

**THE PREVALENCE OF DIET RELATED DISORDERS  
AMONG THE SELECTED POPULATION IN SHILLONG  
AND THE EFFECT OF DIET MODIFICATION**

*BY*

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## CERTIFICATE

*This is to certify that the dissertation entitled “**The prevalence of diet related disorder among the selected population in Shillong and the effect of diet modification**” submitted to Avinashilingam Institute for Home Science and Higher Education for Women (Deemed University), Coimbatore for the award of the degree of **Master of Philosophy in Food Service Management and Dietetics** the record of original research work done by **Ivorica.L.Nongpiur** during the period of her study in the Faculty of Home Science, Avinashilingam Institute for Home Science and Higher Education for Women (Deemed University), Coimbatore under my supervision and guidance and thesis had not formed the basis for the award of any Degree / Diploma / Associateship / Fellowship or other similar title to any candidate of any university.*

  
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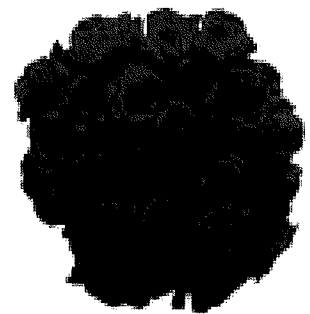
  
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## DECLARATION

*I hereby declare that the dissertation entitled “**The prevalence of diet related disorder among the selected population in Shillong and the effect of diet modification**” submitted to Avinashilingam Institute for Home Science and Higher Education for Women (Deemed University), Coimbatore, is the result of investigation carried out by me in the Faculty of Home Science, **Department of Food Service Management and Dietetics**, Avinashilingam Institute for Home Science and Higher Education for Women (Deemed University), Coimbatore and has not formed the basis of the award of any Degree / Diploma / Associateship / Fellowship or other similar title to any candidate of any university.*

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## *INTRODUCTION*

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# I INTRODUCTION

Health is not a status phenomenon but a dynamic life process which being at birth and governed by the genetic, nutritional and environmental factors throughout life (Ghosh, 2003).

Human need enough food to live and the right assortment of foods for optimal health. Every individual has a range of optimal nutrient intake. On either side of the optimal range are level of intake associated with impaired cell and body functions. Inadequate essential nutrients intake, if prolonged, result in obvious deficiency disease (Brown, 2002).

Changes in life-style and dietary pattern increase in the occurrence of non-communicable yet chronic and degenerative diet related diseases like diabetes mellitus, hypertension, cardiovascular disease, obesity and cancer.

Non-communicable diseases are becoming the main causes of death and diseases in the developing world and the risk factors tend to accumulate in the lower socio-economic segment of the population in most countries (Pushba *et al.*, 2001).

Diabetes mellitus is one of the most burdensome chronic disease. The prevalence of diabetes mellitus in adult is around 4 per cent world wide, and this mean that over 143 million people are now affected. The disease prevalence will be 4.5 per cent by the year 2005, with global diabetic population reaching 300 million of which, nearly 77 per cent of the global burden of disease is projected to occur in the developing countries (Park and Park, 2000).

WHO (1999) reported that the prevalence of cardiovascular disease is 18 per cent and it is only 9.7 per cent in low middle income group which can be related to the fat especially of animal origin.

Hypertension is a silent disease and is one of the important risk factor of cardiovascular disease. Kamath (2003) states that nearly 1/3 of the Indian population is in danger of being affected by two major killer disease, namely hypertension and diabetes by the year 2015.

According to Ko *et al.*, (1999) increasing BMI is associated with higher risk of diabetes mellitus, hypertension and other cardiovascular risk factors.

Devadas (2000) pointed out that anaemia is a wide spread health problem. More than 300 million people in India suffer from iron deficiency anaemia with the highest prevalence among women and children (40-80 per cent expected women, 60-70 per cent children and 50 per cent adolescent girls).

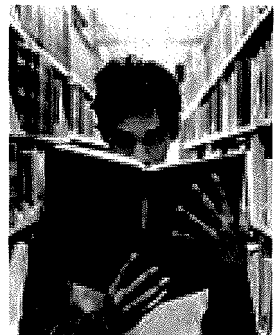
As pointed out by Basu (2000) the health nutrition problem of diverse tribal groups have been found to be unique and present a bewildering diversity and variety in socio-economic and ecology setting.

Meghalaya a state which is known as abode of clouds is a hilly area where the tribal natives khasi and non-khasi tribe who are the migrants from Assam and Bangaldesh reside. These non-khasi tribal settle in Shillong for their livelihood.

The life-style pattern and the culture is different from other states. The secluded nature of the tribal groups, their dietary pattern is also very peculiar.

Since researchers have not paid much attention to study the health status of the tribal population, a survey on pattern of disease prevalent, dietary habits and diet modification among the tribal population would help to initiate intervention programmes to improve the health status of the tribal population, the present study was conceived with the following objectives : To

- ❧ Elicit background information on the socio-economic status and nature of occupation.
- ❧ Find out the prevalence of diet related disorders among the selected subjects.
- ❧ Assess the nutritional profile of selected subjects through anthropometric measurement, biochemical estimations and diet survey.
- ❧ Provide appropriate diet modification to the subjects affected with diet related disorders and
- ❧ Evaluate the effect of diet modification among the selected subjects.



## *REVIEW OF LITERATURE*

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## II REVIEW OF LITERATURE

The review of literature pertaining to the study “The prevalence of diet related disorders among the selected population in Shillong and the effect of dietary modification” is discussed under the following heading.

- A. Diet related disorders – an overview
- B. Prevalence of diet related disorders
- C. Prevention of diet related disorders

### A. DIET RELATED DISORDERS – AN OVERVIEW

According to Hakajima (2000) good health is a major resource and an important dimension of the quality of life. But in present times, changes in lifestyles and dietary pattern stemming from rapid modernization have favoured an increase in the occurrence of non-communicable yet chronic and degenerative diet related diseases among which cardio-vascular diseases occupy a primary place.

Khor (2001) states that by 2020, non-communicable diseases are expected to account for seven out of every ten death in the developing countries.

#### 1. Anaemia

Penninx *et al.*, (2003) suggest that (a new epidemiological study supported by National Institute on Ageing) anaemia doubles the risk that of an elderly person by developing serious physical declines that can curtail the ability to live independently, (Penninx *et al.*, 2003).

Al Quiz (2001) found dietary habits, menorrhagia and history of ingestion of NSHID or antacid as an increased risk factors of iron deficiency anaemia, among Saudi women of child bearing age.

Anaemia is the most prevalent nutritional problem in the world today affecting more than 700 million persons (Gupta 2003).

Yegammai *et al.*, (2004) states that anaemia is estimated to affected 3.5 billion individuals in the developing world, or well over 2 persons out of 3. More than 320 million people in India suffer from iron deficiency anaemia with the highest prevalence among women and children.

Iron deficiency anaemia is responsible for <sup>one</sup> a fifth of early neonatal mortality and tenth of maternal mortality. It also reduces cognitive development and work performance. About 8,00,000 death and 2.4 per cent of global DAILY's have been attributed to iron deficiency and 3.5 per cent are anaemic (Black, 2003).

Prevalence of iron deficiency in United States <sup>from</sup> a sampling of nearly 25,000 person in the Third National Health and Nutrition Examination survey finds approximately 10 per cent of young women <sup>have</sup> are iron deficiency and 3-4 per cent are anaemic (Eichner, 2001).

In developing countries of south-Asia prevalence of anaemia among pregnant women is as high as 60-70 per cent (Sari *et al.*, 2001).

According to the studies carried out by Food and Nutrition Board and National Institute of Nutrition, the prevalence of anaemia was noted to be 56.5 per cent in adult women, 75 per cent in pregnant women, 77 per cent in pre-school children and 54 percent in all adult men from poor rural communities (Devadas, 2000).

A survey done by Charkravathy and Ghosh (2000) in Gumla district of Bihar found that mild and moderate anemia were very high in the females (82.7% and 79.1% in comparison to males 67 per cent and 63.9 per cent) in the age group of 19-45 years and 40-60 years respectively. In pregnant women a very high

prevalence of anemia was observed which is in the range of 82 per cent and 18 per cent.

## 2. Diabetes Mellitus

Diabetes mellitus and hypertension are both major public health problems in our country which co-exist frequently resulting in significant morbidity and mortality. Globally, diabetes will more than double by 2025, with the number of people affected rising from about 135 million to 300 million (World Health Organization, 2003). India leads the world with its largest number of diabetic subjects. It is estimated that between 10-12 per cent of the urban population and 4-6 per cent of the rural population in India have diabetes (Ananthanarayan, 2003).

The current estimates from United States shows more than 13 million people have physician-diagnosed diabetes and another 5-4 million may have undiagnosed diabetes mellitus (American Heart Association, 2000).

Native American, Mexican American, other Hispanic and non-Hispanic blacks have approximately a 160 per cent, 100 per cent, 80 per cent and 60 per cent greater rate of Type II diabetes when compared with non-Hispanic whites (Macintosh *et al.*, 2001).

In new castle study about 18 per cent of south Asian aged 25-74 were found to have diabetes and an additional 29 per cent had impaired glucose tolerance (Unwin *et al.*, 2001).

The study conducted by Wassy *et al.*, (1999) among the Sandi and non-sandi inhabitants revealed that the overall prevalence of diabetes mellitus was 9.7 per cent and 25.20 per cent.

Patrasa (2003) reported that at present 7-10 per cent of Sri-Lankans suffer from diabetes mellitus and it is expected to increase three fold by the year 2025.

According to Rema (2001) India has the highest prevalence rate of diabetes than ~~is~~ about 20 per cent of the total diabetic population in the world.

The health statistic (2003) has found out the prevalence of diabetes mellitus among rural population of Ahmedabad, Calcutta, Cuttak, Delhi, Pune and Trivandrum were found to be 3.8 per cent, 1.78 per cent, 2.02 per cent, 0.95 per cent, 1.86 per cent and 1.83 per cent respectively.

Erasmur (2001) studied among 374 factor workers of Transkei South Africa shows that age adjusted prevalence using a standard world population were 4.5 per cent and 5.1 per cent for diabetes were 2.45 per cent and 2.7 per cent respectively.

According to National Cholesterol Education Programme Expert Panel (2001) diabetes is the major risk factor for cardiovascular disease, the relative risk for coronary heart disease for men with diabetes mellitus is 2 to 3 and that for women with diabetes mellitus is 3 to 4.

Kennedy (2003) research director at diabetes U.K said that the risk of death from type I diabetes increases with age. It is caused by the long-term complications of diabetes which include heart disease, stroke and kidney failure.

According to Kothari (2001) diabetes mellitus once considered to be a single disease entity is basically heterogeneous, resulting from diverse etiologies in which environmental and genetic factors acting in concord.

According to the study conducted by Riste (2001) in the ethnic groups in Britain, South Asian suffer from an increased risk of non-insulin dependent diabetes mellitus together with adverse fat distribution, hyperinsulinemia and insulin resistance relative to other ethnic group.

Diabetes is a metabolic disorder, characterized by various microvascular and macrovascular complications particularly of heart, kidney, brain, peripheral nerves and retina (Gandhi *et al.*, 2003).

The cross sectional study conducted in 2202 diabetic subjects in Lebanon revealed that the major complication of diabetes was cardiovascular disease followed by retinopathy (Yusef, 2000).

Meher *et al.*, (2002) reported that the complication of nephropathy, neuropathy and retinopathy was more common in type II than in other type of diabetes and patients with a strong family history of diabetes.

Cardiovascular disease among Asian is frequently associated with insulin resistance, diabetes and abdominal obesity yielding specific abnormalities in lipoprotein metabolism (Wardena, 2002).

Morbidity and mortality due to premature onset of coronary heart disease, diabetes are increasing world wide and studies indicates that early stages of atherosclerosis begin in childhood itself and the lesions progress through several stages before becoming clinically manifested in middle / late adult hood (Passi *et al.*, 2002).

Dietary affluence coupled with sedentary life styles and imbalanced diets contribute to several chronic degenerative diseases such as Cardiovascular Diseases (CVD), diabetes and cancer.

### **3. Hypertension**

A study among the 1900 workers in PRISMLONI found that the prevalence of diabetes mellitus and hypertension was 1.21 per cent and four per cent respectively (Dixit and Kulkarni, 1995).

A study from Belgium shows a significant association with age, occupation, smoking, hypertension and sick leave. More prominent in female a trend in increasing year of prevalence of sick leave with increase body mass index (Moens *et al.*, 1999).

Overweight in general population, as well as in specific group like bank clerks, highlights the urgent need for definition and development of prevention and control policies capable of reducing the risk factors for obesity and ultimately leading to decrease in the social cost due to mortality from chronic disease (Elle *et al.*, 1999).

Hypertension is the major health risk factors for cardiovascular mortality, which accounts for 20 to 50 per cent of all deaths (WHO, 1998).

According to Kulkarni (1998) high blood pressure is fast emerging as a modern epidemic in the world, killing twelve million people annually world-wide, more than any other single disease.

World Health Organization (1996) stated that, sedentary and unfit normotensive individuals have a 20 to 50 per cent increased risk of developing hypertension.

Hypertension is the important risk factor for both coronary artery diseases and stroke (Mafauzy *et al.*, 2000).

In the Asia-Pacific region, a population wide reduction of 3mm Hg in diastolic pressure is likely to decrease the number of strokes by about one-third (Worsley, 2001).

The prevalence of hypertension in diabetes varies widely but is probably 1.5-2 times higher than that reported in the general population. The presence of

hypertension in diabetic patients increases the mortality 4-5 fold largely through coronary artery disease and stroke (Shahay and Sahay, 2003).

World Health Organization reported that hypertension is an important public health problem in developing countries and also reported in adults aged 40-45 years. Blood pressure were the highest among Indian men as compared to those twenty others developing countries (Gupta, 1999).

#### **4. Obesity**

According to World Health Organization estimates, the global prevalence of obesity exceeds 250 million or 7 per cent of the world's adult population (Gill, 1999).

Bezbaruah (2003) states that 80 per cent of obese adolescents grow into obese adults.

According to Misra *et al.*, (2004), stated that obesity (BMI > 25) is Healthy Asian Indian in Northern India (17) has been observed to be 19 per cent in men and 30 per cent in women.

James (2003) pointed out that the obesity has doubled among American adults since 1980. In 1999, 61 per cent of the American adults were over weight and obese.

According to WHO global database (2003) 53 per cent of school going children are malnourished.

Popkin (2002) reports that nearly 30 per cent of the world's population is currently suffering from one or more of the multiple forms of malnutrition.

In Australia, between 1986 and 1996 mortality from coronary heart disease in men and women aged 30-69 years declined by 46 per cent and 85 per cent respectively (Sexton *et al.*, 2000).

## **B. PREVALENCE OF DIET RELATED DISORDERS**

### **1. Anaemia**

Incidence of anaemia in developing countries is high and its prevalence is mostly attributed to iron deficiency and other nutritional deficiencies indicating more prevalence among the low income group (Bhatra and Chandra, 1993).

According to Devadas (2000) anaemia, a wide spread health problem is estimated to affect 3.5 million individuals in the developing world or well over two person out of three, more than 320 million people in India suffer from iron deficiency anaemia with the highest prevalence among women and children 40 to 80 per cent expected women, 60-70 per cent children and 50 per cent adolescent girls.

### **2. Diabetes Mellitus**

Genetic predisposition and environmental factors have been established to precipitate diabetes in susceptible individuals. Increased consumption of introduced foods are associated with an increased prevalence of diabetes (Lako, 2001).

Singh (2003) has pointed out that the age of onset of diabetes is a decade earlier in Indian compared to other countries.

According to Mokdad *et al.*, (2000) the prevalence of diabetes increased 33 per cent among people of all ages and ethnic group.

The prevalence of diabetes in Northern India was found to be 11.2 per cent in male and 9.9 per cent in females, the over all prevalence being 10.3 per cent (Misra *et al.*, 2001).

The study conducted in the costal Karnataka reveals that the prevalence of diabetes to be 5.6 per cent and 15.9 per cent in the rural and urban population (Rao, 1999).

The prevalence of diabetes in the general population of Hyderabad was found to be 16.6 per cent (Snehalatha *et al.*, 2001).

In Trivandrum district, the prevalence of diabetes was found to be 16.2 per cent to 18 per cent (Soman, 2002).

According to Gupta (2003) people with diabetes are 25 times more likely to develop blindness, 17 times more likely to develop kidney disease, 30-40 times more likely to suffer a heart attack and twice as likely to get a stroke than normal individual.

Chennai Urban Population Study (CUPS) by Pradeepa *et al.*, (2002) found that the prevalence rate (age standarised of diabetes and impaired glucose tolerance) were significantly higher in the middle compared to the low income group people (diabetes : 12.4 per cent versus 6.5 per cent respectively and IGT : 75 per cent and 2.9 per cent respectively).

High prevalence of Impaired Fasting Glucose (IFG) and Diabetes Mellitus (DM) was found in screening females belonging to high risk group and the prevalence was influenced by factors such as age, social class, community, menstrual status, BMI, physical activity and multiplicity of risk factors (Samanta, 2004).

The cohort studies conducted among 10,000 diabetics to model the life time costs for the type II diabetic complication reveals that the macrovascular disease is estimated to be the largest cost component, accounting for 52 per cent of the cost, nephropathy 21 per cent, neuropathy 17 per cent and retinopathy 10 per cent of the cost of the complication (Caro *et al.*, 2002).

The study conducted <sup>among</sup> in 8922 non insulin dependent diabetes patients at Bengazhi reported that most common complications of diabetes were neuropathy (45.7%), retinopathy (30.5%) and nephropathy (25.2%) (Kadiki *et al.*, 1999).

Diabetic retinopathy is a leading cause of blindness and visual disability. Research finding suggested that after 15 years of diabetes, approximately 2 per cent of people become blind, while about 10 per cent develop visual handicap (World Health Organization, 2003).

According to Narang *et al.*, (2002) diabetic retinopathy is the leading cause of blindness in about 35 per cent diabetic patients.

Study conducted by Ali *et al.*, (2001) among Pakistani's reported diabetic foot ulcer in 100 subjects and the main factor for this as lack of awareness, poor glycemic control and duration of diabetes.

In India, <sup>out</sup> of the total diabetic population 15-20 per cent have foot problems. The loss of limb in these patients is preventable as majority of diabetic foot problems in India is neuropathic (Bal, 2002).

The overall prevalence of neuropathy in our country appears to be lower than Europeans. In the Chennai urban population study (CUPS) the prevalence of neuropathy was 7.7 per cent (Ramu *et al.*, 2002).

According to the Casale monferrato study on overt nephropathy in type II diabetes, 3.7 per cent progress every year to overt nephropathy, where microalbuminuria is the major risk factor (Bruno *et al.*, 2003).

The degree of retinopathy in diabetes mellitus is higher with increased duration of hypertension, poorly controlled hyperglycemia and nephropathy (Biswas, 2002).

### **3. Hypertension**

Gupta *et al.*, identified risk factors for hypertension, which are essentially age, smoking, higher body mass index in urban and rural population using multivariate and logistic regression analysis (Mukherjee, 1999).

Hypertension is a silent disease and is one of the important risk factors of cardiovascular diseases. The president elect of the hypertension society of India, Kamath (2003), states that nearly one-third of the Indian population is in danger of being affected by two major killers diseases, namely hypertension and diabetes by the year 2015.

According to Gupta *et al.*, (1997) reported shows that among Indians, urbans have high prevalence of hypertension than in rural areas. Thirty-one per cent of urban Indians have high blood pressure and south Indian have the highest prevalence rates (Kennedy, 1999).

Singh *et al.*, (1999) stated that, socio-economic status, sedentary lifestyle, food consumption pattern and obesity are the major determinants for the prevalence of hypertension in older men.

According to Davidson (1990) an increase in salt intake is known to increase blood pressure as sodium increases the sensitivity of arteriole to vasoconstrictor substances in the body.

Smoking raised body mass index and waist hip ratio, are important risk factor lead to hypertension (Jain *et al.*, 2003).

Kulkarni (1998) states that when both the parents are hypertensive, the chance of developing hypertension to their children are 50 per cent whereas when only one parent has hypertension, the chance of developing hypertension to their children are 25 per cent.

Hypertension with BMI > 25 / kg / m<sup>2</sup> had high prevalence of diabetes and impaired fasting glucose with BMI <25/kg/m<sup>2</sup>. Female hypertensives with BMI < 25/kg/m<sup>2</sup> had high prevalence of diabetes mellitus than male hypertensive with BMI < 25 / kg / m<sup>2</sup> (Samatha, 2003).

Protein, fat and salt are risk factor of hypertension. Kodali (1999) states that intake of excess fat was found to be an incriminating factor for men, while for women protein played a significant role.

A study among the 194 subjects, shows that the onset possibility of hypertension and diabetes mellitus among chronic degenerative diseases was higher in labourers than in office workers, while the onset possibilities of obesity was higher in office workers than in labourers (Hyummel *et al.*, 2001).

Manchanda (2000) states that the risk of getting heart attack is increased by atleast 6 times in people who smoke than 15 cigarettes per day.

Bulliyya (2001) study states, the post menopausal women had significant high levels of blood pressure, pulse rate and serum total cholesterol. High prevalence of risk factors of coronary heart disease among women in older age group suggest that when estrogen production ceases in menopausal women, the risk of coronary heart disease increase.

Gnandurai (2001) states that the risk of death from heart disease is also 30 per cent higher among people exposed to environmental tobacco smoke at home. This figure could be much higher for people exposed to higher levels of smoke at work.

Isolated low High Density Lipoprotein cholesterol and isolated high triglyceride cholesterol were the commonest isolated lipid abnormalities among rural and urban population of North West India. Prevalence of dyslipidemia is in the range of 45-50 per cent in normotensive and hypertensive in India. The prevalence was highest among rural hypertensive population (21.5%). The prevalence of these lipid abnormalities was lowest in urban hypertensive population (12.8%) (Malhotra *et al.*, 2003).

Abnormalities of lipid and lipoprotein metabolism occur more frequently in patients with hypertension. Hisalkar *et al.*, (2003) found dyslipidemia and hypertension are common risk factors of coronary artery disease. Thirty eight of all the hypertensive subjects had diabetes. Lipid abnormalities were more prevalent in males than females.

#### **4. Obesity**

According to Bowman (2004) obesity poses a major risk for serious diet-related non-communicable diseases including diabetes mellitus, cardiovascular diseases, hypertension and stroke and certain forms of cancer.

The National Health and Nutrition Examination Surveys (2002) show that the percentage of adults who were overweight or obese increased from 55.9% in 1988 through 1994 to 64.5% in 1999 through 2000. During this same period, the percentage of overweight teenagers increased from 10.5 percent to 15.5 per cent.

A study by Shaw *et al.*, (1999) shows that there is a strong familial aggregation of hyperglycemia and obesity in the relatives of the subjects with type

II diabetes and these subjects have higher fasting plasma insulin concentration and lower high density lipo protein cholesterol than the general population.

Tripathi *et al.*, have reported that malnutrition plays an important role in the development of malnutrition modulated diabetes mellitus (Iyer, 2003).

Karmally (2003), states that south-Asians living in urban areas and in western countries are at the high risk of heart diseases compared to other ethnic groups. High plasma triglycerides and low high density lipoprotein levels have been documented in Asian Indians.

A cross-sectional study by Vikram *et al.*, (2003) among low socio-economic stratum of urban slums in New Delhi shows that Asian Indians have excess cardiovascular risk at body mass index and waist circumference values considered normal.

Vander *et al.*, (2001) states that family history of hypertension, diabetes and stroke was a significant risk factor for obesity and hyperlipidemia with increasing age.

A study among Saudi females of child bearing age shows that overweight and obesity are frequently encountered in Saudi females of child bearing age (Al-maiki, 2003).

Epidemiology studies by Sawaya *et al.*, (2003) suggest an association between childhood nutrition stunting and increasing risk of obesity and chronic degenerative disease in adulthood.

High fat diets play an important role in the increased prevalence of obesity. The back of adjustment of fat oxidation to a high-fat intake can be counteracted by performing physical activity, leading to lowering of glycogen stores (Schrauwen *et al.*, 2000).

Increasing body mass index was associated with higher levels of the classic cardiovascular risk factors in both sexes, particularly in men. Total cholesterol and low density lipoprotein, energy malnutrition, physical activity and dietary intake of carbohydrate, total fat and saturated fatty acid were determinants in men. Protein was a better determinant of body mass index than fat in women (Schroder *et al.*, 2003).

## **C. PREVENTION OF DIET RELATED DISORDERS**

### **1. Anaemia**

Iron fortification of selected foods of daily consumption is essential for frequent supply of iron to vulnerable groups who suffers from iron deficiency but remained undiagnosed due to absence of clinical symptoms (Bains and Mann, 2000).

Veteri *et al.*, (2000) study shows that, long term weekly iron supplementation improves and sustains non-pregnant women's iron status better than currently recommended short term daily supplementation.

Dark green leafy vegetables such as spinach, certain fruits especially dried apricots, peaches, prunes and raisins are useful sources of iron but in general fresh fruits and vegetables are for greater value because of their ascorbic acid content which facilitates iron absorption (Gupta, 2003).

### **2. Diabetes Mellitus**

A high mono-unsaturated fat diet seemed to have a favourable effect on fasting lipo protein profile in people with type I diabetes (Strychar *et al.*, 2003).

Chandalia *et al.*, (2000) states that a high intake of dietary fibre particularly of the soluble type above the level recommended by American Diabetic

Association, improves glycemic cholesterol, decreases hyperinsulinaemia and lower plasma lipid concentration in patients with type II diabetes.

Serum lipid abnormalities are an increasing concern and reason for medication use in diabetes and may be improved by viscous fibre, soy and other vegetable proteins and plants sterols. Nuts are also increasingly seen useful in improving the blood lipid profile (Jenkins *et al.*, 2003).

Life style modification is an important and cost effective first line approach in the management of type II diabetes (Shahay, Sahay, 2002).

Weight control is of fundamental importance in the population strategy for the prevention of glucose intolerance especially in high risk individual (Rao, 2002).

Moderate weight loss (5.7per cent) combined with an increased in moderate activity was significantly more effective than drug treatment in delaying the development of type II diabetes (Sheard, 2003).

Ellingsen *et al.*, (2003) advised that chance in diet and smoking habits reduce the relative risk of ischemic heart disease and mortality after 23 years in men with high triacylglycerol concentration.

Primordial prevention of coronary heart disease can be achieved by encouragement of positive health behaviour and promotion of the concept of health as a social value. The intervention are smoking cessation, increased physical activity, weight regulation, blood pressure control and lipid regulation and diabetes management (Gupta, 2000).

Regular substitution of low glycemic index carbohydrates such as whole grains for high glycemic index products may help prevent excess weight gain and

is a dietary recommendation consistent with current U.S dietary guideline (Roberts, 2000).

Daily consumption of soy oil and lin-seed containing foods and canola by mildly hypercholesterolemic women resulted in clinically significant improvement in plasma cholesterol after 3 weeks (Ridges *et al.*, 2001).

Control of diabetes and achievement of normoglycaemia is essential for primary prevention cardiovascular events (Greendy *et al.*, 1999).

### **3. Hypertension**

Diets high in fruits and vegetables and low-fat dairy products are extremely effective in lowering blood pressure, in short-term (Lenfant, 2001).

Weight reduction, moderate salt and fat restriction, alcohol reduction and increasing the fibre in the diet may lower blood pressure and their use can be made feasible in the long term (Chhabra, 2001).

For the prevention and / or non pharmacologic therapy of hypertension, potassium <sup>from</sup> dietary source should be encouraged rather than potassium supplements (Suter, 1998).

Reducing salt intake by 9g / day would reduce strokes by approximately one-third and ischemic heart disease by one quarter and thus would prevent 20,500 strokes death and 31,400 ischemic heart disease deaths a year in United Kingdom (He and Max Greyer, 2003).

Dash study shows that dietary change can reduce blood pressure under optimal conditions, with the likelihood that it can have substantial protector effects on cardiovascular disease outcomes. Dash study demonstrated that providing 8-10

fruits and vegetables and 2-3 low fat dairy foods / days significantly lowered blood pressure (Tucker, 1999).

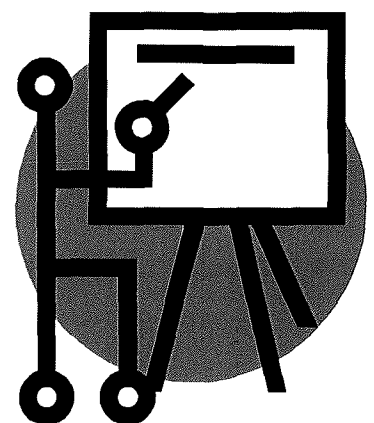
Wattanapenpaiboon (2001) states, eating fresh fruits daily was associated with a 32 per cent reduction in mortality from cerebrovascular diseases, a 24 per cent reduction in ischemic heart diseases and a 21 per cent reduction in all cause mortality.

The most important role of exercise however is in the maintenance of the weight loss. In this respect, the volume of exercise seems to be important because several times of evidence have indicated the exercise must expend roughly 2400 kcal / week to maintain weight loss (Votruba, 2000).

According to Steffen *et al.*, (2003) the intake of whole grain foods was inversely associated with total mortality and incidence of coronary artery disease.

Yahia *et al.*, (2003) reported that fish protein attenuated the development of hypertension and also decreased plasma total cholesterol concentration. Thus it enhance protection against cardiovascular diseases.

Robert (2002) view that for people who have had heart attacks, one or two fish meals each week could reduce the risk of early death by 20 to 30 per cent.



*METHODOLOGY*

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### **III METHODOLOGY**

The methodology for the study entitled “The prevalence of diet related disorders among the selected population in Shillong and the effect of diet modification” is discussed under the following headings.

- A. Selection of area and identification of subjects
- B. Collection of data
- C. Study the prevalence of diet related disorder among the selected subjects
- D. Assess the nutritional profile of the subjects through anthropometric measurement, biochemical estimation and diet survey of subjects
- E. Diet modification
- F. Effect of diet modification
- G. Interpretation of data

#### **A. SELECTION OF AREA AND IDENTIFICATION OF SUBJECTS**

Shillong, the capital of Meghalaya which constitutes both tribal and non-tribal tribes was chosen as area of the study by the investigator, as there are limited study related to prevalence of diet related disorders, among these tribal population.

Two places of Shillong namely Mawlai and Mawroh where tribal Khasi and non-khasi tribes reside were selected by purposive sampling method for the study.

When units of universe are purposively chosen for constituting the sample, the method of sampling is called purposive sampling method (Kothari, 2001).

Random sampling refers to the sampling technique in which each and ever unit of the population has an equal opportunity of being selected in the sample (Gupta, 2004).

Six hundred subjects comprising of 465 tribal khasi and 135 non-khasi tribes were selected at random for the study.

The number of subjects selected for the study from the different age group is given below.

		<b>N = 600</b>	
<b>Age group and sex</b>		<b>Khasi N = 465</b>	<b>Non-Khasi N = 135</b>
Adolescent (15-19 years)	Male	72	25
	Female	127	43
Adult (20-60 years)	Male	125	34
	Female	141	33
Total		465	135

Since the incidence of diet related disorders such as cardiovascular disease, diabetes, hypertension, obesity and cancer occurred with increased incidence between the age of 15-60 years, this age group was chosen for the study.

## **B. COLLECTION OF DATA**

### **1. Background information**

Gupta (2001) has defined interview schedule as a set of questions, which are asked and filled in by an interviewer in a face-to-face contact.

With the help of an interview schedule developed (Appendices Ia), information on age, sex, educational status, occupation, income, type and size of the family were obtained from the selected subjects.

### **2. Life style pattern**

A sedentary life style increase the incidence of diet related disorders (Parcel, 2003).

Details regarding life style factors such as physical activity, smoking, pan chewing, consumption of alcohol, consumption of tea, coffee, carbonated drinks, fruit juice and exercise pattern were collected with the help of an interview schedule (Appendices Ib).

### **C. STUDY THE PREVALENCE OF DIET RELATED DISORDERS AMONG THE SELECTED SUBJECTS**

Park and Park (2000) states that obesity, cardiovascular disease, diabetes mellitus and hypertension are the diet related disorder as changes in the life style and dietary excess are found to be the common route cause for its occurrence.

The related population of 465 tribal khasi and 135 non-khasi were interviewed by the investigator to find out the prevalence of diet related disorders.

Information on the nature of diet related disorders, age of onset, duration and since incident, treatment undergone were elicited by the investigator by the personal interview and recorded in an interview schedule (Appendices Ic).

### **D. ASSESS THE NUTRITIONAL PROFILE OF THE SUBJECTS THROUGH ANTHROPOMETRIC MEASUREMENT, BIOCHEMICAL ESTIMATION AND DIET SURVEY OF SUBJECTS**

The dietary practices were collected and recorded using an interview schedule. Information collected were (whether the subject was a vegetarian or non-vegetarian), meal pattern, frequency of food consumed, method of preparation and the type and the quantity of oil used by all the subjects.

## 1. Anthropometry

Nutritional anthropometry is concerned with the measurement of variations of the dimension, proportion and some aspect of the gross composition of the human body at different level of nutrition (Jelliffe, 1989).

The anthropometric measurement such as height, weight, waist and hip circumference of selected subjects was measured following standard procedures.

### a. Measuring of height

The subjects were asked to stand against a wall with bare foot and with heels, buttocks, shoulders and back of the head touching the wall. The head was held comfortably erect with the arm hanging, then a mark was made on the wall after which a non-stretchable measuring tape was used to measure the height of the subjects (Plate I).

### b. Measurement of weight

Weight of the selected subjects was recorded using a bathroom scale. The subject was asked to stand on the weighing scale, barefooted without touching anything, knees not bent and head straight and looking forward. This reading was carefully viewed and recorded.

The body mass index (BMI) was calculated using the formula:

$$\text{Body mass index (Quetelet index) : } \frac{\text{Weight in Kg}}{\text{Height in m}^2} \quad (\text{Park and Park 2000})$$

BMI accounts for differences in body composition by defining the level of adiposition to the relationship of weight to height. It also indicates over-nutrition or under nutrition (Plate II).



**WEIGHT MEASUREMENT OF SELECTED SUBJECTS**

**PLATE 1**



**HEIGHT MEASUREMENT OF SELECTED SUBJECTS**

**PLATE 2**

### **c. Waist-hip circumference**

The circumference of waist and hip were measured using a flexible non-stretchable tape. The smallest circumference between ribs was taken as waist circumference (Boyle, 1993). The largest circumference between waist and knee was taken as hip circumference (Krause, 2000).

Waist hip ratio was calculated by using the formula

$$\text{Waist hip ratio : } \frac{\text{Waist circumference (cm)}}{\text{Hip circumference (cm)}}$$

## **2. Biochemical estimation**

Blood haemoglobin estimation by cyanmethaemoglobin was done for 25 male and 67 female khasi and 5 male and male and 21 female non-khasi who were identified as anaemic.

Fasting and post prandial blood glucose levels were estimated and recorded for 23 khasi comprising of 14 male and 9 female and 4 non-khasi male who were identified as diabetics.

Blood pressure was checked with sphygmomanometer for 33 khasi comprising 13 male and 20 female and 6 non-khasi comprising of 5 male and 1 female who were identified as hypertensive.

## **3. 24-hour recall method**

The 24 hour recall method of data collection requires individual to remember the specific foods and amount of foods they consumed in the past 24 hours (Krause, 2004).

The food consumed by the selected 184 subjects were obtained by a 24 hour recall method. The nutrient content of the diet was calculated and compared with RDA of ICMR (2004).

## **E. DIET MODIFICATION**

Nutrition counseling is the means by which an individual patient, client or family learns food choice and eating habits designed to maintain health or to treat control and prevent specific illness (William, 1989).

Diet modification was provided to the selected subjects with the help of a booklet, poster and chart. The modification included the food exchange list, glycemic index of foods, fibre-rich foods, iron-rich foods, sodium and potassium rich and low foods, foods to be avoided, restricted and foods to be used liberally.

The diet modification suggested for the diabetes was to include complex carbohydrate, fibre-rich foods, reduce fat intake and fried foods items and reduce root vegetables and fruit like banana.

The diabetes were advised to include vegetable like bitter gourd, ladies fingers, ash gourd, ridge gourd, brinjal, cabbage, beans, cucumber in their diet.

Anaemic subjects were advised to include iron-rich foods, folic acid rich foods, vitamin B12 and Vitamin C rich foods like egg (hen), goat meat, orange, guava, spinach, mint, liver (goat), rice flakes, dates, pomegranate and raisins.

Hypertensive subjects were advised to avoid high sodium foods like pickle, canned foods, bakery (bread, cake, biscuits), soft drinks, bournvita. Fleshly foods, pulses like lentil, fruits like pineapple and vegetable like broad beans, amaranth, radish and lettuce.

They were advised to reduce fat consumption especially animal fat.

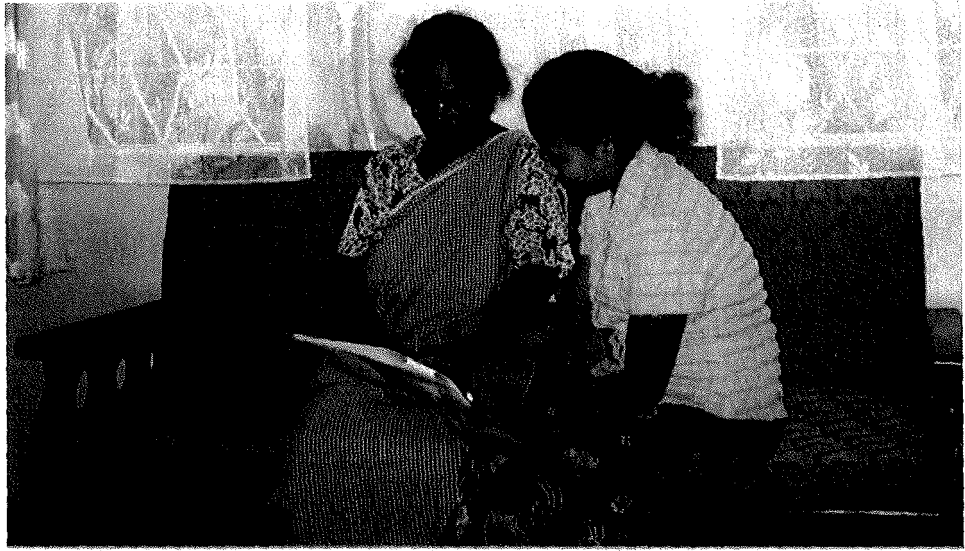
They were also advised to include foods like tomato, leafy vegetables, bitter gourd and brinjal, since they contain low sodium and high potassium. They were asked to consume liberally fruits like plum, banana, apple, amla, orange, guava, pear and pomegranate (Plate III).

#### **F. EFFECT OF DIET MODIFICATION**

This effect of diet modification was done after a period of one month.

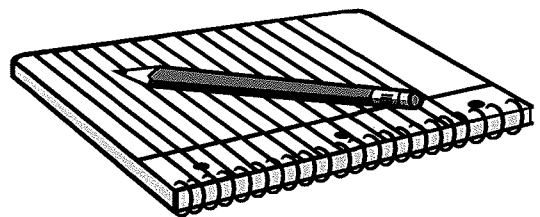
#### **G. INTERPRETATION OF DATA**

The data collected was analysed and interpreted.



**DIET MODIFICATION**

**PLATE 3**



## *RESULTS AND DISCUSSION*

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## V RESULTS AND DISCUSSION

The results pertaining to the present study entitled “The prevalence of diet related disorders among the selected population in Shillong and the effect of diet modification” is discussed under the following headings.

- A. Background information and lifestyle pattern of the selected subjects
- B. Prevalence of diet related disorders among the selected subjects
- C. Nutritional profile of the selected subjects with diet related disorders
- D. Effect of diet modification

### A. BACKGROUND INFORMATION AND LIFESTYLE PATTERN OF THE SELECTED SUBJECTS

#### 1. Background information

The distribution of selected khasis and non-khasis based on their age and sex is shown in Table I.

**TABLE I**  
**AGE WISE AND SEX WISE DISTRIBUTION OF THE SELECTED SUBJECTS**

135 N = 600

Age (years)	Khasis (n = 465)				Total	Non-khasis (n = 465)				Total
	Male n = 197		Female n = 268			Male n = 59		Female n = 76		
	No	%	No	%		No	%	No	%	
15-19	72	36	127	47	199	25	42	43	57	68
20-30	33	17	50	19	83	11	19	18	24	29
30-40	44	23	35	13	79	8	14	9	12	17
40-50	34	17	41	15	75	8	13	5	6	13
> 50	14	7	15	6	29	7	12	1	1	8
Total	197	100	268	100	465	59	100	76	100	135

Total number of khasi tribal subjects were 465 and non-khasi 135. Seventy two male and 127 female adolescent, 125 adult male and 141 adult females were from khasi tribes, 25 male adolescent and 43 female adolescent and 34 adult male and 33 adult female were from non-khasi tribes. Among the 600 selected subjects, 267 were adolescents.

Table II presents the data on the education status of the selected subjects.

**TABLE II**  
**EDUCATION STATUS OF THE SELECTED SUBJECTS**

**N =600**

Education status of the subjects	Khasis (n = 465)		Total	Non-Khasis (n = 135)		Total
	Male n = 59	Female n = 268		Male n = 59	Female n = 268	
	No	No		No	No	
Primary	15	32	47	12	5	17
High school	76	64	410	13	1	26
Higher secondary	33	115	148	12	38	50
Graduate	49	45	94	18	20	38
Post-graduate	24	12	36	4	-	4
Total	197	268	465	59	76	135

From Table II, it can be noted that all the 465 tribal khasis were literate and so were 135 non-khasis. A majority of 76 male had high school education and 115 females were higher secondary qualified and 18 male non-khasi and 38 female were graduates and higher secondary school qualified respectively.

Table III given details of the occupation of the selected adult subjects.

**TABLE III**  
**OCCUPATIONAL STATUS OF THE SELECTED SUBJECTS (ADULTS)**

**N =277**

<b>Occupation of the selected subjects</b>	<b>Khasis (n = 212)</b>		<b>Total</b>	<b>Non-Khasis (n = 65)</b>		<b>Total</b>
	<b>Male n = 109</b>	<b>Female n = 103</b>		<b>Male n = 37</b>	<b>Female n = 28</b>	
	<b>No</b>	<b>No</b>		<b>No</b>	<b>No</b>	
Labourer	20	10	30	8	6	14
Teacher	12	24	36	6	6	12
Business	18	14	32	8	-	8
Government servant	59	25	84	15	9	24
Housewife	-	30	30	-	7	7
<b>Total</b>	109	103	212	37	28	65

Data from the above Table shows that majority of 59 male and 25 female khasi were employed in government sector as also 15 male and 9 female non-khasi while among the female 30 khasi and 7 non-khasi women were housewives.

The sedentary activity pattern of the government and private sector employees may increase their chances for development of diet related disorders as opined by Wu (1995).

Table IV presents the details on the income status of the selected subjects.

**TABLE IV**  
**DISTRIBUTION OF SELECTED SUBJECTS BASED ON THEIR INCOME**  
**LEVEL**

N =600

Income level of the subjects	Khasis (n = 465)				Total	Non-Khasis (n = 135)				Total
	Working n = 182		Non-working n = 283			Working n = 58		Non-working n = 77		
	Male n=109	Female n=73	Male n=88	Female n=195		Male n=37	Female n=21	Male n=22	Female n=55	
	No	No	No	No		No	No	No	No	
700-500	20	10	Nil	Nil	30	8	6	Nil	Nil	14
2500-4500	18	18	Nil	Nil	36	2	4	Nil	Nil	6
4500-7500	18	13	Nil	Nil	31	8	4	Nil	Nil	12
>7500	53	32	Nil	Nil	85	19	7	Nil	Nil	26
Total	109	73	Nil	Nil	182	37	21	Nil	Nil	58

The subjects were classified based on their income following housing unit development corporation (2000) standards a total of 240 of the selected subjects including 116 khasis and 36 non-khasis both male and female were on the high income group with a total income of more than Rs.7500. Thirty six khasi and 6 non-khasi comprised of both male and female were in the middle income group whereas 30 khasi and 14 non-khasi both male and female belonged to low income group.

The result is in accordance with the study of Agrahal *et al.*, (2003) which states that highest percentage of the population of Meghalaya had an income of upto Rs.7500/month.

Table V present the distribution of selected subjects based on type of family.

**TABLE V**  
**DISTRIBUTION OF SELECTED SUBJECTS BASED**  
**ON TYPE OF FAMILY**

**N =600**

Type of family	Khasi (n = 465)		Non-khasi (n = 135)		Total
	No	No	No	No	
Nuclear	253		85		338
Joint	212		50		262
Total	465		135		600

Table shows that out of 465 khasis 253 live nuclear families and 212 live in joint families. Out of 135 non-khasis, 85 lives in nuclear families whereas 50 lives in joint families.

Table VI gives the distribution of the selected subjects based on the size of the family.

**TABLE VI**  
**DISTRIBUTION OF THE SELECTED SUBJECTS BASED ON THE SIZE**  
**OF THE FAMILY**

**N =600**

Size of the family	Khasis (n = 465)		Total	Non-Khasis (n = 135)		Total
	Male n = 226	Female n = 239		Male n = 59	Female n = 76	
	No	No		No	No	
1-4	73	44	117	19	28	47
4-7	93	120	213	30	48	78
7-9	60	75	125	10	-	10
Total	226	239	465	59	76	135

Among the khasis 93 males and 120 females live in families comprising of 4-7 members which is the average size of the families of the people of Meghalaya. Of the 135 non-khasis the average families size of 30 males and 48 females is between 4-7 members respectively.

## 2. Lifestyle pattern

Table VII gives the information on the pattern of smoking habit of the selected adult subjects.

**TABLE VII**  
**PATTERN OF SMOKING HABIT OF THE ADULT MALE SUBJECTS**

**N=43**

No. of cigarette smoked / day	Khasis (n = 19)			Total	Non-Khasis (n = 24)			Total
	Duration (Years)				Duration (Years)			
	0-5	5-10	>10		0-5	5-10	>10	
1-5	2	4	7	10	Nil	Nil	2	2
5-10	Nil	7	Nil	7	13	4	5	22
>10	Nil	Nil	2	2	Nil	Nil	Nil	Nil
Total	2	11	6	19	13	4	7	24

Table above Table VII shows that 10 khasi males smokes about 1-5 cigarettes a day and 22 male non-khasi smokes about 5-10 cigarettes a day. Seven males khasi have been smoking for a period of 5-10 years and 13 males non-khasi for a period of 0-5 years.

Hence smoking may be contributory factor to the development of cardiovascular diseases among selected population as suggested by World Health Organization (2000).

Table VIII gives details on the pan chewing habit of the selected subjects.

**TABLE VIII**  
**PAN CHEWING HABIT OF THE SELECTED SUBJECTS**

**N=306**

<b>No. of pan chewed / day</b>	<b>Khasis (n = 255)</b>						<b>Total</b>	<b>Non-Khasis (n = 51)</b>						<b>Total</b>
	<b>Male n=95</b>			<b>Female n=160</b>				<b>Male n=32</b>			<b>Female n=19</b>			
	<b>Duration (Years)</b>							<b>Duration (Years)</b>						
	<b>0- 5</b>	<b>5- 10</b>	<b>&gt;10</b>	<b>0- 5</b>	<b>5- 10</b>	<b>&gt;10</b>		<b>0- 5</b>	<b>5- 10</b>	<b>&gt;10</b>	<b>0- 5</b>	<b>5- 10</b>	<b>&gt;10</b>	
1-5	Nil	42	Nil	4	29	5	80	4	10	Nil	7	5	4	30
5-10	4	39	10	6	13	62	133	Nil	18	Nil	Nil	2	1	21
>10	Nil	Nil	Nil	Nil	42	Nil	42	Nil	Nil	Nil	Nil	Nil	Nil	Nil
<b>Total</b>	4	81	10	10	83	67	255	27	28	Nil	7	7	5	51

Fifty three male and 80 female khasi had the habit of chewing 5-10 pieces of pan a day and 16 female non-khasi had the habit of chewing 1-5 pieces of pan a day whereas 18 male had the habit of chewing 5-10 pieces of pan / day. Forty two male and 62 female khasi had the habit of pan chewing for 5-10 years and more than 10 years respectively. Seven female 18 male non-khasi had the habit of pan chewing for 0-5 years and 5-10 years respectively.

Since pan chewing causes destruction effect on the heart as well as on the lung, the chances of incidence of diet related disorders among the khasi and non-khasis may increase (Suresh and Shailaya, 1997).

Table IX gives information on the type, quantity and duration of consumption of alcoholic beverages among the male adults.

**TABLE IX**  
**PATTERN OF CONSUMPTION OF ALCOHOLIC BEVERAGES**

N=115

Type	Quantity (ml) weekly	Khasis (n = 92)			Non-Khasis (n = 23)		
		Duration (Years)			Duration (Years)		
		0-5	5-10	>10	0-5	5-10	>10
Brandy	50-100	2	Nil	10	Nil	Nil	Nil
	100-150	Nil	12	Nil	Nil	4	Nil
Whisky	50-100	Nil	4	9	5	Nil	Nil
	100-150	15	5	Nil	Nil	6	Nil
Beer	50-10	10	5	Nil	Nil	Nil	3
	100-150	Nil	20	Nil	Nil	5	Nil
Total		27	46	15	5	15	3

Data from the above Table clearly indicate that 46 khasi male consumed alcohol weekly for a period between 5-10 years as well as 15 male non-khasi. Heavy drinking is prevalent among 37 male khasi and 15 male non-khasi.

Table X present data on pattern of consumption of non-alcoholic beverages.

**TABLE X**  
**PATTERN OF CONSUMPTION OF NON-ALCOHOLIC BEVERAGES**

N=600

No. of pan chewed / day	Quantity (ml/d)	Khasis (n = 255)						Non-Khasis (n = 51)					
		Male n=197			Female n=268			Male n=59			Female n=76		
		Number of cups						Number of cups					
		0-1	1-2	>2	0-1	1-2	>2	0-1	1-2	>2	0-1	1-2	>2
Coffee	100-150	2	4	3	Nil	28	1	Nil	24	Nil	Nil	12	Nil
	150-200	5	Nil	1	Nil	Nil	Nil	Nil	1	Nil	1	Nil	Nil
Tea	100-150	96	4	2	65	72	10	Nil	20	5	14	41	Nil
	150-200	38	42	Nil	10	52	30	Nil	8	Nil	Nil	Nil	Nil
Total		147	50	6	75	152	41	Nil	59	5	15	53	Nil

One hundred and two male and 147 female khasi and 25 male and 55 female non-khasi consumed between 100-150ml of tea daily. Twenty nine female and 9 male khasi and 24 male and 12 female non-khasi consumed coffee between 100-150 ml daily. Forty female khasi consumed more than two cup of tea a day as habit which is attributable to the cold climate condition of Shillong.

Tea flavonoids are the most powerful anti-oxidant which reduces the risk of cardiovascular diseases (Venson, 1995).

Fruit juices, carbonated beverages were occasionally consumed by 90 male and 103 female khasi and 15 male and 32 female non-khasi.

Table XI gives details on the type, frequency and duration of exercise done by the selected subjects.

**TABLE XI**  
**TYPE, FREQUENCY AND DURATION OF EXERCISE PATTERN**

N=337

Type of exercise	Khasis (n=291)								Non-Khasis (n=46)							
	Male n=178				Female n=113				Male n=23				Female n=23			
	Daily		Weekly		Daily		Weekly		Daily		Weekly		Daily		Weekly	
	30 min	1hr	30 min	1hr	30 min	1hr	30 min	1hr	30 min	1hr	30 min	1hr	30 min	1hr	30 min	1hr
Walking	42	15	15	Nil	15	Nil	15	Nil	10	Nil	4	Nil	8	Nil	4	Nil
Jogging	Nil	42	10	4	Nil	4	42	42	5	5	2	2	4	4	2	1
Bicycling	Nil	35	15	Nil	Nil	12	10	15	2	Nil	Nil	Nil	1	Nil	3	Nil
Total	42	92	40	4	15	16	67	15	17	Nil	6	Nil	13	Nil	9	1

Data from the above Table clearly shows that out of 465 khasi only 291 of them had the habit of exercise and out of 135 non-khasi only 46 of them had the habit of exercise.

Walking and jogging was the most preferred form of exercise noted among 72 male and 30 female khasi and 56 male and 46 female khasi respectively. Mostly preferred exercise for non-khasi was walking among 14 male and 12 female.

Forty two male khasi walk 30 minute and other 42 male khasi jog 1 hour daily. Ten male and 8 female non-khasi walk 30 minute daily. Fifteen female khasi walk 30 minute daily and 42 other female jog 30 minute weekly.

The American Heart Association (2004) recommend that adult should exercise at least for half an hour five times a week. On comparison with the above criteria it was found that 92 khasi and 17 non-khasi male and 15 khasi and 13 non-khasi females met the recommendations.

## **B. PREVALENCE OF DIET RELATED DISORDERS AMONG THE SELECTED SUBJECTS**

Table XII presents the prevalence of diet related disorders among the selected subjects.

**TABLE XII**  
**PREVALENCE OF DIET RELATED DISORDERS AMONG SELECTED**  
**SUBJECTS**

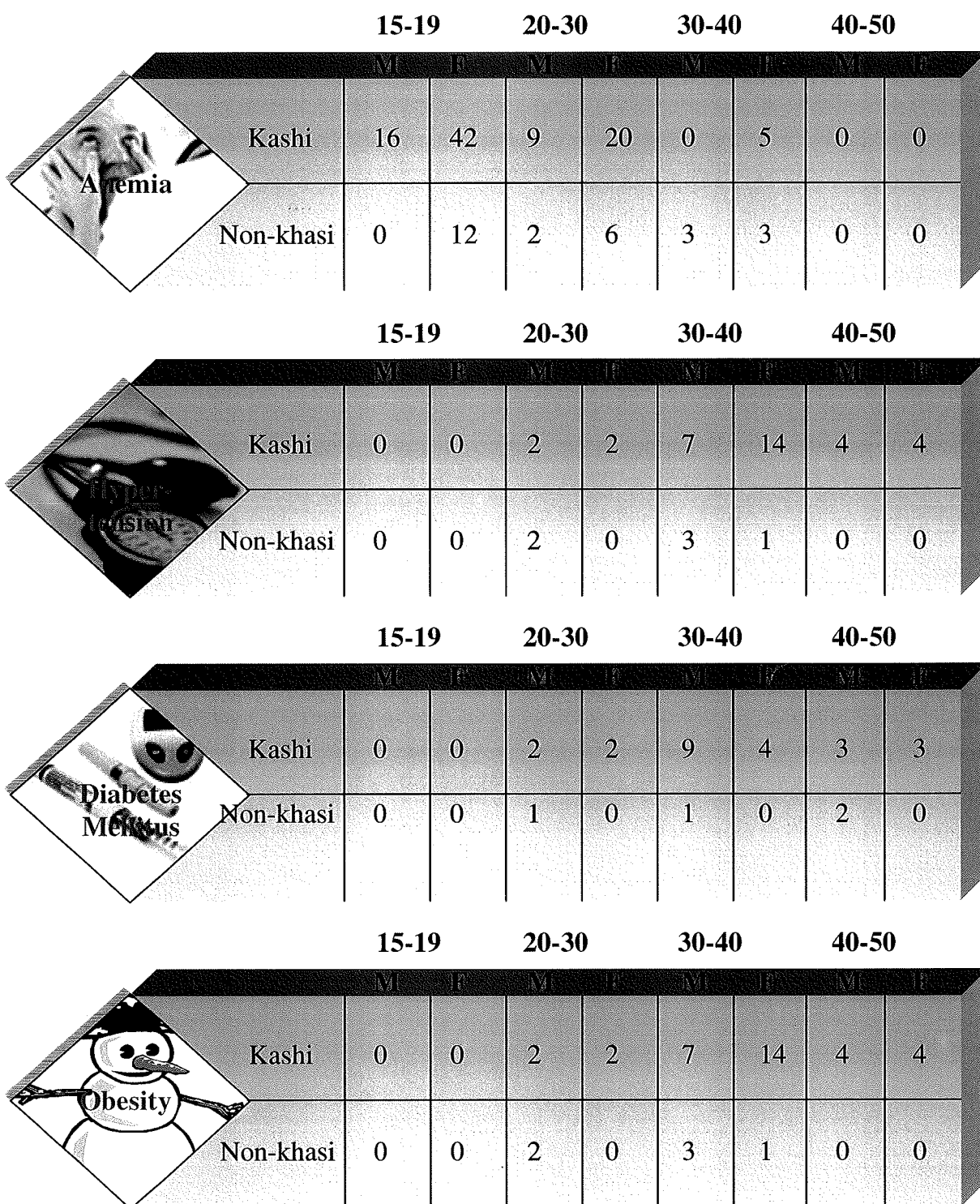
N=192

Diet related disorder		Khasis (n = 154)				Total	Non-khasis (n=38)				Total
		Anaemia	Hypertension	Diabetes mellitus	Obesity		Anaemia	Hypertension	Diabetes mellitus	Obesity	
Age	Sex	No	No	No	No		No	No	No	No	
15-19	Male	16	Nil	Nil	Nil	16	Nil	Nil	Nil	Nil	Nil
	Female	42	Nil	Nil	Nil	42	12	Nil	Nil	Nil	12
20-30	Male	9	2	2	Nil	13	2	2	1	Nil	5
	Female	20	2	2	Nil	24	6	Nil	Nil	1	7
30-40	Male	Nil	7	9	Nil	16	3	3	1	Nil	7
	Female	5	14	4	2	25	3	1	Nil	Nil	4
40-50	Male	Nil	4	3	2	9	Nil	Nil	2	1	3
	Female	Nil	4	3	2	9	Nil	Nil	Nil	Nil	Nil
Total		92	33	23	6	154	26	6	4	1	38

2

Data from the above Table shows that 25 male and 67 female khasi and 5 male and 21 female non-khasi were suffering from anaemia. Thirteen male and 20 female khasi and 5 male and 1 female were found to be hypertensive subjects. Fourteen male and 9 female khasi and 4 male non-and female khasi were found to be diabetic subjects. Two male and female khasi and one male and one female non-khasi were obese (Figure I).

**PREVALENCE OF DIET RELATED DISORDER AMONG SELECTED SUBJECTS**



**FIGURE I**

Table XIII shows the symptoms that provoked patients with diet related disorders to seek medical attention.

**TABLE XIII**  
**SYMPTOMS WHICH PROVOKED PATIENTS WITH DIET RELATED**  
**DISORDERS TO SEEK MEDICAL ATTENTION**

Symptoms	Khasis (n=48)		Total	Non-khasis (n=36)		Total
	Male n=52	Female n=96		Male n=52	Female n=96	
	No	No		No	No	
<b>Anaemia n=118</b>						
Fatigue	12	26	38	3	12	15
Anorexia	5	11	16	Nil	9	9
Pallor of the skin	8	30	38	2	Nil	2
Total	25	67	92	5	21	26
<b>Hypertension n=39</b>						
Dizziness	5	10	15	2	Nil	2
Weakness	6	5	11	3	1	4
Odema	2	5	7	Nil	Nil	Nil
Total	13	20	33	5	1	6
<b>Diabetes mellitus n = 27</b>						
Polyuria	2	2	4	1	Nil	1
Polyphagia	6	2	8	Nil	Nil	Nil
Polydypsia	6	5	11	3	Nil	3
Total	14	9	23	4	Nil	4

As shown in the data in Table XIII fatigue and pallor of the skin provoked 12 male khasi and 3 male non-khasi and 12 female non-khasi and 30 female khasi, and 2 male non-khasi to seek medical attention.

Five and 10 hypertensive khasi and 3 male non-khasi and 6 male khasi reported that dizziness and general weakness provoked them to seek medical attention.

Polyphagia and polydipsia was the most prevalent symptom that prompted 6 male to seek medical attention. None of the female non-khasi have diabetes mellitus. None of the adult suffering from diet related disorders have undergone surgery. Out of 92 khasi and 26 non-khasi suffering from anaemia only 12 khasi have taken iron and vitamin B-complex tablets. All the diabetic subjects were on medication and only 20 khasi hypertensive were under mediation.

Table XIV shows the age of incidence of anaemia, hypertension and diabetes mellitus among selected subjects.

**TABLE XIV**  
**AGE OF INCIDENCE OF ANAEMIA, HYPERTENSION, DIABETES MELLITUS AND OBESITY AMONG SELECTED SUBJECTS SUFFERING FROM DIET RELATED DISORDERS**

N=192

Age of incidence		Khasis (n = 154)				Total	Non-khasis(n=38)				Total
		Anaemia	Hypertension	Diabetes mellitus	Obesity		Anaemia	Hypertension	Diabetes mellitus	Obesity	
Age	Sex	No	No	No	No		No	No	No	No	
15-19	Male	16	Nil	Nil	Nil	16	Nil	Nil	Nil	Nil	Nil
	Female	42	Nil	Nil	Nil	42	12	Nil	Nil	Nil	12
20-30	Male	9	2	2	Nil	13	2	2	1	Nil	5
	Female	20	2	2	Nil	24	6	Nil	Nil	1	7
30-40	Male	Nil	7	9	Nil	16	3	3	1	Nil	7
	Female	5	14	4	2	25	3	1	Nil	Nil	4
40-50	Male	Nil	4	3	2	9	Nil	Nil	2	1	3
	Female	Nil	4	3	2	9	Nil	Nil	Nil	Nil	Nil
Total		<del>87</del>	33	26	6	154	26	6	4	1	38

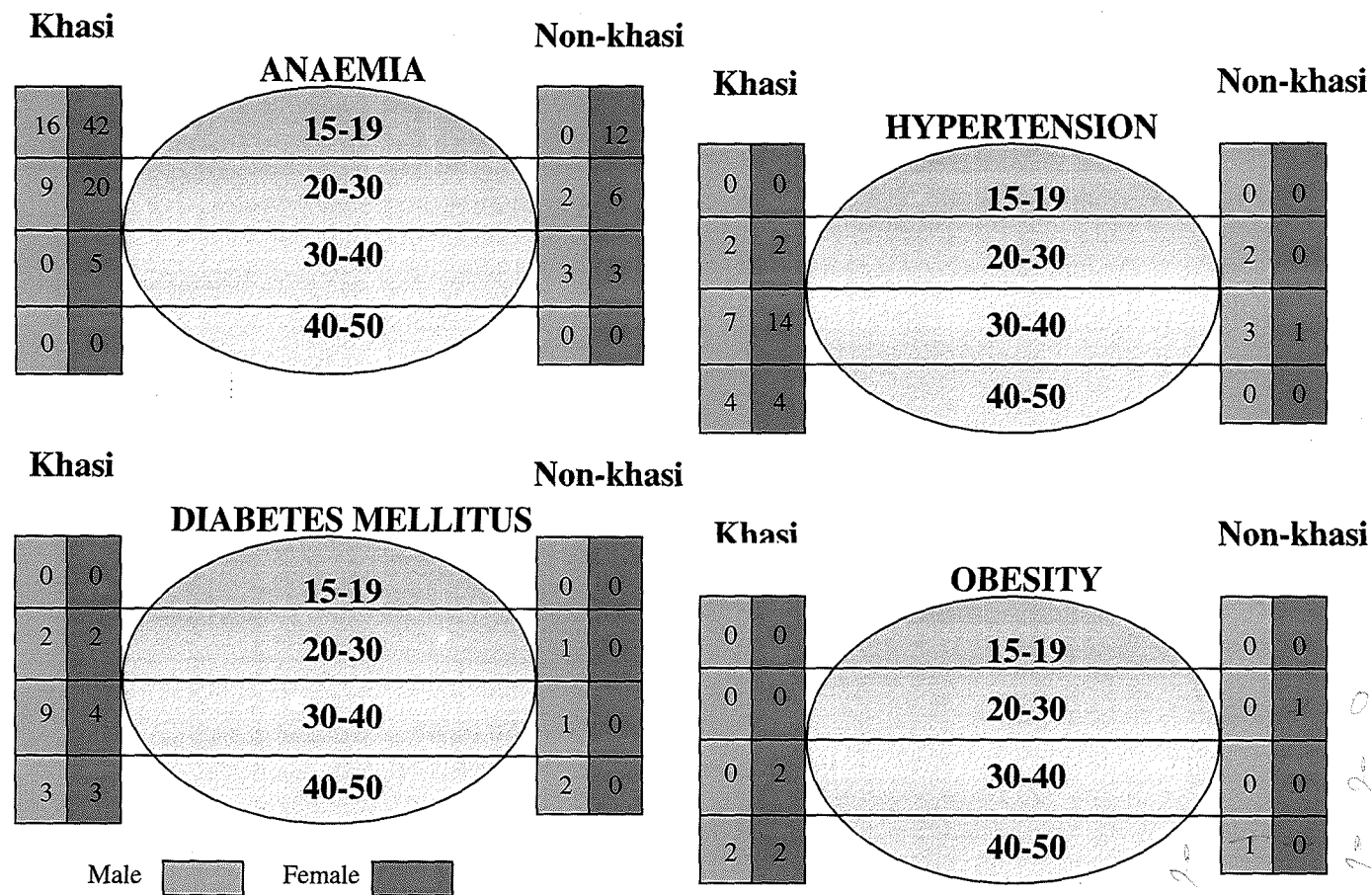
From the above Table data reveal that 16 male and 42 female khasi and 12 female non-khasi were first diagnosed with anaemia in the age of 15-19 years.

Most of the hypertensive subjects were first manifested in 7 male, 14 female khasi and 3 male non-khasi between 30-40 years and 4 male, 4 female khasi between 40-50 years.

In accordance with the study Saradha and Easwaran (2002) which shows that the onset of cardiovascular diseases disease was in the 3<sup>rd</sup> decade for male while it was the 5<sup>th</sup> decade for female.

Nine male, 4 female khasi and 1 male non-khasi were diagnosed with diabetes between the age 30-40 years (Figure II).

**AGE OF INCIDENCE OF ANAEMIA, HYPERTENSION, DIABETES MELLITUS AMONG SELECTED SUBJECTS  
SUFFERING FROM DIET RELATED DISORDERS**



**FIGURE II**

Table XV presents data on the duration since incidence of diet related disorders among the target subjects.

**TABLE XV**  
**DURATION OF DIET RELATED DISORDERS OF SELECTED**  
**SUBJECTS**

N = 184

Duration of the disorder (yrs)	Khasis (n = 148)						Non-khasis (n = 36)					
	Male n = 52			Female n = 96			Male n = 14			Female n = 22		
	Anaemia	Hypertension	Diabetes mellitus	Anaemia	Hypertension	Diabetes mellitus	Anaemia	Hypertension	Diabetes mellitus	Anaemia	Hypertension	Diabetes mellitus
1-3	25	9	4	57	12	3	5	2	2	17	1	Nil
3-5	Nil	4	9	10	8	5	Nil	3	2	4	Nil	Nil
> 5	Nil	Nil	1	Nil	Nil	1	Nil	Nil	Nil	Nil	Nil	Nil
Total	25	13	14	67	20	9	5	5	4	21	1	Nil

Twenty five male, 57 female khasi and 5 male, 17 female non-khasi have been suffering from anaemia for a duration between 1-3 years.

Out of 13 male hypertensive khasi, 9 male and out of 20 female khasi hypertensive, 12 were diagnosed with hypertension between 1-3 years and only 3 male non-khasi out of 5 hypertensive male have been suffering for a duration of 3-5 years.

Nine male and 5 female khasi and 2 male non-khasi have been suffering from diabetes mellitus for a duration of 3-5 years and only one male and female khasi for a duration of more than five years.

Table XVI gives the information on the family history on diet related disorders.

**TABLE XVI**  
**HISTORY OF INCIDENCE OF DIET RELATED DISORDERS**  
**IN THE FAMILY**

N=76

Symptoms	Khasis (n=63)		Total	Non-khasis (n=13)		Total
	Male n=23	Female n=40		Male n=10	Female n=13	
	No	No		No	No	
Obesity	11	15	26	2	Nil	2
Hypertension	8	14	32	4	4 <sup>2</sup>	6
Diabetes mellitus	4	11	15	4	1	5
Total	23	40	63	10	3	13

It can be noted from the above Table that 11 male and 15 female khasi and 2 male non-khasi have family history of obesity. Eight male and 14 female khasi and 4 male and 2 female non-khasi have the family history of hypertension. Four male and 11 female khasi and 4 male and one female non-khasi have family history of diabetes mellitus (Figure III).

### HISTORY OF INCIDENCE OF DIET RELATED DISORDERS IN THE FAMILY

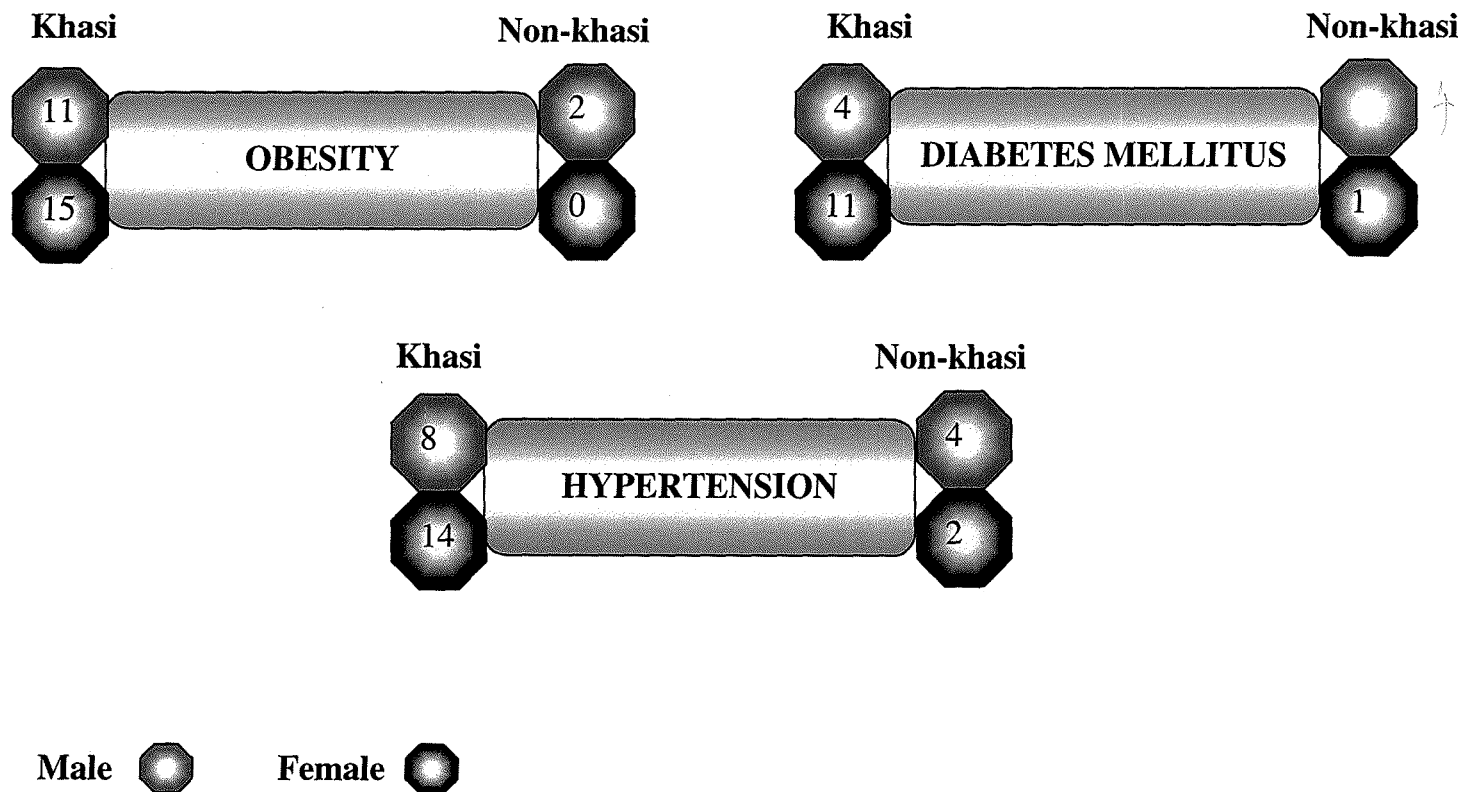


FIGURE III

## **C. NUTRITIONAL PROFILE OF THE SELECTED SUBJECTS WITH DIET RELATED DISORDERS**

### **1. Anthropometric measurement**

Table XVII shows the body mass index of the subjects with diet related disorder.

**TABLE XVII**

**BODY MASS INDEX OF THE SELECTED SUBJECTS WITH DIET RELATED DISORDERS**

**N = 184**

Body mass index Kg/m <sup>2</sup>	Khasis (n = 152)										Non-khasis (n = 32)									
	Male (n = 55)					Female (n = 97)					Male (n = 11)					Female (n = 21)				
	Age group	<18.5	18.5-24.9	25-29.9	30-34.9	Total	<18.5	18.5-24.9	25-29.9	30-34.9	Total	<18.5	18.5-24.9	25-29.9	30-34.9	Total	<18.5	18.5-24.9	25-29.9	30-34.9
15-19	Nil	12	4	Nil	16	4	27	11	Nil	42	Nil	Nil	Nil	Nil	Nil	Nil	10	2	Nil	12
20-30	Nil	9	2	Nil	11	Nil	20	4	Nil	24	Nil	Nil	1	Nil	1	Nil	3	2	2	6
30-40	Nil	10	3	Nil	13	Nil	9	4	2	15	Nil	1	1	Nil	2	Nil	2	1	1	3
40-50	Nil	5	2	2	9	Nil	7	2	2	11	Nil	3	1	1	5	Nil	Nil	Nil	Nil	Nil
> 50	Nil	5	1	Nil	6	Nil	4	1	Nil	5	Nil	2	1	Nil	3	Nil	Nil	Nil	Nil	Nil
Total	Nil	41	12	2	55	4	67	22	4	97	Nil	6	4	1	11	Nil	15	5	1	21

It is seen from the above Table that 12 male khasi out of 55 were overweight and only 2 were obese. Twenty-two out of 95 female khasi were overweight and only 4 were obese. Out of 11 male non-khasi 6 with normal BMI and 4 were overweight. Five female non-khasi were overweight and 15 with normal BMI (Figure IV).

Obesity is recognized as the underlying risk factor for several chronic diseases which is strongly influenced by life style habits such as poor diet and sedentary behaviour (American Heart Association, 2000).

# BODY MASS INDEX OF THE SELECTED SUBJECTS WITH DIET RELATED DISORDERS

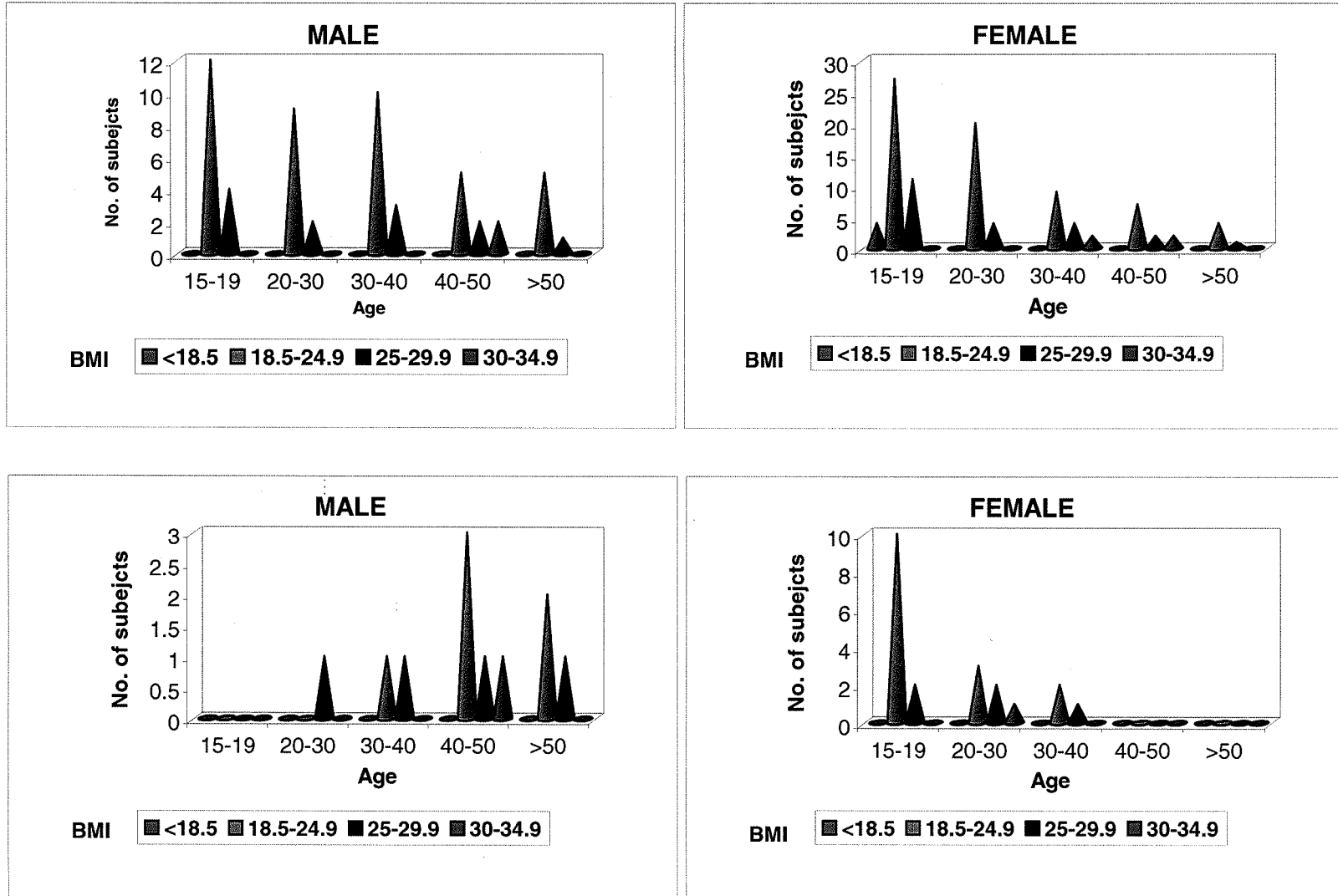


FIGURE IV

The waist hip ratio of all the 184 subjects were calculated using the formula.

$$\frac{\text{Waist circumference (cm)}}{\text{Hip circumference (cm)}}$$

The details on the waist hip ratio of the selected subjects in depicted in Table XVIII.

**TABLE XVIII**

**WAIST HIP RATIO OF THE SELECTED SUBJECTS WITH DIET RELATED DISORDERS**

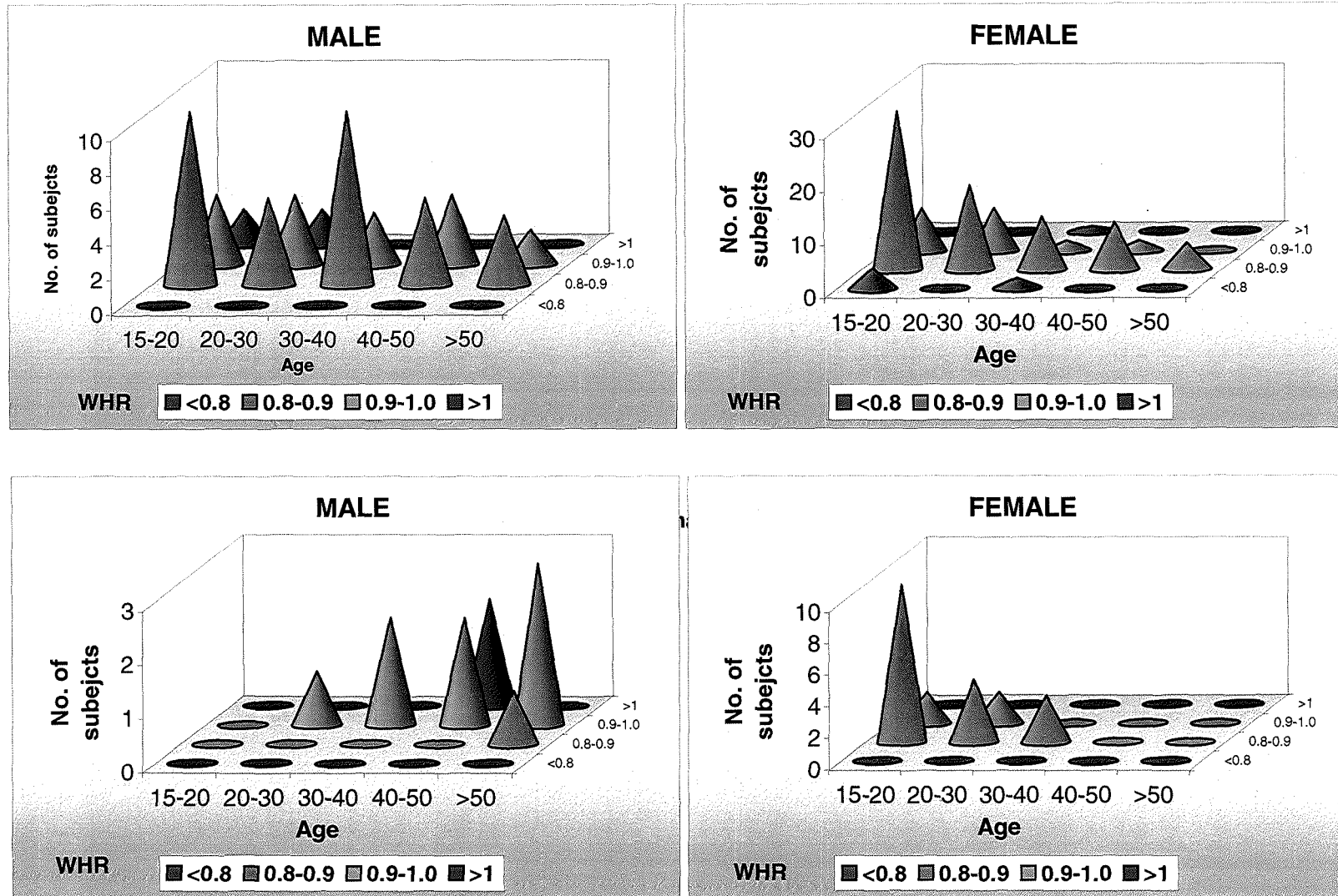
**N = 184**

Age group	Khasis (n = 152)										Non-khasis (n = 32)									
	Male (n = 55)					Female (n = 97)					Male (n = 11)					Female (n = 21)				
	<0.8	0.8-0.9	0.9-2.0	>1	Total	<0.8	0.8-0.9	0.9-2.0	>1	Total	<0.8	0.8-0.9	0.9-2.0	>1	Total	<0.8	0.8-0.9	0.9-2.0	>1	Total
15-20	Nil	10	4	2	16	4	30	8	Nil	42	Nil	Nil	Nil	Nil	Nil	Nil	10	2	Nil	12
20-30	Nil	5	4	2	11	Nil	16	8	Nil	24	Nil	Nil	1	Nil	1	Nil	4	2	Nil	6
30-40	Nil	10	3	Nil	13	2	10	2	1	15	Nil	1	2	Nil	2	Nil	3	Nil	Nil	3
40-50	Nil	5	4	Nil	9	Nil	9	2	Nil	11	Nil	Nil	2	2	5	Nil	Nil	Nil	Nil	Nil
> 50	Nil	4	2	Nil	6	Nil	5	Nil	Nil	597	Nil	1	3	Nil	3	Nil	Nil	Nil	Nil	Nil
Total	Nil	34	17	4	55	6	70	20	1	Nil	Nil	Nil	8	2	11	Nil	17	4	Nil	21

The data from Table XVIII points out that four male and 20 female khasi and 2 male and 4 female non-khasi have waist hip ratio above normal value. Faulty dietary habits, lack of exercise and sedentary life style pattern may have contributed to the increased value of waist hip ratio (Figure V).

Epidemiologic studies have clearly shown that central adiposity is highly correlated with the presence of hypertension, coronary heart disease, type II diabetes and increased mortality risk (Grinker *et al.*, 2000).

## WAIST HIP RATIO OF THE SELECTED SUBJECTS WITH DIET RELATED DISORDERS



**FIGURE V**

## 2. Biochemical estimation

### a. Haemoglobin levels

The mean haemoglobin levels of 92 male and female khasis and 26 male and female non-khasis with anaemia obtained by the investigator is given in Table XIX.

**TABLE XIX**  
**MEAN HAEMOGLOBIN LEVEL OF THE ANAEMIC SUBJECTS (g/dl)**

N=118

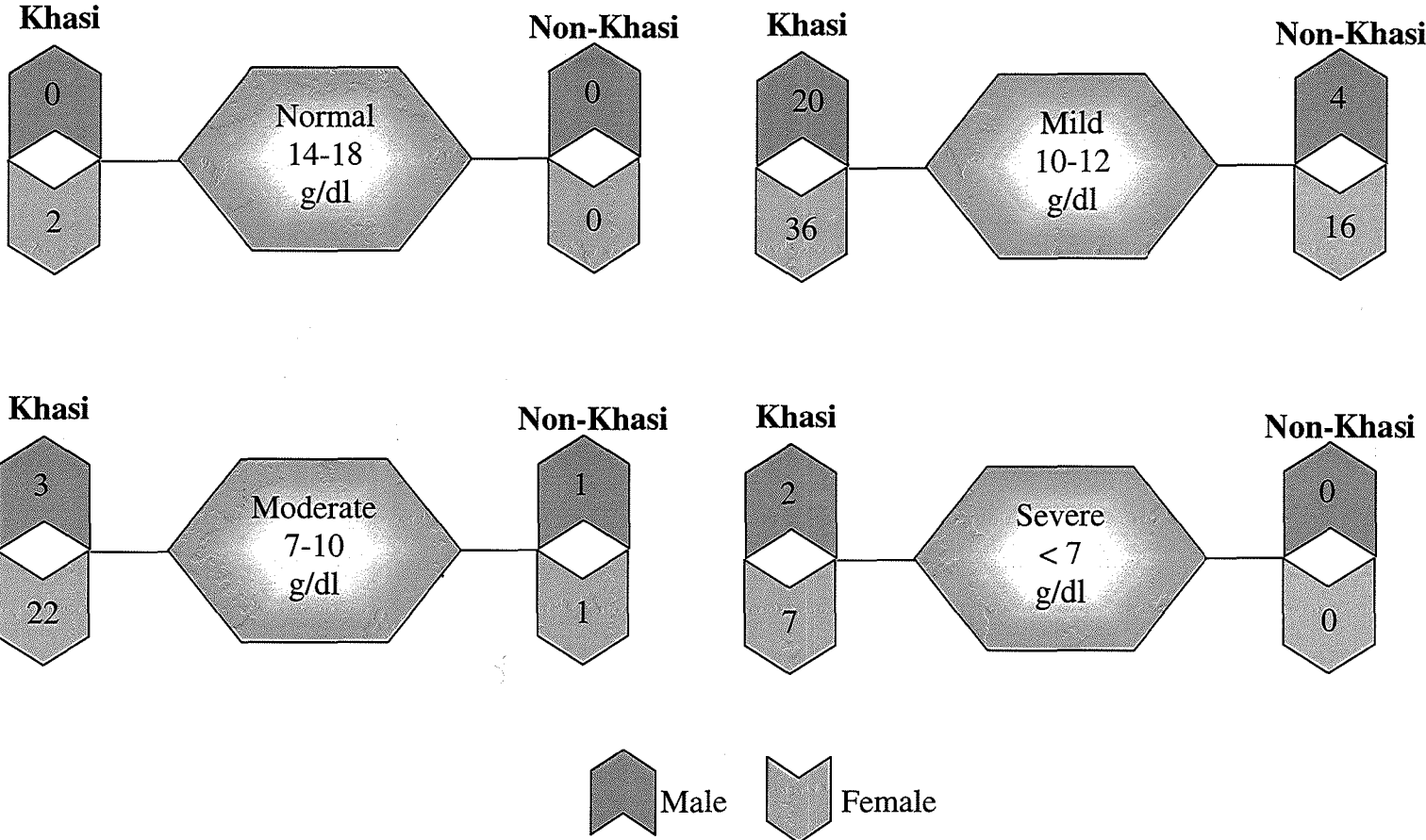
Anaemia g/dl	Khasis (n=92)		Non-khasis (n=26)	
	Male (n=25)	Female (n=67)	Male (n=5)	Female (n=21)
*Normal 18-14	Nil	2	Nil	Nil
*Mild 10-12	20	36	4	16
*Moderate 7-10	3	22	1	5
*Severe < 7	2	7	Nil	Nil
Total	25	67	5	21

\*Source : Harrison, (2001)

It can be noted from the above Table that 2 male and 7 female khasi were severely anaemic. Twenty male thirty six female, khasi, 4 male and 16 female non-khasi were mildly anaemic, while 3 male and 22 female khasi and 1 male and 5 female non-khasi were moderately anemic (Figure VI).

Iron deficiency anaemia (IDA) is the most widespread nutritional problem in the world. It is a major problem affecting between 20-70 per cent of the population in various countries (Forentino and Khatri, 2003).

**MEAN HAEMOGLOBIN LEVEL OF THE ANAEMIC SUBJECTS**



**FIGURE VI**  
60

**b. Blood pressure measurements**

Table XX gives the mean of blood pressure of hypertensive adults.

**TABLE XX**  
**MEAN BLOOD PRESSURE OF THE HYPERTENSIVE SUBJECTS**

**N=39**

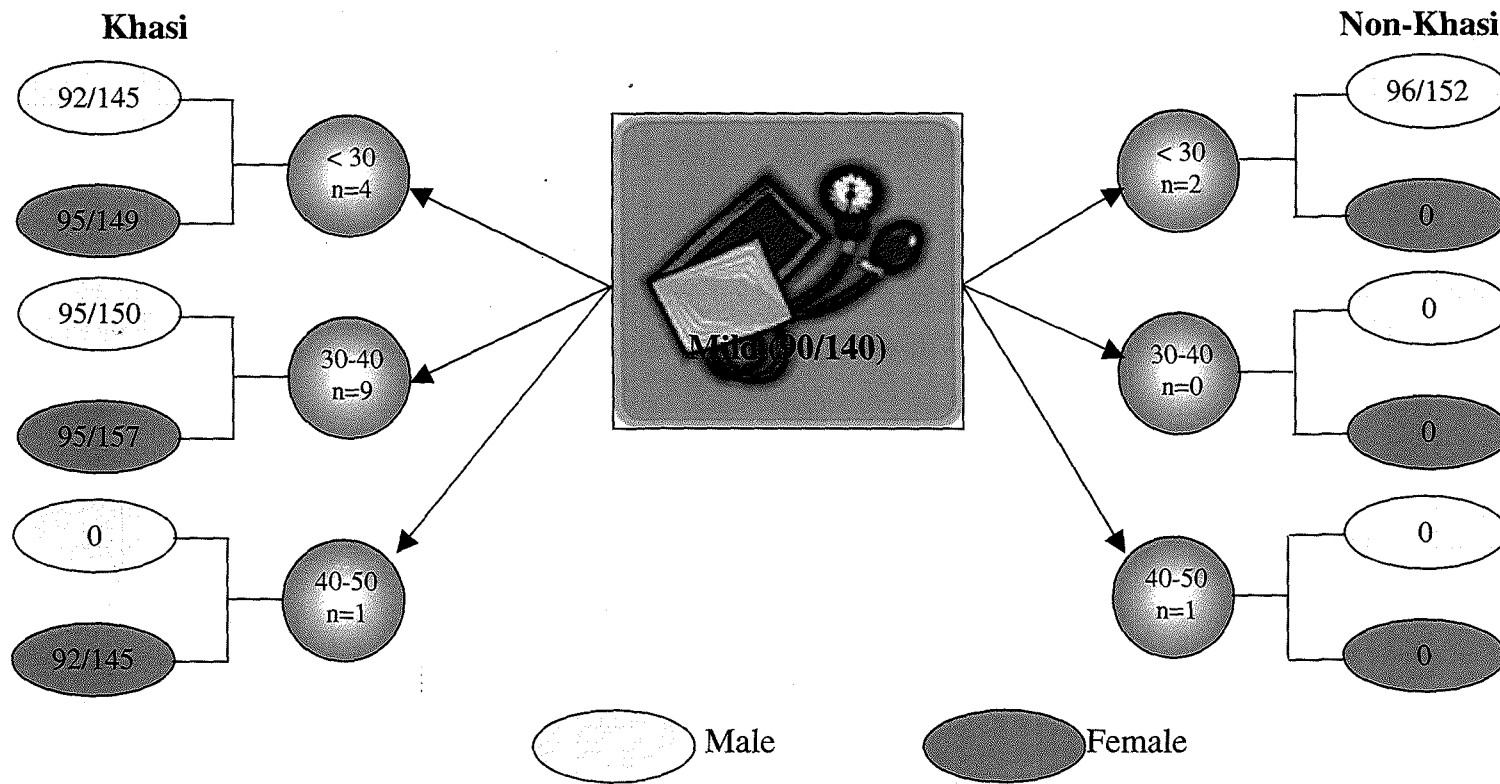
Blood pressure	Mean blood pressure level mm Hg											
	Khasis (n = 33)						Non-khasis (n = 6)					
	Male n = 13			Female n = 20			Male n = 5			Female n = 1		
	<30 n=2	30- 40 n=7	40 - 50 n=4	<30 n=2	30- 40 n=7	40- 50 n=4	<30 n=2	30- 40 n=7	40- 50 n=4	<30 n=2	30- 40 n=7	40- 50 n=4
*Mild 90/140	92/ 145	95/ 150 (n=4)	Nil	95/ 149 (n=2)	95/ 157 (n=5)	92/ 145 (n=1)	96/ 152 (n=2)	95/ 149 (n=2)	Nil	Nil	Nil	Nil
*Moderate 100/160	Nil	105/ 160 (n=3)	102/ 162 (n=4)	Nil	107/ 178 (n=5)	106/ 165 (n=2)	Nil	102/ 160 (n=1)	Nil	Nil	107/ 162 (n=1)	Nil
*Severe >110/180	Nil	Nil	Nil	Nil	120/ 185 (n=4)	120/ 182 (n=1)	Nil	Nil	Nil	Nil	Nil	Nil

\*Source : [www.who.int/bulletin](http://www.who.int/bulletin)

Data from the above Table and Figure VIIA, B, and C shows that 6 males and 8 female khasi and 4 male non-khasi were found to have a mild blood pressure about 90/140 mg Hg. Seven males and 7 female khasi and 1 male and 1 female non-khasi were found to have a moderate blood pressure above 100/160 mm Hg. Only 5 female khasi have blood pressure above 110/180 mm Hg which is severe.

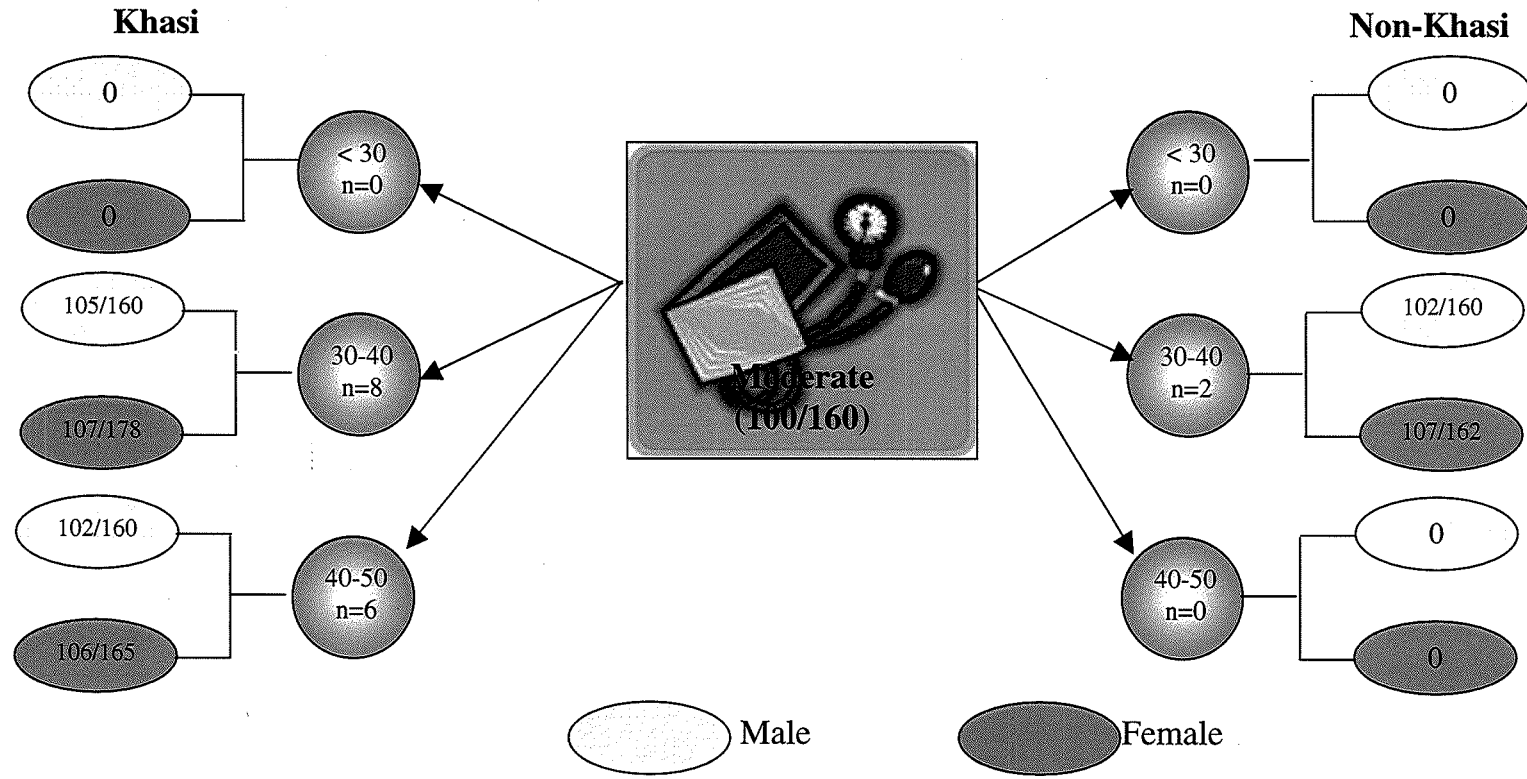
Chanda *et al.*, (1996) opines that consumption of more fat and salt with the decreased intake of complex carbohydrate predisposes to the incidence of diabetes, obesity and hypertension.

## MEAN BLOOD PRESSURE OF THE HYPERTENSIVE SUBJECTS



**FIGURE VIIA**

## MEAN BLOOD PRESSURE OF THE HYPERTENSIVE SUBJECTS



**FIGURE VIIB**

## MEAN BLOOD PRESSURE OF THE HYPERTENSIVE SUBJECTS

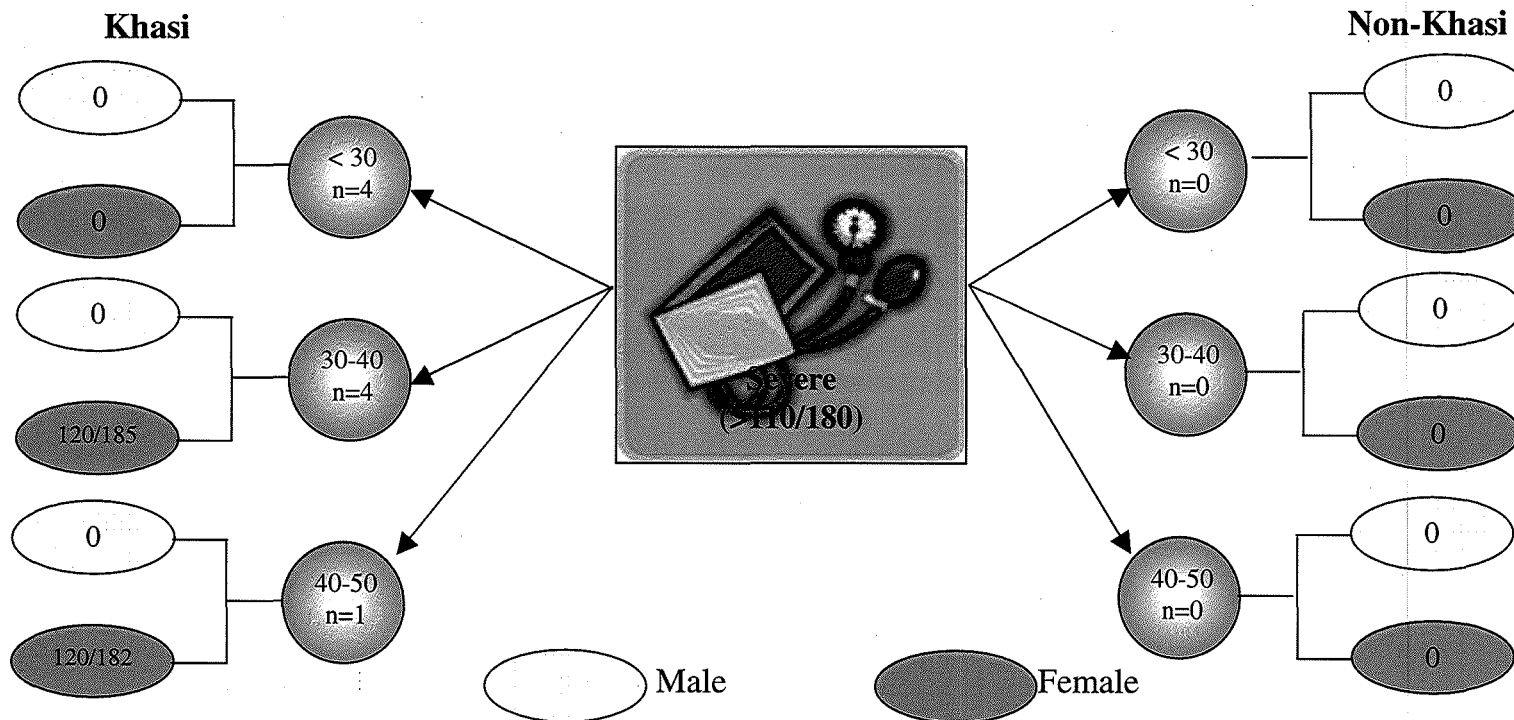


FIGURE VIIC

**c. Blood glucose levels**

The mean blood glucose levels of the diabetic subjects is shown in Table XXI.

**TABLE XXI**  
**MEAN BLOOD SUGAR LEVELS OF DIABETICS SUBJECTS**

N=27

Age  Blood sugar	Mean blood glucose levels (mg / dl)								
	Khasis (n = 23)						Non-khasis (n = 4)		
	Male (n = 14)			Female (n = 9)			Male (n = 4)		
	<30 n=2	30-40 n=9	40-50 n=3	<30 n=2	30-40 n=4	40-50 n=3	<30 n=1	30-40 n=1	40-50 n=2
Fasting * ≥ 126	142	146	140	145	149	145	146	146	145
Post prandial * ≥ 200	210	240	275	220	260	200	240	265	200

\* Source : Harrison (2001)

Data from the above Table indicate that fasting levels of 14 male and 9 female khasi and 4 male non-khasi is above 126 mg/dl so as the post prandial levels is above 200 mg/dl.

Carbohydrate foods with high glycemic index in many Asian diets has resulted in increasing the incidence of complication among diabetics (Abeywardena 2003).

**d. Mean Nutrition intake of adolescent subjects with anaemia**

The mean nutrient intake of adolescent subjects with anemia is given in Table XXII.

**TABLE XXII**  
**MEAN NUTRIENT INTAKE OF ADOLESCENT SUBJECTS SUFFERING**  
**FROM ANAEMIA (AGE GROUP – 15-19 YEARS)**

N=70

Nutrients	Recommended intake for adolescent body	Male		Recommended intake for adolescent girls	Female	
		Khasis	Anaemia (n=16)		Khasis	Non-khasis
					Anaemia (n=42)	Anemia (n=12)
Energy (kcal)	2640	2472		2060	1939	1845
Protein (g/d)	78	69		63	54	58
Fat (g/d)	22	32		22	32	32
Calcium (mg/d)	500	604		500	300	598
Iron (mg/d)	50	19		30	15	17
β-carotene (μg/d)	2400	1402		2400	1202	1347
Thiamin (mg/d)	1.3	1.2		1.0	1.0	0.9
Niacin (mg/d)	-	14		-	8	13
Vitamin C (mg/d)	40	32		40	23	33
Carbohydrate (g/d)	-	350		-	396	280.2
Fibre (g/d)	-	7.2		-	5.3	3.5

Data from the above table shows that only half of the recommended intake of iron was met by the anaemic khasi and non-khasi girls. The intake is only 15mg for khasi female and 17 mg for non-khasi female. The anaemic khasi boys were deficit in iron by 31 mg. Both non-khasi boys and girls and boy khasi consumed less of vitamin C with a deficit of 8 mg, 17 mg and 7mg respectively.

The mean nutrient intake of adult subjects (age 20-60 years) with diet related disorders is given in Table XXIII.

**TABLE XXIII**

**MEAN NUTRIENT INTAKE OF SELECTED ADULTS SUBJECTS WITH DIET RELATED DISORDERS  
(AGE GROUP 20-60 YEARS)**

**N = 114**

Nutrient	Recommended intake for man	Male N = 50						Recommended intake for man	Female N = 64				
		Khasis			Non-khasis				Khasis			Non-khasis	
		Anaemia n=9	Hypertension n=13	Diabetes n=14	Anaemia n=5	Hypertension n=5	Diabetes n=4		Anaemia n=25	Hypertension n=20	Diabetes n=9	Anaemia n=9	Hypertension n=1
Energy (kcal)	2875	1895	2476	2689	1894	2647	2208	2225	1652	2459	2298	2159	2199
Protein (g/d)	60	67.5	60	72	68.4	68	72	50	94	64	65	44	65
Fat (g/d)	20	35	40	32	16.9	42	45	20	44	33	36	33	32
Calcium (mg/d)	400	516.1	689	660	1517	598	664	400	394	769	604	759	739
Iron (mg/d)	28	19	30	23	18	28	23	30	17	25	23	15	19
Betacarotene (µg/d)	2400	516	1979	2042	2938	1678	1402	2400	297	4500	1402	4570	1409
Thiamin (mg/d)	1.4	2	2.2	3.9	1.2	1.0	1.2	1.1	1	1.8	1.1	1.8	1.7
Niacin (mg/d)	-	15	21	9	11.5	13	14	-	11.5	8	14	8.8	10
Vitamin C (mg/d)	40	22	46	30	60.4	36	52	40	28.2	29	52	23	36
Carbohydrate (g/d)	-	327.1	512	604.2	354.1	290	421		221	351	423	350	350.0
Fibre (g/d)	-	6.1	8.9	5.8	3.9	4.5	6.7	-	4	5.4	3.0	26.	3.3
Sodium (mg/d)	8	-	282.6	-	-	354.2	-	8	-	482.1	-	-	472
Potassium (mg/d)	-	-	348.4	-	-	502.1	-	-	-	742	-	-	925

Considering the anaemic khasi and non-khasi nutrient intake. The intake of iron was met only half of the recommended intake by both khasi and non-khasi anaemic subject.

From the above table it is shown that the intake of fat is 32g and 45g by the khasi and non-khasi male and 36g by khasi female which is higher than 20g of the recommended intake for diabetic subjects. Only 5.8g and 6.7 g of fibre is consumed by diabetic male khasi and non-khasi respectively. Similarly only 3.0g of fibre is taken by the khasi female.

Fat intake is very high among the hypertensive subjects with 40 and 42g against 20g by khasi and non-khasi male respectively which is almost twice the amount recommended. In case of khasi and non-khasi female fat intake is deficit by 13g and 12g respectively against 20g.

Sodium intake is 282.6mg and 354.2mg by khasi and non-khasi male respectively. Similarly 482.1mg and 472mg is consumed by khasi and non-khasi female respectively. The daily salt intake of both khasi and non-khasi male and female range between 8-10g which is recommended for the hypertensive adult.

#### **D. DIET MODIFICATION**

Table XXIV presents the aspects of diet modification given to the subjects with diet related disorders.

**TABLE XXIV****DIET MODIFICATION FOR THE SUBJECTS WITH DIET RELATED DISORDERS**

<b>Sl.No.</b>	<b>Diet related disorders</b>	<b>No.</b>	<b>Diet modification</b>
1	Anaemia	118	<ul style="list-style-type: none"><li>• Iron rich foods like dates, raisins, mint, liver (sheep), rice flakes.</li><li>• Folic acid rich foods like bengal gram, ladies finger, mint, whole bengal gram</li><li>• Vitamin B<sub>12</sub> rich foods like goat meat, egg yolk, curd (cow' milk)</li><li>• Vitamin C rich foods like amla, guava, lemon, orange, capsicum</li></ul>
	Diabetes mellitus	27	<ul style="list-style-type: none"><li>• Food exchange list</li><li>• Glycemic index of foods like bread, milk, potato chips, apple, orange, banana</li><li>• Importance of fibre rich foods like green leafy vegetable</li><li>• Complex carbohydrate like whole wheat</li><li>• Fat and cereal restriction</li><li>• Foods to be avoided like sugar, ice cream, maida, bakery products, butter, root vegetables, banana, dried fruits, aerated drinks, proprietary drinks / horlicks</li><li>• Foods to be included like green salad</li></ul>
3	Hypertension	39	<ul style="list-style-type: none"><li>• Avoid high sodium foods like baking power, bakery products (bread, cake, biscuits), papads, soft drinks and salt intake</li><li>• Avoid intake of processed foods like canned foods, pickles</li><li>• Avoid fleshy foods like chicken, fish, meat, beef</li><li>• Include foods low in sodium like: tomato, leafy vegetables (mustard leaves, raddish leaves), bitter gourd, brinjal</li><li>• Fruits like mango and pineapple</li><li>• Vegetables like broad beans, amaranth, raddish, cauliflower and lettuce to be restricted</li></ul>

From the above Table it is seen that diet modification was provided to all the subjects with diet related disorders. They were advised to follow the diet modification for their better health.

The changes in the effect of diet modification is presented in Table XXVa.

**TABLE XXVA**  
**BIOCHEMICAL PROFILE OF SUBJECTS BEFORE AND AFTER DIET MODIFICATION**

N = 25				
Mean values	Before		After	
	Khasis (n=12)	Non-khasis (n=4)	Khasis (n=12)	Non-khasis (n=4)
<b>Hypertension</b> N = 16	<b>Blood Pressure – mmHg</b>			
Mild : 90/140mm Hg	95/157	95/152	90/142	91/142
Mean values	Khasis (n=7)	Non-khasis (n=2)	Khasis (n=7)	Non-khasis (n=2)
<b>Diabetes mellitus</b> N = 9	<b>Blood Sugar Level mg/dl</b>			
Fasting ≥ 126	145	145	143	144.5
Post prandial ≥ 200	240	200	238	200

Twelve khasi and 4 non-khasi who followed the diet modification have a mean blood pressure levels, which was found to be near normal.

Seven khasi and 2 non-khasi who followed the diet modification and have followed exercise management also had a slight change in their blood glucose levels by 2 mg/dl and .5 mg/dl respectively.

The no-changes in the effect of diet modification are presented in Table XXVb.

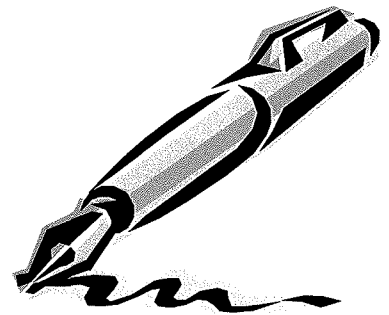
**TABLE XXVB**  
**BIOCHEMICAL PROFILE OF SUBJECTS BEFORE AND AFTER DIET**  
**MODIFICATION**

Mean values		Before		After	
		Khasis (n=129)	Non-khasis (n=30)	Khasis (n=129)	Non-khasis (n=30)
<b>Hypertension</b> <b>N = 23</b>		<b>Blood pressure – mm Hg</b>			
Mild	90/140mm Hg	95/157 (n = 2)	Nil	Nil	Nil
Moderate	100/160	107/178 (n=14)	107/162 (n=2)	Nil	Nil
Severe	> 110/180	120/185 (n = 5)	Nil	Nil	Nil
<b>Diabetes mellitus</b> <b>N = 18</b>		<b>Blood sugar level mg/dl</b>			
Male	Fasting ≥ 126	146(n = 12)	146 (n = 2)	Nil	Nil
	Post prandial ≥ 200	240	265	Nil	Nil
Female	Fasting ≥ 126	149 (n = 4)	Nil	Nil	Nil
	Post prandial ≥ 200	260	Nil	Nil	Nil
<b>Anaemia</b> <b>N = 118</b>		<b>Haemoglobin level</b>			
Mild 10-12	Male	20	4	Nil	Nil
	Female	36	16	Nil	Nil
Moderate 10-7	Male	3	1	Nil	Nil
	Female	22	5	Nil	Nil
Severe < 7	Male	2	Nil	Nil	Nil
	Female	7	Nil	Nil	Nil

In case of 23 hypertensive subjects there is no change seen in the blood pressure of 21 khasi and 2 non-khasi subjects.

There is no change seen in blood glucose levels of 16 khasi and 2 non-khasi subjects.

In case of anaemia, no anaemic subjects had any changes in their blood haemoglobin within one month of diet modification.



## *SUMMARY AND CONCLUSION*

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## V SUMMARY AND CONCLUSION

Diet and health are synonymous with the well being of an individual. The pattern of disease prevalence seen today indicate non-communicable diseases like diabetes mellitus, hypertension, cardiovascular disease, obesity and cancer which occurs due to the changes in life style and dietary pattern. The shift from the conventional diet to modern coupled with less physical activity are responsible for the steep rise of the so called modern man made disease, while the health of the general population at large is an issue of great concern, the health status of the side line section of the population such as the tribes requires greater concern. Shillong the capital of Meghalaya is the home town of the tribal khasi while the migrant from Assam and Bengal who have come to Shillong in search of livelihood were the non-khasi.

The present study “The prevalence of diet related disorders among the selected population of Shillong and effect of diet modification was undertaken with the following objectives, to elicit background information on the socio-economic status and nature of occupation, find out the prevalence of diet related disorders among the selected subjects, assess the nutritional profile of selected subjects through anthropometric measurement, biochemical estimations and diet survey provide appropriate diet modification to the subjects affected with diet related disorder and to evaluate the effect of diet modification among the selected subjects.

Two places of Shillong namely Mawlai and Mawroh where tribal Khasi and non-khasi tribes reside were selected by purposive sampling method for the study.

Six hundred subjects comprising of 465 tribal khasi which includes 72 males and 127 females adolescent and 135 non-khasi comprising of 25 male and

43 female adolescent and 34 male and 33 female adult were selected at random for the study.

A survey to elicit background information and life style pattern was conducted on all the selected subjects with the aid of an interview schedule.

Information on the nature of diet related disorder, age of onset, duration since incident, treatment, diet prescribed and followed by the subjects was elicited with the help of an interview schedule.

The dietary pattern was studied using an interview schedule. Anthropometric measurement like weight, height, waist and hip circumference were taken and the corresponding body mass index and waist-hip ratio was found out. The biochemical profile of 184 subjects comprising of 118 anaemic 39 hypertensive and 27 diabetic was carried out for blood haemoglobin estimation, blood pressure and blood sugar levels respectively. Twenty four recall method for 184 subjects was obtained and calculated and compared with RDA of ICMR (2004).

Diet modification was provided to subjects with diet related disorder and its effects was done after one month period. The data collected was analysed and interpreted.

The findings of the study are:

#### **A. BACKGROUND INFORMATION AND LIFE STYLE PATTERN**

- ❖ Out of 600 selected subjects 465 were tribal khasi and 135 non-khasi. Seventy-two male and 127 females adolescent and 125 adult male and 141 adult females were khasi and 25 male 43 female adolescent and 34 male and 33 female adult were from non-khasi tribes. Among 600 selected subjects, 267 were adolescents

- ❖ All the 465 khasi and 135 non-khasi were literate. Seventy-six male khasi had high school education and 115 females khasi and 38 females non-khasi were higher secondary qualified and 18 male non-khasi were graduates.
- ❖ Fifty nine male and 25 female khasi are employed in government sector as also 15 male and 9 female non-khasi, thirty female khasi and 7 female non-khasi were house wives.
- ❖ One hundred and sixteen khasi and 36 non-khasi both male and female were on the high income group. Thirty-six khasi and 6 non-khasi both male and female were in the middle income group and 30 khasi and 14 non-khasi both male and female belonged to low income group.
- ❖ Two hundred and fifty-three and 85 khasi and non-khasi respectively live in nuclear families and 212 khasi and 50 non-khasi live in joint families.
- ❖ Ninety three male and 120 female live in families with 4-7 members which is the average size of the family of Meghalaya, and 30 males and 48 females non-khasi out of 135 non-khasi have an average families size of 4-7 members respectively.
- ❖ Ten khasi male smokes about 1-5 cigarettes a day and 22 male non-khasi smokes about 5-10 cigarettes a day. Seven males khasi have been smoking for a period of 5-10 years and 13 males non-khasi for a period of 0-5 years.
- ❖ One hundred and two male and 147 female khasi and 25 male and 55 female non-khasi consumed 100-150ml of tea daily. Twenty nine female and 9 male khasi and 24 and 12 female non-khasi consumed coffee 100-150 ml daily. Forty female khasi consumed more than two cup of tea a day.
- ❖ Fruit juices and carbonated beverages were occasionally consumed by all the subjects.

- ❖ Fifty three male and 80 female khasi had the habit of chewing 5-10 pieces of pan and 16 female 1-5 pieces a day and 18 male had 5-10 pieces a day. Forty two male and 62 female khasi had the habit of pan chewing for 5-10 years and more than 10 years respectively. Seven and 18 female and male had the habit for 0-5 years and 5-10 years respectively.
- ❖ Out of 465 khasi only 291 had the habit of exercise and out of 135 non-khasi only 46 had the habit of exercise. Seventy two males and 30 females khasi and 56 male and 46 female preferred walking and jogging respectively and 14 male and 12 female non-khasi preferred walking.

## **B. PREVALENCE OF DIET RELATED DISORDERS**

- ❖ Twenty five male and 67 female khasi and 5 male and 25 female non-khasi were suffering from anaemia. Thirteen male khasi and 20 female khasi and 5 male non-khasi and 1 female non-khasi were hypertensive. Fourteen male and 19 female khasi and 4 male non-khasi were diabetic subjects. Two male and 2 female khasi and one male and one female non-khasi were obese.
- ❖ Fatigueness and pallor of the skin provoked 12 male khasi and 3 male non-khasi and 12 female non-khasi and 30 female khasi and 2 male non-khasi to seek medical attention. Dizziness and general weakness provoked five and 10 hypertensive khasi and 2 male non-khasi and 6 male khasi and 3 male non-khasi to seek medical attention. Polyphagia and polydypsia prompted 6 male and 5 female khasi and 3 female non-khasi to seek medical attention.
- ❖ Sixteen male and 42 female khasi and 12 female non-khasi were first diagnosed with anaemia at the age of 15-19 years.
- ❖ Seven male and 14 female khasi and 3 male non-khasi hypertensive subjects were first manifested with hypertension in the age of 30-40 years and 4 male and 4 female khasi between the age of 40-50 years. Nine male and 4 female

khasi and 1 male non-khasi with diabetes mellitus were diagnosed at the age of 30-40 yeas.

- ❖ Twenty five male and 57 female khasi and 5 male and 17 female non-khasi were suffering from anaemia for a duration of between 1-3 years. Nine male and 12 female hypertensive khasi and 3 male hypertensive non-khasi were suffering for a duration of 1-3 years and 3-5 years respectively. Nine male and 5 female khasi and 2 male non-khasi diabetic suffered for a duration of 3-5 years and only one male and one female khasi for a duration of more than 5 years.
- ❖ Eleven male and 15 female khasi and 2 male non-khasi have family history of obesity. Eight male and 14 female khasi and 4 male and 2 female non-khasi have family history of hypertension and 4 male and 11 female khasi and 4 male and one female non-khasi have family history of diabetes mellitus.

### **C. NUTRITIONAL PROFILE OF THE SELECTED SUBJECTS WTH DIET RELATED DISORDERS**

- ❖ Two male and 4 female khasi were obese and one male and one female non-khasi are obese.
- ❖ Four males and 20 females khasi and 2 male and 4 female non-khasi have waist hip ratio above normal value.
- ❖ Six males and 8 females khasi and 4 males non-khasi were found to have a mild blood pressure above 90/140 mm Hg and seven males and 7 females khasi and one male and one female non-khasi have a moderate blood pressure above 100/160 mm Hg. Five female khasi have blood pressure above 110/180mm Hg which is severe.

- ❖ Two male and 7 female khasi were severely anaemic and twenty male and 36 female khasi and 4 male and 16 female non-khasi were mildly anaemic and 3 male and 22 female khasi and 1 male and 5 female non-khasi were moderately anaemic.
- ❖ The fasting level of 14 male and 9 female khasi and 4 male non-khasi is above 126 mg/dl and the post prandial is above 200mg / dl.
- ❖ The iron intake of the anaemic adolescent was only half of the recommended intake for both khasi and non-khasi against 30mg. Vitamin C is deficit by 8mg, 17mg, respectively for both non-khasi boys and girls.
- ❖ Iron intake of anaemic khasi and non-khasi adults was met only half of the recommended intake. Fat intake is in excess by double the amount recommended for diabetic subjects. Only 5.8 and 6.7g of fibre was consumed by both khasi and non-khasi male subjects and 3.0g of fibre is taken by the khasi female.
- ❖ Fat intake is very high for hypertensive subjects which is double the recommended intake.
- ❖ Sodium intake is 282.6mg and 354.2mg by khasi and non-khasi male respectively and 482mg and 472 mg is consumed by khasi and non-khasi female respectively. Salt intake range from 8-10g for both khasi and non-khasi.

#### **D. DIET MODIFICATION**

- ❖ Diet modification was provided to all the subjects with diet related disorders.
- ❖ Twelve khasi and 4 non-khasi who followed diet modification have a mean blood pressure levels near normal.

- ❖ Seven khasi and 2 non-khasi had a slight change in their blood glucose levels by 2 mg/dl and .5mg/dl who followed diet modification.
- ❖ There is no changes in the blood haemoglobin level with anaemic subjects. Twenty one khasi and 2 non-khasi hypertensive subjects have no changes in blood pressure, and 16 khasi and 2 non-khasi diabetic subjects have no changes in blood glucose, after one month of diet modification.

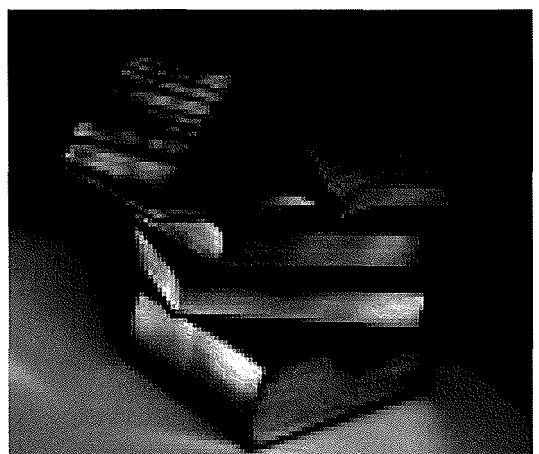
## **CONCLUSION**

The prevalence of diet related disorders was higher among 148 tribal khasi as against 36 non-khasi. Anaemia was higher among 92 khasi against 26 non-khasi, followed by hypertension with 33 khasi against 6 non-khasi and diabetes mellitus with 23 khasi against 4 non-khasi which comprised both male and female.

Despite the enormous government assistance for various welfare programmes for the tribal groups, awareness on the dietary pattern is still very limited. Programmes creating awareness to the tribal group on these aspects periodically are essential. A team of nutritionists, dietitians, and social workers should work towards bringing about attitude changes to avoid the health and nutrition problems among the tribal population. Diet modification and nutrition programmes should be available in all micro level nutrition intervention programmes.

## **RECOMMENDATION**

1. The tribal population must be educated to utilize the nutrition intervention programmes through proper education.
2. Similar studies can we undertaken to cover all khasi tribes residing in Meghalaya.



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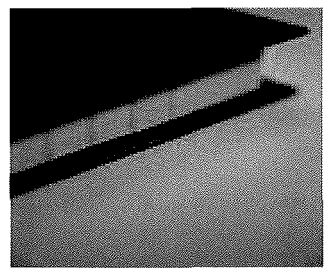
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## *APPENDICES*

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## APPENDICES

### APPENDIX I

AVINASHILINGAM INSTITUTE FOR HOME SCIENCE AND HIGHER  
EDUCATION FOR WOMEN, DEEMED UNIVERSITY,  
COIMBATORE - 4 3

#### APPENDIX 1A

INTERVIEW SCHEDULE TO ELICIT BACKGROUND INFORMATION  
ON SOCIO-ECONOMIC STATUS AND NATURE OF OCCUPATION OF  
THE SELECTED SUBJECTS OF SHILLONG

#### I. BACKGROUND INFORMATION

1. Name :
2. Age :
3. Sex : Male  Female
4. Address :
5. Community : Khasi  Non-Khasi
6. Educational Status : Primary School  High School   
Graduate  Post Graduate
7. Marital status : Married  Unmarried
8. Type of family : Nuclear  Joint
9. Total monthly income :
10. Size of the family :

No. of family members	Male	Female	Total
Infant (0-3 years)			
Pre-school (3-6 years)			
School going (6-12 years)			
Adolescent (13-18 years)			
Adult (18-60 years)			
Elderly (60 years and above)			

II. Lifestyle pattern

1. Do you have the habit of smoking cigarette / Beedi Yes  No

If yes

Type	Duration of smoking			No / Days
	0-5 years	15-10 years	10-15 years	
Cigarette				
Beedi				
Others				

b. Tobacco / Pan chewing :  yes  No

If yes, specify

Type	Duration			No. of pieces / d	No. of Packet / d
	0-5 years	15-10 years	10-15 years		

c. Alcohol consumption :  Yes  No

If yes

Type	Duration			Quantity	Frequency
	0-5 years	15-10 years	10-15 years		

d. Consumption of others beverages :  Yes  No

If yes

Type	Quantity	Frequency
Coffee		
Tea		
Carbonated beverage		
Fruit juice		
Others		

e. Do you exercise regularly ? :  Yes  No

If yes

Type	Duration	Frequency
Walking		
Jogging		
Cycling		
Swimming		
Any others		

## APPENDIX 1B

### INTERVIEW SCHEDULE TO ELICIT INFORMATION ON DIET RELATED DISORDERS

1. Are you suffering from any disease ?

Disease	Yes / No	Symptom which provoked medical attention	If present	Age of onset	Duration
Diabetes mellitus		a. Polydypsia b. Polyuria c. Polyphagia			
Anaemia		a. Fatigue b. Anorexia c. Dyspnea d. Pallor of the skin			
Hypertension		a. Dizziness b. Weakness c. Pain in the chest d. Edema			
Cardiovascular		a. Pain in the chest b. Pain radiating to the leaf hand c. Profound sweating			

Disease	Yes / No	Risk factors	If present	Age of onset	Duration
Obesity		Diabetes mellitus Cardiovascular diseases Hypertension			

II. Do you have a family history ?

Condition	Familial inheritance			
	Yes	No	If yes, indicate relationships	
			Maternal	Paternal

III. Indicate medication and diet prescribed :

Medical intervention			Dietary intervention	
Disease	Nature of surgery	Drugs	Prescribed	Followed

## APPENDIX 1C

### INTERVIEW SCHEDULE TO ELICIT DATA ON NUTRITIONAL PROFILE OF SELECTED POPULATION THROUGH ANTHROPOMETRIC MEASUREMENT, BIOCHEMICAL ESTIMATIONS AND DIET SURVEY

#### I. Dietary practices

a. Indicate your meal pattern : Vegetarian  Non-vegetarian

b. Type of oil used :

S.No	Type	Quantity / dl Cooking (gm /dl)			Frequency	
		10-30	30-50	Above 50	Daily	weekly
1.	Mustard oil					
2.	Sunflower oil					
3.	Hydrogenated vegetable oil					
4.	Ghee (Dalda)					
5.	Butter					

c. Cooking methods adopted

Food items	Boiling	Steaming	Frying		Stewing	Others
			Shallow fry	Deep fry		
Cereals						
Pulses						
Vegetables						
Eggs						
Meat						
Fish						
Others						

d. Details of other food stuffs consumed per month

Food stuff	Qty / month	Frequency
<b>Cereals</b>		
Raw rice		
Wheat		
Maida		
Others (Specify)		
<b>Pulses</b>		
Lentil dhal		
Red gram dhal		
Black gram dhal		
Bengal gram dhal		
Green gram dhal		
Others		
<b>Roots and Tubers</b>		
Potatoes		
Carrot		
Yam		
Others		
<b>Green leafy vegetables</b>		
Mustard leaves		
Cauliflower greens		
Radish leaves		
Amaranthus		
Spinach		
Celery		
Coriander leaves		
Mint leaves		
Others		
<b>Other vegetables</b>		
Brinjal		
Ladies finger		
Beans		
Pumpkin		

<b>Food stuff</b>	<b>Qty / month</b>	<b>Frequency</b>
Tomato		
Cabbage		
Cauliflower		
Knol Khol		
Others		
<b>Fruits</b>		
Apple		
Orange		
Grapes		
Plantain		
Plumps		
Others		
<b>Flesh foods</b>		
Mutton		
Fish (fresh)		
Fish (dried)		
Chicken		
Egg		
Beef		
Pork		
<b>Milk and milk products</b>		
Milk		
Curd		
Butter milk		
Ghee		
<b>Sugar and jaggery</b>		
Sugar		
Honey		
Jaggery		

## **II. Anthropometric Measurements**

Height in (cm) :

Weight in (kg) :

Body Mass Index :

Waist circumference (cm) :

Hip circumference (cm) :

Waist Hip Ratio :

### III. Records of Biochemical Parameters

Disease	Condition	Date	Biochemical parameter	Level

### IV. 24 hour dietary recall survey method

a. 24 hour recall for 3 consecutive days

Meal	menu					
	1 <sup>st</sup> day	Qty	2 <sup>nd</sup> day	Qty	3 <sup>rd</sup> day	Qty
Early morning						
Breakfast						
Lunch						
Evening Tea						
Dinner						
Bed time						

## **APPENDIX II**

### **SAHLI'S METHOD**

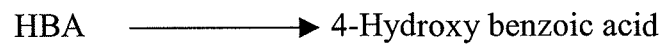
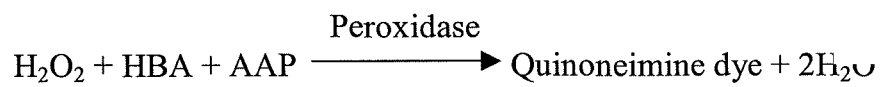
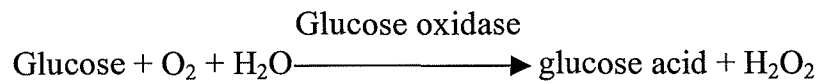
#### **Principle**

One of the original techniques for measuring haemoglobin calorimetrically, with a haemometer. The Sahli haemometer method utilizes the conversion of haemoglobin into acid haematin which has a brown colour in solution, the intensity of the colour is related to the amount of haemoglobin in the blood sample. Water is added to dilute the brown solution until it matches that of a standard. The more haemoglobin, the more water required to obtain a colour match. Haemoglobin values are read at the meniscus of the brown solution.

## APPENDIX III

### GOD-PAD METHOD

#### Principle



The intensity of the pink colour formed is proportional to glucose concentration and can be measured photometrically between 490 and 540 nm.