regulates blood sugar. Hyperglycemia, or raised blood sugar is a common effect of uncontrolled diabetes and over the time leads to serious damage to many of the body's systems, especially the nerves and blood vessels.

As diabetes is a risk factor for many diseases, there are many risk factors for diabetes itself. Some of them being non modifiable but a large number of them being easily modifiable by appropriate interventions and lifestyle modifications.

Diabetes has become a global scare especially in the countries like India, China and the US that prompted the UN General Assembly in Dec 2006, to pass a landmark resolution recognising diabetes as a chronic, debilitating and costly disease. The blue circle was recently adopted as the symbol for Diabetes.[14]

Diabetes can now be found in almost every population in the world and epidemiological evidence suggest that, without effective preventive and control measures, diabetes 'the lifestyle disease' will continue to increase globally.[15]

History of Diabetes

Diabetes is not a new disease it has been with the mankind for ages. The disease Diabetes Mellitus was first described in an Egyptian papyrus, discovered by Ebers in the tomb of Thebes in Egypt in 1862, which is said to have been written between 3000 and 1500 BC.[16]

Ancient Hindu writings, many thousands of years old, document how black ants and flies were attracted to the urine of diabetics. The Indian physician Sushruta in 400 B.C. described the sweet taste of urine from affected individuals, and for many centuries to come, the sweet taste of urine was the key to diagnosis.[17]

Around 250 B.C. the name "Diabetes" was first used. It is a Greek word that means "To Siphon" reflecting rapid drain of fluids from the affected individual. The Greek physician Aretaeus noted that as affected individuals wasted away, they passed increasing amounts of urine as if there was "liquefaction of flesh and bones into urine". The complete term "Diabetes mellitus" was coined in 1674 by Thomas Willis, personal physician to King Charles II. Mellitus is Latin for honey, which is how Willis described the urine of diabetics (as if imbued with honey and sugar).

Until the mid-1800s, the treatments offered for Diabetes varied tremendously. Various "fad" diets were prescribed, and the use of opium was suggested, also there were bleeding and other therapies. In 1870, a French physician had discovered a link between Diabetes and diet intake and an idea to formulate individual diet plan came into picture. In 1900-1915 Diabetic diet was formulated with inclusion of milk, oats and other fibre containing foods.

In 1923, Dr. Banting, Prof. Macleod and Dr. Collip, discovered insulin and were awarded the Nobel Prize for their discovery. In the year 1940, it was discovered that different organs like kidney and skin are also affected if diabetes is creeping for a long term. One more major turn in this research came in the year 1955, when the oral hypoglycemic drugs were manufactured.

Definition and classification

The term Diabetes mellitus describes a metabolic disorder of multiple aetiology characterized by chronic hyperglycaemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action, or both.[11]

Diagnosis of Diabetes

1. Symptoms of Diabetes, i.e. polydypsia, polyuria and polyphagia plus random blood glucose concentration ≥11.1 mmol/L (≥200 mg/dL), (Random is defined as without regard to time since the last meal).[18]

2. Fasting plasma glucose ≥7.0 mmol/L (≥126 mg/dL), (Fasting is defined as no caloric intake for at least 8 hours).[18]

3. Two-hour plasma glucose ≥11.1 mmol/L (≥200 mg/dL) during an oral glucose tolerance test, (The test should be performed using a glucose load containing the equivalent of 75 g anhydrous glucose dissolved in water; not recommended for routine clinical use). [18]

For population based studies of glucose intolerance and Diabetes, individuals have been classified by their blood glucose concentration measured after an overnight fast and /or 2 hour after a 75 g oral glucose load. Since it may be difficult to be sure of the fasting state, and because of the strong correlation between fasting and 2–hour values, OGTT is most preferred method for diagnosis of diabetes, however if it is not possible to perform the OGTT (e.g. for logistical or economic reasons), the fasting plasma glucose alone may be used for epidemiological purposes.[19]

Classification of Diabetes Mellitus

I. Type 1 Diabetes

Type 1 diabetes results from pancreatic β-cell destruction usually leading to absolute insulin deficiency.

A. Immune-mediated

B. Idiopathic

II. Type 2 Diabetes

Type 2 Diabetes is characterised by predominantly insulin resistance with relative insulin deficiency to a predominantly insulin secretory defect with insulin resistance. Type 2 Diabetes constitutes about 85% to 95% of all diabetes in developed countries and accounts for an even higher percentage in developing countries.[20]

III. Other specific types of Diabetes

A. Genetic defects of cell function characterized by mutations in:

1. Hepatocyte nuclear transcription factor (HNF) 4- Maturity Onset Diabetes mellitus of Young – 1 (MODY-1)
2. Glycosidase (MODY 2)
3. HNF-1 (MODY 3)
4. Insulin promoter factor-1 (IPF-1; MODY 4)
5. HNF-1 (MODY 5)
6. NeuroD1 (MODY 6)
7. Mitochondrial DNA
8. Pro-insulin or insulin conversion

B. Genetic defects in insulin action

1. Type A insulin resistance
2. Leprechaunism

3. Rabson-Mendenhall syndrome

4. Lipodystrophy syndromes

C. Diseases of the exocrine pancreas - pancreatitis, pancreatectomy, neoplasia, cysticfibrosis, hemochromatosis, fibrocalculous pancreatopathy, mutations in carboxyl ester lipase.

D. Endocrinopathies - acromegaly, cushing's syndrome, glucagonoma, pheochromocytoma, hyperthyroidism, somatostatinoma, aldosteronoma

E. Drug or chemical induced - vacor, pentamidine, nicotinic acid, glucocorticoids, thyroid hormone, diazoxide, adrenergic agonists, thiazides, phenytoin, interferon, protease inhibitors, clozapine

F. Infections - congenital rubella, cytomegalovirus, coxsackievirus.

G. Other genetic syndromes sometimes associated with diabetes—Down's syndrome, Klinefelter's syndrome, Turner's syndrome, Laurence-Moon-Biedl syndrome.[20]

IV. Gestational diabetes mellitus (GDM)

Insulin resistance can occur due to metabolic changes of late pregnancy and the increased insulin requirements may lead to impaired glucose tolerance (IGT). Gestational diabetes mellitus occurs in approximately 4% of pregnancies; most women revert to normal glucose tolerance post-partum, but have a substantial risk (30–60%) of developing Diabetes Mellitus later in life.[20]

Magnitude of the problem

Global situation:

The World Health Organization (WHO) estimates that more than 180 million people worldwide have Diabetes. This number is likely to be more than double by 2030. In the year 2005, an estimated 1.1 million people died from Diabetes.

About 80% of Diabetes deaths occur in low and middle-income countries. Almost half of Diabetes deaths occur in people under the age of 70 years; 55% of Diabetes deaths are in women.

WHO projects that Diabetes death will increase by more than 50% in the next 10 years without urgent action. Most notably, Diabetes deaths are projected to increase by over 80% in upper-middle income countries between 2006 and 2015.[21]

Following is the list of countries with highest numbers of estimated cases of Diabetes for 2000 and 2030.[22]

Ranking	**2000**		**2030**	
	Country	**People with Diabetes (millions)**	**Country**	**People with Diabetes (millions)**
1.	India	31.7	India	79.4
2.	China	20.8	China	42.3
3.	U.S.	17.7	U.S.	30.3
4.	Indonesia	8.4	Indonesia	21.3
5.	Japan	6.8	Japan	8.9
6.	Pakistan	5.2	Pakistan	13.9
7.	Russian federation	4.6	Bangladesh	11.1
8.	Brazil	4.6	Brazil	11.3
9.	Italy	4.3	Philippines	7.8
10.	Bangladesh	3.2	Egypt	6.7

Situation in India:

The prevalence of Diabetes is rising rapidly in India. Since 1971 to 2000, a ten fold increase is observed. The increase in prevalence is more in urban area than the rural areas.[23]

India leads the world with largest number of diabetic subjects earning the distinction of being termed as the "Diabetes capital of the world". According to the Diabetes Atlas 2006 published by the International Diabetes Federation, the number of people with diabetes in India currently is around 40.9 million, which is likely to reach 69.9 million by 2025 unless urgent preventive steps are taken.[23]

Various studies conducted from 1971 to 2001 in India by different authors have shown that there is a steady increase in the prevalence of Diabetes mellitus from 2.3% to 10%.[23]

The reasons for this escalation of Diabetes is the rapid epidemiological transition associated with changes in life style such as dietary patterns and decreased physical activity as evident from the higher prevalence of diabetes in the urban population and partly due to genetic factors. [23]

Early identification of at-risk individuals using simple screening tools like the Indian Diabetes Risk Score (IDRS) and appropriate lifestyle intervention would greatly help in preventing or postponing the onset of Diabetes and thus reducing the burden on the community and the nation as a whole.[24]

Situation in Indian armed forces:

The armed force of India is a mixed population comprising of people of different genetic backgrounds from different parts of the country and with widely differing socio-economic backgrounds. The study of Diabetes mellitus, a metabolic disorder known for its varied spectrum of presentation, in a community representing a good cross section of people from the length and breadth of our country should therefore make it interesting. Besides, the implications of developing a chronic

disorder with such far reaching consequences for a person serving in an establishment where fitness takes priority over every thing else is also worth considering.

Though the armed forces personnel are a good representative sample from the whole country there are considerable differences compared to a general population sample. They are much younger, generally healthier, better nourished, and their physical fitness is of the top order. They are all males except an insignificant number of medical and paramedical personnel who are females.

There are considerable socioeconomic and cultural differences between the officer class on one hand and the junior commissioned officers (JCOs) and other ranks (ORs) on the other. The former tend to lead a more sedentary and affluent life style.[25]

Indian army gives top priority to the maintenance of highest level of health among its personnel. Their pattern of living is different from others. They are generally moderate to heavy workers and are subjected to different grades of physical and psychological stress at work and at home and extremes of climate and long duration of family separation. It is therefore Diabetes is now identified as an important health problem in the organization.

Data from annual health report of the armed forces indicate that Diabetes is an important cause of morbidity next to injuries and coronary heart diseases. Also the incidence of Diabetes and admissions rates due to Diabetes is increasing significantly in the past 10 years. Diabetes is seen in all ranks in the army but its incidence is more amongst officers who occupy higher socioeconomic status in the army.[11] Because of the silent course of the disease, a large number of cases are likely to be hidden and are undetected in the community. Only few studies are available in this field and even

these studies are conducted long back and are not entirely focused on the prevalence and the risk factor for the disease.

A study conducted by Varma et al[12] amongst 1659 armed forces and naval personnel in Mumbai and new Delhi found a prevalence of 10.2%, 8.6% and 0.5% among officers, JCOs / CPOs and sailors respectively. Overall prevalence rate was 1.5%. In this study prevalence of Diabetes was significantly high among officers, skilled personnel, obese and among those who had family history of diabetes. Age, diet, alcohol use and hypertension were also positively associated with the disease.

Datta and Prasad[13] observed the prevalence of 2.18% in their study undertaken amongst 1697 Army personnel at Lucknow cantonment. In their study the prevalence of diabetes was significantly associated with higher ranks, age and length of service, educational status and type of occupation. Family history, stress factors and dietary factors were also significantly associated.

Diabetes as a risk factor for other diseases:

Diabetes is a devastating disease as it can affect nearly every organ and system in the body. Generally, the injurious effects of hyperglycemia are classified into "Microvascular" complications (Diabetic nephropathy, neuropathy, and retinopathy) and "Macrovascular" complications (coronary artery disease, peripheral arterial disease, and stroke).

Microvascular Complications of Diabetes:

Diabetic retinopathy is the most common microvascular complication of Diabetes. According to the U.K. Prospective Diabetes Study (UKPDS), development of Diabetic retinopathy in patients with type 2 Diabetes was found to be related to the severity of Diabetes and the presence of hypertension. Most of the patients with type 1 Diabetes develop evidence of retinopathy within 20 years of diagnosis. Retinopathy

may begin to develop as early as 7 years before the diagnosis of Diabetes in patients with type-2 Diabetes.[26]

Diabetic nephropathy is the leading cause of renal failure in developed countries. It is defined as proteinuria of more than 500 mg in 24 hours. Usually it begins with lower degrees of proteinuria or 'microalbuminuria'. without intervention, Diabetic patients with microalbuminuria typically progress to proteinuria and overt Diabetic nephropathy.[26]

Diabetic neuropathy is an important complication of Diabetes. It is defined as the presence of symptoms and /or signs of peripheral nerve dysfunction in people with Diabetes after the exclusion of other causes. More than 80% of amputations done for foot ulceration or injury leading to gangrene are due to Diabetic neuropathy.[27]

Macrovascular Complications of Diabetes:

Among macrovascular Diabetes complications, coronary heart disease and stroke are the most important. The central pathological mechanism is the process of atherosclerosis, which leads to narrowing of arterial walls throughout the body and increased platelet adhesion and hypercoagulability in type 2 Diabetes. The Framingham study has shown that Diabetes increases the risk of cardiovascular disease (CVD) and, the risk of myocardial infarction (MI) in people with Diabetes.[28]

Diabetes is also a strong independent predictor of risk for stroke and cerebrovascular disease. As in coronary artery disease, Patients with type 2 Diabetes have a much higher risk of stroke, which is increased up to 150-400%. The risk of stroke-related dementia, as well as stroke-related mortality is elevated in patients with Diabetes.[29]

Risk factors for Diabetes:

As diabetes is the major risk factor for many diseases, a number of risk factors are responsible for Diabetes itself. Some of them are modifiable with adopting healthy lifestyles and some are non modifiable risk factors.

Age:

Age is independent risk factors for the development of diabetes. Numerous epidemiological studies have clearly demonstrated a positive relationship between Diabetes and increasing age.

Sex:

Various epidemiological studies have demonstrated that there is very little difference between sexes and the occurrence of Diabetes.

Ethnicity:

Being of Aboriginal, African, Latin American or Asian ethnic ancestry increases the risk of developing of type 2 Diabetes. Risk levels for these groups are between two and six times higher than for Canadians of Caucasian origin.

Pre-diabetes:

Pre-diabetes is a condition in which blood sugar level is higher than normal, but not high enough to be classified as type 2 Diabetes (Fasting glucose level ≥ 100 mg/dl and <126 mg/dl or by OGTT ≥ 140 mg/dl and < 200mg/dl). If left untreated, pre-diabetes often progresses to type 2 diabetes.[30]

Obesity:

An excessive body weight increases Diabetes risk. The Body Mass Index (BMI) is a simple, widely accepted means of assessing body weight in relation to health for most people aged 20 to 65 years (Exceptions include people who are very

muscular, athletes, pregnant or nursing.) A BMI greater than 25 indicates a risk for developing type 2 Diabetes, and other health problems which include cardiovascular disease, and premature death.

Waist-hip ratio:

Individuals who carry most of their weight in the trunk of their bodies (i.e. above the hips), Apple shaped figure tend to have a higher risk of Diabetes than those of similar weight with a pear-shaped body (excess fat carried mainly in the hips and thighs). A waist – hip ratio of more than 0.9 in men and 1.0 in women suggests an increased risk.

Sedentary lifestyle:

Decreased physical activity is an important risk factor for Type 2 Diabetes mellitus which can be prevented by regular physical activity. Physical activity also improves blood sugar control in persons who already have type 2 Diabetes.

Genetic factors:

Diabetes Mellitus has a strong genetic component. The genetic link for type 2 Diabetes is stronger than for type 1 Diabetes. The occurrence of type 2 Diabetes in identical twins is around 70 to 90%. Individuals with a parent with type 2 Diabetes mellitus have an increased risk of Diabetes; if both parents have type 2 Diabetes, the risk is even higher.[20]

History of Diabetes in Pregnancy:

Nearly 40 percent of the women who have diabetes during their pregnancy go on to develop type 2 Diabetes later, usually within five to ten years of giving birth. Giving birth to a baby that weighs more than nine pounds (4 kg) is another symptom of gestational diabetes. Babies born with weight more than 4 kg are also at risk of developing Diabetes in future.[20]

High Cholesterol or other fats in the Diet:

Diabetes is more commonly seen in those who are in regular habit of consuming food items containing high amount of saturated fatty acids and cholesterol in excess of normal diet. This is also associated with an increased risk of cardiovascular disease among persons with Diabetes.

Diabetes and Metabolic Syndrome:

Metabolic syndrome is an important risk factor for the development of Diabetes mellitus. People who suffer from metabolic syndrome are at a much greater risk of developing type 2 Diabetes as well as other diseases. Metabolic syndrome is an increasingly common phenomenon throughout the world. It occurs when a range of metabolic risk factors come together in a single person. These risk factors generally include: Obesity, Insulin resistance or intolerance to glucose, Pro-inflammatory state Prothrombotic state, Atherogenic Dyslipidemia, and High blood pressure.[31]

polycystic ovary disease (PCOD):

Women with history of polycystic ovary disease (PCOD) are at increased risk of developing Diabetes.[20]

Hypertension:

A close association between hypertension and insulin related abnormalities have been reported from various studies. over past three decades, many obese as well as non obese hypertensives have hyperinsulinemia even if they are not overt Diabetics. Hyperinsulinemia increases blood pressure possibly by enhancing renal sodium and water absorption and by stimulation of sympathetic nervous system.[32]

Smoking:

A study conducted by Kristi et al on effect of Smoking and Cardiometabolic Risk Factors among Youth with Diabetes mellitus. They found a cause and effect association between smoking and Diabetes. Current smokers had longer Diabetes duration, lower HDL cholesterol, and higher mean % hbA1c (glycosylated haemoglobin), systolic and diastolic blood pressures, and triglycerides than past smokers or non-smokers.[33]

Alcohol:

Various studies have noted a positive association between alcohol and diabetes. There seems to be a dose and duration relationship between alcohol and Diabetes. Probably alcohol in the long term destroys the pancreatic beta cells and predisposes a person for Diabetes by decreasing the production of hormone insulin. The North Indian Diabetes Study which was launched to investigate the relative contributions of the risk factors to the susceptibility to Type 2 DM among the Punjabi population in North India, found that alcohol intake was significantly higher and physical activity was significantly lower in diabetic subjects than in the controls.[34]

Thrifty genes:

The concept of Thrifty genes has been postulated by Neel. Genes that are metabolically thrifty give a survival advantage in times when there is a constant threat of famine and starvation. When food is abundant, these genes aid the efficient metabolism of the food, enabling rapid build up of fat stores. But when food is always abundant, a thrifty genetic makeup turns into a survival disadvantage. Thrifty genes cause obesity, which in turn predisposes to diabetes.[35]

A nation wide Diabetes prevalence survey was conducted in India covering all the regions of the country. The results of this national study revealed that the overall prevalence of Diabetes among adults was 12.15%; the prevalence among males was 12.5%, and among females 11.9%. The study also found that age, BMI, family history of Diabetes, monthly income and sedentary lifestyle were positively associated with the Diabetes mellitus.[36]

An urban population in a township of kudremukh, chikmagalur district, in south India, was screened for Diabetes mellitus. The population selected was those who were registered at the local iron ore company's hospital. The results showed that 5% had Diabetes mellitus among both men and women. Diabetes was present in 21% of people aged 40 years and above. The peak prevalence was 41%, seen in the age group of 55-64 years. Diabetes was related to obesity in women. The prevalence of Diabetes was significantly high in those subjects who had higher income.[37]

A cross sectional population survey was undertaken to determine the prevalence of Diabetes in subjects aged 40 years and above, in Kashmir valley, India. The standard WHO criteria were used to diagnose Diabetes mellitus. The study revealed that the overall prevalence of Diabetes mellitus in both sexes was 6.14%.

Increasing age positive family history of diabetes mellitus, obesity, female sex were associated with Diabetes mellitus.[38]

A house to house survey for patients with known Diabetes was carried out in defined area of south hall, west London where significant proportions of Asians live. The results showed that the prevalence of Diabetes mellitus among Asians was 6.4% where as for Europeans it was 1.2%, thus the survey revealed that the Asians had high prevalence of Diabetes, as compared to Europeans.[39]

Another house to house survey conducted at Darya ganj, an affluent suburb of New Delhi, showed that the overall prevalence of Diabetes among the study population was 3.1%; of them 3.8% were males and 2.3% were females. Higher income groups, family history of Diabetes, and obesity were significantly associated with Diabetes.[40]

A study conducted in Jaipur, western India to determine the prevalence of Diabetes mellitus among adults using standard criteria. The results showed that the prevalence of Diabetes mellitus was 9.3% among men and 11.5% among women, and the overall prevalence of Diabetes was 10.4%. The study showed that, Diabetes was significantly associated with obesity, sedentary lifestyle and hypertension.[41]

An epidemiological survey of Diabetes was conducted in Chennai, south India, to know the prevalence of Diabetes mellitus in relation to various factors. The study revealed that the overall prevalence of Diabetes was 12%. The prevalence of Diabetes mellitus and glucose intolerance was high among those subjects who had family history of Diabetes as compared to those who did not have the family history. Also physical inactivity and high socioeconomic status were significantly associated with high prevalence of Diabetes mellitus.[42]

An ethnic group sample survey was conducted among Bhatia community in Jaipur to find out the prevalence of risk factors for Diabetes and coronary heart disease. They found that the prevalence of Diabetes mellitus was 17.7% among males and 14.2 % among females. They also found that obesity was significantly associated with Diabetes.[43]

A study conducted among the South African Indians residing in Durban, to know the prevalence of Diabetes mellitus. The results showed that the prevalence of diabetes mellitus was 7.6% among men and 13.5% among women. The overall prevalence of Diabetes mellitus was 11%.[44]

Another study conducted in Greece with the aim of determining the prevalence of Diabetes mellitus and to identify associated risk factors in sample of adult population using standard criteria. The results revealed that the overall prevalence of Diabetes was 8.7%. Increasing age, male sex, overweight and obesity, family history of diabetes and hypertension were found to be independent risk factors for Diabetes mellitus. Lower educational status, among women was found independently associated with increased risk for Diabetes.[45]

A study conducted in the United States to estimate the prevalence of diabetes mellitus among three American Indian populations aged 45 to 74 years. The results revealed that Arizona had the highest prevalence of age adjusted rates for diabetes: 65% in men and 72%in women. Diabetes rates in Oklahoma were 38% in men and 42% in women, and in south and North Dakota the prevalence rate was 33%in men and 40% in women. Diabetes rates in all the population was positively associated with increasing age, level of obesity and parental Diabetes mellitus.[46]

An epidemiological study carried out in Spain to investigate the prevalence of Diabetes mellitus and the associated risk factors. The results showed that the

prevalence of Diabetes mellitus was 7.1% among men and 5.6% among women. The Diabetes mellitus was positively associated with overweight, hypertension and other biochemical markers.[47]

An epidemiological survey conducted in Sindh province in Pakistan to study the prevalence of Diabetes mellitus, the results showed that the prevalence of diabetes mellitus was 16.2% in men and 17.2% among women. The prevalence rose to a peak of 30% and 21% among the subjects aged 65-74 years for men and women respectively. Obesity and family history of diabetes were strongly associated with Diabetes.[48]

The Turkish diabetes epidemiology study (TURDEP), a cross sectional population based study conducted to find out the prevalence of Diabetes mellitus nationwide. The results showed that prevalence of diabetes was 7.2%. The study also showed that the prevalence rate increased with age and BMI. Family history of Diabetes, and hypertension were significantly associated with diabetes.[49]

The Hoorn study conducted among the general Caucasian population in Amsterdam, found the prevalence of Diabetes as 8.3%. They found that the prevalence was more in those having higher waist hip ratio, and who were consuming alcohol > 30g / day, and those who were consuming excess of fat in their diet. The study also noted that maternal history of diabetes was twice as prevalent as paternal history. It was interesting to know that smoking has a negative association with Diabetes.[16]

A study conducted by Pan et al in china to find out the effects of diet and exercise in preventing NIDDM amongst people with impaired glucose tolerance, they found that the cumulative incidence of Diabetes at 6 years was significantly high in the control group compared with the study group.[50]

An epidemiological survey carried out among 318 male Police personnel of Chennai city to determine the prevalence of Diabetes and cardiovascular risk factors. They found that the Crude prevalence of Diabetes was 32.1% and Crude prevalence of hypertension as 29%. In this study obesity was significantly associated with diabetes.[51]

A study conducted in Kolkata amongst 2,160 Police personnel aged 20 to 60 years, observed the prevalence of the Diabetes around 12%. They found that High stress factor, long working hours and the fast lifestyle have contributed to prevalence of Diabetes. The study also showed that over 6% personnel suffer from fasting glycemia, a pre-diabetic state. These patients are at a high risk of developing Diabetes in near future. The study also revealed that over 40% police personnel have high blood pressure, and most of them are obese, which is an important risk factor for Diabetes.[52]

A follow-up was study conducted in Japan amongst 5,130 healthy men aged 30-49 years for the development of Diabetes mellitus. The study consisted of three worker-groups; clerical workers, manual workers, and policemen / firefighters. During mean follow-up periods of 8.4 years, 155 clerical workers, 51 manual workers, and 74 policemen / firefighters developed Diabetes Mellitus (Incidence was 5.9, 5.7, and 9.6 per 1,000 person-years, respectively). The study also noted that Policemen / firefighters have increased risk for Diabetes mellitus probably due to their large BMI.[53]

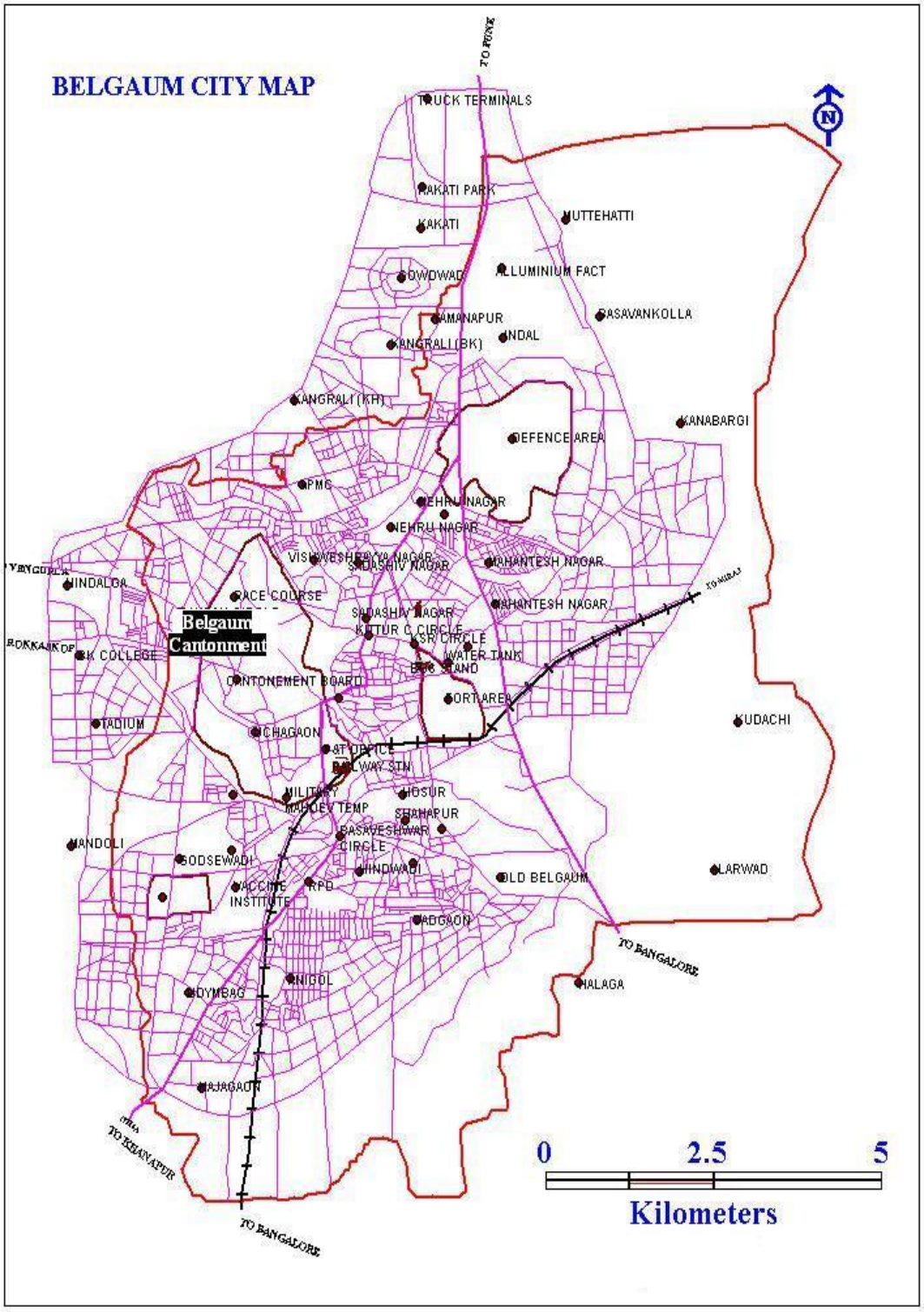


Figure 1: Map of Belgaum city showing the study area.

METHODOLOGY

Study Design:

The present study was a cross-sectional study undertaken to find out the prevalence of Diabetes mellitus and its association with various risk factors / determinants amongst army personnel. The study was undertaken in Belgaum Cantonment and the study period covered one year from January 2007 to December 2007.

Before starting the study, the Station Commander of the Belgaum Cantonment was contacted for obtaining the administrative sanction and to solicit the co-operation of the heads of various military units located in Belgaum Cantonment.

Sample size:

Sample size was calculated on the basis of guidelines described in "Sample determination in health studies".[55] Sample size (n) was calculated to be 1200 by using the formula $n=4pq/D^{2;}$ where D (allowed error) was taken as 5%. Since the Belgaum Cantonment has finite population of serving army personnel, the modified sample size (n') was calculated to be 582 (n'=n/1+n/N where n-calculated sample size i.e. 1200, N-actual population of serving personnel). An even larger sample of 600 was taken for the present study.

n = 1200, N=1125, D=5

n'=n/1+(n/N)

n'=1200/1+(1200/1125)

n’=1200/1+1.06

Sample size = 582

Sampling procedure:

A complete list of all serving army personnel was collected from all military units located in Belgaum Cantonment. A sample of 600 study participants was drawn from the list using random number tables. The required sample was selected from different categories (Officers, JCOs and Other ranks using stratified random sampling method). Recruits were excluded from the study.

Instruments used for data collection:

The instruments used in this study included Questionnaire, stadiometer, weighing machine, measuring tape, and sphygmomanometer. All the instruments and techniques were initially standardized during the pilot study. In addition, they were regularly standardized throughout the period of data collection.

Questionnaire:

A detailed questionnaire was prepared and was pretested and validated during the pilot study. It included the information on sociodemographic variables, physical examination and the laboratory examination findings.

Data collection procedure:

The data collection procedure consisted of personal interview, physical examination, anthropometry and fasting blood glucose estimation.

An informed written consent was obtained from all the participants before starting the data collection procedure.

Personal interview:

Study participants were interviewed using a pretested proforma. It was carried out with adequate privacy in a quite comfortable room. Before commencing the interview, initial rapport was established with the subject and was informed about the scope of the study. He was also assured that this information would be kept strictly confidential. After recording the data on various study variables the subject was thanked for his co-operation.

Physical examination:

It included measurement of height, weight, waist circumference, hip circumference and the blood pressure.

Laboratory Tests:

It included the fasting blood sugar estimation on venous blood sample.

Categorisation of subjects by Blood sugar levels:

The subjects were divided in to "Normoglycemics" or "Hyperglycemics" on the basis of their Blood sugar levels as per the latest WHO guidelines.[56]

Normoglycemics: Fasting Blood sugar levels ≤ 125mg/dl.

Hyperglycemics: Fasting Blood sugar levels ≥ 126mg/dl.

Categorisation of subjects by Blood pressure levels:

The subjects were categorised in to "Normotensives" or "Hypertensives" on the basis of their Blood pressure levels as per the latest definition criteria of WHO.[57]

Normotensives: systolic BP < 140 mm Hg and diastolic BP < 90 mm Hg.

Hypertensives: systolic BP ≥ 140 mm Hg and diastolic BP ≥ 90 mm Hg.

Definitions of study variables:

Age:

Subjects were asked about their actual age of birth and it was calculated in years and months. Age was recorded to the nearest completed year i.e. less than 6 months being rounded off to the previous year and 6 months and above being to the next year.

Socioeconomic status (Army ranks):

The military rank in Indian army greatly determines the income, privileges, standards of living, social status and administrative power and hence is a good measure of socioeconomic status. There are three categories of army ranks, "officers" (class 1, group A, gazetted central government officers), "junior commissioned officers" (JCOs) who are equivalent to group B civilian central government officers, and other ranks (ORs) who are equivalent to the group C and only few of them are equivalent to senior group D central government employees.

Occupational status:

There are two main categories of occupation in Indian army namely "Arms" which includes personnel who belong to fighting component of army (e.g. Infantry personnel), and "Services" which include personnel involved in supportive duties (e.g. Medical and Supply personnel).

Place / Region:

The subjects were asked about their place of nativity originally they belong to and were grouped in to four part of the country viz "North", "East", "West" and "South".

Educational status:

For the purpose of assessing the educational status, the subjects were asked about their educational qualifications and were grouped in to three categories namely secondary i.e. those who were educated up to 10^{th} standard, PUC / Diploma and graduate and post graduate level.

Religion:

The subjects religion were noted and were grouped in to different religion viz 'Hindu', 'Muslim', 'Sikh', 'Christian' and others.

Diet:

Subjects were asked about their food habits i.e. consumption of non vegetarian and / or vegetarian food in their diet. Interpretation was made as "vegetarian diet" and "mixed diet" (those who were consuming vegetarian and non vegetarian food).

Marital status:

For recording the marital status, four categories were made ‘Unmarried’, ‘Married’, ‘Divorced’ and ‘Widower’.

Alcohol consumption:

For assessment purpose, period of recall was kept as “past one year”. Subjects who had never consumed alcohol were kept in the category of “non drinkers” while those who had not consumed any alcoholic drinks during the past one year but used to consume alcohol earlier were kept as “ex drinkers”. Subjects were inquired in detail regarding their drinking habit, on an average, number of times they consume alcoholic drinks in one week, quantity (in terms of number of drinks) of alcohol consumed on the day of drink, type of alcoholic drinks consumed and the duration of alcohol consumption. For recording purpose quantity of alcoholic drink consumed was recorded in terms of large pegs (which is popular traditional term used in army and all personnel are familiar to pegs). In case of Beer, number of bottles was recorded. For computation purpose alcohol content was calculated on the basis of alcohol content of that particular drink (Rum, Whisky, Brandy etc as 42.8%). One large peg of Rum was taken as 60 ml and its alcohol content as 42.8%. One bottle of Beer was taken as 650 ml and its alcohol content as 5%. Therefore, for computing the alcohol content of one large peg of Rum = 42.8 × 60 /100 = 25.7ml of alcohol. Similarly one bottle of Beer would have an alcohol content of 5 × 650 / 100 = 32.5 ml of alcohol and it would be equal to 32.5/25.7=1.26 large pegs of Rum. The alcohol consumption in week was computed as: average number of large pegs per week (no. of large pegs usually consumed at the time of drinking multiplied by the no. of times the subject consumed

alcohol in a week). This procedure of assessing alcohol consumption was based on a large scale survey undertaken among army personnel (AFMRC report 1994).[58]

Assessment of extra fat intake:

For assessment of extra fat intake subjects were asked to give detail of items, meal wise that he usually eats in a day. Subjects were categorized in to two groups "no extra fat intake" and "extra fat intake". "No extra fat intake" group included those subjects who were not regularly consuming food items containing high fat content like butter, cheese etc and those who were not adding extra ghee, oil or butter to their dishes on dining table. "Extra fat intake" group included those subjects who were regularly consuming the food items having high fat content and / or were adding extra ghee, oil or butter to their dishes.[59]

Physical activity:

For assessing the physical activity undertaken by the subjects, the period of recall was kept as past one year. As recommended by WHO, the assessment was based on leisure time physical exercise i.e. out side the routine office duty hours.[57] This included morning physical training (PT), organized parade (drill), and evening games, which are part of the routine of army personnel. Subjects were asked about the details of the number of days that they usually undertook such physical exercise in a week and the time spent on such physical activity (in minutes). Details of any other forms of physical exercise undertaken over and above these activities like swimming, cycling, and weight lifting were also recorded.

Tobacco use:

For the purpose of assessing tobacco use, subjects were asked about their smoking habit and use of tobacco in forms other than smoking (smokeless tobacco) viz chewing, snuffing etc.

Tobacco smoking:

Subjects were asked regarding the details of their tobacco smoking habit like type of smoking (cigar, cigarette, beedi etc), number of days of smoking in a week, number of cigarettes or beedis, they usually smoked on the day of smoking and the duration of smoking etc. The period of recall was kept as "past one year". Subjects who had never smoked were kept in the category of "non smokers". While those who had not smoked in past one year but used to smoke earlier were kept in the category of "ex smokers". The average number of cigarettes (or equivalent) per day were computed as (no. of days of smoking in a week) × (no. of cigarettes or other form of tobacco smoked on the day of smoking) divided by seven. This procedure of assessing details of tobacco smoking was based on a survey undertaken among army personnel (AFMRC-report 1994).[58]

Smokeless tobacco use (viz tobacco chewing):

For the purpose of assessing use of smokeless tobacco, the period of recall was kept as "past one year". Subjects were asked about the details of their tobacco consumption habit in forms other than smoking viz tobacco chewing, gutkha, khainee, snuff etc. Subjects were also asked about the total duration of tobacco use in above forms. Subjects who had not used smokeless tobacco during past one year but used to

consume earlier were kept in the category of "ex tobacco users". While those who had never used tobacco were kept in the category of "non tobacco users".

Family history of diabetes:

For the purpose of assessing the family history, the subjects were asked whether a confirmed history of "Diabetes Mellitus" among their mother/father/real brothers/real sisters, is known to them. The information obtained was recorded as family history of diabetes 'Present' or 'Absent'.

Personal history of diabetes:

For assessment of already known cases of diabetes included in the study, subjects were asked whether they have been diagnosed as having diabetes earlier and was he taking any treatment for Diabetes. [60]

Assessment of psychosocial stress:

Assessment of psychosocial stress was based on the total duration of field service, high altitude / operational service and prolonged mental stress due to personal and / or family problems. The subjects were asked about the details of their posting places in their entire service. Mental stress due to personal and / or family problem was recorded as 'Present' or 'Absent'.

Measurement of Body Mass Index (BMI):

As recommended by the WHO, males with BMI values of less than 25 indicate "normal weight", 25 to 29.99 indicate "Overweight" and 30 and above indicate "Obese". [61] BMI = weight (in kg)/height (in meter) ^{2}

Height: Height was measured without footwear to the nearest millimeter using a standard calibrated height stand. The subject stood straight with heels, buttocks and back touching the vertical limb of the height stand, eyes looking straight ahead (visual axis horizontal, when the top of exterior auditory meatus levels with the inferior margin of the orbit), with a set square resting on the scalp and against the height stand.[61]

Weight: Body weight was measured without any footwear in shorts and vest to the nearest kilogram, using a standard portable weighing machine, which was standardized periodically during the study. Since, the physical examination was conducted in the morning, it was also ensured that, subjects had visited the toilet and had not taken breakfast. The scale was zeroed before each session and weight was recorded in kilogram.[61]

Measurement of waist hip ratio (WHR):

As recommended by WHO, waist hip ratio has been categorized as "Normal" when it is less than 0.9 and "high" when it is 0.9 and / or above.

Waist Hip Ratio= waist circumference/hip circumference

Measurement of waist and hip circumference was recorded to the nearest millimeter.[61]

Waist circumference:

It was measured on the unclothed abdomen, by asking the subject to stand in erect posture and placing the tape horizontally around the waist, with the upper border of tape touching the lower margin of the umbilicus. The subject was first asked to take

in normal inspiration and then to take normal expiration, the measurement of the waist was then noted.[61]

Hip circumference:

It was measured with the subject standing erect, both thighs and feet touching to each other and the tape was placed horizontally at the level of the greater trochanters.[7]

Blood pressure measurement:

Blood pressure was measured using mercury sphygmomanometer, first by palpatory method followed by auscultatory method. A standard cuff size 13×30 Cm was applied evenly to the exposed right upper arm of the study participants in sitting posture in a fully relaxed state. The cuff was inflated 30 mmHg above the level at which the pulse disappeared and then slowly deflated. The first perception of Korotkoff"s sound, while auscultating with stethoscope placed over the brachial artery was taken as 'Systolic blood pressure' and the complete disappearance of Korotkoff"s sound (Phase v) was taken as 'Diastolic blood pressure'. Two such readings were recorded with an interval of at least 3 minutes and the mean value was recorded.[61]

Fasting blood sugar estimation:

Blood sugar estimation was done on fasting venous blood sample. Since the blood sample was collected in the morning, it was ensured that the participant had not taken tea or coffee and eaten breakfast.

Pilot study:

Pilot study was conducted among 60 subjects (i.e. 10% of total sample size) who were selected randomly with a view to ascertain the prevalence of risk factors in the community under study. All the instruments and techniques were standardized and validated during pilot study so as to ensure high content criteria and validity.

The study was given ethics approval by the Jawaharlal Nehru Medical College Institutional Ethics Committee on Human Subjects Research (MDC/IECHSR/2515 dated 28th November 2006).

Statistical analysis:

The following procedures of Statistical analysis were used in the study. [62]

(a) Chi-square test for the difference in proportions and association between attributes.

(b) Z-test for the difference between means.

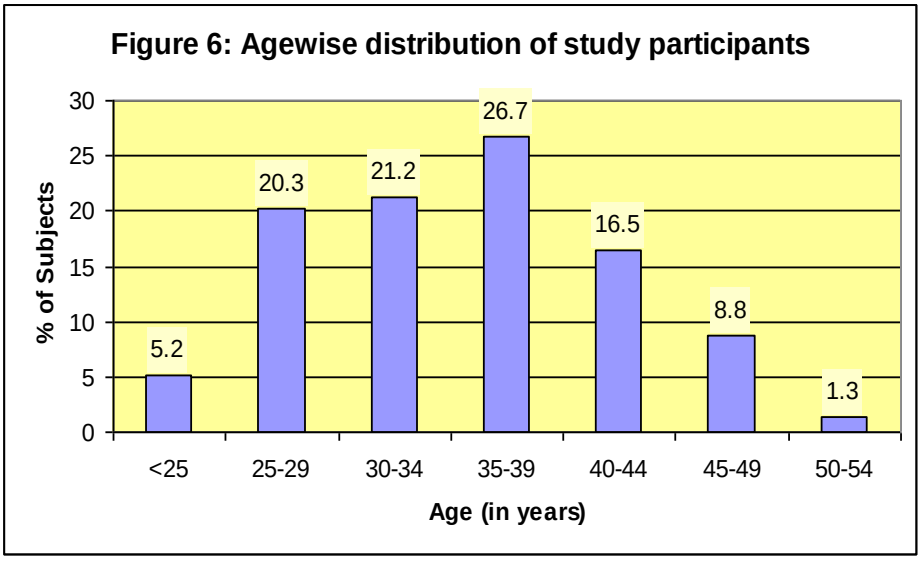
c) Fischer's test for the difference between two means.

All the participants detected to be Diabetic were referred to the medical specialist at military hospital, Belgaum for follow up. After completing the data collection, all the personnel were given health education regarding the causation, consequences, diagnosis, prevention and control of Diabetes Mellitus.

RESULTS

Table 1: Age wise distribution of study participants

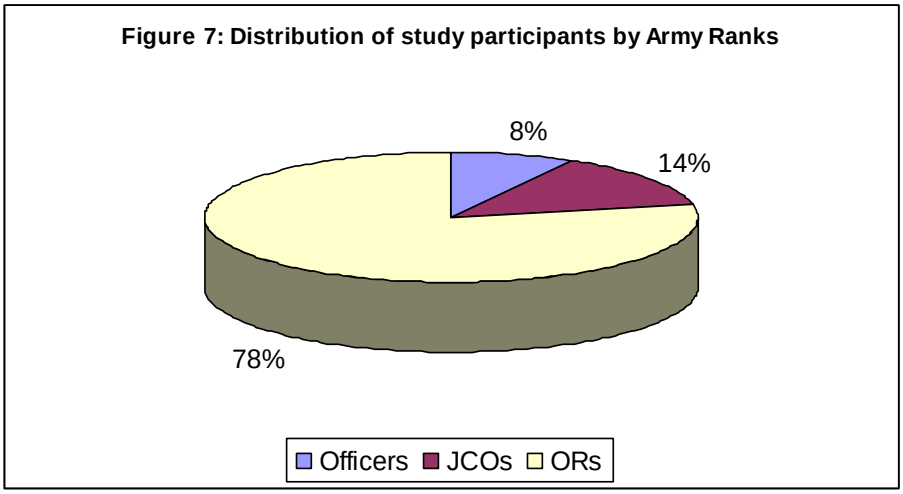
Age (in years)	Total	
	No.	%
<25	31	5.2
25-29	122	20.3
30-34	127	21.2
35-39	160	26.7
40-44	99	16.5
45-49	53	8.8
50-54	8	1.3
Total	600	100



In the present study out of 600 study participants, 31(5.2%) were aged less than 25 years, 122 (20.3%) were in the age group of 25-29 years, 127 (21.2%) in the age group 30-34 years, 160(26.7%) belonged to 35-39 year age group, 99(16.5%) in the 40-44 year age group, 53(8.8%) were in the age group of 45-49 years. Only 8(1.3%) out of 600 study participants were aged more than 50 years.

Table 2: Distribution of study participants by Army ranks

Rank	Total	
	No.	%
Officers	48	8
Junior commissioned officers(JCOs)	84	14
Other Ranks (ORs)	468	78
Total	600	100



In this study out of 600 study participants, 48(8%) were from officer rank, 84(14%) were Junior commissioned officers (JCOs), and 468(78%) belonged to Other ranks.

Table 3: Distribution of study participants by Occupational status

Occupation	Total	
	No.	%
Arms	479	79.8
Services	121	20.2
Total	600	100

Out of 600 study participants 479(79.8%) belonged to the category of Arms (involved in combat duties), and 121(20.2%) belonged to the Services category (involved in supportive duties).

Table 4: Distribution of study participants by Educational status

Education	Total	
	No.	%
Graduation & Above	86	14.3
PUC / Diploma	321	53.5
Secondary	193	32.2
Total	600	100

Out of 600 study participants, 86(14.3%) were in graduate or post graduate level of education. 321(53.5%) were educated up to PUC / Diploma and 193(32.2%) were educated up to Secondary level.

Table 5: Distribution of study participants by Religion

Religion	Total	
	No.	%
Hindu	466	77.6
Sikh	72	12
Muslim	37	6.16
Christian	21	3.5
Others	04	0.66
Total	600	100

Majority of study participants in this study were Hindus 466(77.6%), followed by Sikhs 72(12%). Muslims constituted 37(6.16%), Christians 21(3.5%), and 4(0.66%) of them were from other religions i.e. Jain and Parsee.

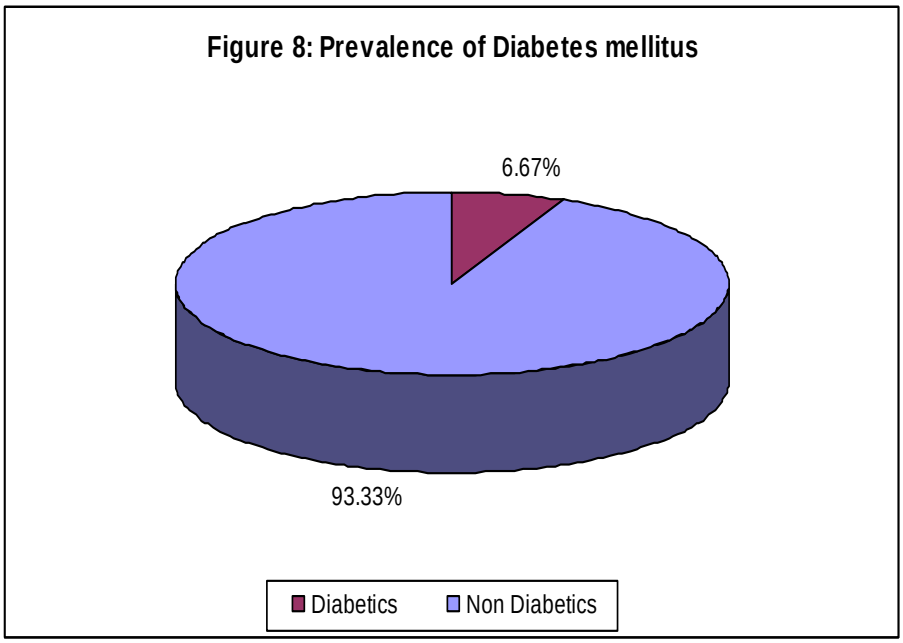
Table 6: Distribution of study participants by Region

Region	Total	
	No.	%
North	217	36.16
South	200	33.3
West	155	25.8
East	28	4.66
Total	600	100

In this study 217(36.16%) study participants were from northern part of India, 200(33.3%) were from south, 155(25.8%) from west and 28(4.66%) were from eastern part of India.

Table 7: Prevalence of Diabetes Mellitus

Status	No. of subjects	Prevalence (%)
Diabetics	40	6.67
Non Diabetics	560	93.33
Total	600	100

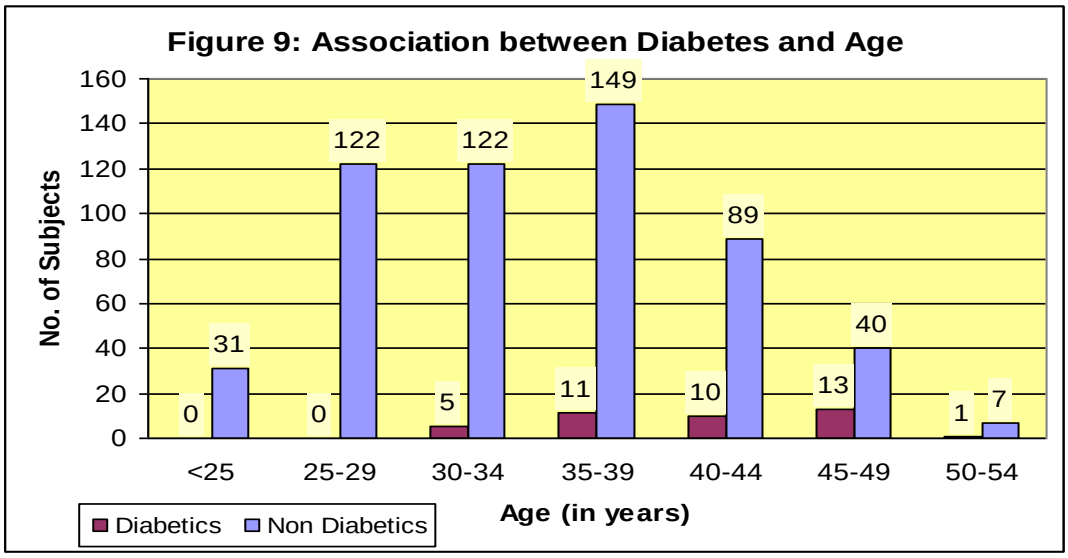


Out of 600 study participants examined to find out the prevalence of Diabetes Mellitus, using WHO criteria (Fasting blood glucose ≥126 mg/dl), 40(6.67%) were found to have Diabetes and 560(93.33%) were Non Diabetics.

Table 8: Association between Diabetes and Age

Age (in years)	Diabetics		Non Diabetics		Total	
	No.	%	No.	%	No.	%
<25	0	0	31	100	31	5.2
25-29	0	0	122	100	122	20.3
30-34	5	3.93	122	96.07	127	21.2
35-39	11	6.87	149	93.13	160	26.7
40-44	10	10.1	89	89.9	99	16.5
45-49	13	24.5	40	75.5	53	8.8
50-54	1	12.5	7	87.5	8	1.3
Total	40	6.67	560	93.33	600	100

χ^2 =38.605 DF=3 P=0.000



The present study shows that the overall prevalence of Diabetes Mellitus among serving army personnel in Belgaum Cantonment is 6.67%. The majority of the Diabetics were in the 35-49 year age group. Prevalence of Diabetes Mellitus was nil in the age group below 30 years. There were 5(3.93%) diabetics in the age group 30-34 years, 11(6.87%) in age group 35-39years. It rose to 10.1% in the 40-44 year age group and then to 24.5% in the age group of 45-49 years. Only 1(12.5%) personnel above 50 years had Diabetes. Thus an upward trend of Diabetes prevalence was observed with increase in age, and the association was statistically highly significant.

Table 9: Association of Age with fasting blood sugar

Age (in years)	Fasting Blood Sugar Mean	S.D.
<25	86.7	8.29
25-29	88.7	10.71
30-34	93.4	13.66
35-39	97.03	16.83
40-44	102.2	17.78
45-49	109.4	23.7
50-54	111	16.49

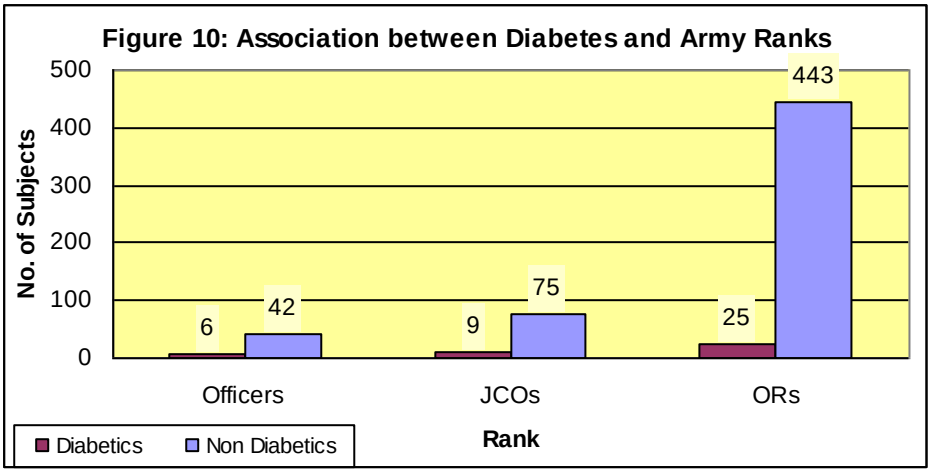
$F_{6,593} = 17.041$ P=0.000

The mean fasting blood sugar level of study participants aged less than 25 years was 86.7 ± 8.29 mg/dl, it increased to 88.7 ± 10.71 mg/dl in the 25-29 year age groups. The mean blood sugar level increased as the age advanced. It reached a maximum of 111 ± 16.49 mg/dl for those in the age group 50-54 years. This upward trend of the mean blood sugar level with increasing age was highly significant.

Table 10: Association between Diabetes and Army ranks

Rank	Diabetics No.	%	Non Diabetics No.	%	Total No.	%
Officers	6	12.5	42	87.5	48	8
Junior commissioned officers(JCOs)	9	10.71	75	89.29	84	14
Other Ranks (ORs)	25	5.34	443	94.66	468	78
Total	40	6.67	560	93.33	600	100

$\chi^2 = 6.157$ DF=2 P=0.046



In the present study 6(12.5%) of diabetics were from officer rank, while 9(10.71%) were Junior commissioned officers (JCOs) and 25(5.34%) were from Other Ranks (ORs). It was observed that the prevalence of Diabetes Mellitus was higher among officers and junior commissioned officers (JCOs) when compared with Other Ranks (ORs). The association between the prevalence of Diabetes and army ranks was statistically significant.

Table 11: Association between Diabetes and Occupational status

Occupation	Diabetics		Non Diabetics		Total	
	No.	%	No.	%	No.	%
Arms	28	5.84	451	94.16	479	79.8
Services	12	9.99	109	90.01	121	20.2
Total	40	6.67	560	93.33	600	100

χ^2 =2.53 DF=1 P=0.109

Out of 479(79.8%) of the study participants belonging to the occupational category of Arms (involved in combat duties), 28(5.84%) were found to have Diabetes, while 12(9.99%) out of 121(20.2%) belonged to the Services category (involved in supportive duties) had Diabetes. The prevalence of Diabetes Mellitus was higher in the Services category than the Arms category, but the different was not statistically significant.

Table 12: Association between Diabetes and level of Education

Education	Diabetics		Non Diabetics		Total	
	No.	%	No.	%	No.	%
Graduates & Post Graduates	11	12.8	75	87.2	86	14.3
PUC / Diploma	20	6.2	301	93.8	321	53.5
Secondary	9	4.6	184	95.4	193	32.2
Total	40	6.67	560	93.33	600	100

χ^2 =6.527 DF=2 P=0.038

As regards to the educational status, the prevalence of Diabetes Mellitus among graduates and post graduates was 12.8%, and it was 6.2% among those educated up to PUC / Diploma. The prevalence was 4.6% among those who were educated up to Secondary level. An upward trend was noted with level of education and diabetes which was found statistically significant.

Table 13: Association between Diabetes and Religion

Religion	Diabetics		Non Diabetics		Total	
	No.	%	No.	%	No.	%
Hindu	28	6	438	94	466	77.6
Sikh	7	9.72	65	90.28	72	12
Muslim	3	8.1	34	91.9	37	6.16
Christian	2	9.5	19	90.5	21	3.5
Others	0	0	04	100	04	0.66
Total	40	6.67	560	93.33	600	100

χ^2 =1.099 DF=3 P=0.894

The prevalence of Diabetes Mellitus among Hindus was 6%, and in Sikhs it was 9.72%. Among Muslims the prevalence was 8.1%, and in Christians it was 9.5%. None in the other category had diabetes. The study shows an increased prevalence of diabetes among Sikh and Christian when compared to Hindus and Muslims, but no significant difference could be proved statistically.

Table 14: Association between Diabetes and Region

Region	Diabetics		Non Diabetics		Total	
	No.	%	No.	%	No.	%
South	10	5	190	95	200	33.3
North	15	6.91	202	93.1	217	36.16
West	11	7.09	144	92.91	155	25.8
East	4	14.2	24	85.8	28	4.66
Total	40	6.67	560	93.33	600	100

χ^2 =3.572 DF=3 P=0.312

In this study the prevalence of diabetes was 5% among study participants belonging to South and 6.91% for Northern India. The prevalence increased to 7.09% for western region and 14.2% for study participants hailing from Eastern part of the country. There was increased prevalence of diabetes in western and Eastern region, but the difference between the different regions was statistically not significant.

Table 15: Association between Diabetes and Marital Status

Marital Status	Diabetics		Non Diabetics		Total	
	No.	%	No.	%	No.	%
Married	34	6.57	483	93.43	517	86.16
Unmarried	6	7.31	76	13.57	82	13.66
Widower	0	0	1	1.7	1	0.2
Total	40	6.67	560	93.33	600	100

χ^2 =0.065 DF=1 P=0.798

In this study majority of the study participants i.e. 517(86.163%) were married and the prevalence of diabetes was 34 (6.57%) and among Unmarried personnel out of 82(13.66%) study participants 6(7.31%) had diabetes. There was one widower who was non diabetic. The difference observed was not statistically significant.

Table 16: Association between Diabetes and Diet

Diet	Diabetics		Non Diabetics		Total	
	No.	%	No.	%	No.	%
Vegetarian	8	12.3	57	10.17	65	10.83
Mixed diet	32	5.98	503	89.82	535	89.17
Total	40	6.67	560	93.33	600	100

χ^2 =2.781 DF=1 P=0.095

As regards to food habits of the study participants, out of 65(10.83%) vegetarians, 8(12.3%) had diabetes, and out of 535(89.17%) subjects consuming mixed diet, 32(5.98%) had diabetes. statistically the difference was not significant.

Table 17: Association between Diabetes and Extra Fat Consumption

Extra Fat Consumption	Diabetics		Non Diabetics		Total	
	No.	%	No.	%	No.	%
Yes	20	9.9	182	90.1	202	33.6
No	20	5.02	378	94.98	398	66.4
Total	40	6.67	560	93.33	600	100

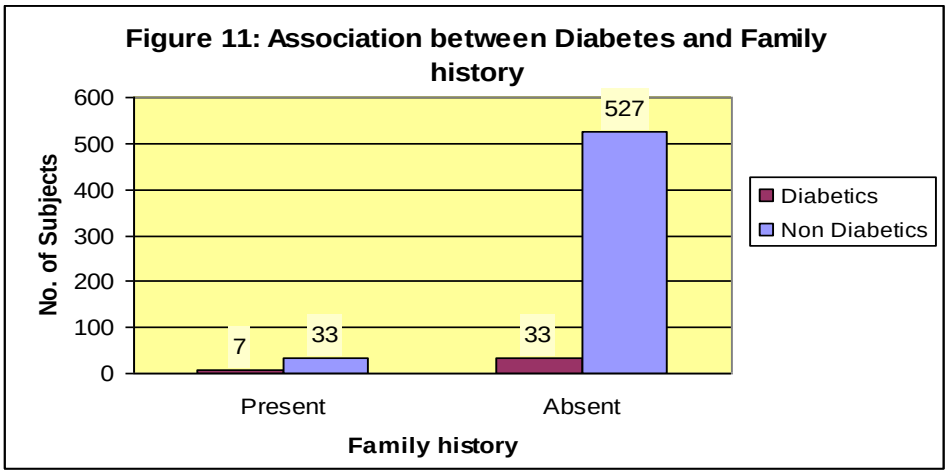
χ^2 =5.120 DF=1 P=0.0236

The prevalence of diabetes was found to be higher i.e. 9.9% among 202 study participants consuming extra fats in their diet as against 5.02% among 398 subjects who were not consuming extra fats in their diet. The difference observed was statistically significant.

Table 18: Association between Diabetes and Family History

Family History	Diabetics		Non Diabetics		Total	
	No.	%	No.	%	No.	%
Yes	7	17.5	33	82.5	40	6.6
No	33	5.8	527	94.2	560	93.4
Total	40	6.67	560	93.33	600	100

χ^2 =6.326 DF=1 P=0.0118
(With Yates correction)

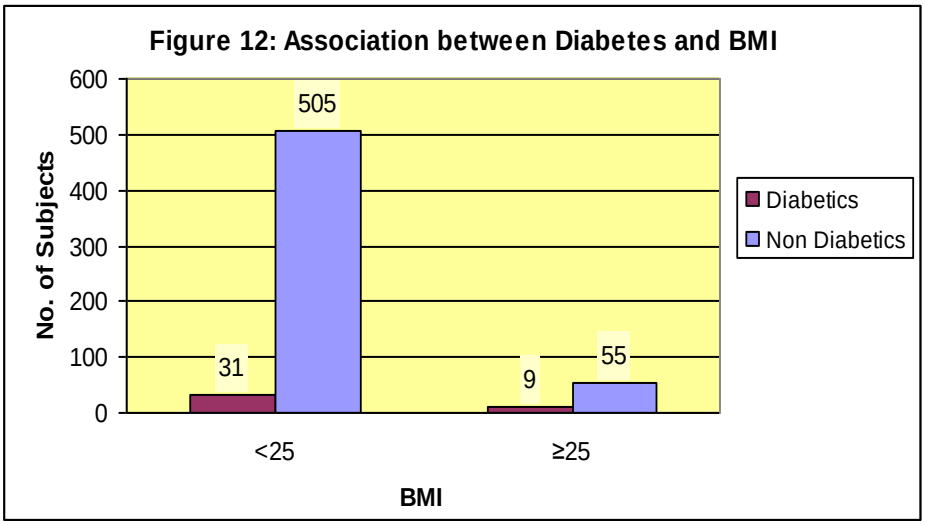


In this study the prevalence of diabetes was 17.5% among 40 study participants having family history of diabetes as compared to 5.8% among those 560 subjects who did not have such family history. The difference found was statistically highly significant.

Table 19: Association between Diabetes and overweight

BMI	Diabetics		Non Diabetics		Total	
	No.	%	No.	%	No.	%
<25	31	6.1	505	93.9	536	89.3
≥25	9	14.06	55	85.94	64	10.7
Total	40	6.67	560	93.33	600	100

Range: 20.31-28.1
χ^2 =5.038 DF=1 P=0.025
(With Yates correction)



The study demonstrated that the prevalence of diabetes was 6.1% among 536(89.3%) study participants having BMI <25 as compared to 14.06% among those 64(10.7%) subjects whose BMI was ≥25. The difference found was statistically highly significant.

Table 20: Association between Diabetes and BMI

Diabetes Status	No. of subjects	BMI	
		Mean	S.D.
Diabetics	40	24.15	1.88
Non Diabetics	560	22.72	1.63
Total	600		

Z=4.68 P<0.001

The study revealed that the mean BMI was higher among 40 Diabetics (24.15 ±1.88) as compared to the mean BMI of 560 Non Diabetics (22.72 ± 1.63). Statistically, the difference was highly significant.

Table 21: Association between BMI and Mean Blood Sugar

BMI	No. of subjects	Blood Sugar	
		Mean	S.D.
≥25	64	103.21	19.62
<25	536	95.34	16.38
Total	600		

Z=3.14 P<0.001

It was also observed that the mean blood sugar among 64 study participants having BMI ≥25 was higher i.e. (103.21 ± 19.62) as compared to those 536 subjects whose BMI was <25 i.e. (95.34 ± 16.38). The difference found was statistically highly significant.

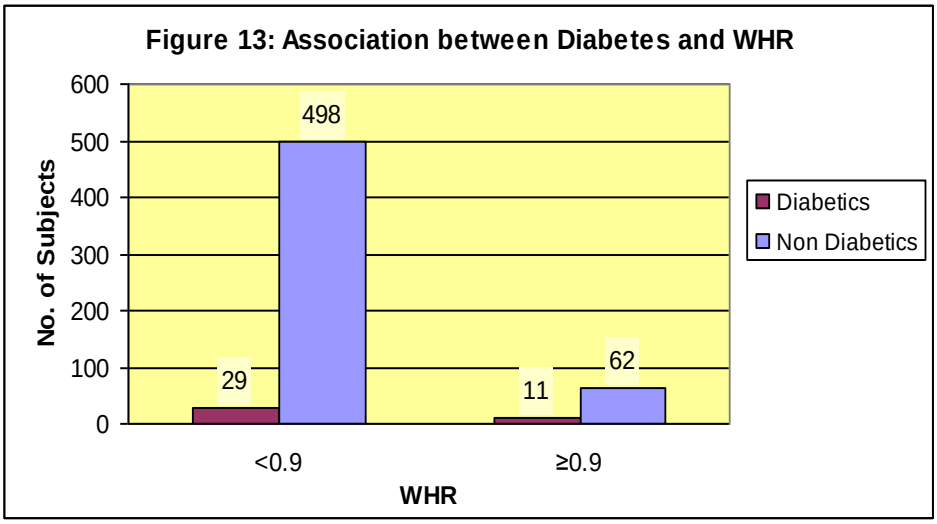
Table 22: Association between Diabetes and WHR

WHR	Diabetics		Non Diabetics		Total	
	No.	%	No.	%	No.	%
<0.9	29	5.5	498	94.5	527	87.8
≥0.9	11	15	62	85	73	12.2
Total	40	6.67	560	93.33	600	100

Range: 0.78-1.02

χ^2 =7.954 DF=1 P=0.005

(With Yates correction)

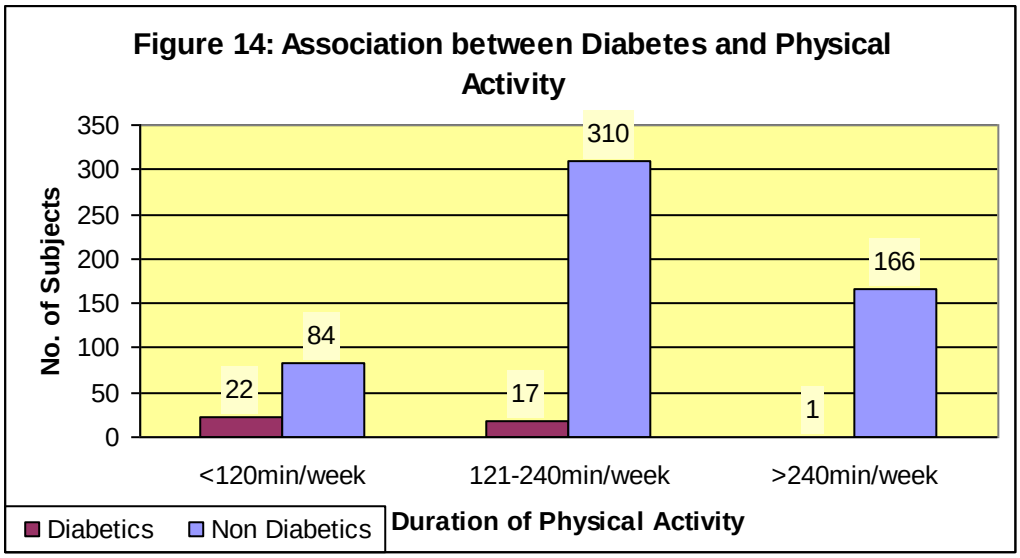


The prevalence of diabetes was found to be 5.5% among 527(87.8%) study participants having waist hip ratio <0.9 as compared to 15% among those 73 (12.2%) subjects whose waist hip ratio was ≥0.9. The difference found was statistically highly significant.

Table 23: Association between Diabetes and Physical Activity

Physical Activity	Diabetics		Non Diabetics		Total	
	No.	%	No.	%	No.	%
<120min/week	22	20.7	84	79.3	106	17.7
121-240min/week	17	5	310	95	327	54.5
>240min/week	1	0.6	166	99.4	167	27.8
Total	40	6.67	560	93.33	600	100

χ^2 = 44.826 DF= 2 P=0.000



In this study it was found that the prevalence of diabetes was very high i.e. 20.7% among those study participants who were undertaking physical activity less than120 minutes per week. The prevalence decreased to 5% among those who were undertaking physical activity in the range of 121-240 minutes per week and it further decreased to 0.6% among those who were exercising for more than 240 minutes per week. The difference observed was highly significant.

Table 24: Association between Diabetes and Duration of Physical Activity

Diabetes Status	No. of subjects	Duration of Physical Activity	
		Mean	S.D.
Diabetics	40	142.25	48.11
Non Diabetics	560	215.12	65.54
Total	600		

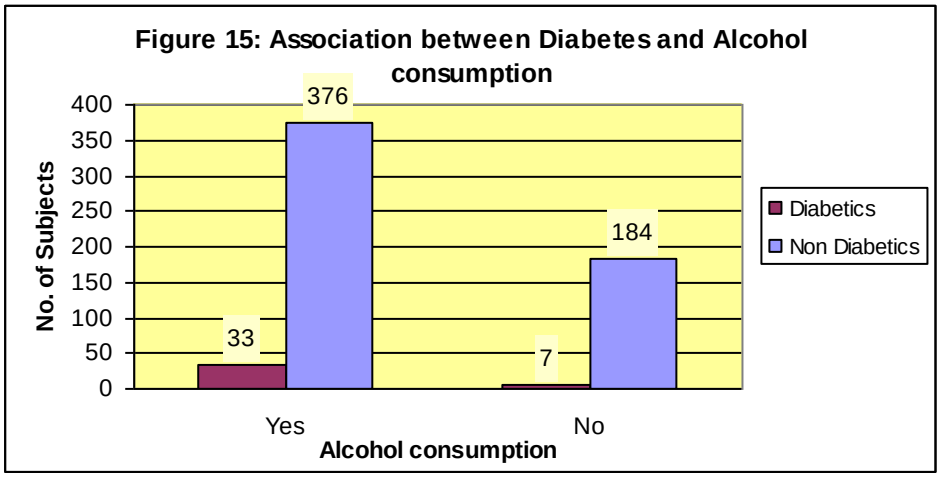
Z= -9.00 P<0.000

It was also seen that the mean duration of physical exercise per week was 142.25 ± 48.11 minutes among Diabetics, while it was 215.12 ± 65.54 minutes among Non Diabetics. The difference of the two means was found to be highly significant.

Table 25: Association between Diabetes and Alcohol Consumption

Alcohol Consumption	Diabetics		Non Diabetics		Total	
	No.	%	No.	%	No.	%
Yes	33	8.1	376	91.9	409	68.2
No	7	3.7	184	96.3	191	31.8
Total	40	6.67	560	93.33	600	100

χ^2 =4.058 DF=1 P=0.044



It was observed that 409(68.2%) study participants were consuming alcohol while 191(31.8%) were non drinkers. The prevalence of diabetes was 8.1% among those who were consuming alcohol and 3.7% among non drinkers. The difference observed between drinkers and non drinkers was statistically significant.

Table 26: Association between Diabetes and Duration of Alcohol Consumption

Duration of Alcohol (in years)	Diabetics		Non Diabetics		Total	
	No.	%	No.	%	No.	%
Non Drinker	7	3.66	184	96.34	191	31.84
≤ 5 years	5	5.1	93	94.9	98	16.34
5-10 years	8	6.01	125	93.99	133	22.16
> 10 years	20	11.2	158	88.8	178	29.66
Total	40	6.67	560	93.33	600	100

χ^2 =9.215 DF=3 P=0.002

It was also observed that the prevalence of diabetes increased with duration of alcohol consumption. It was 3.7% among those who never consumed alcohol. The prevalence increased to 5.1% among those who were consuming alcohol for last 5 years, and it rose to 6.01% and then to 11.2% among those who were consuming alcohol for 5-10 years and for more than 10 years respectively. The difference observed was highly significant.

Table 27: Association between Diabetes and Quantity of Alcohol Consumption

Quantity of Alcohol	Diabetics		Non Diabetics		Total	
	No.	%	No.	%	No.	%
Non Drinker	7	3.7	183	96.3	190	31.7
≤3Pegs	22	6.8	298	93.2	320	53.3
>3Pegs	11	12.3	79	87.7	90	15
Total	40	6.67	560	93.33	600	100

χ^2 =7.203 DF=2 P=0.027

In this study it was observed that the prevalence of diabetes increased with quantity of alcohol consumption. It was 3.7% among those who never consumed alcohol. The prevalence increased to 6.8% among those who consume up to 3 Pegs of alcohol / day and 12.3% among those who were consuming more than 3 Pegs of alcohol / day. The difference found was statistically significant.

Table 28: Association between Diabetes and Smoking

Smoking	Diabetics		Non Diabetics		Total	
	No.	%	No.	%	No.	%
Yes	26	8.4	284	91.6	310	51.7
No	14	4.8	276	95.2	290	48.3
Total	40	6.67	560	93.33	600	100

χ^2 = 3.051 DF=1 P= 0.081

It was observed that 310(51.7%) study participants were smokers, while 290(48.3%) were non smokers. The prevalence of diabetes was found to be 8.4% among smokers and 4.8% among non smokers. Although the prevalence of diabetes

was higher among smokers than the non smokers, the difference observed between them was not statistically significant.

Table 29: Association between Diabetes and Smokeless Tobacco

Smokeless Tobacco	Diabetics		Non Diabetics		Total	
	No.	%	No.	%	No.	%
Yes	4	8	46	92	50	8.4
No	36	6.54	514	93.46	550	91.6
Total	40	6.67	560	93.33	600	100

$\chi^2 = 0.156$ DF=1 P= 0.69

In the present study it was observed that 50(8.4%) study participants were using smokeless tobacco, while 550 (91.6%) were not using it. The prevalence of diabetes was found to be 8% among those who use smokeless tobacco and 6.54% among those who do not use smokeless tobacco. The prevalence of diabetes was higher among smokeless tobacco users than those who were not using it. The difference observed between them was not statistically significant.

Table 30: Association between Diabetes and Duration of Field Service

Diabetes Status	No. of subjects	Duration of Field Service	
		Mean	S.D.
Diabetics	40	94.15	18.99
Non Diabetics	560	51.94	33.53
Total	600		

Z= 12.71 P<0.001

It was observed that the mean duration of total field service rendered by all 40 study participants found to have diabetes was 94.15 ± 18.99 months as compared to 51.94 ± 33.53 months among non diabetics. Statistically this difference was highly significant.

Table 31: Association between Diabetes and Prolonged Mental Stress

Prolonged Mental Stress	Diabetics		Non Diabetics		Total	
	No.	%	No.	%	No.	%
Yes	7	15.5	38	84.5	45	7.5
No	33	5.94	522	94.06	555	92.5
Total	40	6.67	560	93.33	600	100

χ^2 =4.730 DF=1 P=0.030
(With Yates correction)

The prevalence of diabetes was found to be higher i.e. 15.5% among those 45(7.5%) study participants who had Prolonged Mental Stress due to personal or family problems as compared to 5.94% among 555 (92.5%) participants who did not have mental Stress. The difference observed between them was statistically significant.

Table 32: Prevalence of Hypertension

Status	Number	Percentage
Normotensives	509	84.83
Hypertensives	91	15.17
Total	600	100

The present study shows that the overall prevalence of Hypertension (as per latest WHO guidelines) among serving army personnel in Belgaum Cantonment is 15.17%.

Table 33: Distribution of Blood Pressure

Age	Systolic BP	Diastolic Blood Pressure					
		60-69	70-79	80-89	90-99	100-109	Total
<25	100-109	0	1	0	0	0	1
25-29	110-119	0	54	32	0	0	86
30-34	120-129	0	7	258	1	0	266
35-39	130-139	0	0	124	27	1	152
40-44	140-149	0	0	3	63	11	77
45-49	150-159	0	0	0	5	9	14
50-54	160-169	0	0	1	1	2	4
	Total	0	62	418	97	23	600

Mean Systolic Blood Pressure: 125.7 ± 9.96, Range: 108-160 mm of Hg.

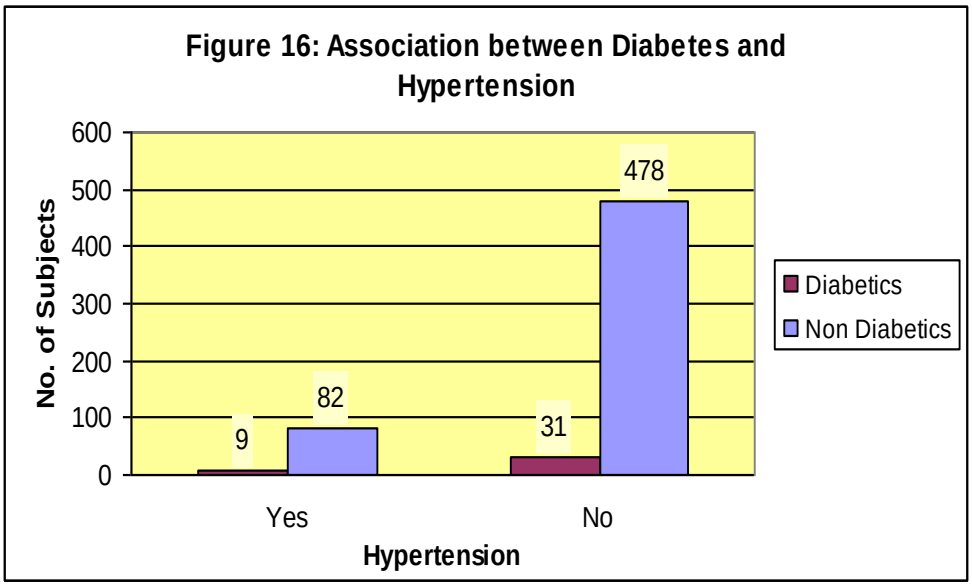
Mean Diastolic Blood Pressure: 81.9 ± 6.56, Range: 70-100 mm of Hg.

The present study shows that the overall prevalence of Hypertension among serving army personnel in Belgaum Cantonment is 15.17%. The majority of the hypertensives were in the 40-54 year age group. Prevalence of Hypertension was nil in the age group below 30 years. There on wards an upward trend of Hypertension prevalence was observed with increase in age.

Table 34: Association between Diabetes and Hypertension

Hypertension	Diabetics		Non Diabetics		Total	
	No.	%	No.	%	No.	%
Yes	9	9.9	82	90.10	91	15.17
No	31	6.09	478	93.90	509	84.83
Total	40	6.67	560	93.33	600	100

χ^2 =42.696 DF=1 P=0.000
(With Yates correction)



The prevalence of diabetes was found to be higher i.e. 9.9% among 91(84.83%) study participants who had high blood pressure as compared to 6.09% among 509(15.17%) Normotensives. The difference observed between them was statistically highly significant.

Table No35: Association between Blood Pressure and Fasting Blood Sugar

Status	No.	Systolic B P		Diastolic B P		Fasting Blood Sugar	
		Mean	S.D.	Mean	S.D.	Mean	S.D.
Diabetics	40	135.5	12.94	87.5	6.43	140.8	7.15
Non Diabetics	560	124.9	9.35	81.5	6.39	92.9	12.29
t		6.674		5.669		24.329	
DF		598		598		598	
P		0.000		0.000		0.000	

The present study revealed a strong positive association between Diabetes Mellitus and both Systolic and Diastolic Blood pressure. It was seen that the mean Systolic Blood pressure among 40 diabetics was 135.5 ± 12.94 mm of Hg, while it was 124.9 ± 9.35 mm of Hg among Normoglycemics. The difference of the two means was statistically highly significant. Also the mean Diastolic Blood pressure among 40 diabetics was 87.5 ± 6.43 mm of Hg, while it was 81.5 ± 6.39 mm of Hg among Normoglycemics. The difference of the two means was statistically highly significant.

DISCUSSION

The present study was undertaken among 600 serving army personnel in Belgaum cantonment to find out the prevalence of Diabetes mellitus and its distribution and determinants.

Age wise distribution of study participants: Table 1

In the present study out of 600 study participants, we noted that the majority of the participants 280(47%) were in the age group of 25- 35 years. Only 8(1.3%) study participants were aged more than 50 years. It is important to note that the most of the study participants were young.

Distribution of study participants by Army ranks: Table 2

In this study out of 600 study participants 48(8%) were from officer rank, 84(14%) were Junior commissioned officers (JCOs) and 468(78%) belonged to other ranks (ORs).

Distribution of study participants by Occupational status: Table 3

Out of 600 study participants 479(79.8%) belonged to the category of Arms (involved in combat duties), and 121(20.2%) belonged to the Services category (involved in supportive duties).

Distribution of study participants by Educational status: Table 4

Out of 600 study participants, 86(14.3%) had graduate or post graduate level of education, 321(53.5%) were educated up to PUC / Diploma and 193(32.2%) were educated up to Secondary level.

Distribution of study participants by Religion and Region: Table 5 and 6

Majority of study participants were Hindus 466 (77.6%), followed by Sikhs 72 (12%), and Muslims 37 (6.16%). Only 21(3.5%) were Christians.

Region wise, 217(36.16%) study participants were from northern part of India, 200(33.3%) were from south, 155(25.8%) from west and 28(4.66%) were from eastern part of India.

Prevalence of Diabetes Mellitus: Table 7

The present study shows that the overall prevalence of Diabetes mellitus (as per latest WHO criteria) is 6.67%, i.e. out of 600 study participants 40(6.67%) were found to be Diabetics and 560(93.33%) were Non Diabetics. Out of these 40 Diabetics identified, 23(57.5%) were known cases of Diabetes and 17 (42.5%) were newly detected.

The prevalence of Diabetes observed in this study is much higher when compared with findings of Varma et al[12] who observed a prevalence of 1.5% amongst army personnel. Also the prevalence of Diabetes is higher when compared with the findings of Datta and Prasad[13] where the prevalence was 2.18%. When compared with overall (world wide) prevalence of diabetes among adult population (4.8%) [54] there is slightly high prevalence of diabetes mellitus among the army personnel. However the prevalence of Diabetes mellitus is much less when compared with the findings of Ramachandran who reported the prevalence of Diabetes as 11.6% in his study amongst adult population in some major cities of India.[9] Also the prevalence is very less when compared to the prevalence of Diabetes among police personnel in Chennai where it was found to be 32.1%.[51] The prevalence of Diabetes observed in this study is much less as compared to Kolkata police personnel where the prevalence of

Diabetes was noted at 12%.[52] The prevalence of Diabetes was 9.6% among Japanese fire fighters, where as in this study it is 6.67%. The low prevalence of diabetes in army personnel when compared with national diabetes statistics can be attributed to the fact that majority of army personnel are young, healthy, and they undertake regular physical exercise.

Association between diabetes and study variables

Age: Table 8 and 9

The study revealed a highly significant association between age of the study participants and the prevalence of Diabetes mellitus. Prevalence of Diabetes Mellitus was nil in the age group below 30 years. There was a low prevalence of Diabetes i.e. 3.93% in the age group of 30-34 years, which increased to 6.87% and then to 10.1% in age groups of 35-39 years and 40-44 years respectively. Maximum prevalence was seen in the age group of 45-49 years (24.5%). The mean fasting blood sugar level of study participants aged less than 25 years was 86.7 ± 8.29 mg/dl, it increased to 88.7 ± 10.71 mg/dl in the 25-29 year age groups. The mean blood sugar level increased as the age advanced. It reached a maximum of 111 ± 16.49 mg/dl for those in the age group 50-54 years. This upward trend of the mean blood sugar level with increasing age was highly significant.

These findings compare well with the findings of Varma et al[12] who observed an upward trend of Diabetes with increase in age among Armed forces and Naval personnel in Delhi and Mumbai. Another study conducted by Datta and Prasad[13] at Lucknow cantonment also observed that increasing age has a highly significant association with Diabetes. In both the studies the highest prevalence was found in the

age group of 40- 49 years, which compares well with the findings of present study. Similar findings of upward trend of diabetes with the increase in age have been shown by various other studies.[36, 37, 38, 47]

Army rank: Table 10

In Indian army, the military rank greatly determines the income, privileges, standards of living, social status and administrative power and hence is a good measure of socioeconomic status. In the present study, socioeconomic status was measured on the basis of three categories of army ranks i.e. officers, junior commissioned officers (JCOs), and other ranks (ORs). The prevalence of Diabetes mellitus was higher among officers (12.5%), followed by the junior commissioned officers (JCOs) i.e. 10.71%, and 5.34% in other ranks (ORs). This difference was statistically significant. It compares well with the study report of Varma et al[12] who found the higher prevalence of diabetes among officers in his study amongst Armed forces and naval personnel at Delhi and Mumbai. Similarly Datta and Prasad[13] in a study among defence personnel at Lucknow cantonment observed higher prevalence of Diabetes among officers. The findings are also in accordance with the Chennai urban population study by Mohan et al who observed a highly significant association of Diabetes Mellitus with socioeconomic status.[42]

Occupational status: Table 11

As regards to the occupational status, the prevalence of Diabetes Mellitus was higher among the Services personnel (9.99%) as compared to the arms personnel (5.84%). Although the prevalence of Diabetes Mellitus was higher in the Services category than the Arms category, the different was not statistically significant. The results commensurate well with the study done by Varma et al[12] who observed an

increased prevalence of diabetes among services category. The higher prevalence of diabetes among services personnel can be attributed to their deployment in the administrative and supportive duties and majority of them were not undertaking regular physical activity.

Level of Education: Table 12

The present study revealed a strong association of Diabetes with education level of the army personnel. The prevalence of Diabetes Mellitus among graduates and post graduates was 12.8%, while it was 6.2% among those educated up to PUC / Diploma and 4.6% among those who were educated up to Secondary level. The difference observed was statistically significant. The findings of present study compare well with the findings of Varma et al[12] who observed an upward trend of Diabetes with increase in the level of education of defence personnel. Another study conducted by Datta and Prasad[13] at Lucknow cantonment, also observed an increased prevalence of Diabetes among army personnel with higher educational level. The higher prevalence of Diabetes mellitus among personnel having higher educational qualification may be because majority of them belonged to higher socioeconomic status. 82% of the Diabetics who were graduates and above belonged to the Officer and JCO category, while only 2 i.e. 18% among the Other ranks category were graduates.

Religion: Table 13

In this study the prevalence of Diabetes Mellitus was more among Sikhs (9.72%) and Christians (9.5%) as compared to Hindus (6%) and Muslims (8.1%). The difference observed was not statistically significant.

Region: Table 14

The present study showed an increased prevalence of diabetes mellitus among personnel belonging to Eastern (14.2%) and western region (7.09%) as compared with North (6.91%) and South (5%), but the association of diabetes with different region of nativity was not statistically significant.

Marital status: Table 15

A higher prevalence of diabetes was observed among Unmarried personnel (7.31%) as compared to Married personnel (6.57%). However the difference was not statistically significant.

Diet: Table 16

Prevalence of diabetes was higher among those who were consuming mixed diet (12.3%) as compared to those consuming vegetarian diet (5.98%). Statistically the difference was not significant. The Hoorn study[16] demonstrated a high prevalence of diabetes among those who were regularly consuming animal protein in their diet.

Extra Fat Consumption: Table 17

The present study revealed a positive association between diabetes and extra dietary fat intake. The Prevalence of diabetes was higher among subjects who were consuming extra fat regularly (9.9%) than those who were not consuming extra fat regularly in their daily diet (5.02%). The difference observed was statistically significant. The findings are in accordance with a study conducted by padmini et al[63] who noted that diabetes was associated with those who were consuming high carbohydrate and fats in their regular diet. The Hoorn study[16] also observed a strong

association between diabetes with those who were consuming animal protein and excess of fats.

Family History: Table 18

A significant association between diabetes and family history was observed in this study. The prevalence of diabetes was 17.5% among those having family history of diabetes as compared to 5.8% among those who did not have such family history. The Family history of diabetes is one of the strongest risk factors for the future development of diabetes mellitus. A study conducted in Greece showed hat the prevalence of diabetes mellitus was significantly higher in those with the family history of diabetes than those without such history of diabetes.[45] Another study conducted at Belagavi by Jali et al[63] also observed that the risk of developing diabetes is more among individuals with a family history. Further, he noted that stronger the family history, higher the chances of getting diabetes. The prevalence of diabetes was more among family members with both parents being diabetic (14.94%) as compared with family members with a single parent being diabetic (8.22%). Various other studies have also brought out a significant association between family history and diabetes.[12, 13, 42, 45, 54]

Body mass index (BMI): Table 19-21

In this study the prevalence of overweight (BMI ≥25) was observed to be 10.7%, which compares well with the earlier findings of Varma et al[12] in the study amongst armed forces and naval personnel in Delhi and Mumbai Cantonment. The prevalence of overweight amongst army personnel is much less when compared with the findings of various studies conducted in major Indian cities, which have reported the prevalence of overweight and obesity ranging from 12% to 50%.[66]

The study has brought out a significant association between Diabetes and Body Mass Index. The prevalence of Diabetes was quite high (14.06%) among study participants having BMI ≥ 25 as compared to those having the BMI < 25 i.e. 6.1%.

In the present study the mean BMI of Diabetics was 24.15 ± 1.88 as compared to mean BMI 22.72 ± 1.63 of Non Diabetics (Table No 19). The difference between the two mean BMI was statistically highly significant.

It was also observed that the mean blood sugar among those having BMI ≥25 was higher i.e. (103.21 ± 19.62) as compared to those personnel whose BMI was <25 i.e. (95.34 ± 16.38). The difference found was statistically highly significant. These findings commensurate well with the findings of Varma et al[12]. Various other epidemiological studies also proved a strong association between diabetes and increased BMI.[36, 38, 42, 48 63,]

Waist hip ratio (WHR): Table 22

A significant association between Diabetes and Waist hip ratio (WHR) was observed in the present study. The prevalence of Diabetes was found to be much higher (15%) among those having WHR ≥ 0.9 and was lower (5.5%) among those having WHR less than 0.9. These observations correlate well with the findings of padmini et al[63] who observed a significant association of Waist hip ratio with Diabetes. Various other epidemiological studies have also provided evidence of a strong association between Diabetes and Waist hip ratio. [34, 36,38,40,42]

In the present study BMI and WHR have proved an easy, simple and reliable method of estimation of obesity and the predictor of diabetes mellitus. Keeping in view of significant association of diabetes with BMI and WHR, emphasis should be laid on regular measurement of these two indicators in regular medical check ups.

Physical Activity: Table 23 and 24

The study revealed that a higher prevalence of Diabetes mellitus among subjects who were undertaking physical exercise less than 120 minutes per week (20.7%), as compared to 5% among those exercising 121-240 minutes per week. The prevalence was very less (0.6%) among those exercising more than 240 minutes per week. The difference observed was highly significant. This finding is in close agreement with the findings observed in various other studies which have shown positive association of physical exercise with diabetes mellitus. The findings of this study commensurate well with the findings of the Da Qing IGT and Diabetes Study[50] who observed a significantly low incidence of diabetes in the exercise group when compared with the control group. It was also seen that the mean duration of physical exercise per week was 142.25 ± 48.11 minutes among Diabetics, while it was 215.12 ± 65.54 minutes among Non diabetics (Table 23). The difference of the two means was found to be highly significant. The findings is in total agreement with the findings of Bhalwar et al[65] in his study among healthy middle aged army personnel, who observed higher blood sugar values among those personnel exercising lesser duration than those who were exercising regularly for longer duration of time. Similar findings have also been have also been reported by Mohan et al[42] who observed a lower prevalence of hyperglycemia in those who undertake exercise regularly.

Alcohol Consumption: Table 25-27

In this study it was found that nearly 70% of army personnel consume alcohol. Such high prevalence of alcohol consumption by army personnel is cause of concern. Gaur et a[67] also found similar prevalence of alcohol consumption amongst army

personnel at Belgaum Cantonment. The present study observed that the prevalence of diabetes was higher (8.1%) among those who consume alcohol as compared to non drinkers (3.7%). The difference observed between drinkers and non drinkers was statistically significant. Similarly, the prevalence of Diabetes increased with duration of alcohol consumption. It was 3.7% among non drinkers, and the prevalence increased to 5.1% among those who were consuming alcohol from last 5 years, and it rose to 6.01% and then to 11.2% among those who were consuming alcohol for 5 to 10 years and for more than 10 years respectively. The difference observed was highly significant. Present study also observed an increasing prevalence of diabetes with quantity of alcohol consumption. It was 3.7% among non drinkers, and the prevalence increased to 6.8% among those who consume up to 3 Pegs of alcohol per day and 12.3% among those who consume more than 3 Pegs of alcohol per day. The difference found was statistically significant. The Hoorn study[16] also observed a high prevalence of diabetes among Dutch Caucasian population who were consuming alcohol more than 30 g per day. The North Indian Diabetes Study conducted among the Punjabi population also found that alcohol intake was significantly higher and physical activity was significantly lower in diabetic subjects than in the controls.[34]

Smoking: Table 28

It was observed that 51.7% of study participants were smokers. It compares well with the earlier studies under taken among army personnel. Gaur et al[66] reported the prevalence of tobacco smoking among army personnel as 49.6%. Bhalwar et al[58] also reported that 46% of army personnel use tobacco.

The prevalence of diabetes was found to be higher among smokers (8.4%) as compared to non smokers (4.8%), but the difference observed between them was not

statistically significant. An epidemiological survey conducted in Greece shows that the prevalence of diabetes in smokers was significantly higher than non smokers.[45]

Smokeless Tobacco: Table 29

It was observed that 8.4% of study participants were using Smokeless Tobacco. An increased prevalence of diabetes was observed among smokeless tobacco users (8%) than those who do not use smokeless tobacco (6.54%), but the difference observed between them was not statistically significant.

Psychological stress: Table 30-31

It was observed that the mean duration of total field service rendered by all 40 study participants found to have Diabetes was higher (94.15 ± 18.99 months) as compared to mean duration of field service (51.94 ± 33.53 months) among non diabetics. Statistically this difference was highly significant.

Field service in the army means postings to areas such as remote mountainous, forest terrains, high altitude areas, the deserts and border areas. They are also forced to live in areas of extremes of temperatures and in close proximity with the troops of neighboring countries. Army personnel posted to such field areas are likely to lead a very stressful life. The findings of the present study clearly indicate that the psychological stress assessed in the form of total duration of field service is significantly associated with Diabetes.

In the present study, 45(7.5%) personnel gave a history of definite stress. Among these 7(15.5%) were found to be diabetic and 33(5.94%) non diabetic. The prevalence of diabetes mellitus was higher among personnel having mental stress as compared to those who did not have mental stress. The difference observed was statistically significant. Stress has long been recognized as a factor which may precipitate the occurrence of diabetes or may worsen it when present. This finding has

been strengthened by the work of Datta and Prasad[13] amongst defence population in Lucknow cantonment, who noted a significant association between Diabetes and prolonged mental stress.

Hypertension: Table No32-35

The present study shows that the overall prevalence of Hypertension among serving army personnel in Belgaum Cantonment is 15.17%.

The present study brought out a significant association between Hypertension and Diabetes. The prevalence of diabetes was found to be higher i.e. 9.9% among Hypertensives as compared to 6.09% among Normotensives. The difference observed between them was statistically highly significant.

It was seen that the mean Systolic Blood pressure among 40 diabetics was 135.5 ± 12.94 mm of Hg, while it was 124.9 ± 9.35 mm of Hg among Non Diabetics. The difference of the two means was statistically highly significant. Also the mean Diastolic Blood pressure among 40 diabetics was 87.5 ± 6.43 mm of Hg, while it was 81.5 ± 6.39 mm of Hg among Non diabetics. The difference of the two means was statistically highly significant. The findings of this study are in agreement Bhalwar et al[66] who observed a significant association of Hypertension with diabetes among army personnel. Varma et al[12] also documented similar results in his study among armed forces and naval personnel, who observed a strong correlation with both systolic and diastolic blood pressure with the increasing prevalence of diabetes. These observations are also supported by the findings of Ramachandran et al[54] who found that the mean blood sugar among Hypertensives was significantly high as compared to that of Normotensives. Aristofanis et al[45] in their study in Greece also observed that the prevalence of Diabetes Mellitus was higher among Hypertensives as compared to

Normotensives. Various other studies are available to support the above findings, where the researchers found a strong association of blood pressure (both systolic and diastolic) with Diabetes.[34, 41 42,43,45] It is thus clear that there is a positive correlation between high blood pressure and Diabetes.

CONCLUSION

On the basis of observations brought out in the present study, the following conclusions can be drawn.

The prevalence of Diabetes Mellitus among army personnel in Belgaum Cantonment is 6.67% (using latest WHO criteria). Out of 40 diabetics detected 17(42.5%) of them are newly detected cases of diabetes.

The sociodemographic determinants found to be significantly related to the prevalence of Diabetes in the present study are, increasing age, Officer Rank and higher level of education.

The various risk factors found to be significantly associated with Diabetes in the present study are, lack of physical exercise, alcohol intake, Hypertension, increased Body Mass Index (BMI), increased Waist Hip Ratio (WHR), family history of diabetes, extra fat intake in the diet and psychological stress including long duration of field service and prolonged mental stress.

To conclude, we observed a modest prevalence of diabetes mellitus among army personnel i.e. 6.67%. Urgent actions need to be taken to prevent diabetes becoming a major health problem in this organization.

SUMMARY

The present study was a cross sectional study undertaken to determine the prevalence of Diabetes Mellitus among army personnel and its association with various risk factors or determinants.

The study was conducted in Belgaum Cantonment for a period of one year from Jan 2007 to Dec 2007. The sample size of the present study was estimated to be 600 and was drawn from the study population by stratified random sampling method. The data collection procedure consisted of personal interview, physical examination and fasting blood sugar estimation. The categorization of the subjects in to Normoglycemics or Hyperglycemics was done using latest WHO criteria i.e. fasting blood sugar ≥ 126 mg/dl.

The sociodemographic characteristics of the study participants revealed that a majority of the subjects (68.2 %) were aged less than 35 years, predominantly they were Hindus (77.6%), from occupational category of "Arms" (79.8%), married (86.16%), consuming mixed diet (89.17%) and majority were educated up to PUC / Diploma (85.7%). Officers, junior commissioned officers and other ranks constituted 8%, 14% and 78% of study participants respectively.

The overall prevalence of diabetes was found to be 6.67%, i.e. 40 out of 600. Of these 40 study participants detected to have diabetes 23(57.5%) were known cases and 17(42.5%) were newly detected cases.

A significant association between Diabetes and increasing age was found in the present study. The prevalence increased from 3.93% in the age group 30-34 years to 24.5% in the age group of 45-49 years.

Diabetes was significantly associated with higher army ranks. The prevalence of Diabetes Mellitus was significantly higher among officers (12.5%) as compared to junior commissioned officers (10.71%) and Other Ranks (5.34%). The prevalence Diabetes was also higher among those having higher educational qualification, i.e. graduation and post graduation (12.8%), as compared to those who were educated up to Secondary level (4.6%).

The prevalence of Diabetes was higher in the Services category (9.99%) than the Arms category (5.84%), but the different was not statistically significant.

However, Diabetes was not found to be significantly associated with marital status, food habits, religion and region of the study participants.

The present study showed a significant association between Diabetes and alcohol consumption. The prevalence of diabetes was higher among drinkers (8.1%) than non drinkers and ex drinkers (3.1%); also the duration and quantity of alcohol consumption were positively associated with Diabetes. Similarly there was increased prevalence of Diabetes among those who were consuming extra fats regularly in their diet.

The prevalence of Diabetes was higher among smokers and those who use smokeless tobacco than those who were not using them, but the difference observed between them was not statistically significant. It was also observed that as many as 51.7% subjects were smokers, which is cause for serious concern.

As regards to psychological stress, a significant association was found between duration of field service and Diabetes. The mean duration of field service was more among Diabetics (94.15 ± 18.99 months) than Non diabetics (51.94 ± 33.53

months). Prolonged mental stress due personal and family problems was also positively associated with Diabetes.

A positive association was established between family history and Diabetes. 17.8% of diabetics had family history as against 5.8% of diabetics who did not have such family history.

The present study showed a significant association of Diabetes with physical exercise. The prevalence was very high i.e. 20.7% among those study participants who were undertaking physical activity less than 120 minutes per week, as compared to 5% and 0.6% among those undertaking physical activity in the range of 121-240 minutes and more than 240 minutes per week respectively. Also the mean duration of physical exercise per week was less among Diabetics than Non Diabetics (142.25 ± 48.11 and 215.12 ± 65.54 minutes respectively).

A significant association between Diabetes and obesity was established in the present study. The prevalence of Diabetes was 6.1% among those having BMI <25 as compared to 14.06% among those having BMI ≥25. Also the mean BMI was higher among Diabetics (24.15 ± 1.88) as compared to the mean BMI of Non Diabetics (22.72 ± 1.63). The prevalence of Diabetes was higher (12.2%) among those having WHR ≥0.9 as compared to (5.5%) among those having WHR <0.9.

The present study shows that the overall prevalence of Hypertension among serving army personnel in Belgaum Cantonment is 15.17%. The Prevalence of Hypertension was nil in the age group below 30 years. There on wards an upward trend of Hypertension prevalence was observed with increase in age. High blood pressure, both systolic and diastolic were significantly associated with Diabetes in this study. The prevalence of Diabetes was found to be higher i.e. 9.9% among

Hypertensives as compared to 6.09% among Normotensives. The mean Systolic Blood pressure among 40 Diabetics was 135.5 ± 12.94 mm of Hg, while it was 124.9 ± 9.35 mm of Hg among Non Diabetics. The mean Diastolic Blood pressure among 40 Diabetics was 87.5 ± 6.43 mm of Hg, while it was 81.5 ± 6.39 mm of Hg among Non Diabetics.

LIMITATIONS

1. For population based studies of glucose intolerance and Diabetes, OGTT is most preferred method for diagnosis of diabetes, but due to logistical and economic reasons, the fasting plasma glucose estimation was used in this study.

2. For assessing various risk factors e.g. physical activity, alcohol and tobacco use, the period of recall was kept as one year; it may give rise to recall bias. But diabetes being chronic disease risk factors should be assessed over longer duration of time.

RECOMMENDATIONS

Based on the observations of the present study, following recommendations are suggested for the prevention and control of Diabetes.

- As the disease is becoming common in younger age group, regular periodic medical check up should be conducted and annual blood sugar estimation should be made mandatory from 30 years onwards.
- The finding of higher prevalence of diabetes among Officers needs special attention and measures should be taken for early detection and treatment; also a preventive strategy should be developed.
- In army provision of alcoholic drinks to the personnel is considered to be related to the morale of the troops. But due to higher prevalence of diabetes among alcoholics as observed in this study, alcohol should be restricted among the troops.
- As the disease is more common in those who were not undertaking regular physical activities, there is a need to strictly enforce regular physical activity among all ranks.
- Keeping in view of higher prevalence of Diabetes among personnel who had longer duration of field service, regular and systematic turnover of field and peace postings may be considered as much as they are feasible administratively. At the same time steps should be directed to those who are having prolonged mental stress due to personal and family problems.
- The significant association of Diabetes with BMI and WHR as brought out in this study indicates that the measurement of BMI and WHR should be incorporated as a part of periodic medical checkups.

- Health education should be given to the troops to adopt healthy lifestyles i.e. avoidance of excess fatty foods in the diet, tobacco use, and promoting regular exercises and yoga.
- Lastly it is suggested that, findings and recommendations of this study be reconfirmed with other large scale studies so that a strategy can be formulated for the prevention and control of Diabetes in Indian Army.

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INFORMED CONSENT FORM

A CROSS SECTIONAL STUDY OF PREVALANCE OF DIABETES MELLITUS AMONG ARMY PERSONNEL IN BELGAUM CANTONMENT

Principal Investigator: Maj(Dr). Madhusudhana M.V.

Guide: Dr. A.S. Wantamutte, MD (BHU)

VOLUNTARY PARTICIPATION / WITHDRAWAL:

You are being invited to participate in this study to find out the prevalence rate of Diabetes Mellitus among army personnel in Belgaum Cantonment.

In this study you will have to undergo some blood tests to measure the blood sugar level, blood pressure measurements, height and weight measurements which may have indirect bearing on developing diabetes in future life. Also you are required to provide information regarding the habits, physical activity, personal and family history of Diabetes Mellitus. The entire procedure may take about 30 minutes.

If you agree to participate, you will be randomly (like a toss of a coin) selected for the study and you have an equal chance of getting into the study.

The investigator do not promise or guarantee that you will receive direct benefit being in the study. If you happened to be selected in to the study you have the benefit of knowing your diabetes status which may help on seeking definite treatment and may prevent development of serious complication in the future.

There are no known physical risks involved to the participants in this study. The procedures will be done taking aseptic precaution using standard equipments.

CONFIDENTIALITY:

Your identity will not be revealed. All information collected will be collected and coded so that no one will know your identity.

Participation in this study is voluntary. If you do not wish to participate in this study, you will not lose benefits to which you are entitled. You are free to withdraw your consent and to discontinue participation in this study at any time.

Any significant new findings discovered during the course of this study, which may influence your decision to participate in the study, will be made known to you.

COSTS:

The cost of the study will be borne by the researcher. There will be no additional cost to you for participating in this study.

COMPENSATION:

There will be no payment to you for participating in this study. If, as a result of your participation, if you experience injury from known or unknown risk of the research procedures as described, immediate care and treatment, including hospitalization if necessary, will be available. However there will be no monetary compensation in the event of injury resulting from the research and in the event of such injury, treatment is provided.

If you have any questions about this study, questions about a research related injury, or experience any problems during the study, you should contact Dr. MADHUSUDHANA M.V. at 9844303329 or Dr.A.S.WANTAMUTTE at 0831240915481 and, if you have any questions about your rights as a study participant, you may contact Dr V.D. PATIL, Chairman, JNMC Institutional ethics committee on human subjects research at 0831 2741701.

By signing this consent form, you are not waiving any of your legal rights. You are making a voluntary decision whether or not to participate in this study. Your signature below indicates that you have decided to participate, that you have read (or been read) the information provided above, that you were given the opportunity to ask questions and that they have been answered to your satisfaction, and that you have received a copy of this signed consent form.

CONSENT OF THE SUBJECT TO PARTICIPATE IN THE STUDY:

I voluntarily agree to take part in this study by signing below. I may withdraw at any time. I am not giving up any of my legal rights by signing this form. My

signature below indicates that I have read, or it has been read to me, this entire consent form, and have had all my questions answered.

_____

Signature of the participant Date

_____

Signature of Principal Investigator Date

_____

Signature of Witness Date

PROFORMA

A CROSS SECTIONAL STUDY OF DIABETES MELLITUS AMONG ARMY PESONNEL AT BELGAUM CANTONMENT.

PART – 1: INFORMATION ON SOCIODEMOGRAPHIC VARIABLES.

1. Serial No:_____

2. Subject examination no. _____.

3. Date:_____

4. Name_____

5. Age (to the nearest completed year):_____

6. Occupation /Army unit:

   Arms / Services

7. Socioeconomic status (according to army rank):

   Officers / Junior commissioned officers / Other ranks (ORs)

8. Religion:

   Hindu / Muslim / Sikh / Christian / Other

9. Marital Status:

   Married / Unmarried / Widower / Divorced

10. Region:

    North / South / East / West

11. Food Habit:

    Vegetarian / Mixed diet

12. Educational Status:

    a. Graduate & Post graduate

    b. PUC / Diploma

    c. Secondary

PART- 2: INFORMATION ON RISK FACTORS

A. Alcohol Consumption:

1. Do you have or ever had the habit of consuming alcohol?

Answer: Yes / No

2. If yes

Quantity per day	Quantity per week	Duration	If left, since when?

(One large peg=60ml, one bottle of Beer =650ml)

B. Smoking:

1. Do you have or ever had the habit of Smoking?

Answer: Yes / No

2. If yes

Type of tobacco	No. per day	No. per week	Duration	If left, since when?
Beedi/Cigarette/Cigar				

C. Smokeless Tobacco use:

1. Do you have or ever had the habit of using Smokeless tobacco?

Answer: Yes/ No

2. If yes

Type of tobacco	No. per day	No. per week	Duration	If left, since when?
Gutkha/Khainee/Snuff				

D. Physical Activity:

1. Have you been undertaking any type of exercises regularly?

Answer: Yes / No

2. If yes

Type of exercise	**Minutes/day**	**Minutes/week**	**Total duration**
Brisk walk			
Running/jogging			
Parade/Games			
other			

E. Extra Fat consumption:

Do you regularly add extra fats like Ghee / Butter / Cheese to food on dining table?

Answer: Yes / No

F. Psychological factors:

1. How many years/ months have you served in field/operational areas?

_____ Months.

2. Are you having any major personal or family problem (not related to service) bothering you mentally for long time?

Answer: Yes / No / No Comments

G. personal history of Diabetes:

1. Have you ever been diagnosed as a case of Diabetes?

Answer: Yes / No

2. If yes since how long you are having Diabetes?

_____ Years.

3. Are you taking any treatment for Diabetes?

Answer: Yes / No

H. Family history of Diabetes:

1. Do any of your family members have diabetes mellitus?

   Answer: Yes / No

2. If yes who are suffering from the disease?

   Father / Mother / Both / Brother / Sister

Part -3: Physical examination:

1. Height: _____ cms.
2. Weight: _____ kgs.
3. Body Mass Index (BMI)

   $= \frac{\text{Weight in kg}}{\text{Height (in meters)}^2}$

   =_____

4. Waist circumference:_____cms.
5. Hip circumference:_____cms.
6. Waist Hip Ratio (WHR): _____

7. Blood pressure:

1st_____mm of Hg.

2nd_____ mm of Hg.

Mean_____mm of Hg.

Part -4: Laboratory examination:

1. Fasting Blood Sugar:_____mg/dl.

KEY TO MASTER CHART

Column	Key
4.	O-Officers
	J-Junior commissioned officers

	OR-Other Ranks
5.	A-Arms
	S-Services
6.	N-North
	S-South
	E-East
	W-West
7.	A-Graduate & above
	B-PUC / Diploma
	C-Secondary
8.	H-Hindu
	M-Muslim
	S-Sikh
	C-Christian
	O-Other
9.	N-No
	Y-Yes
10.	M-Mixed diet
	V-Vegetarian
11	M-Married
	UM-Unmarried
	W-Widower
	D-Divorced

16. N-No

33	FBS (mg / dl)

Y-

Yes

EX-Ex Smoker

21. N-No

Y-Yes

22. N-No

Y-Yes

23. 0-No

1-Yes

24. 0-No

1-Yes

MASTER CHART

32	Blood pressure	Diastolic (mm of Hg)
31		Systolic (mm of Hg)
30	WHR	
29	Hip	
28	Waist	
27	BMI	
26	Weight (Kg)	
25	Height (Cm)	
24	Family history	
23	Diabetes status	
22	Psychological factors	Mental stress
21		Job satisfaction
20		Field service (months)
19		Total service (yrs)
18	Physical activity	Total duration(minutes)
17		Frequency per week
16	Smokeless Tobacco	
15	Tobacco smoking	No per day
14		If yes duration (yrs)
13	Alcohol consumption	Quantity(in pegs)
12		If yes duration (yrs)
11	Marital status	
10	Diet	
9	Extra fat intake	
8	Religion	
7	Education	
6	Region	
5	Unit / Occupation	
4	Rank / Socioeconomic status	
3	Sex	
2	Age	
1	Sl. No.	