

**NUTRITIONAL STATUS AND FOOD CONSUMPTION PATTERN OF
DIABETIC PATIENTS IN DINAJPUR DISTRICT, BANGLADESH**

**A THESIS
BY**

MD. MOKADDES ALI
Registration No.: 1705048
Session: 2017-2018
Semester: January-June, 2018

**MASTER OF SCIENCE
IN
FOOD SCIENCE AND NUTRITION**



**DEPARTMENT OF FOOD SCIENCE AND NUTRITION
HAJEE MOHAMMAD DANESH SCIENCE AND TECHNOLOGY
UNIVERSITY, DINAJPUR**

JUNE, 2018

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JUNE, 2018

Dedicated
To
My Beloved Parents

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The author

June, 2018

ABSTRACT

The purpose of the study was to assess nutritional status and food consumption pattern of diabetic patients in Dinajpur district, Bangladesh. A total 128 diabetic patients (male 77 and female 51) and ages between 20 to 69 years of age from Dinajpur Diabetes O Swasthoseba Hospital in Dinajpur, Bangladesh were selected for the study. Participants completed a set of questionnaire containing 24 hour diet recalls. Weight and height of participants were used to calculate their individual Body Mass Index (BMI). From the study it was found that majority of the participants had normal weight and a least number were obese. In specific, 9.38% patients were underweight, 60.16% were normal, 23.44% were overweight and 7.03% were obese. The mean energy intakes of male patients were higher (1782.305 kcal) compared to female patients (1573.333 kcal). Only 53.13% of the patients fulfill their energy requirement. 45.31% of the patients took five meals per day which fulfilled their requirements but the rest of the participants took fewer meals. Consumption of carbohydrate (male 326.62 gm and female 291.61 gm) was higher than protein (male 82.35 gm and female 71.54 gm) and fat (male 36.56 gm and female 30.96 gm). Blood glucose level was higher in both conditions, during fasting (male 9.81 mg/dl and female 9.81 mg/dl) and after two hours of breakfast (male 17.09 mg/dl and female 15.69 mg/dl). There was a strong significance between education level and nutritional knowledge ($p < 0.0297$) as well as nutritional knowledge and nutritional status ($p < 0.0293$) of the participants.

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LIST OF ABBREVIATIONS

ABF	After Breakfast
ADA	American Diabetic Association
BDHS	Bangladesh Demographic and health survey
BBS	Bangladesh Bureau of Statistics
BMI	Body Mass Index
cm	Centimeter
DH	Diabetes Hospital
DM	Diabetes Mellitus
FAO	Food and Agriculture Organization
HIES	Household Income and Expenditure Survey
IDF	International Diabetes Federation
ml	Milliliter
SPSS	Statistical Package for the Social Science
T1D	Type 1 Diabetes
WHO	World Health Organization



CHAPTER I

INTRODUCTION

CHAPTER I

INTRODUCTION

All living things depend on food for growing and maintenance of their body because health is wealth. Food intake depends on individual body size such as height, weight, age, disease condition and physical activity level (Ajhe, 2013). Diabetes mellitus is a group of characterized by high blood glucose concentrations resulting from defects in insulin secretion, insulin action, or both. Abnormalities in the metabolism of carbohydrate, protein, fat are also present (Mahan *et al.*, 2016).

Diabetes has become a major public health concern in the world than any other disease due to increased prevalence of diabetes related complications (Sarah *et al.*, 2004). Diabetes does not cure permanently but it may control in various technique. One of the most important techniques is to nutrition therapy (ADA, 2015). For nutrition therapy, patients need own nutritional knowledge to control blood glucose. Inadequate glycemic control may occur due to the poor nutritional knowledge and misguide of dietary prescriptions (Castro-Sánchez *et al.*, 2013).

There are four types of diabetes such as type1, type2, gestational and malnutrition related diabetes (WHO, 2006).Type 1 diabetes (T1D) is caused due to the autoimmune destruction of insulin-producing pancreatic β cells (Atkinson, 2001) and unable to produce insulin, usually leading to absolute insulin deficiency and resulting in hyperglycemia, polyuria, polydipsia, weight loss, dehydration, electrolyte imbalance and ketoacidosis (Mahan *et al.*, 2016).,

Type 2 diabetes is a chronic disease that is caused by inherited and acquired insulin resistance and an increasing insulin secretion disorder. In order to reduce the morbidity and mortality rates among type 2 diabetics, which are increased significantly by macro- and microangiopathic complications diabetic dyslipidaemia and hyper coagulopathy that are often associated with type 2 diabetes(Gaede *et al.*, 2003).

Gestitional diabetes is the degree of glucose intolerance with onset or first recognition during pregnancy. Other types of diabetes includes diabetes associated with specific genetic syndromes, surgery, malnutrition, infection, drugs, and other illness. Diabetes

has been characterized as a demolishing and a deadly disease after 2000 years (Agbabiaka, 2010).

Diabetes mellitus has arise an important public concern as over four million people are suffering this ailment and only 20 percent of this group is aware of what they passing through (Lang *et al.*, 2008). World Health Organization indicates that there were 171 million people in the world with diabetes in the year 2000 and in 2030 it will increase to 366 million (WHO, 2006). It is estimated that diabetes mellitus currently accounts for 5.2% of all deaths worldwide (Roglic *et al.*, 2000).

In the world diabetic patients were 140 million people. This figure will rise to 300 million by the year 2025. Asia is the largest continent in the world. In 2025, more than 150 million will be in Asia. In Asia, there are two countries contain more daibetic patients. These are India and China. In India it is predicted to rise 15 million in 1995 to 57 million in 2025. In China recent estimates rise 15 to 20 million, with predicted rise to 50 million in 2025. In 2025, more than 30% diabetes will be in these two countries alone in the world (King H, 1999).

The International Diabetes Federation (IDF) was published in 2014 that the diabetes mellitus patients in the middle east 3%, southeast Asia 8.8% and western Pacific region 7.9%, respectively(Anjana *et al.*, 2015).

Another report has estimated that diabetes mellitus is supposed to double from 175 million in 2000 to 353 million in 2030.The largest increase is expected to occur in developing countries with 305 million individuals likely to have DM by 2030 (Yaehet *al.*, 2006).

Diabetes is a situation primarily defined by the level of hyperglycaemia giving rise to risk of microvascular damage such as retinopathy, nephropathy and neuropathy. It is associated with decreased life expectancy, increase morbidity due to diabetes related microvascular complications, increased risk of macrovascular complications such as heart disease, stroke and peripheral vascular disease. The American Diabetes association estimated the national costs of diabetes in the USA for 2002 to be 132 billion USD, increasing to 192 billion USD in 2020 (ADA, 2000).

Taking of appropriate amount of nutrition is an important section of diabetes management and self care of education, everyday physical exercise, aiming at the attainment and maintenance of optimal metabolic outcomes (WHO, 2004).

The mortality rates of Bangladesh are cardiovascular diseases 17%, cancers 10%, chronic respiratory diseases 11%, diabetes 3%, other NCDs 18%, communicable maternal, perinatal, nutritional conditions 32%, injury 9% (WHO, 2014).

Low calorie fruits and vegetables help to maintain optimal blood glucose level and decrease mortality rate, obesity, cancer, hypertension, cardiovascular disease (Thomas, 2005).

Keeping the present situation of diabetes in mind the present study was aimed to determine the health and nutritional status of the diabetics of Dinajpur district visiting the Diabetes O Swasthoseba Hospital in Dinajpur.

Aim of the study:

The aim of the study was to generate information that would contribute towards improving the nutritional status of diabetic and enhancing their nutritional education to control diabetes at a normal range.

Objectives of the study:

The main objective of the study was to determine the nutritional status of Diabetic patients in Dinajpur district, Bangladesh.

The specific objectives of the study were:

- To assess the nutritional status of diabetic patients.
- To study the socio-demographic characteristics of the respondents.
- To study the medical history of the diabetic patient like disease and blood glucose levels.
- To assess the anthropometric status of diabetic patients attending Diabetic Hospital in Dinajpur, Bangladesh.
- To study the dietary pattern and food consumption data of the diabetics.



CHAPTER II

REVIEW OF LITERATURE

CHAPTER II

REVIEW OF LITERATURE

2.1 General Overview of Nutritional Status

Nutrition may be defined as the consumption of food, considered in relation to the body's dietary needs (WHO, 2011). Food contains different nutrients that include water, carbohydrates, proteins, fats, vitamins and minerals. Good nutrition is important to ensure survival and that critical functions operate, including; the body producing energy for survival, movement, work and temperature control, growth, development, replacement and repair of cells and tissues, chemical processes such as digestion, metabolism and maintenance and protection against illness, fighting infections and recovery from illness. Poor nutrition can lead to reduced immunity, increased susceptibility to disease, impaired physical and mental development, and reduced productivity (Sakamaki *et al.*, 2005). Good eating habit is an essential part of a healthy lifestyle. It helps to prevent civilization diseases keep our body fit. The Body Mass Index (BMI) and eating plan analysis are useful in individual's nutritional assessment (Nieradko-Iwanicka *et al.*, 2004). Nutritional status is a measure of the health condition of an individual and is affected primarily by the intake of food and the utilization of nutrients. Malnutrition defines a state when the body does not have enough of the required nutrients (under-nutrition) nor has an excess of required nutrients (over-nutrition) (Miere *et al.*, 2007). Accurate measurement of individual nutritional status is required in clinical practice. Population measures are more important in research. They can be used to describe nutritional status of the group, to identify populations or population segments at risk for nutrition-related health consequences, and to evaluate interventions (Labib *et al.*, 2001).

2.2 Nutrition Education

To fill nutritional requirements one should know which food contains good nutrition. People need to know what constitutes a healthy diet and how to make good choice. Nutrition education is defined as the combination of educational tricks, along with environmental supports that designed to facilitate the voluntary adaptation of food choices and nutrition related behaviors beneficial to health and well-being (Contento IR Nutrition Education, 2008).

Nutrition education is an effective technique to control diabetes. Several trials have shown that those people who have more nutritional knowledge with practice have got effective outcome (Coppola *et al.*, 2015). To control diabetes need to lifestyle change along with diet therapy. Lifestyle change may vary according to education (Brunton *et al.*, 2008).

2.3 Energy Deficiency

Energy deficiency is defined as negative energy balance and includes chronic energy deficiency which is characterized by decreased body mass index i.e., BMI less than 18.5kg/m^2 . This is also termed as adult under nutrition. Present under nutrition among both sexes in the country is about 25% (WHO, 2011). Maternal under nutrition (body mass index $<18.5\text{ kg/m}^2$) in non-pregnant rural women in Bangladesh declined from 54% in 1996/97 to 38% in 2003, 34% in 2004 and 30% in 2007 (BDHS). Intrauterine and/or early childhood under nutrition is also linked with adult obesity or abdominal obesity and related adult diseases such as hypertension and diabetes (Godfrey and Barker, 2000; Popkin, 2001). Under nutrition at critical periods in intrauterine development causes permanent changes in the structure and/or function of the developing systems of the fetus (Lucas, 1991; Barker, 1998; Yajnik, 2004). This increases the susceptibility to disease in later life. Of the many possible insults during the intrauterine life, Hales and Barker have highlighted under nutrition as the most likely cause, though many factors could operate in a similar manner. The original hypothesis overlooked the classic association among maternal diabetes, fetal macrosomia and increased risk of diabetes for the offspring but new hypothesis allows for this (Hales and Barker 2001). However, the relationships among maternal nutrition, fetal nutrition, neonatal size and later diabetes appear to be more complicated than originally proposed (Harding, 2001).

2.4 Energy Requirements and Reference Body Weight

Dietary energy requirements of a healthy, well-nourished population should allow for maintaining an adequate BMI at the population's usual level of energy expenditure. At the individual level, a normal range of 18.5 to 24.9 kg/m^2 BMI is generally accepted (WHO 1995, 2000). At a population level, a median BMI of 21.0 was suggested by the joint WHO/FAO Expert Consultation on Diet, Nutrition and the Prevention of Chronic Diseases (WHO/FAO, 2003). Age, gender, height, weight and BMI are interlinked to the energy and nutrient requirements of individuals. Anthropometric standards for

population groups differ from country to country. Each country has to set up its own reference standards since height and weight of the population are not equal with other country. The purpose of recommending nutrient requirements help in planning norms for attaining anthropometric reference standards. International Organizations WHO, FAO have proposed reference standards applicable for developing countries. The 95th percentile values of weights and heights for given age/gender can be taken to be representative of well- nourished normal population and considered as standard reference values for India. For children below age 17, the reference body weight is fixed at the median of the range of weight-for-height given by the BMI reference tables (WHO, 2006 and 2007). For adults and children of age 10 and above, the reference body weight is estimated on the basis of the fifth percentile of the distribution of the BMI (WHO, 1995 and 2007).

2.5 Overview of Diabetes

Diabetes mellitus is a metabolic disorder that occurred due to hyperglycemia resulting from defect in insulin secretion or insulin action or both due to genetic and/or environmental factors acting along. It is noticed as the body's incapability to effectively regulate the sugar balance which leads to acute and chronic complexity such as, diabetic ketoacidosis, hyperosmolar non-ketotic coma, hypoglycemia, hyperglycaemia, obesity, , retinopathy, cardiopathy, neuropathy, nephropathy, osteoporosis and coma leading to death. Pancreatic dysfunction of cells causes disordered glucose homeostasis. Glucose is the only fuel that the neuronal tissue can use for energy under normal circumstances (Sokoloff, 1981). There are four types of diabetes individuals. Type 1 diabetes (T1D) is a condition that arises following the autoimmune destruction of β cell that produce insulin (Bluestone *et al.*, 2010). Type 1 diabetes is most often found in children and adolescents and/ or who are below 30 years of age with classifying symptoms (i.e., polydypsia, polyphagia, polyuria). Among these are questions related to the percentage of T1D cases that are diagnosed in adults whose estimates range from a low of 25% to as much as 50% (Thunandera *et al.*, 2008). Due to insulin resistance that is termed as Non Insulin Dependent Diabetes Mellitus (NIDDM) or Type2 it has been estimated that 5%–15% of adults diagnosed with T2D may, in actuality, have T1D (Palmer *et al.*, 2005), Gestational diabetes mellitus (GDM) diagnosed in the second or third trimester of pregnancy, others types of diabetes due to hormonal disease, drugs, pancreatic disease (ADA, 2015).

First in 1910 English physiologist Sir Edward Albert Sharpey-Schafer's study of the pancreas leads him to the discovery of a substance that would normally be produced in non-diabetics: insulin. The name comes from the Latin *insula*, meaning island, referencing the insulin-producing islets of Langerhans in the pancreas. In 1921 Frederick Banting, MD, and his then student assistant, Charles Best, MD, extract insulin from dog pancreases. In 1922 Fredrick Banting and his assistant Charles Best discovered insulin to save the lives of diabetics and anteing and Macleod were awarded the 1923 Nobel Prize in Physiology or Medicine, though the contributions of all four men have been recognized as important in the discovery of insulin (Banting *et al.*, 1922).

Eli Lilly and Company begins commercial production of insulin. In the decades that follow, manufacturers develop a variety of slower-acting insulins, the first being protamine insulin introduced by Novo Nordisk in 1936. In 2013 FDA approves Invokana (Canagliflozin), the first in a new class of drugs know as the SGLT-2 inhibitors, for lowering elevated blood sugar in patients with type 2 diabetes. SGLT-2 inhibitors block the activity of sodium glucose transport proteins in the kidney, reducing glucose re-uptake and increasing secretion of glucose in the urine (American Diabetic Association).

2.6 Prevalence and incidence of diabetes

Bangladesh is a densely populated country in the Asian continent. There are total 158.9 million people in Bangladesh (BBS, 2017). Epidemiological studies suggested that the incidence of diabetes is increasing worldwide. More than 85% of total diabetic population throughout the world belongs to type-2 diabetes mellitus. Recent estimates indicate there were 171 million people in the world with diabetes in the year 2000 and this is projected to increase to 366 million by 2030. The American Diabetes association (ADA) estimated the national costs of diabetes in the USA for 2002 to be 132 billion USD, increasing to 192 USD billion in 2020 (WHO, 2006). Type 2 diabetes mellitus has now become an epidemic form because of nature the disease. All type 1 diabetes mellitus can be diagnosed earlier in the comparison to only 50% of type 2 diabetes. In 2007 the prevalence rate of diabetes in the world among people of 20-79 years of age was 5.9%. Prevalence of impaired glucose tolerance (IGT) in the world was about 7.5% in people of 20-79 years of age in 2007. In Bangladesh the prevalence of diabetes in 2007 among people o 20-79 years of age was 4.8% that of IGT was 8.5% (WHO, 2006).

2.7 Anthropometric Measurement

Anthropometry is the measurement of physical dimensions and composition of the body. (Onis *et al.*, 1996). This method can be used to detect the degree of malnutrition in an individual or population. To assess the presence or absence of malnutrition, three measurements are taken and they include; age, height and weight. These measurements are used to calculate the major anthropometric indicators of nutritional status namely; weight-for-age, weight-for-height and height-for-age. These indicators are then compared with those obtained from an international reference population (WHO, 2006). The use of height-for-age and weight-for-height as primary indicators of nutritional status in children was recommended by a joint board consisting of FAO, UNICEF and WHO (WHO, 2006).

2.8 Dietary Methods

Low dietary intakes, either due to a primary deficiency (low levels in the diet), a secondary deficiency (interference with ingestion, absorption, transport, utilization or excretion of nutrients), or inadequate food consumption, are a first indicator of malnutrition (Lohman *et al.*, 1988), Dietary assessment can be done in two ways;

A. By quantitative measurement of recalls or records of consumption at meal time over a one day period.

B. By use of dietary history and the food frequency questionnaire. These two methods obtain retrospective information on the patterns of food consumption during a longer and precisely defined time period.

2.9 Dietary Pattern in Bangladesh

Cereals, largely rice, form the main components of the diet in Bangladesh. The typical diet in Bangladesh is not balanced and remains dominated by a high intake of cereals (Jahan *et al.*, 1998; BBS, 2005 and 2010).

Table 2.1: Per capita/d intake of major food items (g) in Bangladeshi population, HIES

Food items, (gm)	1995-96	2000	2005	2010	
				Poor	Non-poor
Rice	464.3	458.54	439.64	406.19	420.52
Wheat	33.7	17.24	12.08	20.36	28.73
Potato	49.5	55.45	63.30	63.44	73.78
Vegetables	152.5	140.47	157.02	141.8	177.25
Edible oil	9.8	12.82	16.45	14.20	23.41
Chicken/Duck	4.0	4.50	6.85	4.11	15.09
Beef	6.6	8.30	7.78	1.55	9.27
Mutton	1.0	0.49	0.59	0.11	0.83
Fish	43.8	38.45	42.14	31.16	57.81
Eggs	3.22	5.27	5.15	3.40	9.02
Milk & milk products	32.6	29.71	32.40	12.18	43.63
Onion	11.6	15.41	18.37	15.69	24.74
Sugar/Gur	9.20	6.85	8.08	3.32	10.88
Fruits	27.6	28.35	32.54	20.46	56.0
Food taken outside (fast food)	-	-	24.74	17.17	35.41
Miscellaneous	50.9	55.44	48.38	50.28	81.81

Household food consumption studies over the last 15 years have shown the consumption of cereal intake decreases but it still makes up the largest share (70 percent) of the diet, followed by non-leafy vegetables, roots and tubers, which together comprise more than four-fifths of the rural peoples total diet (BBS, 2010). Protein and micronutrient-rich foods like fish, meat, eggs, milk, milk products, fats and oils account for less than 10 percent of the rural person's diet, and the consumption of vegetables and fruits are slowly improving over the years. Rural consumption of leafy and non-leafy vegetables has remained more or less the same over the past two decades after increasing over the preceding 30 years. With an average national per capita consumption of 31g of leafy vegetables, 136g of non-leafy vegetables and 45g of fruit, the average Bangladeshi eats a

total of 212g of fruit and vegetables daily (HIES 2010). This is far below the amount of 400 g of vegetables and fruit recommended by FAO/WHO in 2003. It is encouraging that the HIES 2010 points towards an increase in vitamin A and iron consumption as compared to HIES 2005 and (Bermudez *et al.*, 2012), but it still needs improvements to fulfill the requirements. In addition, cultural norms dictate a better diet for males over females with the male head of the household getting the best meal portions. Persistent poverty, inadequate nutrition information and gender inequity cause pervasive malnutrition among women, especially pregnant women and lactating mothers.

2.10 Previous studies on nutritional status of diabetic patients

F A M Anjuman *et al.*, 2004, determined nutritional status of diabetic patients, a total 117 diabetic patients aged 20-65 years. Most (64%) of the patients were normal in nutritional status followed by underweight (4.3%) and overweight (31%). 50.4% of the male patients were affected by diabetes as compared to 49.6% of the female patients. Middle age group was appeared to suffer more diabetes than others age group. Diabetes range was shown more on the basis of occupation in retired persons (50%), housewives (32%) as compared to others profession. So health education should be aimed to enhance awareness of particularly rural and illiterate people for regular visit to nearby diabetic center and to strictly adhere to dieticians' advice.

University, College of Agricultural Sciences, Home and Hotel Management, P.M.B 0012, Ayetoro, Ogun State, was used 90 respondents to determine nutritional status of the diabetic patients. According to the study, 41.9% of the male respondents were suffered from diabetes and 58.9% of the female respondents were suffered from diabetes. Middle age group (35.8%) was more diabetes than others age groups. 45.4% of the retired persons was more diabetes than others professions. 59.5% of the male respondents and 41.5% of the female respondents were overweight in nutritional status followed by normal 24.3% male and 11.3% female, 2.7% male and 3.8% female underweight.

Oladapo A.A *et al.*, 2014, a total 60 subjects were selected to determine nutritional status of the diabetic patients. A structured questionnaire was used to collect the information from the patients. The study revealed that 40% of the male and 60% of the female were in diabetes. Middle age (36.7%) group appeared to suffer more diabetes than others age groups. Diabetes rate were high both in employee and businessman. Leg ulcer was higher than other disease among the patients. 41.7% of the male and 38.9% of the female

were normal nutritional status. Rate percentage of overweight and obese was higher as compared to underweight.

Mohlakotsana Mokhehle, 2014, a total 124 subjects were conducted to viva-voice to collect information of the diabetic patients. Most (82.9%) believed that overweight causes diabetes, yet based on BMI, 89.2% were overweight/obese; were at risk for diabetes-related complications. Almost all were knowledgeable about prudent dietary and lifestyle guidelines and the importance thereof for the management of diabetes.

Zakia Sultana *et al.*, 2013, a total 140 diabetic patients were randomly selected to collect information for the study. Majority (50.7%) of the middle age group was suffered from diabetes than all others group. 60.7% of the patients age were bellow one years. 57.1% of the patients were female and 42.9% of the patients were male. Majority (50.7%) of the housewives were diabetes than others occupation.

Md. Ruhul Amin *et al.*, 2010, a total 90 patients were randomly selected for the study. Dietary intakes were collected by an interviewer administered 24-hour recall. Average daily intakes of total energy and nutrients as well as the food habit were recorded for each case. Rate of diabetic patients were high in the middle age group. Most of the patients were consumed more carbohydrate rich food than protein and fat containing food. Fiber consumption was also very low. Overweight, obesity were high than normal body weight.

Somayyeh Firouz *et al.*, 2015, a total 104 diabetic patients were included in the study. Majority of the respondents were middle group with diabetes. Most of the patients were overweight. Blood glucose level was high than the normal range. The respondents depended on drug as compared to diet to control diabetes.

Emily Wahom *et al.*, 2016, a cross-sectional study was conducted to collect information of the 153 diabetic patients attending on a hospital. The study revealed low nutritional knowledge (69.3%) and high prevalence of obesity (50.9%) among the respondents. statistically significant association between nutritional knowledge and nutritional status of the respondents. 47.7% of the employee were suffered from diabetes among all others occupations. The results showed significant association between nutritional knowledge the nutritional status of the respondents. Analysis of Variance showed that those with a normal nutritional status had the highest nutritional knowledge score. Significant differences were also noted between the mean score of the different nutritional status groups.



CHAPTER III

MATERIALS AND METHODS

CHAPTER III

MATERIALS AND METHODS

3.1 Study Region

The study was carried out at Dinajpur Diabetes o Swasthoseba Hospital in Dinajpur, Bangladesh. This hospital was selected because this hospital represents the all other diabetic hospitals in Bangladesh.

3.2 Subject Selection

The study was conducted at Dinajpur Diabetes o Swasthoseba Hospital in Dinajpur, Bangladesh. In this study 128diabetic subjects aged from 20 to 69 years were selected randomly.

3.3 Study Design

A cross-sectional retrospective study design was employed in this study. The study population consisted of 128 peoples aged 20-69 years from Dinajpur Diabetes o Swasthoseba Hospital in Dinajpur, Bangladesh. Socio-demographic characteristic, Medical history, Physical activity, Anthropometric and dietary intake data were collected from each study subjects.

3.4 Study Population

The study involved 128 respondents with diabetes agedfrom20-69years old diabetics attending the Dinajpur Diabetes o Swasthoseba Hospital in Dinajpur, Bangladesh were included in the study. Pregnant and lactating women were excluded from the study. All those who declined to participate were also excluded from the study.

3.5 Inclusion Criteria

The eligible diabetic patients living in Dinajpur district were included in the study. Adult diabetic patients were selected. Diabetes patients living in Dinajpur sadar upazilla were given preferences.

3.6 Exclusion Criteria

Diabetes patients who were not patients of Dinajpur district were not included in the study population. Also, diabetes patients from the selected groups but not below the age of 20 years or above 69 years were not included in the study.

3.7 Sample Size and Sample Determination

The following formula, (Fisher's *et al.*, 1999) was used to determine the sample that the proportion of population was approximately 22% as found, 2017 by Dinajpur Diabetes o Swasthoseba Hospital in Dinajpur, Bangladesh

$$n = \frac{NZ^2pq}{d^2(N - 1) + Z^2pq}$$

Where,

n= the desired sample size.

N= Estimated population.

Z=the standard normal deviate set at 1.96 which corresponds to 95% of confidence interval.

P (proportion of the estimated diabetic patients) = 22 % (Diabetes o Swasthoseba Hospital in Dinajpur, 2018).

q= (Estimated proportion of normal)=1-P

q=1-0.36=0.64

d= Degree of accuracy desired set at 0.05.

Therefore,

$$n = \frac{8154 \times (1.96)^2 \times 0.22 \times 0.78}{(0.05)^2(8154 - 1) + (1.96)^2 \times 0.22 \times 0.78}$$

n = 255.49 ≈ 255

This study conducts 128 samples rather than actual sample size which should be taken 255 due to lack of resources, manpower and inconsistent variables.

3.8 Study Tools

3.8.1 Structured Interview Questionnaire

The main tool was a structured questionnaire which was divided into different sections as per the objectives. A semi-structured questionnaire was used to gather information on socio- demographic characteristics of the respondents. Information collected included; name, sex, age, education, occupation marital status, monthly income. Medical history included: family history of diabetes, other disease apart from diabetes, duration of illness, blood glucose level, knowledge of diabetes, types of treatments. Anthropometric assessment included: height, weight, BMI. Dietary pattern and food consumption data included: breakfast, lunch, dinner, mid morning, afternoon.

3.9 Anthropometric Tools

3.9.1 Weight

Weight was measured with bathroom scale that was kept on a firm horizontal surface. Subjects were asked to wear light clothing and weight was recorded to the nearest 0.5 kg.

3.9.2 Height

This was measured with tape to the nearest centimeter 0.01 cm. Subjects were requested to stand upright without shoes with their back against the wall, heels together and eyes directed forward.

3.9.3 Body Mass Index

Nutritional status among the diabetic patients was classified based on the following classes as provided by WHO.

Category	BMI (kg/m ²)
Under weight	< 18.5
Normal	18.5-24.9
overweight	25.0-29.9
Class I obesity	30.0-34.9
class II obesity	35.0-39.9
class III obesity	≥40

Source: WHO (1995, 2000 and 2004)

Obesity was defined as anyone having BMI equal and above 25 kg/m² according to the recommended guidelines for Indians.

3.9.4 Ideal Body Weight

IBW of the subject was calculated by using the formula given by Jelliffe (1996).

3.9.5 Blood Test

Fasting blood glucose was taken in the morning after an overnight fast 8-14 hours. Water was allowed, but smoking, tea, and any kind of foods or drinks were prohibited. No physical activity was allowed.

Again blood was collected from vein and in tube containing EDTA after consumption of 75 gm of glucose mixed with 250-300 ml of water within 5 minutes. Blood glucose were measured from the study subjects. Blood test was done at the laboratory of Dinajpur Diabetes o Swasthoseba Hospital in Dinajpur, Bangladesh.

3.10 Data Collection Procedure

3.10.1 Administration of the Questionnaire

Structured questionnaires were specifically administered to selected diabetic patients through face-to-face interview. The questionnaires were explained in Bengali for easy understanding by the interviewee. Data that was collected in the questionnaires included; Socio-demographic data, socio-economic condition, Medical history, anthropometric data, and dietary intake. The completeness of the questionnaires was checked before releasing every patients.

3.10.2 Socio-demographic characteristic

In Socio-demographic characteristic included personal information, sex, ages between 20-69 years, marital status, educational qualification and occupation.

3.10.3 Medical history

In this section included family history of diabetes, other disease apart from diabetes, duration of illness, blood test, knowledge of diabetes, types of treatment.

3.10.4 Anthropometric Measurements

Anthropometric measurements i.e., height and weight together with the age and sex of the diabetes patients were collected. Height was obtained by positioning the measuring board in a vertical position. A barefooted person was asked to stand straight against the measuring board while looking straight ahead. With the help of the field assistant, the heels were maintained together and the body positioned so that the shoulder blades, buttocks and heels were touching the vertical surface of the height meter. The feet were maintained flat on the floor although slightly apart with the back straight and the hands freely hanging on the sides. As he/she stood still, the horizontal headboard was placed lightly but firmly against the head perpendicular to the height meter. The height of the each patient was then read to the nearest 0.1 cm at the point where the headboard touched the height meter. Two measurements were taken for each patient and the average height computed as the actual height of his/her. Weight was taken using a bathroom scale, which was calibrated in kilograms and grams. The patient was weighed with minimum clothing on and without shoes. Two readings were recorded to the nearest 0.1 kg and their average was taken as his/her actual weight. The balance was properly tarred before any weight was taken.

3.10.5 Dietary Intake

Data on dietary consumption of study subjects was collected by using 24hrs recall method, the total calorie, carbohydrates , protein, fats, were calculated. Food frequency questionnaire was used to obtain data on the types of foods eaten by the diabetes patients. Questionnaire was listed all the possible types of foods consumed by the diabetes patients. Each respondent was asked to give the frequencies at which he/she consumes the listed food. Each respondent was asked to recall in detail of all the food items and drinks that were consumed during the last 24 hour period preceding the survey and then findings were recorded on an individual dietary diversity score sheet.

3.11 Data Quality Control

Data quality control measures were employed during data collection as follows-

3.12 Standardization/Calibration of Instruments

The scale was calibrated before each weight was taken. Standardization tests were performed every morning prior to the field work with known weights to ensure that the scale used was accurate and reliable.

3.13 Accuracy of Anthropometric Measurements

Accuracy of the measurements was achieved through good training and supervision of the field assistants by the principal investigator. During height and weight measurement, two measures were taken on the same patient and the average of the two measures was taken as the actual measurement.

3.14 Minimizing Biases

In order to minimize bias and obtain complete and reliable information, the study respondents were informed about the purpose of the research. To avoid observer bias and assure validity of anthropometric measurements, two readings were taken.

The completed questionnaires were cross-checked for completeness of data, consistency of answers and measurements obtained and for the correct filling of the questions. Any errors identified were corrected. After data entry, data cleaning was done to ensure that data had been entered correctly in the computer.

3.15 Determination of Nutritive Values of Food

The nutritive values of different food items eaten by the patients were obtained from Food composition table for Bangladesh (2013) published by Institute of Nutrition and Food Science, University of Dhaka. Conversion factor for converting cooked food weight to raw food weight was determined. Then raw weight of foodstuff was determined by dividing cooked food weight by conversion factor.

3.16 Data processing and analysis

Data from the completed questionnaires and anthropometric measures were put, cleaned and analyzed using IBM SPSS/PC version 20 statistical software. Anthropometric data was converted into nutritional indices. Chi-square tests were employed to test for proportionality differences in the study distribution. Associations/correlations were also done for continuous variables.



CHAPTER IV

RESULTS

CHAPTER IV

RESULTS

4.1 Distribution of Socio-demographic characteristics of the respondents

Table 4.1: Distribution of Socio-demographic characteristics of the respondents

		Frequency	Percentage (%)
Sex	Male	77	60.16
	Female	51	39.84
Age (Years)	20-29	17	13.28
	30-39	22	17.19
	40-49	37	28.90
	50-59	30	23.44
	60-69	22	17.19
Marital Status	Single	3	2.34
	Married	113	88.28
	Widow	4	3.13
	Widower	6	4.69
	Divorce	2	1.56
Educational Qualification	Primary	27	21.09
	Secondary	21	16.41
	Higher Secondary	25	19.53
	Graduation	17	13.28
	Illiterate	38	29.69
Occupation	Employee	15	11.72
	Businessman	18	14.06
	Retired	11	8.59
	House Wife	44	34.38
	Farmer	37	28.91
	Student	3	2.34
Income	Below 9999	64	50
	10000-14999	24	18.75
	15000-19999	25	19.53
	Above 20000	15	11.72

The socio-demographic characteristics of the respondents are shown in the Table 4.1. Among the study subjects 60.16% were male while 39.84% were female. The age of 28.90% diabetic patients was in the range of 40-49 years. Majority of married 88.28% people are affected by diabetes. Illiteracy rates 29.69% were more than compared to the

higher education rates 13.28%. Most of the respondents were house wives 34.38% and farmers were 28.91%.

4.2 Medical history of the respondents

Table 4.2: Medical history of the respondents

		Frequency	Percentage (%)
Family History of diabetes	Yes	57	44.53
	No	71	55.47
Other disease apart from diabetes	Hypertension	25	19.53
	Kidney problem	11	8.59
	Visual problem	45	35.16
	Leg ulcer	25	19.53
	Diabetic foot	22	17.19
Duration of illness	< 1 Year	44	34.38
	1-5 Years	33	25.78
	6-10 Years	21	16.41
	Above 10 Years	30	23.44
Regular blood glucose check-up	Yes	66	51.56
	No	62	48.44
First knowledge of diabetes	Before coming to clinic	6	4.69
	During routine medical check-up	43	33.59
	Study	0	0
	During treatment of disease	79	61.72
Types of treatment	Only diet therapy	15	11.72
	Diet and drug therapy	113	88.28
Regular physical activity level	Yes	61	47.66
	No	67	52.34

Table 4.2 shows the medical history of the respondents. In the medical history of the respondents were shown that 44.53% of the family members had diabetes while 55.47% of the family had no diabetes. Visual (35.16%) problem was high compared with other disease apart from diabetes. Rate of diabetic patients were more than one year (34.38%);

51.56% of the respondents were performed regular blood glucose check-up while 48.44% of the respondents were not. Maximum (61.72%) number of the respondents came to know that they had affected by diabetes during their treatment of the disease. 88.28% of the patients were depended on the diet and drug therapy. Lifestyle of the patient reveals that 52.34% have no regular physical activity.

4.3 Demographic Profile of the Study population

The study covered diabetic patients in Dinajpur district out of whom 60.16% (n=77) were male and 39.48% (n=51) were female. The patients were randomly selected from Dinajpur Diabetes o Swasthoseba Hospital in Dinajpur, Bangladesh and were aged from 20-69 years.

A total 128 diabetic patients randomly were divided into five age from groups of which 17 were 20-29 years of age, 22 were 30-39 years of age, 37 were 40-49 years of age, 30 were 50-59 years of age, 22 were 60-69 years of age. The total number of population under the study was 128 of whom 77 were male and 51 were female among diabetic patients.

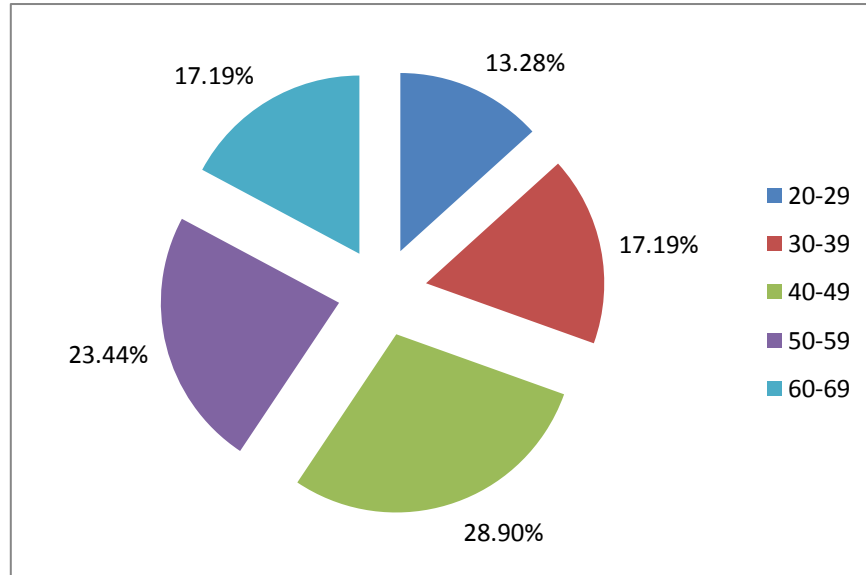


Figure 4.1: Demographic Profile of the Study population

Table 4.3: Frequency of diabetic patients at different age limits

		Age group					Total
		20-29	30-39	40-49	50-59	60-69	
Male	Frequency	6	16	22	18	15	77
	% within Age group	35.29	72.73	59.46	60	68.18	60.16
	% of Total	4.69	12.50	17.19	14.06	11.72	60.16
Female	Frequency	11	6	15	12	7	51
	% within Age group	64.71	17.27	40.54	40	31.82	39.84
	% of Total	8.59	4.69	11.71	9.38	5.47	39.84
Total	Frequency	17	22	37	30	22	128

Table 4.4: Nutritional status of different age group of diabetic patients

		BMI Category			
		Underweight	Normal	Overweight	Obese
20-29	Frequency	1	10	5	1
	% within Age group	8.33	12.99	16.67	11.11
30-39	Frequency	1	12	9	0
	% within Age group	8.33	15.58	30	0
40-49	Frequency	4	24	4	5
	% within Age group	33.33	31.17	13.33	55.56
50-59	Frequency	6	16	5	3
	% within Age group	50	20.78	16.67	33.33
60-69	Frequency	0	15	7	0
	% within Age group	8.33	19.48	23.33	0
Total	Frequency	12	77	30	9

The anthropometric measurements of the diabetic patients are described in Table 4.4. It was observed that 9.38% (n=12) patients were underweight, 60.16% (n=77) patients were normal weight, 23.44% (n=30) were overweight and 7.03% (n=9) were obese. The prevalence of overweight is higher than the underweight. In this study the percentage for underweight and overweight were 9.38% and 23.44% respectively.

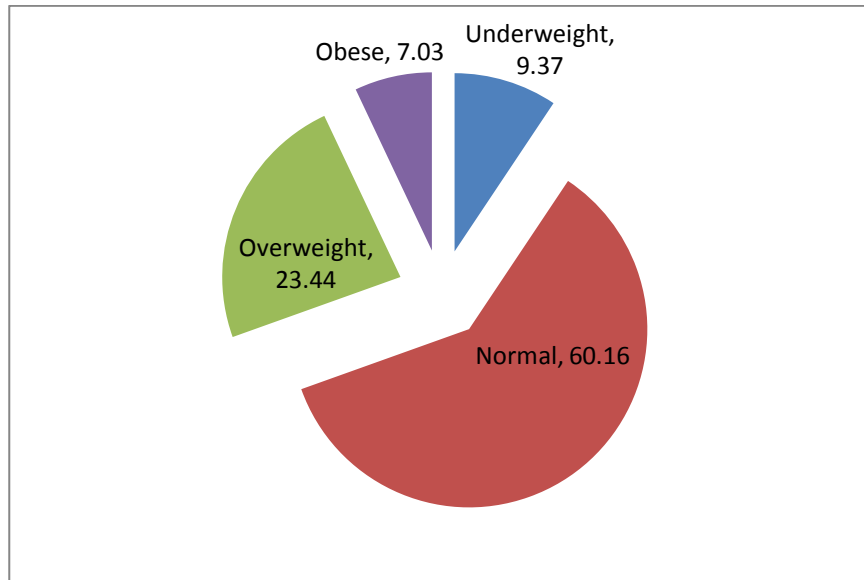


Figure 4.2: Nutritional status of the study population

Table 4.5: Energy and nutrient intake by male and female diabetic patients

Sex	Energy required (Mean±SD) Kcal	Energy intake (Mean±SD) Kcal	Energy from Carbohydrate (g)	Energy from Protein (g)	Energy from Fat (g)
Male	1706.68±214.89	1782.30±586.08	326.62±91.56	82.35±46.60	36.55±17.35
Female	1359.50±197.09	1573.33±305.56	291.61±46.37	71.53±30.31	30.95±10.16
Total	1568±268.35	1699.04±502.85	312.67±78.48	78.04±41.07	34.32±15.11

The comparison of energy and nutrient intake between male and female diabetic patients in this study is presented in Table 4.5. There was a significant difference in energy intake in regards to gender. The mean energy intake of male patients (1782.30 kcal) was higher than the energy intake by female patients (1573.33 kcal).

There is a significant difference of macronutrient intake between two genders. The mean carbohydrate intake was 326.62 g in male and 291.61 g in female while mean protein

intake was 82.35 g in male and 71.54 g in female. The mean fat intake was 36.56 g in male and 30.96 g in female patients respectively. The total macronutrient intake was 312.67 g carbohydrate, 78.05 g protein, 34.33 g fat in male and female diabetic patients. Both male and female were consumed more energy compared to the required energy. In male required 1706.69 g of energy while intake 1782.31 g of energy. In female required 1359.50 g of energy while intake 1573.33 g of energy.

Table 4.6: Number of meal per day

Number of meal per day	Frequency	Percentage (%)
2	3	2.34
3	27	21.09
4	38	29.69
5	58	45.31
6	2	1.57
Total	128	100

Diabetic patients should take 5-6 meals in a day to control blood glucose level. If the duration time of taking meal is longer, the patients may hypoglycemia. The Table 4.6 shows that 45.31 patients take meal five times in a day.

Table 4.7: Blood Glucose level

Blood Glucose Level	Male Mean±SD	Female Mean±SD	Total Mean±SD
Fasting	9.80±3.39	8.33±2.51	9.21±3.14
Ab2H	17.08±6.40	15.69±5.96	16.53±6.24

This table shows the amount of blood glucose level between fasting and after two hours breakfast. According to the table blood glucose was higher than normal range both fasting and after two hours breakfast. Mean blood glucose level was 9.805 mmol/l in male while 8.333 mmol/l in female, total 9.219 mmol/l both male and female during fasting condition. Mean blood glucose level was 17.087 mmol/l in male while 15.69 mmol/l in female, average 16.53 mmol/l both in male and female after two hours breakfast. Higher blood glucose represents that the patients did not control diabetes.

Table 4.8: Mean Anthropometry of the Respondents

Anthropometric measurement	Male Mean±SD	Female Mean±SD	(Male and Female) Mean±SD
Height	163.35±6.40	151.65±6.01	158.69±8.57
Weight	62.94±11.01	54.01±12.30	59.38±12.30
BMI	23.52±3.45	23.36±4.62	23.45±3.94

Table 4.8 shows the anthropometric measurements result, there were significant differences between the weight of the male (62.94 kg) and female (54.00 kg). There was no significant differences between the BMI of the male (23.521) and female (23.363).

Table 4.9: Energy fulfilment rate

		Do they fulfil their energy requirement?	
		Yes	No
Male	Frequency	34	43
	% of Male	44.16	55.84
Female	Frequency	34	17
	% of Female	66.67	33.33
Total	Frequency	68	60

From the Table 4.9 it is found that only 34 (44.16%) of total 77 male patients and 34 (66.67%) of total 51 female patients had fulfilled their energy requirement. On the other hand, 43 (55.84%) male patients and 17 (33.33%) female patients deficit of energy intake. Only 53.13% of the total patients fulfilled their energy requirement and 46.87% patients deficit of energy intake.

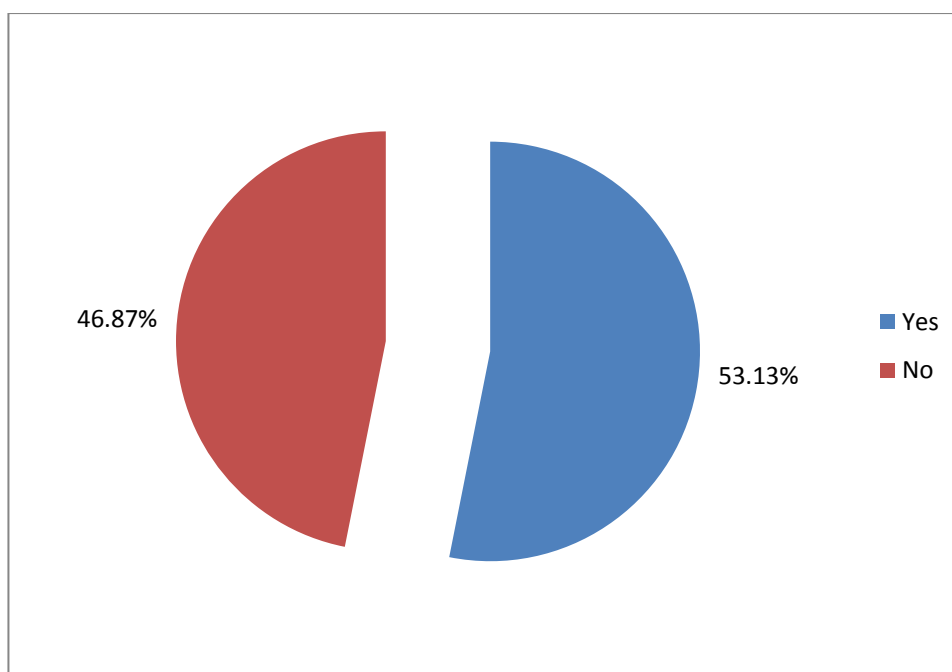


Figure 4.3: Percentage of fulfilment of energy requirement

Table 4.10: Relationship between education level and nutritional knowledge

Education level	Nutrition knowledge		P-value
	Low (0-5%)	Medium (6-10%)	
Primary	88.89	11.11	0.0297
Secondary	61.91	38.09	
Higher secondary	20	80	
Graduation	00	100	
Illiterate	97.27	2.63	

Organization between the dependent and the independent variables was installed. Education level was significantly associated with nutritional knowledge. The Table 4.10 that those patients with higher level of education had higher nutritional knowledge. On the other hand those patients with lower level of education and higher level of illiteracy had lower level of nutritional knowledge (P=0.0297).

Table 4.11: Relationship between nutritional knowledge and nutritional status

	Low (0-5%)	Medium (6-10%)	P value
Low BMI	61.54	38.46	0.0293
Normal BMI	59.74	40.26	
Overweight	70.0	30.0	
Obese	77.78	22.22	

The Table 4.11 showed that there were significant difference between nutritional knowledge and nutritional status of the patients. Study showed that those with normal nutritional status had the higher nutritional knowledge level. On the other hand those with undernourished and over nourished had lowest nutritional education level (P=0.0293).



CHAPTER V

DISCUSSION

CHAPTER V

DISCUSSION

In this study among 128 subjects normal nutritional status was 60.16% as well as underweight 9.37%, overweight 23.44% and obese 7.03%. Anjuman *et al.*, 2004, determined (64%) of the patients were normal in nutritional status followed by underweight (4.3%) and overweight (31%) among 117 diabetic patients aged 20-65 years, which indicates the similarities between these studies based on the geographical regions.

Most of the (28.90%) study subjects were middle aged group between 40 to 49 years of age. Ayetoro, and Ogun State (2012) found 35.8% middle aged group diabetics among 90 respondents than other aged groups. Oladapo *et al.*, 2014 also revealed that middle aged (36.7%) group appeared to suffer more diabetes than other age groups. Percentage of overweight and obese was higher as compared to underweight. May be this was not similar due to food habit, physical condition and geographical region.

In the present study 34.38% housewives were suffering from diabetes was than the other profession. Zakia *et al.*, 2013 also reported that majority 50.70% of the housewives were diabetics than other occupations.

In the study blood glucose level was higher than normal range both fasting and after two hours breakfast. Mean blood glucose level was 9.80 mmol/l in male and 8.33 mmol/l in female, while in both male and female mean fasting blood glucose level was 9.22 mmol/l. Two hours after breakfast mean blood glucose was 17.09 mmol/l in male and 15.69 mmol/l in female, whereas 16.53 mmol/l was found in both male and female. Higher amount of blood glucose represents that the patients do not control diabetes. Zakia *et al.*, 2013, calculated that the mean fasting and after two hours of breakfast glucose levels of diabetic patients were 8.9 mmol/l and 11.2 mmol/l respectively which is much lower than the present study. This could be due to the lack of patient's awareness food habits, meal pattern.

Study revealed that 44.53% patients had family history of diabetes. Almost similar results were revealed by Oladapo *et al.*, 2013, who reported that 46.7% of the family had diabetes.

The study revealed that maximum number of patients had family history with diabetes. The patients had many diseases along with diabetes such as hypertension (19.53%), kidney problem (8.53%), visual problem (35.17%), leg ulcer (19.53%) and diabetic foot (17.89%). In the study visual problem and diabetic foot were higher than other disease. Besides, Oladapo *et al.*, 2013 determined that hypertension (31.7%), kidney problem (10%), visual problem (13.3%), leg foot (22%).

Most of the patients did not know that they have affected by diabetes. They came to know during medical check-up and during treatment of other diseases. The study showed that 61.72% of the patients understood during medical check-up and 33.59% of the patients understood during the treatment of other diseases.

Anthropometric results of the study expressed that there was no significant difference in the mean weight and BMI between male and female patients. In the study female were more obese compared to male. The risk of diabetes increased with increase BMI and decreased with weight loss. This could be managed by maintaining proper nutritional balance that means intake of food according to requirements of the body (Anjuman *et al.*, 2004).

Most of the patients had a poor nutritional knowledge. Nutritional knowledge is important to manage or control diabetes. This could help to good choice of food that would help to maintain body weight and blood glucose level. Diabetes is not a single disease but it could develop risk of others diseases such as heart disease, kidney disease, stroke, visual problem; if diabetes was not controlled. Nutrition education is a pre-requisite aspect to control diabetes associated with others disease (Habib *et al.*, 2016).

In regard to blood glucose level, majority were above normal blood glucose level both fasting and after two hours of breakfast. This could explain the occurrence of diabetes since intake of food more than their requirements and lack of physical activity have been linked to diabetes. Obesity is one of the major factors to diabetes type 2. It results from high intake of food and lack of physical activity. Notably, one in three of the world's adults are overweight and one in ten is obese (WHO, 2008). Overweight and obesity is associated with increased resistance of the cells to the insulin activity (WHO, 2002). The prevalence of diabetes was increased with increase of overweight and obesity. This could be attributed to the fact that when one is educated, they are exposed to diversified

sources of dietary information which would impact positively on their nutritional knowledge.

Blood glucose level was measured in two times, before breakfast and after two hours of breakfast. The mean fasting blood glucose level 9.22 mg/dl was above the normal range and mean after two hours of breakfast 16.53 mg/dl was above the normal range. The results indicate that the respondents intake much amount of food than requirement of their body and also they do not do regular physical exercise. Blood glucose may control by taking accurate amount of food and regular physical exercise. In 24 hours recall shows that carbohydrate intake is more as compared with protein and fat. Fruits and vegetables are the major component of regular diet that is healthy diet than other foods. The control of blood glucose level prevents and manages many major diseases such as heart disease, diabetes and different types of cancers (WHO, 2004).



CHAPTER VI

CONCLUSION

CHAPTER VI

CONCLUSION

In recent time diabetes is a great problem in the world. The disease does not prevent permanently but it may control. This disease may control by changing lifestyle and dietary pattern. Education is an important part to control diabetes which positively influences the nutritional knowledge and nutritional status of diabetic patients. Those patients have higher level of education the better the nutritional knowledge and ultimately the nutritional knowledge. In the study blood glucose level is higher in both condition due to lower intake of non-starchy fruits and vegetables and diabetes was poorly controlled. This is due to the lack of nutrition education. Rate of diabetes is increased with increased obesity and overweight. Risk of other diseases is increased with increased obesity and overweight. The mean energy intake of male and female patients was 1782.305 Kcal and 1573.33 Kcal respectively. Both this energy intake was higher than the energy requirement. Patients should take appropriate amount of carbohydrate, protein, fat and perform regular exercise at a definite time. Government should take different program to develop nutritional knowledge and awareness.



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APPENDIX

APPENDIX

Research Title: Nutritional Status and Food Consumption Pattern of Diabetic Patients in Dinajpur District, Bangladesh

Date:

Questionnaire No:

A. SOCIO-DEMOGRAPHIC CHARACTERISTICS OF THE RESPONDENT

- i. Name:..... Contact No.....
- ii. Sex Male Female
- iii. Age (Years)
- 20-29 30-39 40-49
- 50-59 60 and above
- iv. Marital status
- Single Married Widow Divorce
- v. Educational qualification
- Primary Secondary Higher secondary
- Graduation Others
- vi. Occupation
- Employee Businessma Retired
- House wife Farmer Others
- vii. Income
- Below 9999 10000-14999 15000-19999
- Above 20000

B. MEDICAL HISTORY

- i. Family history of diabetes

Yes:..... No

ii. Other diseases apart from diabetes

Hypertension Heart failure Kidney problem

Leg ulcer Diabetic foot Visual problem

iii. Duration of illness

< 1 Years 1-5 Years

6-10 Years Above 10 Years

iv. Regular blood glucose check-up

Yes No

Where? Home Shop Health care

v. Blood glucose level

Fasting ABF

vi. First knowledge of diabetes

Before coming to clinic During routing medical check-up

Study During treatment of a disease

vii. Types of treatment

Drug and diet Therapy Drug only: Insulin/ Medicine

Only diet therapy

C. REGULAR PHYSICAL ACTIVITY

i. Physical activity level

High Moderate

Light Sedentary

ii. Do you exercise regularly?

Yes min/Day No

D. ANTHROPOMETRIC ASSESSMENT

Height cm Weight Kg

BMI

E. NUTRITIONAL KNOWLEDGE TEST

1. What is Diabetes?
2. Why Diabetes is occurred?
3. Which foods are helpful in controlling Diabetes?
4. Which foods are harmful for Diabetic patients?
5. How many meals should be consumed in a day?
6. What should be interval time between two meals?
7. Which diseases are connected to Diabetes?
8. How much exercise should be done in a day?
9. Which is the amount of normal blood glucose level?
10. Is diabetes a contagious disease?

F. DIETARY PATTERN AND FOOD CONSUMPTION DATA

Which food do you consume as meal?	Breakfast (Amount)	Lunch (Amount)	Dinner (Amount)
a) Rice (cup)			
b) Bread (pc)			
c) Rutii (pc)			
d) Parata (pc)			
e) Khicuri (cup)			
f) Mixed vegetables (cup)			
i) Potato (cup)			
ii) Sweet potato (gm)			
iii) Carrot (cup)			
iv) Sweet pumpkin (cup)			
g) Meat (Beef/ Mutton) (gm)			
h) Fish (pc)			
i) Egg (pc)			
j) Poultry (gm)			
k) Milk (ml)			
l) Dal (cup)			
m) Banana (pc)			
n) Others			

<p>Which snacks do you consume as meal?</p>	<ul style="list-style-type: none"> i. Chola (cup) ii. Puffed rice (cup) iii. Flatten rice (cup) iv. Popped rice (cup) v. Milk products (gm) vi. Fruits (pc) <li style="padding-left: 20px;">Fruits name: vii. Biscuit(pc) <li style="padding-left: 20px;">Biscuit type: viii. Others:
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Signature of the respondent