EVALUATION OF DIETARY PATTERN OF DIABETIC PATIENTS WITH CHRONIC KIDNEY DISEASES

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BY

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Certificate

This is to certify that the thesis entitled "**Evaluation of dietary pattern of diabetic patients with chronic kidney disease**" submitted by AdibaFarzin of registration 461 sessions 2008-2009 for degree of Master of Philosophy, University of Dhaka is a record of original research work. Mrs. AdibaFarzin has carried out this research work under our supervision and guidance at the institute of Nutrition and Food Science, University of Dhaka, Bangladesh. The result used in this thesis has not been used or submitted elsewhere for the award of any degree.

This research work is worthy for the award of the degree of "master of philosophy" in accordance with the rules and regulations of Dhaka University.

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Declaration

I here by declare that this thesis entitled "Evaluation of dietary pattern of diabetic patients with chronic kidney disease" based on work carried by me. No part of it has been presented for higher degree.

This work was carried out under the guidance of Prof. Dr. M. Akhtaruzzaman, Institute of Nutrition and Food Science, INFS, The University of Dhaka and Dr. Masud Iqbal, Associate professor, Department of Nephrology,National Institute of Kidney Disease, NIKDU.

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Abstract

Introduction:

Diabetic patients have many dietary restrictions specially those have renal failure. Poor dietary intake is a predisposing factor for increased morbidity and mortality in chronic kidney disease (CKD) at stage 5.In Bangladesh the number of the dialysis patients is increasing day by day. For these types of patients an appropriate diet plan is essential after knowing their dietary pattern.

Aims:

This study was undertaken to develop an FFQ for assessment of dietary pattern. To compare dietary intake from diet diary, recall and food frequency questionnaire. To evaluate the daily intake before after administering diet plan

Methods:

Total 50 diabetic patients those on dialysis were included from dialysis unit of BIRDEM for this study .Along with anthropometric measurements, demographic data, biochemical parameter, FFQ and recall they were advised to fill-up a three-day dietary diary to calculate nutrient intake. The FFQ was developed from dietary records of healthy and diabetic subjects collected in CRF project database. Daily calorie intake was calculated from 3 day diet diary, recall and FFQ. It was seen that FFQ and recall methods were more suitable than 3 day diet diary for proper calculation of calorie intake. Based on their dietary intake and biochemical parameter diet plan was given to each individual according to guidelines. Another recall was taken after 3 months to see the improvement of dialysis patients.

Results:

In the dialysis patients 66% were male and 34% were female and 92% of their monthly expenditure was above 50,000. Anthropometric comparison was made before and after administering the plan which showed significant improvement in thebiceps skin fold thickness (BSF) that increased from 6.78±2.60 to 6.81±3.01 ($p<0.01$) though triceps skin fold thickness (TSF) increased little bit (12.90±5.33 and 13.42±4.46mm; p=NS) and mid arm circumference (MAC) remained same (25.80±3.38 and 25.75±3.44cm, p = NS) after 3 months.Comparison of biochemical parameter of blood was madebefore and after diet plan of dialysis subjects .Fasting Blood Sugar (FBS) was 4.6±0 before diet plan which was not significantly increased 6.6±0 , (P=NS) after diet plan. The level of serum Creatinine (SCr) was 10.8±4.2 before diet plan and

showed little improvement9.4±2.8 after diet plan, but it was not significant. Similar trends were also noticed in case of serum Albumin (ALB) (38.8±0.2 and 34.6±5, P=NS), Hemoglobin (Hgb) (9.3±1.3 and 9.9±1.5, P=NS), Calcium (Ca) (8±1 and 7.7±2.2, (P=NS), Phosphorus (P) 6.6±2.6 and 5.0±2.4, P=NS), Sodium (Na)(138±6.8 and 136±3.6,P=NS) and Potassium (K) (5.0±0.7 and 4.8±0.7, P=NS). Dietary pattern of diabetic dialysis patients of different food items over a month showed that among cereal group 37.11% of the patients consumed chapati and 29.11% consumed rice. In case of pulses majority (90.47%) were consumed lentil. Among vegetables intake pattern for parwar, bottle gourd, papaya, bitter gourd and pumpkin were 8.5%, 8.3%, 7.6%, 7.5% and 5.5% respectively and which for leafy vegetable red amaranth, ipomoea leaves , jute leaves, bottle gourd leaves and spinach were 1.4%, 1.2%, 1.2%, 1.1%, and 1.0% respectively . The intake frequency of animal protein showed that eggs were mostly taken (20%) then chicken (19%), egg white (17%) and milk (5%) and among fishes percentage ofintakeforrohu,pangas,tilapia,katla and magurwere 13% , 9% ,7% , 2%and 2% respectively. The daily calorie intake from 1st recall 1274.96±219.80 was lower from 2nd recall 1382±233.82 (p<0.02) but 2nd recall 1382±233.82 was also lower than diet plan 1814.68±251.2182 (p<0.01). Macronutrient intake like CHO (168.33±52.22 and 188.99±44.69 g/d, p<0.03) and fat (40.47±20.65 and43.41±12.66 g/d,p<0.03) intake was significantly increased but protein intake (48.43±18.78 and 53.07±11.57g/d, p= NS) was similar. Dietary intake of calcium (430.04±463.69 463.69±262.69 mg/d, p =NS), potassium (1079.18±338.58 and 1059.49±283.94 mg/d, p=NS), phosphate (608.19±163.47and 663.17±160.80 mg/d p =NS) and iron (13.82±19.31and 20.27±37.85 mg/d p =NS) were almost similar.

Conclusions:

It may be concluded that the diet pattern ofdiabetic CKD patients those were on dialysis subjects were taken mostly chapatti, rice, lentils among vegetable parwar, bottle gourd, red amaranth etc. In case of animal part they took mostly egg, chicken and egg white, among fishes rohu was taken significantly. Comparison of dietary assessments showed that FFQ was better than 3 day diet diary but similar to recall method for proper calculation of calorie intake.Their intake of carbohydrate and fat and overall calorie consumption was lower at time of 1st recall but after administer of diet plan their intake was found to be increased in just 3 months but not to the level of the diet plan. So long term effect should be observed to help improving their overall nutritional status.

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ABBREVIATION

aa- amino acid
ADA- American Diabetes Association
BMD -Body Minerals Density
BMI- Body Mass Index
CKD- Chronic kidney disease
cm- centimeter
DHQ- Diet History Questionnaire
DN- Diabetic Nephropathy
ESRF- end stage renal failure
FAO - Food and agriculture organization
FDA- Food and Drug Administration
FFQ- Food Frequency Questionnaire
GFR- Glomerular Filtration Rate
gm- gram
GP- general population
HBV- High Biological value
HD- Hemodialysis
MDRD- Modification of Diet in Renal Disease
mg- milligram
NCD - Non Communicable Disease
NKF-DOQI- National Kidney Foundation Dialysis Outcome Quality Initiative
PURE -Prospective Urban and Rural Epidemiological
SGA- Subjective Global Assessment
SVLPD- supplemented very low protein diet
W/H- waist -hip ratio
WDR- Weighed Dietary Records
WHO- World Health Organization
BMI- Body Mass Index

Chapter 1
Introduction

1.1 Introduction

Diet is vital cause of increasing obesity and chronic diseases and is changing rapidly in low and middle income countries (Popkin BM 1998). To evaluate diet-diseases relationship, the analysis of dietary patterns has been concerned frequently since it was introduced in 1980s (Hoffmann K2000; Appel LJ 1997; Schwerin HS 1982; Hu FB 2002).

1.2 Background

In the past century, the leading cause of death has changed from infectious diseases to chronic diseases such as cardiovascular disease and cancer, chronic kidney disease(CKD), which may be influenced by diet (Gorina Y, Hoyert D et al. 2005). Dietary pattern analysis is very essential which examines the overall diet (FB. 2002)

1.2.1 Dietary pattern

Dietary patterns represent an overall picture of food and nutrient consumption, and may thus be more predictive of diseases risk than individual food or nutrient (Hu FB 2002). Different dietary patterns are largely influenced by socio-economic and lifestyle characteristics (Tseng M 2000). Dietary pattern and its relationship with diseases have widely been investigated in western countries (Lebars MA 2010; Wosje KS 2010). For example, a number of research outcomes indicated that eating a diet high in vegetables and fiber, and low in meat and fat can be associated with a lower risk of obesity and related cardiovascular diseases (Sabate J 2010; Balthazar EA 2011; Estruch R 2006; Hu FB2001; Lim JH 2011; Steemburgo T 2007). Tucker et al. (Tucker KL 2002) reported that a dietary pattern using FFQ with a high consumption of fruit, vegetables and cereals resulted in greater BMD (body minerals density), while Okubo et al. (Okubo H 2006) showed that a Western pattern with a high intake of fat, meat, butter and seasonings was negatively associated with BMD.

In Asian countries such as China, dietary pattern is changing from the traditional pattern (i.e. with high intake of cereals and vegetables and low intake of animal food) to the Western pattern (i.e. with high intake of animal foods and other high-energy-dense foods)

with rapid economic changes (Zhai F 2009; Du S 2002). It is difficult to study on diet and its association with diseases in less developed/ developing countries because diet varies significantly from place to place and among different socio-economic classes (Willett W 1998). Patients suffering from chronic kidney diseases (CKD) have to undergo hemodialysis (HD) on regular basis and hence, for these patients proper dietary intake is of utmost importance to reduce complications. This research work is focused on dietary pattern of diabetic patients suffering from such chronic kidney diseases.

1.2.2 Diabetes

Diabetes mellitus, commonly known as diabetes, is a disorder of carbohydrates metabolism characterized by high blood sugar. It is accompanied in many cases by secondary alteration of fat and protein metabolism resulting in an array of physical disorder. Insulin is a hormone produced by pancreas which is needed to use and store carbohydrates in the body. In diabetes it is deficient. So carbohydrate metabolism is hampered resulting is high blood and urinary sugar. There are different types of diabetes. The most common ones are Type 1 and Type 2. Type 1 diabetes usually occurs in young. It is also called insulin, dependent diabetes mellitus. In this type, pancreas does not make enough insulin and have to take insulin injections to metabolize carbohydrate. Type 2 diabetes, which is more common usually occurs in people over 40 and is called adult onset diabetes mellitus. It is also called non insulin-dependent diabetes mellitus. In Type 2, pancreas makes insulin but it is ineffective or inadequate. So, body cannot use it properly (Dikow R, 2004).

1.2.3 Diabetes and Chronic Kidney disease:

With diabetes, different organs are affected along with large and small blood vessel. The Kidneys are one of the main organs of the body. They are essential for maintaining many aspects of the internal chemical environment of the body. As excretory organ they remove waste products of nitrogen metabolism such as urea, uric acid and creatinine as well as hydrogen ions and sulfates which arise from the degradation of sulfer- containing amino acids. They also excrete surplus quantities of water, sodium, potassium, phosphate, magnesium. When kidney is damaged it cannot remove the metabolic wastes and increases blood level of urea, uric acid and creatinine concentration. When the blood vessels in the kidneys are injured, it can’t clean blood properly. Diabetes also may cause

damage to nerves in body this can cause difficulty in emptying from full bladder can back up and injure the kidneys. About 30% of patients with Type 1 diabetes and 10 to 40% of those with Type 2 diabetes eventually will suffer from kidney failure. The earliest sign of diabetic kidney disease is an increased excretion of albumin in the urine weight gain and ankle swelling may occur. Blood pressure may get too high. At the end stage blood urea nitrogen (BUN) levels will rise as well as the level of creatinine in blood. Nausea, vomiting, a loss of appetite, weakness, increasing fatigue, muscle cramps and anemia may happen. Three types of treatment can be used once kidney is totally failed: kidney transplantation, hemodialysis and peritoneal dialysis. This is call and stage renal failure (ESRF) (Lin J, et al, 2011).

Type 2 diabetes mellitus (DM), the most common form of diabetes; interfere with the glucose metabolism resulting in high blood levels of sugar. Over time, the high sugar level leads to many complications such as blindness (retinopathy), kidney failure (nephropathy) and heart disease. Being overweight and physically inactive increases a person's chances of developing type 2 diabetes. Diabetes affects about 3-7% of the population. About 10 to 40% of those with Type 2 diabetes eventually will suffer from kidney failure. People with kidney failure undergo dialysis, an artificial blood-cleaning process, or transplantation.

Two lifesaving renal replacement therapies, dialysis and renal transplant, developed in the 1960s are now increasingly available. In that period no method was available to screen diabetic patients for early signs of kidney injury so preventive treatments were not possible. The importance of controlling blood sugar and blood pressure was not recognized. Through the 1980s and 1990s, the number of patients developing end-stage kidney failure nearly doubled. Today with good care less number of diabetes develop kidney failure as kidney disease can be detected earlier by standardized tests to estimate renal function. New drugs for better control blood pressure and blood sugar may slow the rate of kidney damage by about 50 percent.

One of the common causes of kidney failure is diabetic kidney disease resulting in diabetic nephropathy. This may occurs in 10 to 21 % of people with type 1 diabetes and 30-40 % among type 2 according to the (ADA). As the incidence of diabetes has sharply raised so has the need for dialysis. Diabetes related kidney failure grew from 23 percent

of new cases in 1982 to 43 Percent in 1999, According to the ADA Minorities with diabetes are in higher risk group as in the United States where kidney failure leading to the need for dialysis is more in this group according to the ADA.

A modified diet can help to control the buildup of waste products and fluid in blood and decrease the workload of the kidneys, control blood pressure and improve eye changes. In general, the diet advised for diabetics is to control the amount of protein, phosphorus, sodium & potassium. Getting enough calories to maintain a healthy weight is also very important at this time.

There are the relationships between glycemic control and survival of hemodialysis patients. Poor glycemic control causes to macrovascular complications and generation of advanced glycation end products (AGEs). The diet for diabetes management can be modified for a patient on dialysis.

1.2.4 Assessment of the nutritional status

Regular assessment of nutritional status in hemodialysis patients is important and early detection of malnutrition can be helpful in improving their condition (Fouque 2003). Inappropriate dietary restrictions, anorexia, and taste alterations, promoting malnutrition in most patients (Lavılle 2000), causes dialysis18-75% prevalence of malnutrition in hemodialysis patients, malnutrition could cause a worse outcome and subsequent mortality (Dwyer 2005). Chazot's study was assessed the nutritional status of twenty hemodialysis patients receiving hemodialysis treatment more than 20 years and was showed that hemodialysis treatment caused to malnutrition the long period of time (Chazot 2001). In prevalent patients treated by dialysis, malnutrition is common (Obrador GT 1998 Owen 1993 Aparicio, M 1999 ,Cano, N 1994) and nutritional factors are strongly predictive of the risk of death. (Aparicio, M, 1999 Cano, N, 1994 , Chertow, GM 2000 Combe, C 2001 , Sreedhara, R 1996 ,Ikizler, TA 1995)

Reduction in mortality in overweight patients was reported as well as an indicator of nutritional status of overweight HD patients was significantly higher than underweight HD patients and to be shorter than the duration of hospital stay. (Glanton 2003, Guida 2004, Kalantar-Zadeh 2005)

Different methods are used in the evaluation of nutritional status in hemodialysis patients. Biochemical, anthropometric measurements, nitrogen and energy balance techniques, record of food intake, subjective global assessment are used to assess the nutritional status of patients with chronic renal failure (Basile 2003).

Some studies (Beddhu 2002, Panichi 2006) describe hypoalbuminemia in HD patients as a strong indicator for mortality and morbidity. As a result of malnutrition, albumin synthesis decreases and develops hypoalbuminemia. In fact, the serum albumin level is a powerful way directly correlated with dietary protein, but recent literature emphasizes that the effect of serum albumin concentration on the inflammatory response. Albumin is a negative acute phase protein, except nutritional status, and its synthesis is supressed during inflammation. For this reason, there are limitations in the use of serum albumin level in order to assess the nutritional status of patients due to be affected by malnutrition and inflammatory reactions (Santos 2003). Indeed, because of longer half-life, it cannot be a sensitive indicator for nutritional therapy

Nutritional history and dietary record provide information about nutrition of patients and determine for malnutrition development at risk whether or not. Because of record of food intake is taken long-term, bored patients may cause to give false information. Therefore, record of food intake 3-day to get more accurate for patients (Kalantar-Zadeh 2003).

1.2.5 Recommendation of Dialysis Patients

Nutrition in hemodialysis (HD) is very important in decreasing complication and improving quality) of patients life Chronic kidney disease (CKD). Hemodialysis patient should receive 30-40 kcal /kg / day energy to provide positive nitrogen balance, prevent tissue destruction and protein catabolism.

According to "National Kidney Foundation Dialysis Outcome Quality Initiative NFK-DOQI and other investigators to advised dietary protein should be at least 1.2 g/kg/day in hemodialysis patients decrease protein catabolism, keep positive nitrogen balance, improve anthropometric measurement , biochemical parameters and lower morbidity.

Total fat content of the diet should be between 25-35% of energy and in this monounsaturated fatty acids 15-20%, polyunsaturated fatty acids 10% saturated fat intake should be 7% of total energy of the diet and cholesterol intake <200 mg / day.

Carbohydrate from the diet should be 60-65% of daily energy to provide enough energy, to protect protein breakdown. Patients with diabetes should avoid concentrated sweets.

Protein with phosphorus restriction and vitamin D deficiencies is common in HD patients (Sarker B R and S 1993). Calcium intake which should be taken 1000 -1500 mg /day in HD patients (Ahmed F 1997). Phosphorus intake should be restricted to 800-1000 mg/day. To prevent anemia 10-18 mg iron is needed in dialysis patients.

Water and sodium intake in hemodialysis patients are adjusted according to the amount of urine, fluid balance and blood pressure, sometimes potassium restriction is also necessary depending on residual renal function. Depending on urine daily fluid intake is recommended 1000-1500ml and sodium intake should be 3-4 gm for oligouric and 1.5-2 gm for anuric HD patients. Excess salt intake causes thirst and water intake.

1.2.5.1Energy

Energy metabolism is impaired and is composed of negative energy balance because of disrupted cellular energy metabolism in hemodialysis patients (Mak 2011) so enough energy should be taken for the effective use of dietary protein and the protection of the nutrients stores of body. In a prospective multicenter clinical trial that included 1901 participants of the Hemodialysis Study, dietary energy intake was 1.02 kcal/kg/day less on dialysis treatment days than on nondialysis treatment days. (Burrowes 2003, Stark 2011).

Some studies indicated that energy intake was low in hemodialysis patients. Poor appetite and hypermetabolism fairly reduce food intake in hemodialysis patients (O'Keefe 2002, Nakao 2003, Morais 2005, İkizler 2002). When the recommended energy requirements compared with consumed amounts, it is concluded that energy intake is inadequate in 90% of patients (Rocco 2002).

1.2.5.2 Proteins

Protein requirement increases due to amino acid losses into the dialysate, increased protein catabolism, metabolic and hormonal changes (Raj 2007) in hemodialysis patients. In research, it is emphasized that the inadequate protein intake increases mortality (Ohkawa 2004).

There is 0.2-0.3 g/kg or 6-8 g/day of protein, amino acids (aa) and peptide losses with the dialysis fluid during hemodialysis. Protein catabolism increases with these losses due to metabolic disorders. The lost in amino acids needs to be replaced to avoid negative nitrogen balance. According to "National Kidney Foundation Dialysis Outcome Quality Initative (NKF-DOQI)" and studies by other investigators to compensate for residual renal losses, dietary protein should be adjusted at least 1.2 g/kg/day in hemodialysis patients (Kopple 2001, Mahan 2012, Kalantar-Zadeh 2003, Locatelli 2005).

According to ESPEN, adjusted diet protein should be consumed as 1.1-1.2 g / kg / day and should be high in the biological value (of animal origin) of 50 % protein in hemodialysis patients (Mehrotra 2001, Karalis 2002, Cano 2006 However, it is required that adequate caloric intake prevent the use of protein as an energy source with gluconeogenessis. Otherwise, a positive nitrogen balance cannot be provided in spite of high protein intake. When patients were given a low protein diet, should be followed adequate energy intakes and adequate phosphorus intakes of patients to ensure optimal nutrition, and to prevent malnutrition (Locatelli 2005, Gribotto 2012).

1.2.5.3 Carbohydrates

When glucose is removed by dialysis in the extracellular fluid, loss of the glucose is completed with absorbed carbohydrates, destruction of liver glycogen, and glyconeogenesis in order to avoid symptomatic hypoglycemia. Then, increased protein breakdown and urea synthesis begin. Deterioration of glucose metabolism and insulin resistance develops in chronic renal failure.

This situation results in rising levels of glucose and urea when coupled with increased hepatic gluconeogenesis. Insulin metabolism in uremia shows severe abnormalities. Basal insulin secretion is reduced and receives limited response to glucose infusion (Kopple 2004).

In one study, it was observed occurrence of the insulin resistance impaired, muscle glucose uptake and nonoxidative glucose metabolism, in the presence of chronic uremia, but recovered after dialysis (Foss 1996).

Carbohydrate from the diet should be higher to provide enough energy, to protect the backup protein to be used for tissue protein synthesis, to cover the energy deficit. It should provided 60-65% of daily energy from carbohydrates (Kopple 2004). Most

patients have difficulty in meeting energy needs with low protein diets. For this reason, the energy gap can be covered by glucose polymers (starch), sugar, simple sugars are pure carbohydrate sources. But patients with diabetes should avoid concentrated sweets (Mahan 2012).

1.2.5.4 Lipids

Hyperlipidemia develops in a large part of dialysis patients; the amount of fat in the diet should not be higher. Saturated fat content of the diet should be reduced and unsaturated fat content should be increased (Vaziri 2006).

Hyperlipidemia progresses in the majority of patients with CKD specially in dialysis; therefore, content of fat in the diet should not be high. Total energy from fat should not exceed 25% to 30.

It is recommended reducing saturated fat intake (total energy <7%) and cholesterol intake (<200 mg / day). Total fat content of the diet should be between 25-35% of energy and monounsaturated fatty acids 15-20% of total energy, polyunsaturated fatty acids 10% of total energy of the diet (Nissesson 2008). Recommended foods for patients with a high biological value such as meat, eggs contain high cholesterol. Therefore assessment of serum cholesterol levels should be specific for each patient. If patients have hypertriglyceridemia and high cholesterol, regulation dietary fat content, weight control, increased physical activity, reducing the use of hypertonic solution, restriction of simple sugars of dietary intake are recommended.

1.2.5.5 Water and electrolytes

1.2.5.5.1Fluid:

The fluid adjustment should be made according to edema and dehydration in the patient. In hemodialysis patients, if conditions such as swelling of the eyes, hands or feet, fluid weight gain, shortness of breath, increased blood pressure or tachycardia are observed, fluid consumption should be restricted (Hegel 1992, Saran 2003). Hemodialysis patients should reduce fluid intake and should limit food consumption such as tea, coffee, soda, water, fruit juices, ice cream, sherbet, gelatin, soups and heavy sauces. Body weight gain during hemodialysis is recommended and should not exceed 1.5-2 kg. A recommended daily amount of fluid of hemodialysis patients should be 500ml + the urinary output in a day or around 1000-1500 ml(Fouque 2003).

1.2.5.5.2 Sodium:

Controlling sodium and fluid intake are important components of the HD diet. Extracellular volume expansion is the main pathophysiologic determinant of hypertension in HD patients. Water and sodium intake in hemodialysis patients are adjusted according to the amount of urine, fluid balance and blood pressure. Sodium restriction should be based on the amount of urine. A mild salt restriction as 3-4 g / day is sufficient in oliguric patients that have an amount of urine totaling more than 1 liter per day. Anuric hemodialysis patients may consume up to 1 liter of liquid 1-1.5-2 g / daily of salt. If hypertension or heart failure is present, salt and water restriction should be more monitored more delicately. Excess salt intake causes an increase for the feeling of thirst and liquid intake (Fouque 2003, Lindley 2009).

To reduce sodium intake in hemodialysis patients, olives, pickles, cured meats, garlic sauce, soy sauce, canned foods, sausages, processed meats, chips, and instant soups should be removed from the diet. Different spices, such as vinegar and lemon, can be used for consumption of unsalted foods or as a salt substitute.

1.2.5.5.3Potassium:

Potassium levels are affected by hemodialysis therapy with the degree of residual renal function and net tissue breakdown (e.g. due to infections) and acid-base status. In HD patients, serum potassium concentrations may change to net intestinal potassium absorption or excretion. An example of this change or excretion is diarrhea. Serum potassium is impressed by dietary potassium intake. It is thought this relationship is stronger when the potassium intake is very low or very high in diets of HD patients (Kaveh 2001, Noori 2010).

Potassium restriction is often required because hemodialysis patients are usually anuric.Anuric HD patients are recommended to restrict their potassium intake to 1600-2000mg daily.

Hypokalemia may occur with symptoms such as severe vomiting, diarrhea, diuretic use, due to the reduction of potassium. In this case, the potassium content of the diet should be increased (Fouquo 2003).

When blood potassium levels in dialysis patients are high, treatment of the patient's diet should be reviewed as a priority. The food consumption should be limited to reduce the

intake of potassium levels, such as milk, meat products, fruits, legumes, cereals, dried fruits and vegetables,etc.

1.2.5.6 Vitamin and minerals

Some studies demonstrate vitamin and mineral supplements for the long-term hemodialysis patients. Hemodialysis patients are potentially at risk of deficiency and excess of trace elements (Inamoto 2003). The lack of foods containing vitamins leads to vitamin and deficiencies that could cause of further possible complications in dialysis patients. (Mahan 2012).

1.2.5.6.1 Thiamine:

Thiamine sources are whole grain and enriched bread and cereals, peas, beans, nuts, brown rice, and meats. It is absent in rice and some cereal products. Thiamine nutritional value is lost with cooking, polishing and purifying(Steiber 2011). The addition of thiamin is controversial among some experts. However, 30 mg thiamine has been shown to support the improving of the activity of translocases red blood cells. Thiamine requirements should be 1.5 mg / daily, when dialysis patients have operations, infections have a high risk of developing, convulsions of the neurological symptoms can occur and large quantities of glucose adds to the diet(Fattal-Valevski 2011, Fouque 2003).

1.2.5.6.2 Vitamin B6, folic acid:

In dialysis patients, B6, folic acid and deficiencies have been occurred (Coveney 2011). Vitamin B6 deficiencies, especially as it plays in amino acid utilization and lipid metabolism and maintains a critical role as a coenzyme, are very important to monitor closely. Vitamin B6 and folic acid intake in HD patients are higher than normal healthy subjects, and respectively, the recommended intake varied between 1 mg and 10mg per day in most studies (Steiber 2011).

1.2.5.6.3 Vitamin C:

The loss of vitamin C has been observed in HD patients. Increasing vitamin C in the diet to a recommended amount of 100-200 mg/daily was at once the standard suggestion of mending this problem (Steiber 2011).

1.2.5.6.4 Calcium:

Protein and phosphorus restriction, loss of appetite, and vitamin D deficiencies are increased the need of calcium in HD patients. Support of calcium and control of serum phosphorus levels, by using calcium-containing phosphate-binding agents, are balanced simultaneously (Miller 2010). Calcium acetate or calcium carbonate is effective with reducing concentration of serum phosphorus, simultaneously, correcting hypocalcemia and negative calcium balance (Isakova 2009, Miller 2010). However, the use of vitamin D and calcium in hemodialysis patients concluded the risk for severe hypercalcemia and renal osteodystrophy (Tilman 2009). Increasing calcium during treatment should be done carefully. As a result, to ensure the positive balance of calcium levels in dialysis patients, 1000-1500 mg of calcium should be taken daily.

1.2.5.6.7Phosphorus:

Lack of phosphorus excretion in the human body can be closely related to the GFR. Even if a single nephron loses its function, it may result in the accumulation of phosphorus in the plasma while showing an inability to the discharging of phosphorus (Kopple 2004). When GFR decreased 120 mL / min to 25 mL / min, the accumulation of phosphorus was observed very clearly in the plasma. HBV protein sources including essential amino acids are rich foods from phosphorus; therefore there are difficulties on the limitation of phosphorus. For this reason, the absorption of phosphorus is prevented with the phosphorus binding agents from the outside. Egg white is a rich source of HBV protein has one of the lowest phosphorus-protein ratios and is also deprived from cholesterol; therefore, it is a particularly healthy food source of protein for patients on dialysis (Noori 2010). Whole eggs instead of egg whites, whole bread instead of white bread, dried beans instead of peas and preferably fish (cod, tuna) that have low phosphorus / protein ratio, should be consumed to reduce dietary phosphorus intakes in dialysis patients (Cupisti 2003). The active form of vitamin D is added in the treatment, this is an important step in the control of serum parathyroid hormone activity (Steiber 20109).

1.2.5.6.8 Iron:

Frequently anemia is shown in dialysis patients due to an iron deficiency (Tarng 1999, Vinay 2009). Because the amount of iron absorbed in the intestine is decreased, severe blood loss can be a symptom. In addition, the formation of erythropoietin decreases due

to bone marrow suppression by urea (Mahan 2012). Adding iron is recommended after assessing the patient's serum ferritin and iron levels (Rambod 2008). Intravenous iron therapy can be applied to patients for the treatment of anemia. Daily 10-18 mg iron is required in dialysis patients.

1.2.5.6.9 Zinc:

Uremic symptoms, such as anorexia, impaired taste sensation, reduced oxidative stress improved immune function and sexual dysfunction is associated with Zn deficiency in HD patients. Concentrations of serum Zn may affected from medications used by hemodialysis patients such as calcium carbonate, calcitriol (Dashti-Khavidaki 2010), aluminum phosphate-binders. For these reasons, Zn is needed 15 mg / day in dialysis patients (Fouque 2003). In addition, good sources of zinc are meat, poultry, nuts, and lentils and fortified breakfast cereals (Rucker 2010).

1.2.5.6.10 Magnesium:

200-300 mg / daily

Recommended dietary nutrient intake for hemodialysis patients are shown below in Table 1 (Nissesson 2008, Rucker 2010, Fouque 2007).

Table 1.2.5.1 - Recommended Dietary Intake of dialysis (From Different Guidelines)

Item	Hemodialysis Subjects
BMI	<25
Energy(kal/kg/day)	35(>60) 30 -35(<60)
Macronutrients	
Protein (g/kg/day)	1.2
Carbohydrate %	45-50
Fat %	25-35
Protein %	15-20
HBV %	50-60
Electrolytes	
Sodium (mg/day)	750-2000
Potassium (mg/day)	2000-2750
Calcium (mg/day)	<1000
Phosphorus (mg/day)	800-1000
Zinc (mg/d)	15
Magnesium (mg/d)	200-300
Micronutrients	
Vitamin A (μg/day)	None
Thiamin (mg/day)	1.5
Riboflavin (mg/day)	1.8
Niacin (mg/day)	20
Folic acid(μg/day)	1000

1.2.5.7 Role of dietitian or diet counseling

Patients with impaired renal function who have not received dietary advice spontaneously reduce their dietary intake of protein (USRDS study 1997), but hardly half of new dialysis patients have been seen by a dietitian and only one third have been seen by a dietitian on two or more occasions before reaching the end stage (Hakim, RM, 1995).

We have previously reported that a good nutritional status could have been maintained until start of dialysis treatment in a study concerning 239 patients treated with a supplemented very low protein diet (SVLPD) (Pollock, CA, 1997). Nevertheless, several authors wondered whether such dietary prescription during a long predialysis period could be responsible for a subsequent poor nutritional status on dialysis with negative consequences on morbidity and mortality. It has also been claimed that these diets delayed the adaptation to a higher protein intake because, once these patients were on dialysis treatment, they were unable to alter their predialysis dietary habits during the first months of dialysis (Locatelli, F, 1998).

At the initiation of dialysis treatment, renal function was similar in the two groups of patients, the lower serum creatinine levels observed in the SVLPD group being due to the restriction of proteins from animal origin, which is accompanied by a lower intake of exogenous creatine (Combe, C, 1993). Concerns have been raised about the ability of incident hemodialysis patients to increase their protein intake early after the initiation of dialysis.(Pollock, CA, 1997) In a study concerning 52 hemodialysis patients, Pollock et al .(Pollock, CA, 1997)reported that, regardless of their predialysis dietary regimen, patients failed to increase their protein intake within 3 months after the initiation of dialysis. Increase in protein intake became significant only 6 to 9 months after the beginning of dialysis. Pollock et al concluded "that adaptation from a low to high protein diet after the initiation of dialysis is almost uniformly unsuccessful in the short term".Close results have been reported in most series dealing with the nutritional outcome of incident dialysis patients with an increase in serum albumin during the first 6 to 12 months after initiation of dialysis (abstract; Pupim et al, J Am Soc Nephrol 12:362A, 2001) (Parker, TF 1996 , Goldwasser, P 1999 Jager, KJ, 2001 ,Kaysen, GA, 2001) Parker et al (Parker, TF 1996) have found that the increase of albumin was earlier and greater in patients who were dialyzed with biocompatible instead of cuprophane

membranes. It is likely that these results were related to the diminution of the inflammatory response during dialysis. In our study, all patients were dialyzed on biocompatible membranes, but we have not evaluated their inflammatory status. The combination of several mechanisms may explain this frequent increase in serum albumin observed during the first months on dialysis: increased protein intake, a relative hemo concentration observed in the first weeks in patients who were volume overloaded at the beginning of their dialysis treatment, and a decline in proteinuria observed after the initiation of dialysis. Inflammation also plays a key role in nutritional status changes in hemodialysis patients. Improvement of general status and of appetite, increased vigor, and functional capacity are commonly observed in newly dialyzed patients. Weight gain is frequently observed, even if it was not the case in all the above-mentioned series. The increase of BMI was statistically significant neither in Jager et al (Jager, KJ, 2001) nor in Ishimura et al (Ishimura, E, 2001) series.

In a study, lean body mass remained stable during the first year of hemodialysis. Ishimura et al (Ishimura, E, 2001), who have observed a decrease in lean body mass, have suggested that this decrease might reflect progressive fluid removal to achieve optimal dry weight. It is likely that, in our patients whose body weight increased steadily until the end of the study, the possible fluid removal was concealed by a regular increase in protein synthesis. Ikizler et al (Ikizler, TA 2002)showed recently that a dialysis session is a catabolic event and leads to a net loss of protein stores. However, longitudinal survey of the nutritional effects of dialysis treatment showed that hemodialysis per se improves body protein metabolism, which may be due to the clearance of uremic toxins counterbalancing the catabolic effects of hemodialysis.

The positive effect of the initiation of dialysis on nutritional status of patients with CRF was recently confirmed in two studies. Mehrotra et al (Mehrotra, R 2002) showed a progressive increase of serum albumin levels in 97 patients during the first 6 months following the initiation of hemodialysis. This increase was associated with an increase of protein intake but the relationship between serum albumin and nitrogen appearance was not significant. Pupim et al (Pupim, LB 2002) found similar results in 50 patients during the first year of hemodialysis with an improvement of biologic parameters and a gain of fat mass without increase of lean body mass. Their patients showed a small decrease in

total body weight and lean mass but it was not significant. A similar evolution of nutritional status after the initiation of hemodialysis was also found in our study in control patients and in patients previously on SVLPD who increased their dietary energy and protein intake.

In Diet in Renal Disease (MDRD) study. Mean duration of follow-up was 2.2 years in both studies Protein and energy intakes were lower in the low protein and very-low-protein diet groups than in the usual protein group. Two patients in Study B reached a "Stop point" for malnutrition. There was no difference between randomized groups in the rates of death, first hospitalizations or other "Stop point" in either study. Mean values for various indices of nutritional status remained within the normal range during follow up in each diet group. There were small but significant changes from baseline in some nutritional in dices, and differences between the randomized groups in some of these changes. In the low protein and very low protein diet groups' serum albumin rose, while serum transferrin, body wt, percent body fat, arm muscle area and urine creatinine excretion declined. Combining patients in both diet groups in each study a lower achieved protein intake (From food & Supplement) was not correlated with a higher rate of death hospitalization on stop points, pr with a progressive decline in any of the indices of nutritional status after controlling for baseline nutritional status and follow-up energy intake. These analyses suggest that the low-protein and very low-protein diets used in the (MDRD) study are safe for periods of two to three years.

Nutritional safety of protein-restricted diets in patients with chronic renal failure is controversial Benoît Vendrely et al assessed the evolution of nutritional status after initiation of hemodialysis in patients previously treated by a supplemented very low protein diet (SVLPD).

Once on hemodialysis, SVLPD patients rapidly increased protein intake. Nutritional status improved in all patients, with a gain in fat mass in all, and a gain in lean body mass in SVLPD men only. These data indicate that treatment with a SVLPD prior to hemodialysis initiation is nutritionally safe.

1.3 Rationale of the study

In Bangladesh the number of the diabetic patients is increasing day by day. Many of these diabetic patients are affected by chronic kidney disease. For these types of patients an appropriate diet plan is essential. Proper dietary intake may decrease the severity of many complications and thereby reduce morbidity and early mortality. There are not many studies on dietary pattern of diabetic subjects in Bangladesh. In this study, the dietary intake, frequency and composition of different food items of the diabetic patient, will be evaluated. Also the association of dietary intakes with different relevant complications will be observed.

1.4 Objective of the study:

General Objectives:

To evaluate the dietary pattern of diabetic patients with chronic kidney disease on dialysis

Specific Objectives:

1. To develop an FFQ for diet assessment of dietary pattern.
2. To compare dietary intake from diet diary, recall and food frequency questionnaire.
3. To evaluate the daily intake before after administering diet plan

Chapter 2
Methodology

2.1. Type of study:

The study was prospective in nature.

2.2. Study subject:

2.2.1 Location

Patients of diabetic with chronic kidney disease (stage 5) was screened and recruited from dialysis unit of Bangladesh Institute of Research and Rehabilitation in Diabetes Endocrine and Metabolic Disorders (BIRDEM) for this study.

2.2.2 Inclusion criteria

- Diabetic patient on dialysis for at least 3 months
- Those are on regular dialysis
- Conscious and follow the verbal command

2.2.3 Exclusion criteria

- Ill patient, unconscious , dimensia
- Suffering from acute chronic infection pneumonia, hepatitis
- Suffering from symptomatic cardiovascular condition.

2.3. Samples size:

Sample size was determined from the formula

$\mathbf{n=z^2pq/d^2}$

Where, n= number, z= 1.96. d= 0.05 as allowable error and

p= prevalence of malnutrition in CKD dialysis patients where 91% according to some study (Vasantha J 2011).

Based on this the sample size in each group was 135. Due to time and economic constrain 50 in the study.

2.4. Study period:

The study was conducted from September 2012 to September 2014.

2.5. Development of the questionnaire:

A standard questionnaire was prepared to collect demographic data, anthropometric measurement, and biochemical parameter. The history sheet used to obtain relevant

information on the socio-economics status, such as age, sex, location, occupation, income status etc.

A 3 day diet diary was advised to fill-up by the patients. Study subjects were also asked what they had taken in the last day to compare 3day intake with recall for minimizing error .The FFQ was developed from dietary records of healthy and diabetic subjects collected from a database in BIRDEM.

2.6 Dietary intake pattern

Dietary intake pattern of different types of food items of the patients was assessed from the FFQ.

2.6.1 What is FFQ?

An FFQ is defined as a questionnaire with a food list and a frequency response section where subjects report how often each food item is consumed (Willet W 1998).

2.6.2 Advantages:

Food frequency questionnaires (FFQs) are generally used to assess the dietary intake of large populations. FFQ is very popular for easy administration, ability to assess dietary intake over an extended period of time, and low costs than weighed dietary records (WDR) or 24-hour recall (Subar AF 2004).

In nutrition research FFQs are extensively used to investigate relationships between food intake and health (Willett WC 2006).

In the PURE pilot study for urban and rural Indian populations showed diverse dietary habits, using standard methods to develop separate FFQs can capture dietary intakes adequately. To develop nutrient databases, substitution of local food composition tables with data from other sources using standard methods to match foods can be adopted (Anura V 2008). In India, evaluation of the food lists of published FFQs developed for regions such as Kerala, Gujarat and Lucknow show that less than 20% of foods are similar across the FFQs due to regional variations in food habits (Herbert JR 1998; Herbert JR 1999; Pandey D).

2.6.3 Steps:

There were 3 major steps in to develop a FFQ.

1 Prepares a list of usually eaten foods including portion sizes and frequencies of intake.

2 develop a long FFQ.

3 test the long FFQ in the field to estimate average frequency of intake of most foods in the previous year (Anwar T M 2005).

2.6.4 Construction Food List:

They used three approaches to create a food list: conducted a 24-hour dietary recall, added foods to the list that were commonly eaten in that Zimbabwean population at other times of the year and on special occasions and expanded list by adding foods that were nutrient rich but were not captured in the previous steps (caterpillar for example) from a previous food composition table for Zimbabwe.

The authors using a previously published self-administered food frequency questionnaire (FFQ) (Sasaki S 2004) concluded that FFQs with more items are better able to rank people according to their intake and that they are able to differentiate between subpopulations, even though they underestimated the magnitude of these differences. Diet; methods; nutrition assessment; questionnaires; review; validation studies their analyses showed that FFQs with a longer food list (200 items) were better at ranking people than FFQs with a shorter food list (100 items).

2.6.5 Portion Size:

Portion size can be defined as the amount of food you choose to eat during a single eating occasion (whether it is a meal out, at home, or even the amount offered within a pre-packaged snack), while a serving is a standardized measurement of food or drink.

An important disadvantage of using standard portions is that inter individual variance decreases (Noethlings U 2003; Burley V 2004). However, two validation studies in Denmark and the Netherlands found only small differences when analyzing FFQs using information from portion-size questions compared with analyzing the same FFQs using standard portions (Cade J 2002; Tjonneland A 1992). These small differences may reflect that quantification of portion sizes is of minor importance compared with frequency that the relevant individual portion sizes were not estimated correctly (Tjonneland A 1992), or

that portion sizes listed do not match well with portions actually consumed. For example, actual portion sizes (e.g., super size) are maybe much larger than standard portions used by US Department of Agriculture and the FDA (Young LR 2003; Young LR 1995). Portion sizes were also estimated in different ways in the FFQs analyzed by including photographs, descriptions, and household measures such as spoons. Thus, it must be taken into account that portion-size questions do not always improve the performance of FFQs or that method to estimate portion sizes should be improved (Marja L 2007).

It is difficult to indicate how much was eaten, especially when they are part of mixed dishes (Subar AF 1995). It is also very hard for Asian subjects to estimate their intake of single ingredients in the mixed dishes especially if the subjects did not prepare or cook their own meals (Date C 1997; Ahn Y 2007).

2.6.6 Categories:

Rimm EB et al. used closed-ended responses consisting of 9 categories: Never or less than once/month, 1–3/ m, 1/week, 2–4/wk, 5–6/wk, 1/day, 2–3/d, 4–5/d, >6/d (Rimm EB 1992).

For each food item, participants indicated their mean frequency of consumption over the past year in terms of the specified serving size by checking 1 of the 7 frequency categories ranging from "almost never" to "2 or more times/d". Frequency data was converted to the gram intake as described previously (Science and Technology Agency 2000).FFQ are different in many ways like number of items or inclusion of portion-size questions which could affect reported intakes (Wolk A 1994; Jain M 2000; Kuskowska W A 1992).

In order to enable the subjects to answer a FFQ more accurately, a questionnaire must be developed including both individual food items and mixed dishes. The FOOD type intake frequencies were classified into four types: seven (i.e., everyday,5-6 times per week, 3-4 times per week, 1-2 times per week, 2-3 times per month, 1 time per month, or never), eight ("2-3 times per day" was added to seven categories), nine ("4-5 times per day" was added to eight categories) and eleven ("8-10 times per day", "6-7 times per day" were added to nine categories) according to general intake frequency of each FOOD type. For example, Japanese people drink the listed beverages, especially Japanese green tea, more

than once per day. Therefore, they included eleven categories in the beverage and milk category (Tomomi K 2010).

2.6.7 Comparison with other dietary assessments:

The mean daily intake of nutrients was calculated using an ad hoc computer program developed to analyse the questionnaire. In the validity study of the present FFQ, the questionnaire provided close estimation of nutrients compared to the 3-day diet record (Sasaki S 1998).

Compared with other approaches, such as 24-hour dietary recalls and food records, the FFQ generally collects less detail regarding the foods consumed, cooking methods, and portion size. Therefore, the quantification of intake is not considered as accurate. However, unlike records or recalls, FFQs are designed to capture usual dietary intake. Researchers at the National Cancer Institute developed a new cognitively based food frequency questionnaire (FFQ), the Diet History Questionnaire (DHQ) and showed that the DHQ and the Block FFQ are better at estimating absolute intakes than is the Willett FFQ but that, after energy adjustment, all three are more comparable for purposes of assessing diet-disease risk (Amy F 2001).

Carlsen et al. (Monica H C 2010) had compared the FFQ to the weighed food records observed that the percentages of energy from fat and added sugar from the FFQ were underestimated, whereas the percentage of energy from total carbohydrates and protein were slightly overestimated. The intake of foods rich in antioxidants did not vary significantly between the FFQ and weighed food records. The FFQ was able to assess average intakes of antioxidant- rich foods and beverages as well as the habitual diet among adult Norwegians. Evaluation of energy and dietary intake estimates from a food frequency questionnaire using independent energy expenditure measurement and weighed food records.

Various methods such as single or multiple 24 hour dietary recalls, weighed diet records, self reports of diet history and Food Frequency Questionnaires (FFQ) have been used to assess dietary intakes in populations (Xu J 2006; Jakobsen MU 2004; Soinio M 2003).

Sasaki S et al, (Sasaki S 1998) had shown the difference of mean intake from the DR and from the DHQ were 1-3% for total energy and macronutrients and 1-25% for the

micronutrients. They concluded diet history questionnaire might be a useful to assess nutrient intake for health education among hypercholesterolemic women in Japan.

To estimate the daily intake of Arab population on average the participants reported eating 3.4 servings/d of fruits and 3.1 servings/d of vegetables in UAE and 2.8 servings/d of fruits and 3.2 servings/d of vegetables in Kuwait. Participants reported eating cereals 4.8 times/d in UAE and 5.3 times/d in Kuwait. Meat was consumed nearly two times/day in both countries and among the meat group; poultry was popular than red meat or fish. The average intake of dairy products was 2.2/d in UAE and 3.4 among Kuwaiti over the past year (Mahshid D 2005).

In the study epidemiologic of Singaporean adults authors concluded that the newly developed semi quantitative FFQ including159-item is an sufficient for the assessment of dietary intakes of energy, total fat, saturated fat, polyunsaturated fat, monounsaturated fat and cholesterol. It can be as a dietary tool to classify individual's intake for purposes of evaluating interactions between dietary intakes and disease risk factors (Mabel D 2000).

2.6.8 Development of an FFQ for our study:

An FFQ was developed for assessing the dietary intake pattern of different types of food items of the dialysis patients.

A food list was constructed including 314 food items which were derived from the 24-hour diet recalls from CRF project database.

A total of 100 food items were determined from the analysis and organized into 9 main food groups: (a) cereals and cereal products; (b) legumes and legume products (c) leafy vegetables; (d) vegetables; (e) fruits; (f) fish and seafood; (g) meat (h) eggs and milk (i) miscellaneous .

Frequency of intake was evaluated based on habitual intake over the previous year. Food frequency consumption of each item was evaluated using seven categories: (a) 2–3 times per day; (b) daily; (c) 3-6 times per week; (d) 1-2 times per week; (e) 1–6 times per month; and (f) monthly. Each food item in the FFQ was assigned a portion size using local household units such as plate, bowl, tablespoon, etc.

2.6 Comparison of diet history, recall and food frequency questionnaire:

Daily calorie intake was calculated separately from 3 day diet diary, recall and FFQ in 10 patients and compared. It turned out that FFQ and recall methods were more suitable than 3 day diet diary for proper calculation of calorie intake. So in further calculation recall method was used in this study. The 10 subjects BMI and WHR showed no deficiency or underweight. Therefore it is reasonable if they were taking around 25-30kcal/d because of maintaining weight in the range as in Table 2.6.1.

Table 2.6.1: Comparison of different dietary assessment types

Dietary assessment	Kcal/kg/day	Significance
Diet diary(DD)	19.13±4.19	DD vs RC, p< 0.02
Recall (RC)	21.70±4.09	RC vs FFQ, p=NS
Food frequency questionnaire (FFQ)	26.13±5.15	FFQ vs DD, p<0.03

2.7. Dietary calculation method:

There are a lot of' vegetables, fruits, crops produced in Bangladesh. The nutritive values of different food elements have not yet determined [15.] In this study the nutritive values of' macronutrients (carbohydrate, protein, fat) and selected micronutrients (calcium, potassium. phosphorus and sodium, vitamins) in food items of study subject were determined. For the conversion to calorie and identifying elements, different methodologies published in and books, both from this Subcontinent and Western countries, were looked for. Some of the references are Ali. (Ali 1992), Gopalan (Gopalan1989) ,Mccane Bowers & Church's (Mccane B 2005) . Example of a food comparisons of different food values by these authors arc shown in table –2.7.1

Table-2.7.1: Comparisons of food values of 100 gm wheat showed by different authors

Ref	energy	CHO	pro	fat	Ca	P	Fe	Na	K	Zn	Mg	vit-B1	vit-B2	Niacin	folate
Gopalan	341.0	69.4	12.1	1.7	48.0	355	4.9	20.0	315	2.2	132.0	0.49	0.17	4.3	35.8
DKP	341.0	69.4	12.1	1.7	48.0		11.5					0.49	0.29		
Bowes	339.2	72.6	13.7	1.8	34.2	346	3.9	5.0	405	2.9	138.3	0.45	0.22	6.3	44.0
INFS	341.0	69.4	12.1	1.7	48.0	355	11.5	20.0	315	2.2	132.0	0.49	0.29	4.3	0.0
Mccane	324.0	68.5	12.6	2.0	130.0	230	3.2	4.0	250	1.9	80.0	0.39	0.07	4.0	51.0

2.8 Diet plan:

Individualized diet plan was given at the starting of this study to the patients to improve their nutritional status. Different guidelines were reviewed to make diet plan. Age, sex, economic condition and physical status were also taken in consideration.

Second time recall and anthropometry was collected from the patients after an average of 3 months.

Dietary intake and anthropometrical measurement was compared with base line to that of 3 months.

2.9 Anthropometries Measurements:

The anthropometric measurements to assess protein energy nutritional status in study subjects will include skin fold thickness at biceps, triceps, mid-arm muscle area or circumference and body mass index (BMI). Harpenden Skin Calipers will be used to measure skin folds. Skin calipers will be used to measures skin folds. Mean at the repeated measurements will be taken.

Triceps: The back at upper arm. This is located halfway between the shoulder the elbow joints. The fold is taken in vertical directly on the center of the back of the arm (Joshi S.A 2002).

Biceps: The font of upper arm. This is taken exactly the same as the triceps except it is on the center of the front of the upper arm (Joshi S.A 2002).

Mid upper arm circumference (MUAC) : To obtain it the subjects right arm was bent at the elbow at a 90 degree angle with the upper arm held parallel to the side of the body, measure the distance between the acromion and olecranon process at the elbow. The mid point between these two landmarks was marked with indelible ink. The subject's right arm was flexible and hanging loosely at his or her side. The metric tape was positioned around the upper arm at the previously marked midpoint. The circumference was recorded to the nearest 0.1 cm. The normal value of Mac is for man – 17.6-29.3 cm and for woman – 17.41-28.5 cm (Joshi S.A 2002).

Waist (W): The waist measurement (cm) was done by using a measuring tape and the reading was taken in the middle to the abdomen in the Transpyloric plane (normal breathing) at the level of umbilicus.

Hip (H): The hip measurement was done while the subjects are wearing normal cloths. The tape was placed just below the buttock and measurements (cm) were taken (Joshi S.A 2002).

Waist-Hip Ratio (W/H): Waist-hip circumferences ratio is used to describe the distribution of both subcutaneous and intra—abdominal adipose tissue. Waist hip ratios greater than 1 .0 for man and 0.8 for woman (Table 2.9.1) are said to be indicative of obesity (Stanfield PS 2003).

Table 2.9.1: Different Waist Hip ratio (W: H)

	Acceptable		**Unacceptable**		
	Excellent	**Good**	**Average**	**High**	**Extreme**
Male	<0.85	0.85-.090	0.90-0.95	0.90-1.00	>1.00
Female	<0.75	0.75-0.80	0.80-0.85	0.85-0.90	>0.90

2.10 Biochemical parameters

Biochemical parameter of blood was collected from medical records of patients. These include - Fasting Blood Sugar (FBS), Serum Creatinine (SCr), Serum Albumin (ALB), Hemoglobin (Hgb), Calcium (Ca), Phosphorus (P), Sodium (Na) and Potassium(K).

2.11 Statistical method:

Appropriate statistical method was used to analyze qualitative and quantitative data. Quantitative data was expressed as mean ± SD and qualitative data as percentage. Comparison between qualitative and quantitative data was done by students "t" test. Significance was taken as $p<0.05$. Software SPSS version 11.5 was used for computations.

2.12 Ethical clearance:

Approved ethical clearance was taken from institutional ethical review board (ERB)
Detail informed written consent was also taken.

2.13 Limitation of the study:

1. Many food items that are locally produced and cooked are not available in different calorie conversion tables. Their factors, portion edible or served are not clearly found.
2. Chronic Kidney disease patients have restrictions on many food items and also often they are sick to take food regularly. So the diet diary may not reflect the actual intake.
3. Sample size in this study is relatively small and several dietary diary of each patient has not been averaged to calculate calorie intakes in this study.
4. Patients were sometime non cooperative because of their physical condition and mental stress.

Chapter 3
Results

3.1 Demography:

The number of male and female in this study was - 33(66%) and 17(34%) respectively. The table 3.1.1 shows the gender distribution of subjects.

Table-3.1.1: Gender distribution of the study subjects

Type	Number	Percent (%)
Male	33	66
Female	17	34
Total	50	100

About half of the patients (48%) on dialysis were in the age group of 62 – 70 years and the least (8%) were below 40 years age. (Table 3.1.2)

Table 3.1.2: Age distribution of the study subjects

Age	Frequency	Percentage
<40	4	8
40-50	7	14
50-60	9	18
60-70	24	48
>70	6	12
Total	50	100

The educational status of the subjects were recorded and categorized into 6 groups in table 3.1.3. It was found illiterate group had only one subject (2%), below S.S.C. level there were 13 (26%) subjects, S.S.C level education attained 8 (16%) subjects, H.S.C. passed subjects were 5 (10%), Graduate level subjects were 9 (18 %) and post graduate subjects numbered 14 (28%).

Table 3.1.3: Educational status of the study subjects

Type	Dialysis subjects	Percent (%)
Illiterate	1	2
<S.S.C.	13	26
S.S.C	8	16
H.S.C.	5	10
Graduation	9	18
Post Graduate	14	28
Total	50	100

Note- S.S.C-Secondary School Certificate exam, H.S.C. - Higher Secondary School Certificate exam, Post graduation- Master degree level of education.

The monthly expenditure of the study subjects was also evaluated and categorized in the following table (3.1.4). That expenditure was 30-40 thousands in one (2%) subject. The 3 (6%) of subjects spent 40-50 thousands taka. The number of subjects found to be 46(92%) whose expenditure was >50 thousands taka per month.

Table 3.1.4: Monthly expenditure of the study subjects

Type	Dialysis subjects	Percent (%)
<20 thousand		
20-30 thousand		
30-40 thousand	1	2
40-50 thousand	3	6
>50 thousand	46	92
Total	45	100

The monthly expenditure on food of the dialysis patients was also evaluated and categorized in the following table (3.1.5). That expenditure was below 5 thousands in 1 (2%) subject. 5-10 thousands ranged in 10 (20%) subjects. 26 (52%) subjects spent20-30 thousands taka , whose expenditure >30 thousands taka per month 1(2%).

Table 3.1.5: Monthly expenditure on food of the study subjects

Type	Dialysis subjects	Percent (%)
<5 thousand	1	2
5-10 thousand	10	20
10-20 thousand	26	52
20-30 thousand	12	24
>30 thousand	1	2
TOTAL	50	100

Professionally the dialysis subjects were found to be in the category of that service, business respectively 3(6%), 6(12%), 1(2%) and 14(28%) subjects were housewives, 26(52%) went on retirement (Table 3.1.6).

Table 3.1.6: Present Profession of the study subjects

Type	Number	Percent (%)
Service	3	6
Business	6	12
House wife	14	28
Retired	26	52
Others	1	2
Total	50	100

Study subjects were also asked about their present habit. Only one (2%) of them were habituated in betel leaves and 49 (98%) had no habit of taking betel leaves or tobacco (Table 3.1.7).

Table 3.1.7: Present Habit of the study subjects

Type	Number	Percent (%)
None	49	98
Betel leaves	1	2
Total	50	100

Table 3.1.8showed that majority of the patients (86%) have undergone dialysis 2days per week and the rest 14% had their dialysis for 3 days per week.

Table 3.1.8: Number of days per week patients undergo dialysis

Type	Number	Percentage
2 days	43	86
3days	7	14
Total	50	100

The mean duration of the subjects suffering from diabetes was about 8 years and that of choric kidney disease was 5 year which indicates the diabetic subject develop kidney disease at the end of third year (Table 3.1.9).

Table 3.1.9: Number of month patients suffering from different diseases during dialysis

	Duration (year)	Significance
Diabetes	7.88±9.11	0.002
Chronic kidney disease	4.88± 10.08	0.002

3.2 Anthropometric changes

After dietary intervention tricep and MAC showed incremental trend, whereas bicep remained same. Waist hip ratio also showed little improvement but BMI remained unchanged (Table 3.2.1).

Table 3.2.1: Anthropometric changes before and after diet plan of dialysis patients

	Before diet plan	**After diet plan**	**Significance**
Biceps (BSF mm)	25.8±3.3	25.7±3.4	NS
Triceps (TSF mm)	12.90±5.3	13.4±4.4	NS
Mid Arm Circ. (cm)	6.7±2.6	6.8±3.0	0.01
Waist hip ratio	0.93±0.7	0.90±0.1	NS
BMI	24±3	24±2	NS

3.3 Biochemical parameter:

Biochemical parameter of blood was compared between before diet plan and after diet plan of dialysis subjects (Table 3.3.1). Fasting Blood Sugar (FBS) was 4.6±0 before diet plan which was not significantly increased 6.6±0 , (P=NS) after diet plan. The level of serum Creatinine (SCr) was 10.8±4.2 before diet plan and showed little improvement9.4±2.8 after diet plan, but it was not significant. Similar trends were also noticed in case of serum Albumin (ALB) 38.8±0.2 and 34.6±5, (P=NS), Hemoglobin (Hgb) 9.3±1.3 and 9.9±1.5, (P=NS) , Calcium (Ca) 8±1 and 7.7±2.2, (P=NS) , Phosphorus (P) 6.6±2.6 and 5.0±2.4, (P=NS), Sodium (Na) 138±6.8 and 136±3.6, (P=NS) and Potassium(K) 5.0±0.7 and 4.8±0.7, (P=NS) .

Table 3.3.1: Biochemical parameter of the study subjects

	Before diet plan	**After diet plan**	**Significance**
Fasting Blood Sugar (FBS)	4.6±0	6.6±0	NS
Serum Creatinine (SCr)	10.8±4.2	9.4±2.8	NS
Serum Albumin (ALB)	38.8±0.2	34.6±5	NS
Hemoglobin (Hgb)	9.3±1.3	9.9±1.5	NS
Calcium (Ca)	8±1	7.7±2.2	NS
Phosphorus (P)	6.6±2.6	5.0±2.4	NS
Sodium (Na)	138±6.8	136±3.6	NS
Potassium (K)	5.0±0.7	4.8±0.7	NS

Systolic blood pressure reduced little after the intervention and diastolic pressure remained normal in the both phase of the study (Table 3.3.2).

Table 3.3.2: Blood pressure of the study subjects

	Before diet plan	**After diet plan**	**Significance**
Systolic	143±14	140±15	NS
Diastolic	80±8	80±6	NS

3.4 Dietary Intake Pattern:

Dietary pattern of the dialysis subjects was evaluated from the FFQ. Frequency of cereal group intake showed that chapatti, rice, noodles, puffed rice , loaf , paratha intake were 37%, 29%, 7%, 7% , 6%, and the intake amount were 124, 280, 37, 9, 16, 15 g/day

respectively; In pulse category intake frequency of lentil and Bengal gram were 90% and 8% and the amount taken were 12g and 0.6g daily respectively(Table 3.4.1).

Table 3.4.1 Intake frequency of cereals and pulses

Food name	**Frequency (%)**	**Average amount (gm/day)**
Cereals		
Chapati	37	124
Rice	29	280
Noodles	7	37
Puffed rice	7	9
Loaf	6	16
Paratha	5	15
Others	9	
Pulses		
Lentil	90	12
Bengal gram	8	0.6
Others	2	

In leafy vegetables group intake frequency for red amararanth, ipomoea leaves, jute leaves bottle gourd leaves, cabbage, spinach were 1.4%, 1.3%, 1.2%, 1.1%, 1.0 %and 1.0% at the amount of 4.0, 3.6, 3.9, 2.9, 3.9 and 2.8g respectively. The frequency for vegetables intake like parwar, bottle gourd , papaya, bitter gourd, pumpkin were 8.5%, 8.3%, 7.6%, 7.5%, 5.8% and their taken amount were 33.9, 32.9, 29.8, 29.9 and 21.0 g respectively (Table 3.4.2).

Table 3.4.2 Intake frequency of leafy vegetable and vegetable

Food name	Frequency (%)	Average amount (gm/d)
Leafy vegetable		
Red amararanth	1.4	4.0
Ipomoea leaves	1.3	3.6
Jute leaves	1.2	3.9
Bottle gourd leaves	1.1	2.9
Cabbage	1.0	3.9
Spinach	1.0	2.8
Vegetable		
Parwar	8.5	33.9
Bottle gourd	8.3	32.9
Papaya	7.6	29.8
Bitter gourd	7.5	29.9
Pumpkin	5.8	21.0
Others	43.4	

Intake frequency of fruits of the this diabetic subjects showed that mango, apple, guava, orange and water melon and other fruits was taken in frequency of 25%, 21%,125, 8% ,8% and 26% respectively and the taken amount of these fruits was 4.5, 2.9, 1.4, 1.1, and 1.5g/day respectively (Table 3.4.3).

Table 3.4.3 Intake frequency of Fruits

Food name	Frequency (%)	Average amount (gm/d)
Mango	25	4.5
Apple	21	2.9
Guava	12	1.4
Orange	8	1.1
Water melon	8	1.5
Others	26	

Animal protein was categorized into two groups ; one group comprised different kinds of fishes and their frequency for ruee, pangas , tilapia, taki, katla were 13%, 9%, 2%, 2%, 2% and taken amount were 17.4, 14.4, 3.3, 2.2, 2.2 g/day respectively . Other group include egg, chicken, egg white, milk were taken at the amount of 60, 39, 16, 16g/day with a frequency of 20, 19 ,13 and 5 respectively (Table 3.4.4).

Table 3.4.4 Intake frequency of animal protein

Food name	**Frequency (%)**	**Average amount (gm/d)**
Fishes		
Ruee	13	17.4
Pangas	9	14.4
Tilapia	2	3.3
Taki	2	2.2
Katla	2	2.2
Meat, egg and dairy		
Egg	20	60
Chicken	19	39
Egg white	13	16
Milk	5	16
Others	15	

3.5 Dietary Intake before and after recommendation:

Individual diet plan was given to the patients. Their daily dietary intake before and after administering the plan were compared with the recommended dietary intake. Comparisons of total calorie intake/day were made between before diet plan and after diet plan of dialysis subjects. Their values were 1274±219and 1383±233kcal/d and the increase was significant ($P<0.02$). The carbohydrate intake was increased from 168 to 188 g/d after dietary recommendation which was significant ($p<.034$). Similar trend of increment were noticed in case of protein (0.79±0.3 and0.85±0.2 g/kg/d, P=NS) and high

biological value protein (68±14 and 76±23 %, *P*=NS) but the change was not significant. Dietary fat (%) intake (28±6 and 28±11, P=NS) remained similar before and after giving diet plan (Table 3.5.1).

Table 3.5.1: Energy and Macronutrient Intake changes before and after diet plan in study subjects

	Recommendation	**Before diet plan**	**After diet plan**	**Significance**
Energy (Kcal/day)	1864±271	1274±219	1383±2331	0.025
CHO (gm)	250±10	168±52	188±442	0.034
PROT(gm)	75±5	48.43±18.78	53.07±11.57g	NS
HBV (%)	60±1	68±11	76±30	NS
FAT (gm)	60±2	40.47±20.65	43.41±12.66	0.03

Note: CHO-Percent of Carbohydrate in diet, PROT/kg- Protein intake/kg body wt,HBV-Percent of High Biological Value protein in diet, Fat-percent of fat in diet and 1,2 - before diet plan vs after diet plan;

Although intake of all minerals except zinc increased after the diet plan but the changes were not significant. The values were 430±463 and 463±262 mg/d, *P*=NS; 608±163 and 663±160 mg/d, *P*=NS; 13±19 and 20.27±37 mg/d, *p*= NS; 226±282 and253±271 mg/d *P*=NS and 11±35 and 10±10 P=NS for calcium, phosphorus, iron, magnesium and zinc respectively **(**Table 3.5.2).

Table 3.5.2: Minerals Intake changes before and after diet plan of dialysis patients

	Recommendation	Before diet plan	After diet plan	Significance
Calcium (mg/d)	1000	430±463	463±262	NS
Phosphorus (mg/d)	800-1000	608±163	663±160	NS
Iron (mg/d)	10-18	13±19	20.27±37	NS
Magnesium (mg/d)	200-300	226±282	253±271	NS
Zinc (mg/d)	15	11±35	10±10	NS

The intake of electrolyte showed no improvement and remained almost similar before and after diet plan. The values for sodium was (714±327 and 740±288 mg/d, *P*=NS) and intake of potassium was (1079±338 and 1059±283 mg/d, *P*=NS) respectively (Table 3.5.3).

Table 3.5.3: Electrolyte changes before and after diet plan of dialysis patients

	Recommendation	Before diet plan	After diet plan	Significance
Sodium (mg/d)	750-2000	714±327	740±288	NS
Potassium (mg/d)	2000-2750	1079±338	1059±283	NS

A comparison of daily vitamin intake was made between before diet plan and after diet plan of dialysis subjects. Thiamin intake was not significant before and after diet plan 0.75±0.2 and 0.82±0.2 mg/d (*P*=NS) but lower than the recommendation (1.1-1.2). Although riboflavin (0.8±0.3 and 1.1±0.4) and niacin (12±5 and 14±6) intake of the dialysis subjects reached the recommended level but the change was not statistically significant. The folic acid intake (22±5 and31±7 mg/d, P=NS) did not meet the recommended level (Table 3.5.4).

Table 3.5.4: Vitamins intake changes before and after diet plan of dialysis patients

	Recommendation	Before diet plan	After diet plan	Significance
Thiamine(B1) (mg/day)	1.1-1.2	0.75±0.2	0.82±0.2	NS
Riboflavin(B2) (mg/day)	1.1-1.3	0.8±0.3	1.1±0.4	NS
Niacin(B6) (mg/day)	14-16	12±5	14±6	NS
Folic acid (mg/day)	100-500	22±5	31±7	NS

There was no significant difference in calorie intake due to age difference.

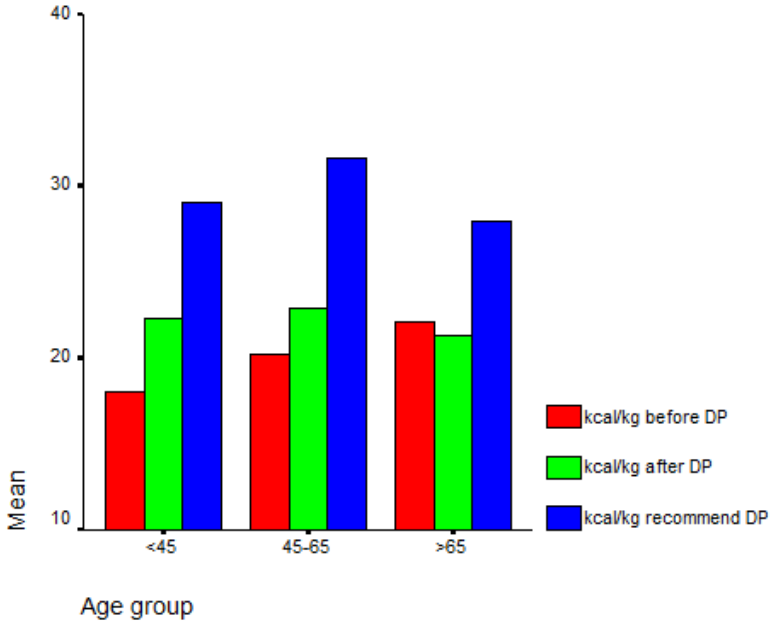

Figure-3.1: Distribution of calorie intake in different age groups

Note: DP- Diet Plan

There was no significant difference to variation in dialysis duration in calorie intake.

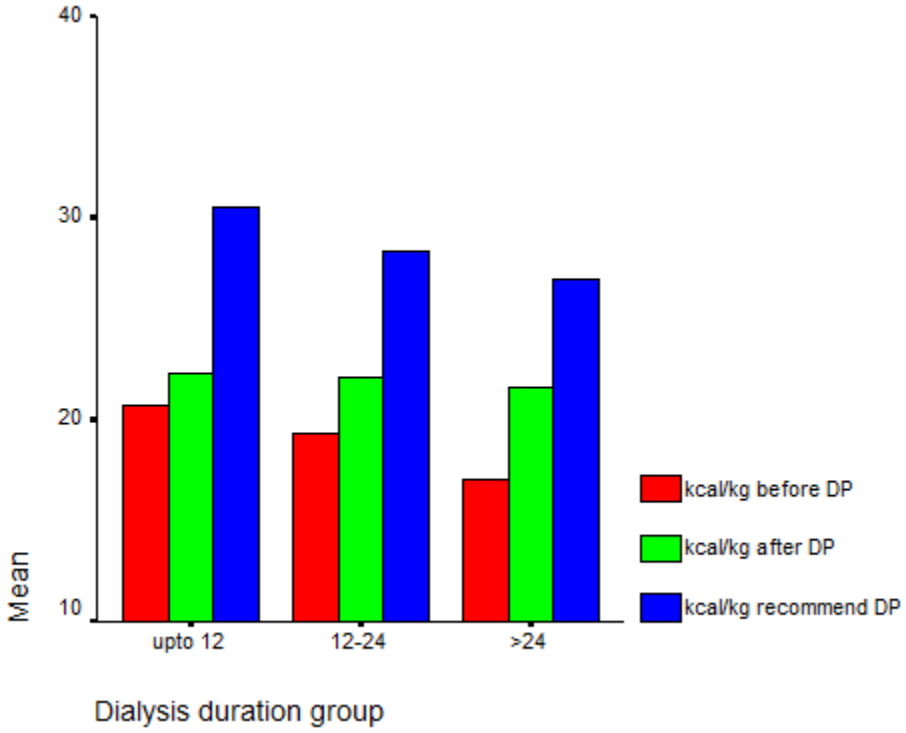

Figure-3.2: Distribution of calorie intake in different dialysis groups

Note: upto 12 months;

There was no significant difference in mineral and electrolyte intake before and after diet plan.

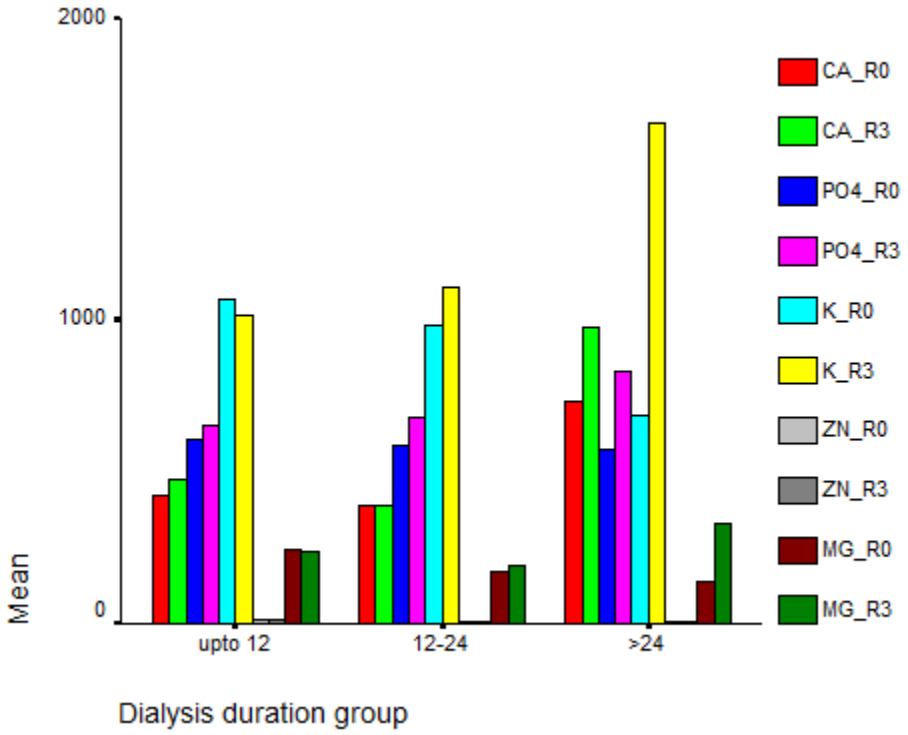

Figure-3.3: Distribution of mineral intake in different dialysis duration group

Note: R0- before diet plan, R3-after diet plan, ca- calcium, po4- phosphorus, K- potassium, ZN- zinc and MG- magnesium.

There was no significant difference in mineral and electrolyte intake in different age group.

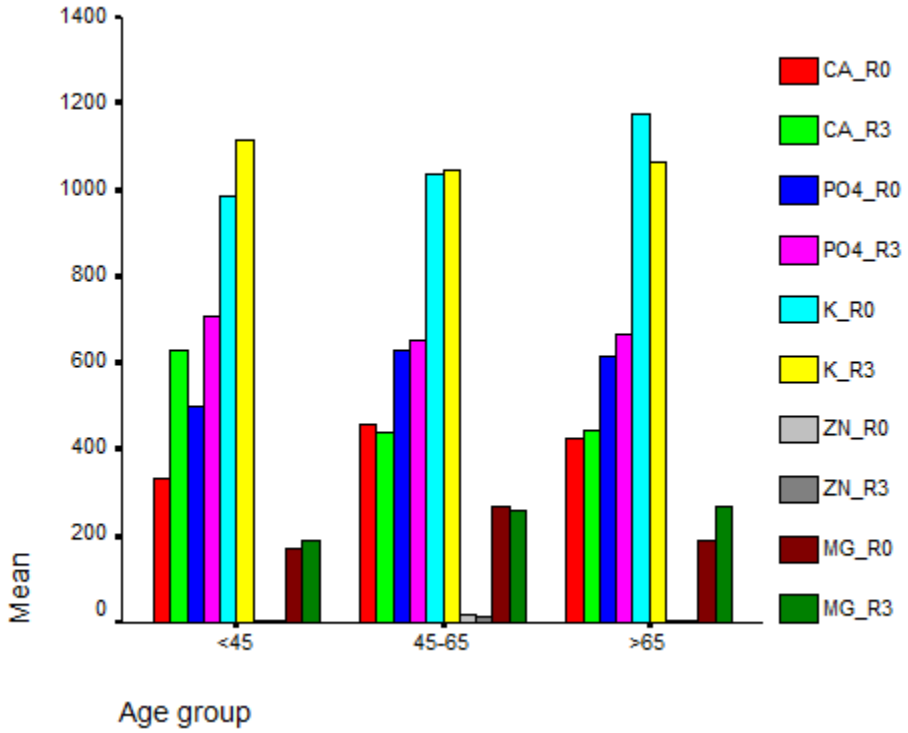

Figure-3.4: Distribution of mineral intake in different age groups

Note: R0- before diet plan, R3-after diet plan, ca- calcium, po4- phosphorus, K- potassium, ZN- zinc , MG- magnesium, <45- less than 45 years.

There was no significant difference in calorie intake to different serum creatinine levels.

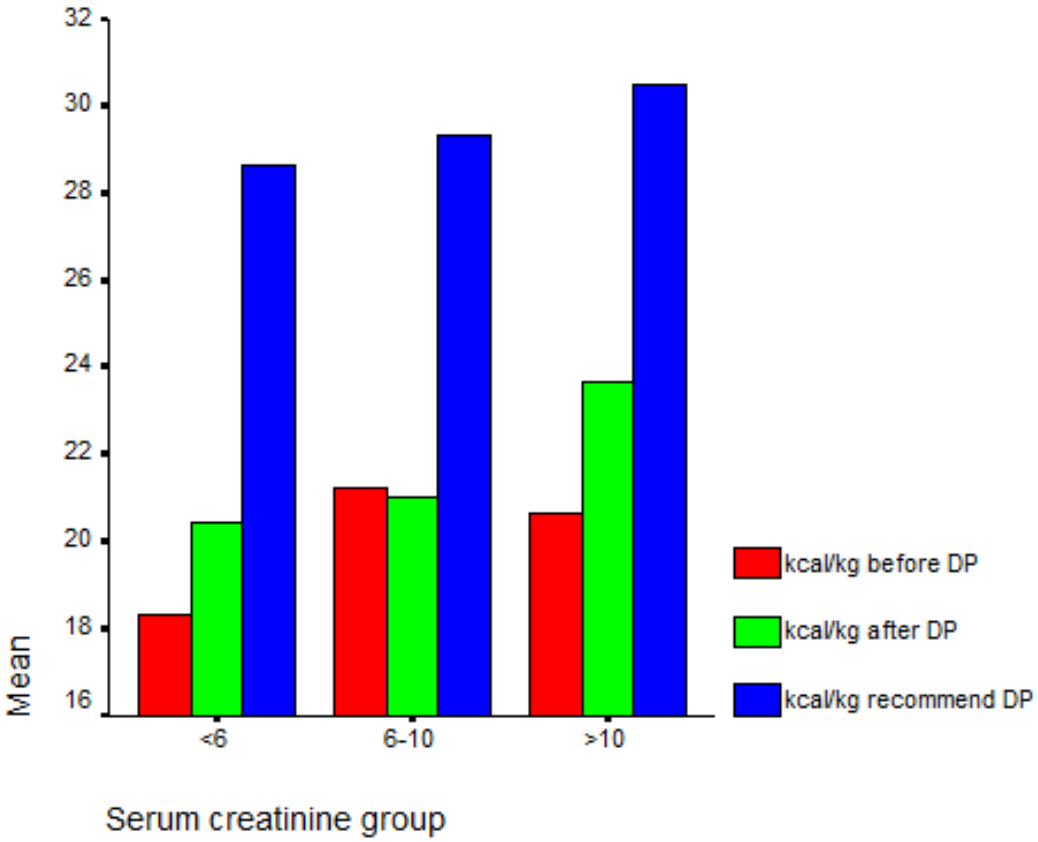

Figure3.-5: Distribution of calorie intake in different serum creatinine levels

Note: DP- diet plan

There was no significant difference in mineral and electrolyte intake in different serum creatinine levels.

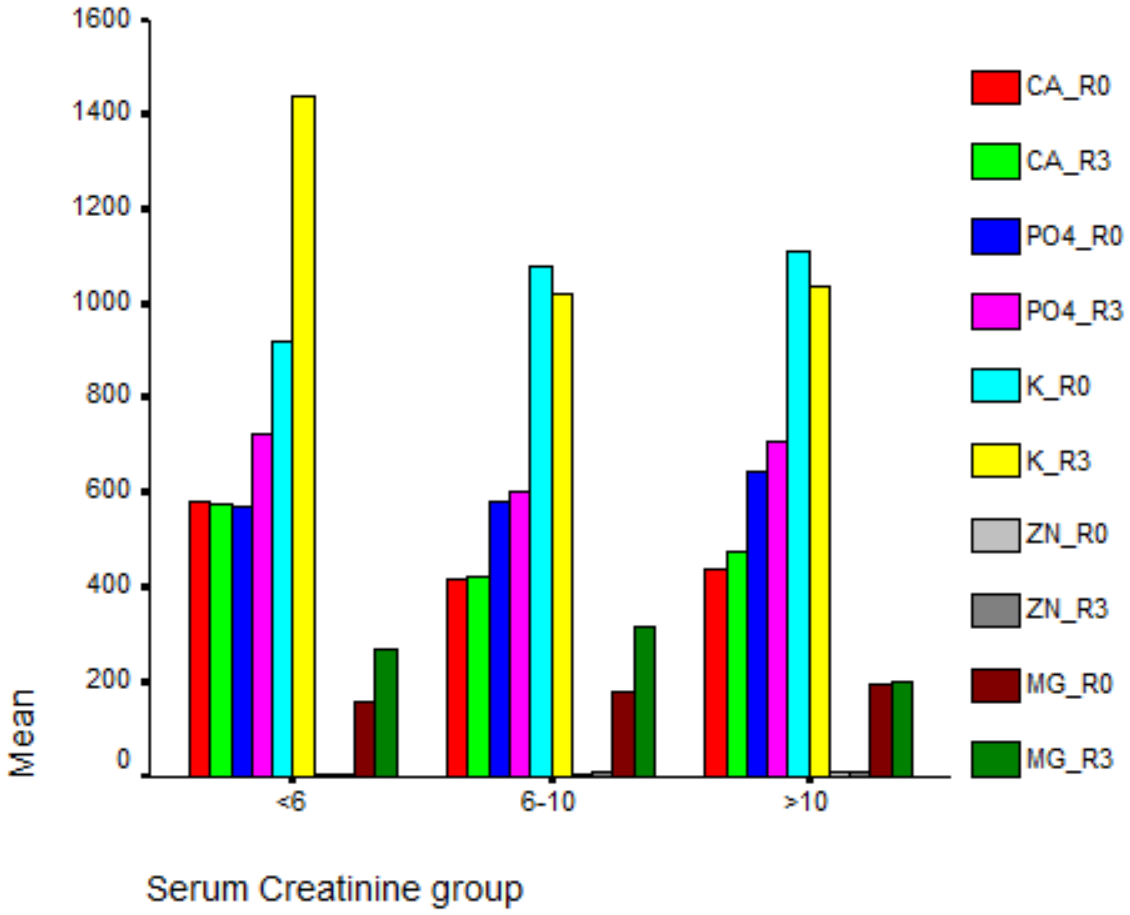

Figure-3.6: Distribution of mineral and electrolyte intake in different serum creatinine levels

Note: R0- before diet plan, R3-after diet plan, ca- calcium, po4- phosphorus, K- potassium, ZN- zinc , MG- magnesium, <45- less than 45 years.

Chapter 4
Discussion

4. Discussion:

The present study was undertaken to evaluate the dietary intake of diabetic patient with kidney disease undergoing dialysis. Since overall nutrition of dialysis patients is crucial to avoid various bodily complications and improve the quality of life.

Majority (72%) of the patients were illiterate and had education from SSC to post graduate level (table 3.1.3) and enjoyed better economic status who (78%) spent monthly taka 10,000(table 3.1.4) and more on foods. The study subjects comprised of 52% retired and 18% were in business and service (table 3.1.6) indicating their sedentary life style, which contributed to the development of diabetes and eventual kidney disease.

This improvement of TCP and MAC (table 3.2.1) attributed to the patients compliant to the recommended protein intake with HBV. A little bit reduction of waist hip ratio also reflect patient adherence to healthy life style.

Energy intake was 1274 ± 214 kcal in the dialysis patients due to inadequate intake of carbohydrate (168 ± 52 g) (table 3.5.1)which was reflected in the lower fasting blood sugar level (4.6 mmol/dl) (table 3.3.2). Usually hyper metabolism and poor appetite fairly reduce food intake of hemodialysis patients. So in order to protect protein catabolism and tissue dysfunction to maintain nutritional status of the body 1864 ± 271 kcal was recommended considering the fair share of carbohydrate, protein of high biological value and fat for the patients, which eventually raised their fasting blood glucose to 6.6 mmol/l.

Macronutrient intake like CHO (168.33±52.22 and 188.99±44.69 g/d, $p<0.03$) and fat (40.47±20.65 and43.41±12.66 g/d, $p<0.03$) intake was significantly increased which reflects on their calorie intake(table 3.5.1).

Hemodialysis causes loss of nitrogen in skeletal muscle and usually 6-8 g/day of protein, amino acids and peptide are lost with the dialysis fluid. To compensate loss in dialysis fluid and residual renal loss dietary protein was recommended 1.2g/kg/day in hemodialysis patients for quality and comfort of the dialysis patients (kopple 2001) this measure increased the protein intake to 0.85 ± 0.2 g/kg/day from 0.79± 0.3 g/kg which might have implication in maintaining patients weight.

Subjects of the present study were anemic with mean Hb level of 9.3± 1.3 mg/dl. Majority of the patients with chronic renal insufficiency unusually develop of

normocylic, normochromic, hypoproliferative anemia inadequate synthesis of erythropoietin by the kidney is the principal factor for the anemia. However shortened red blood cell survival associated iron and folate deficiency and uremic inhibition of erythropoisis also contribute to the decrease in red blood cell mass, so a recommendation of 10-18mg / day iron which contain organic or heme iron of animal origin increased the iron intake 20.27 ± 37 mg/day from 13± 19 mg/day. Although anemia was not fully corrected but hemoglobin level rose from 9.3± 13 mg/day to 9.9 ± 1.5 mg /day due to intervention.

The potassium level of the study subjects was 5.0 meq/l. At this high level potassium is restricted for the patients. Hyperkalmia develops due to low excretion of potassium and intake of high potassium content foods and some medications that inhibit potassium excretion. Dietary modification lowered the level of potassium to 4.8 ± 0.7 mEq/L from 5.0 mEq/L

The subjects were hyperphosphotamic having 6.6 ±2.6 mg/dl > 5.5 mg/dl of serum phosphorus. After dietary intervention the patients became normophosphotamic 5.0±2.4 mg /dl (<5.5 mg/dl). Physiologically kidneys maintain calcium and phosphorus level and activate vitamin. Hyperphosphotemia due to decrease in GFR and reduce renal synthesis of 1,25 dihydroxy D_3 results in the low serum calcium level secondary hyperparathyroidism.

Although phosphorus intake was higher after recommendation individualized variation of phosphate intake foods lowered the serum level which may be due to better compliance of the patients with the advice.

The dietary pattern was investigated using food items taken by the patients on daily basis. It appears that chapatti and rice were the mostly consumed carbohydrate food which could not supplied adequate amount of energy. In order to improve the energy intake more carbohydrate foods that can provide 250 g of carbohydrate each day was suggested. Likewise protein intake from the fish group was dominantly from ruee , pangas, egg and chicken and the amount consumed from this group of food items could not conform to the daily protein need of the patients. As such daily protein recommendation was made to increase the consumption of more protein foods which could supply of 1.2 g/kg/day.

Maintaining adequate vitamin intake is crucial for the dialysis patients (Mahan 2012). Intake of leafy vegetables, the main source of carotene cannot be considered adequate by the patient so they were encouraged to increase the intake. Food intake from fruits group was very negligible (11.4 gm), so patients were advised to consume variety of food items from the fruits and vegetable group to increase water soluble vitamin and minerals intake.

Chapter 5

Summary and conclusions

5.1 Summary:

Diabetic patients have many dietary restrictions especially those who have renal failure. Poor dietary intake is a predisposing factor for increased morbidity and mortality in chronic kidney disease (CKD) on dialysis at stage 5.For these dialysis patients an appropriate diet plan is essential after assessing their dietary pattern. Dietary pattern was shown from the FFQ. Intake of different micro and macronutrients were advised in guidelines for chronic kidney disease patients (table 9). Nutritional assessment was done by-clinical parameter, anthropometric measurements, biochemical parameters and dietary assessment. Assessing their dietary intake diet plan was advised to the patients than their dietary intake was evaluated.

Daily calorie intake was calculated separately from 3 day diet diary, dietary recall and FFQ in 10 patients and compared. Comparisons showed that the FFQ was better but similar to DR.

Dietary pattern of the dialysis subjects was evaluated from the FFQ. Intake frequency of cereals group showed that chapatti, rice were the major foods taken by the study subjects. Among pulses lentil was taken mostly. Dialysis patients took non leafy vegetable in higher amount than leafy vegetable. Mango was the preferred fruit by the patients followed by apple. Amount and quality of protein is very important for the dialysis patients. In this study among fishes ruee, pangas were taken by the most of the patients. Poultry items egg, chicken, egg white was taken mostly.

Different anthropometric parameters like bicep (BSF), triceps (TSF) and BMI were measured. Comparisons of BSF, TSF and BMI showed that they were similar except MAC. The dialysis patients are generally having anorexia due to uremia and take less food. Also the dialysis process itself initiates catabolism which is partly responsible for poor nutritional status leading to lower subcutaneous fat as well as decreased muscle mass. The improvement of tricep and MAC attributed to the patients compliance to the recommended protein intake with HBV. A little bit reduction of waist hip ratio also reflects patients' adherence to healthy life style.

The dietary assessment from 1 day dietary recall in our study subjects showed that calorie intake was increased significantly when diet plan was given to the chronic kidney disease patients at stage 5 (about 1274 to 1383 kcal/day) which can be attributed to higher carbohydrate intake. The protein intake in dialysis patients did not improved significantly according to required amount although intake of HBV percentage was observed to improve than the recommendation. Fat intake was increased after diet plan in this short period.

The different minerals intake was assessed and it showed that the study subjects were gradually increasing mineral intake according to diet plan. Though it was not significant.

Vitamin B1, B2, niacin and folic acid intake from dietary recall was assessed. Riboflavin and niacin intake increased to the level as advised.

5.2 Conclusions:

From this study it may be concluded that in diabetic CKD patients, those on dialysis, the frequent dietary intake pattern of different food items were chapati, rice, lentils, parwar, bottle gourd, red amaranth and mango. They took mostly egg, chicken, egg white and rohu fishes as animal protein.

Comparison of dietary assessments showed that FFQ was better than 3 day diet diary but similar to recall method for proper calculation of calorie intake.

After administering diet plan the intake of carbohydrate and fat as well as overall calorie intake was improved significantly in this short period. Therefore the dietary pattern in diabetic CKD patients can be improved with proper long term monitoring and providing appropriate diet plan.

Chapter 6
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Chapter 7
APPENDIX

1. Data collection Sheet

Sl. No. ……. **Date:** …….....

General Information

Name:……..... **Age:** …….....

Address:…….……..... **Sex:** a) Male b) Female

…….....

Tel/Mobile:…….....

Education:
a) Illiterate b) <S.S.C c) S.S.C. d) H.S.C. e) Graduate g) Post Graduate

Marital Status:
a) Married b) Unmarried c) Divorced d) Widower e) Separated

Monthly Expenditure: (in Taka)
a) <20,000 b) 20,000-30,000 c) 30,000-40,000 d) 40,000-50,000 e) >50,000

Monthly Expenditure on food: (in Taka)
a) <5000 b) 5000-10000 c) 10,000-20,000 d) 20,000-30,000 e) >30,000

Profession:
a) Service b) Business c) Professional…… d) Student
e) Cultivator f) Dependant g) housewife h) Others……

Habit (Present):
a) None b) Tobacco c) Betel leaf d) Alcohol e) Others ……..…

Habit (Past):
a) None b) Tobacco c) Betel leaf d) Alcohol e) Others……..……

Primary Disease:
a) Diabetes Mellitus (DM) b) Glomerulonephritis (GN) c) Other…….

Diabetes duration … . .. (yrs); CKD duration … . .. (yrs); Dialysis duration … . .. (yrs);

Parental History of:

Diabetes: a) None b) Father c) Mother d) Unknown

Hypertension: a) None b) Father c) Mother d) Unknown

Biochemical parameter: a) FBS…… b) ABF …….. c) SCr …… d) STP ……..e) ALB ……..
f) Hgb …… g) U/ RME …. .i) Na..... . j) k.....k) Ca .....j) P.....

Signature ……..... Date ……..

গবেষণা কর্মে অংশ গ্রহণের তথ্য পত্র

গবেষণার শিরোনামঃ ডায়বেটিক ও ধীর গতির কিডনী বিকল রোগীর খাদ্যের ধরণ মুল্যায়ন। (Evaluation of dietary pattern of diabetic patients with chronic kidney diseases.)

প্রধান গবেষকঃ আদিবা ফারজিন
তত্বাবধায়কঃ প্রফেসর ডঃ এম আখতারুজ্জামান, অধ্যাপক খাদ্য ও পুষ্টি বিভাগ, ঢাকা বিশ্ববিদ্যালয়।

গবেষণাবিবরণীঃ বাংলাদেশে দিন দিন ডায়বেটিক রোগীর সংখ্যা বেড়ে চলেছে। যাদের অনেকেরই ধীর গতির কিডনী বিকল (chronic kidney disease) রোগে আক্রান্ত। এদের মধ্যে অনেকেই চিকিৎসার জন্য ডায়লায়সিস করেন।
ডায়বেটিক রোগীদের রক্তের শর্করা ঠিক রাখার জন্য পরিমিত খাবার গ্রহণ করা উচিৎ। ডায়বেটিক রোগীদের কিডনী বিকল হলে খাবার আরো নিয়ন্ত্রণ করতে হয়।তবে ডায়লায়সিস রোগীরা তুলনামুলক অধিক খাবার গ্রহণ করতে পারে। তাই ডায়বেটিক ও ধীর গতির কিডনী বিকল রোগীদের সঠিক খাদ্য পরিকল্পনার জন্য খাদ্যের ধরণ জানা উচিৎ। খাদ্যের ধরণ মুল্যায়নের মাধ্যমে সঠিক খাদ্য পরিকল্পনা করে তাদের অসুস্থতা ও মৃত্যু ঝুঁকি কমানো সম্ভব।

গবেষণার উদ্দেশ্যঃ

১. কোন ধরণের খাবার কত বার খাচ্ছেন তা দেখে হবে।
২. বিভিন্ন খাবারের পুষ্টি মূল্য নির্ধারণ করা।
৩. খাদ্যের পুষ্টি মূল্যের সাথে রক্তের বিভিন্ন ল্যাবটরী পরীক্ষার সম্পর্ক নিরুপণ।

অংশগ্রহনকারীর বৈশিষ্ট্যঃ ধীর গতির কিডনী বিকল ডায়বেটিক রোগী যারা নিয়মেত ডায়লাইসিস করছেন।

গবেষণা পদ্ধতিঃ আপনি যদি এই গবেষণা প্রকল্পে অংশগ্রহণে সম্মতি হন তাহলে আপনাকে আপনার বর্তমান ও পূর্বের শারীরিক অবস্থা ও খাদ্যাভ্যাস সম্পর্কে প্রশ্ন করা হবে।

গবেষণায় অংশগ্রহণঃ এই গবেষনায় আপনার অংশগ্রহণ সম্পূর্ণ ইচ্ছামূলক এবং গবেষনার যে কোন পর্যায়ে আপনি অংশগ্রহণ তেকে বিরত থাকে পারেন। গবেষনায় অংশগ্রহণে কোন মানসিক ও শারীরিক ঝুঁকি নেই।

উপকারিতা সমূহঃ ১. আপনি কি ধরণের খাবার খাচ্ছেন তা সম্পর্কে জানা।
২. কোন কোন খাবার আপনার খাদ্যাভ্যাসে কি পরিমাণ গ্রহণ করা হচ্ছে তা সম্পর্কে জানা।
৩. কোন কোন খাবার কি পরিমাণ খেতে পারেন তার ধারণা পাওয়া।

গোপনীয়তাঃ আপনার চিকিৎসা সংক্রান্ত তথ্যাবলী এবং রক্তের ফলাফল চিকিৎসক এবং গবেষণা সংশ্লিষ্টদের মধ্যে সীমাবদ্ধ থাকবে।

বীমাআর্থিক সহায়তাঃ /এই কাজের জন্য গবেষণা কর্ম থেকে কোন প্রকার অর্থ প্রদান বা বীমার ব্যবস্থা নেই।

সম্মতিপত্র স্বাক্ষরের পাতা

গবেষণার শিরোনামঃ ডায়বেটিক ও ধীর গতির কিডনী বিকল রোগীর খাদ্যের ধরণ মুল্যায়ন। (Evaluation of dietary pattern of diabetic patients with chronic kidney diseases.)

প্রধান গবেষকঃ আদিবা ফারজিন

এই সম্মতিপত্রের স্বাক্ষর প্রদানের মাধ্যমে আমি নিম্নলিখিত বিষয়গুলোর ব্যাপারে সম্মতি দিচ্ছি-

- আমি সম্মতিপত্র বিস্তারিতভাবে পড়েছি।
- গবেষণা সম্পর্কিত আমার সকল প্রশ্নের উত্তর আমি পেয়েছি।
- আমি স্বেচ্ছায় এই গবেষণায় অংশগ্রহণ করতে, গবেষণা পদ্ধতি অনুসরণ করতে এবং প্রয়োজনীয় তথ্যাদি চিকিৎসক, সেবিকা এবং গবেষণা সংশ্লিষ্টদের প্রদান করতে রাজি আছি।
- গবেষণা সংশ্লিষ্টদের জানিয়ে আমি যে কোন সময় এই গবেষণা কর্ম হতে নিজে বিরত রাখতে পারব।
- রোগীর তথ্যাবলী এবং সম্মতিপত্রের এক কপি আমি গ্রহণ করেছি।

রোগীর নামঃ _____

ব্যাখ্যা প্রদানকারীর নামঃ _____

_____

_____

রোগীর স্বাক্ষরঃ তারিখঃ

_____

_____

স্বামী/ স্ত্রী/ অভিভাবকের স্বাক্ষরঃ তারিখঃ

_____

_____

ব্যাখ্যা প্রদানকারীর নামঃ তারিখঃ

2. Food Frequency Questionnaire :

ধরন	খাবার	২-৩ বার/ দিনে	দৈনিক	৩-৬ বার/ সপ্তাহে	১-২ বার/ সপ্তাহে	মাসিক	১-৬ বার/ মাসে	পরিমাণ
শস্য	বাকরখানি							
	ভাত							
	বিরিয়ানি							
	চিড়া							
	খিচুড়ি							
	মুড়ি							
	নুডুলস							
	পাউরুটি							
	পোলাও							
	পরোটা							
	রুটি							
	সেমাই							
	সুজি							
	তন্দুররুটি							
	অন্যান্য							
ডাল	ছোলা							
	ছোলার ডাল							
	মসুর ডাল							
	মুগ ডাল							
	অন্যান্য							
শাক	বাঁধাকপি							
	ডাটাশাক							
	কলমিশাক							
	লালশাক							
	লাউশাক							
	পালংশাক							
	পাটশাক							
	পুঁইশাক							
	অন্যান্য							
সবজি	গাজর							
	আলু							
	মুলা							
	বরবটি							
	বেগুন							
	চিচিঙ্গা							
	ডাটা							
	ঢেঁড়স							
	করলা							
	কচু							

ধরন	খাবার	২-৩ বার/ দিনে	দৈনিক	৩-৬ বার/ সপ্তাহে	১-২ বার/ সপ্তাহে	মাসিক	১-৬ বার/ মাসে	পরিমাণ
সবজি	কচুর লতি							
	কুমড়া							
	লাউ							
	পটল							
	পেপে							
	ফুলকপি							
	শসা							
	শিম							
	টমেটো							
	অন্যান্য							
ফল	আম							
	আমড়া							
	আনারস							
	আঙুর							
	আপেল							
	জাম্বুরা							
	কলা							
	কমলা							
	কাঁঠাল							
	নারকেল							
	পাকাপেপে							
	তরমুজ							
	অন্যান্য							
মাছ	বাটা							
	বেলে							
	চিংড়ি							
	ইলিশ							
	কেচকি							
	কাতলা							
	কই							
	মাগুর							
	মলা							
	পোয়া							
	পুটি							
	পাঙ্গাস							
	রুই							
	শিং							
	শোল							
	শুটকি							
	টাকি							
	তেলাপিয়া							

ধরন	খাবার	২-৩ বার/ দিনে	দৈনিক	৩-৬ বার/ সপ্তাহে	১-২ বার/ সপ্তাহে	মাসিক	১-৬ বার/ মাসে	পরিমাণ
মাংস	গরুরমাংস							
	খাসীরমাংস							
	মুরগীর মাংস							
ডিম ও দুধ	মুরগীর ডিম							
	গরুর দুধ							
	গুড়াদুধ							
	তেল							
অন্যান্য	চা							
	কফি							
	বিস্কুট (মিস্টি)							
	বিস্কুট (নোনতা)							
	কেক							
	চানাচুর							
	বেগুনি							
	পেঁয়াজু							
	পুরী							
	সমুচা							
	সিঙ্গারা							
	চিনি							
	মিস্টি							
	পুডিং							
	অন্যান্য							

3. Dietary recall sheet (খাদ্য তালিকা)

Sl no._____ নামঃ_____

সময়	খাবারের নাম	পরিমান
সকালের নাস্তা	রুটি/পরোটা/পাউরুটি/ভাত/খিচুড়ি/___	
	ডিম(কুসুম সহ/সাদা অংশ) সিদ্ধ/ পোচ/ অমলেট	
	সব্জি ___ ____ ___ ___ ___ ____ ___	
	ডাল(মসুর/মুগ/মাষকলাই/বুট/___ ____ ___)	
	দুধ চা/ রং চা/ কফি/ দুধ/ জুস /___ ____ ___	
	অন্যান্য ___ ____ ___	
মধ্যসকালের নাস্তা	মুড়ি/বিস্কুট/সিঙ্গারা/সমুচা/পুরী ___ ____ ___	
	দুধ চা/ রং চা/ কফি/ দুধ/ জুস /___ ____ ___	
	ফল	
	অন্যান্য ___ ____ ___	
দুপুরের খাবার	ভাত/খিচুড়ি/পোলাও/ রুটি/পরোটা/নানরুটি/___	
	সব্জি ___ ____ ___ ___ ___ ____ ___	
	শাক ___ ____ ___	
	ডিম(কুসুম সহ/সাদা অংশ) সিদ্ধ/ পোচ/ অমলেট	
	মাছ ___ ____ ___	
	মাংস (মুরগী/ খাসী/ গরু/ ___ ____)	
	ডাল(মসুর/মুগ/মাষকলাই/বুট/___ ____ ___)	
	অন্যান্য ___ ____ ___	
বিকালের নাস্তা	মুড়ি/বিস্কুট/নুদডুলস?সেমাই/সিঙ্গারা/সমুচা/পুরী ___ ____ ___	
	দুধ চা/ রং চা/ কফি/ দুধ/ জুস /___ ____ ___	
	অন্যান্য ___ ____ ___	
রাতের খাবার	ভাত/খিচুড়ি/পোলাও/ রুটি/পরোটা/নানরুটি/___	
	সব্জি ___ ____ ___ ___ ___ ____ ___	
	শাক ___ ____ ___	
	ডিম(কুসুম সহ/সাদা অংশ) সিদ্ধ/ পোচ/ অমলেট	
	মাছ ___ ____ ___	
	মাংস (মুরগী/ খাসী/ গরু/ ___ ____)	
	ডাল(মসুর/মুগ/মাষকলাই/বুট/___ ____ ___)	
	দুধ চা/ রং চা/ কফি/ দুধ/ জুস /___ ____ ___	
	অন্যান্য ___ ____ ___	
	দৈনিক লবণ	
	দৈনিক পানি	

Ht____ Wt ___ wrist ____ MAC ____ tricep ____ / ____/ ___ bicep ____ / ____/ ___ waist ____ / ____/ ___ hip ____ / ____/ ___ supra ____ / ____/ ___

4. Format of diet plan:

Sl no: ……. Name:……

কিলোক্যলরি
কার্বোহাইড্রেট
প্রোটিন
ফ্যাট

খাবার সময়	খাবার নাম	পরিমান
সকালের নাস্তা	রুটি	টি
	ডিম	টি
	ডিমের সাদা অংশ	টি
	সব্জি	কাপ
মধ্যসকালের নাস্তা	মুড়ি/বিস্কুট/	কাপ/ টি
	ফল	
দুপুরের খাবার	ভাত	কাপ
	ডাল	কাপ
	শাকসব্জি	কাপ
	মাছ/মাংস	টুকরা
বিকালের নাস্তা	মুড়ি/বিস্কুট/……	কাপ/ টি
	ফল	টি
রাতের খাবার	রুটি/ ভাত	টি/ কাপ
	ডাল	কাপ
	শাকসব্জি	কাপ
	মাছ/মাংস	টুকরা
শোয়ার আগে	দুধ	কাপ
রান্নার জন্য	তেল	মিঃলিঃ

পরিমানঃ ১ কাপ= ১২০মিলিলিটার; ১ চাচামচ= ৫মিলিলিটার; ১ টেবিল চামচ= ১৫মিলিলিটার;
১টি রুটি= ৪৫গ্রাম(৩০গ্রাম আটা)
১ কাপ ভাট= ৯০ গ্রাম (৩০ গ্রাম চাল)
১ কাপ ডাল= ১২০ মিলিলিটার(১৫গ্রাম ডাল)
২কাপ মুড়ি= ১ পরিবেশন (২০গ্রাম)
মাছ/মাংস= ১টুকরা (৩০গ্রাম)
বিনিময়ঃ ৩টি রুটি= ২কাপ ভাত

5. Minerals list

খাবারে পটাসিয়ামের পরিমাণ মিলিগ্রামে (প্রতি ১০০ গ্রামে)	বেশি(>২২৫ মিঃগ্রাঃ)-আম, কলা, কাঁঠাল, পেয়েরা, পাকা পেপে, বেন্থাল, কচুশাক, পুইশাক, ডাঁটাশাক পালংশাক, পাটশাক, লাউশাক, আলু, কাঁচকলা, কাচা পেপে, ধেরস, ফুলকপি, বাধাকপি, বরবটি, সীম, ডাল, তেলাপিয়া, পাঙ্গাস, রুই, গরুর মাংস, মুরগির মাংস গুঁড়াদুধ মাঝারি(১০০-২২৫মিঃগ্রাঃ)- আমড়া, আনারস, কমলা, তরমুজ, নাশপতি, মাল্টা, কলমিশাক, করলা, শসা, বেগুন, মিষ্টিকুমড়া, কাঁচা, টমেটো, রুটি, মুড়ি, চিড়া, বিস্কুট, গরুর দুধ, ডিম, ইলিশ, কাতলা, চিংড়ি কম(<মিঃগ্রাঃ)- আপেল, কালজাম, লেবু, চিচিঙ্গা, ঝিঙ্গা, ধুন্দুল, পটল, লাউ, ভাত, নুডুলস, চা, কফি
খাবারে ফসফরাসের পরিমাণ মিলিগ্রামে (প্রতি ১০০ গ্রামে)	বেশি(>২২০ মিঃগ্রাঃ)-চিড়া, ডাল, গুঁড়াদুধ, ডিমের সাদা অংশ, ইলিশ, কাতলা মাঝারি(১০০-২১৯মিঃগ্রাঃ) রুটি, মুড়ি, বিস্কুট, ডিম, মুরগির মাংস, গরুর মাংস, কাচকি, রুই, চিংড়ি, তেলাপিয়া, পাঙ্গাস কম(<১০০মিঃগ্রাঃ)- আম, আমড়া, আনারস, আপেল, জাম্বুরা, কমলা, নারকেল, পাকাপেপে, তরমুজ, কাঁঠাল, কলা, নাশপাতি, কালজাম, পেয়ারা, বেদানা, মাল্টা, লেবু, কলমিশাক, কচুশাক, পুইশাক, ডাঁটাশাক, পালংশাক, পাটশাক, লাউশাক, আলু, করলা, শসা, কঁচাকলা, কাঁচাপেপে, টমেটো, চিচিঙ্গা, ঝিঙ্গা, ঢেঁড়স, পটল, ফুলকপি, বাঁধাকপি, বেগুন, বরবটি, মিষ্টিকুমড়া, লাউ, শসা, সিম, ভাত, নুডুলস, গরুর দুধ, ডিমের সাদা অংশ, চা, কফি
খাবারের আয়রনের পরিমাণ মিলিগ্রামে (প্রতি ১০০ গ্রামে)	বেশি(>৩.৫ মিঃগ্রাঃ)- কচুশাক পাটশাক চিড়া মুড়ি ডাল ডিমার কুসুম মাঝারি(>২.১মিঃগ্রাঃ)- কলমিশাক ডাঁটাশাক পালংশাক, লালশাক লাউশাক, বরবটি, রুটি, বিস্কুট, ইলিশ, কাচকি, চিংড়ি, গরুর মাংস কম(>০.৭মিঃগ্রাঃ)- আম, আমড়া, আনারস, আপেল, জাম্বুরা, কমলা, নারকেল, পাকাপেপে, তরমুজ, কাঁঠাল, কলা, নাশপাতি, কালজাম, পেয়ারা, বেদানা, মাল্টা, লেবু, পুঁইশাক, আলু, করলা, শসা, কঁচাকলা, কাচাপেপে, টমেটো, চিচিঙ্গা, ঝিঙ্গা, ঢেঁড়স, পটল, ফুলকপি, বাঁধাকপি, বেগুন, মিষ্টিকুমড়া, লাউ, শসা, সিম, ভাত, নুডুলস, গরুর দুধ, ডিম ডিমের সাদা অংশ, গুড়াদুধ, মাছ(রুই কাতলা তেলাপিয়া পাঙ্গাস)

খাবারে সোডিয়ামের পরিমাণ মিলিগ্রামে (প্রতি ১০০ গ্রামে)	বেশি(> ৫০০ মিঃগ্রাঃ) মাঝারি(১২০-৫০০ মিঃগ্রাঃ)-চিংড়ি পোয়ামাছ, ডিম ডিমের সাদা অংশ গুড়াদুধ কনডেন্সড মিল্ক লালশাক কম(<১২০মিঃগ্রাঃ)ছোলার ডাল মাসকলাই ডাল মাছ(ইলিশ পাঙ্গাস তেলাপিয়া রুই কাতলা কাচকি ভেটকি মাগুর শিং মলা সিলভার কার্প টাকি)মুরগির মাংস গরুর মাংস আনারস কাঁঠাল কালজাম কলমিশাক কচুশাক, পুইশাক, ডাঁটাশাক পালংশাক, পাটশাক, লাউশাক, ডাটাশাক ঢেঁড়স ফুলকপি খুব কম (<৩৫মিঃগ্রাঃ) চিঁড়া নুডুলস সাগু মসুরডাল মুগডাল অড়হরডাল মটর টেংরা ডিমের কুসুম আপেল আম বরই শরিফা আতা বাঁধাকপি বেগুন মিষ্টিকুমড়া কাঁচাপেপে টমেটো আলু চিচিঙ্গা ধুন্দুল পটল সোডিয়াম মুক্ত(<৫মিঃগ্রাঃ) ভাত রুটি মুড়ি এরারুট কলা কমলা আমড়া পাকাপেপে নাশপতি তরমুজ পেয়েরা বেদানা করলা লাউ শসা সিম চা কফি
খাবারে ক্যালসিয়ামের পরিমাণ মিলিগ্রামে (প্রতি ১০০ গ্রামে)	বেশি(>২৫০ মিঃগ্রাঃ) মাছ(রুই কাতলা ভেটকি টেংরা শিং)গুড়াদুধ ,কনডেন্সড মিল্ক, গরুর দুধ, লালশাক মাঝারি(১৫০-২৫০মিঃগ্রাঃ)-মাছ(ইলিশ, কাচকি, মলা)মাসকলাই ডাল কম(৭৫-১৪৯মিঃগ্রাঃ)-পাঙ্গাস, টাকি, কলমিশাক, কচুশাক, পুইশাক, ডাঁটাশাক পালংশাক, পাটশাক, লাউশাক, ডাটাশাক, ঢেড়স, কচু, ডিম, রুটি, মুগডাল, মটর খুব কম (<৭৫মিঃগ্রাঃ)-চিঁড়া, নুডুলস, সাগু এরারুট, ডিমের কুসুম, আপেল, আম, বরই, শরিফা, আতা, বাঁধাকপি, বেগুন, মিষ্টিকুমড়া, কাঁচাপেপে, টমেটো, আলু, চিচিঙ্গা, ধুন্দুল, পটল, আমড়া, আনারস, আপেল, জাম্বুরা, কমলা, নারকেল, পাকাপেপে, তরমুজ, কাঁঠাল, কলা, নাশপাতি, কালজাম, পেয়ারা, বেদানা, মাল্টা, লেবু, আঙ্গুর, বরই, জাম্বুরা, বরই, বেগুন, ঝিঙ্গা, করলা, ফুলকপি, সিম, লাউ, কাঁচাকলা, শসা, মাছ(চিংড়ি মাগুর পোয়া সিলভার কার্প) গরুরমাংস, মুরগিরমাংস, ভাত, মুড়ি, মসুরডাল, ছোলারডাল, অড়হর, ডাল, চা, কফি
খাবারে পিউরিনের পরিমাণ মিলিগ্রামে (প্রতি ১০০ গ্রামে)	বেশি(১৫০-৮২৫মিঃগ্রাঃ)- মসুরডাল, মুগডাল, চিংড়ি, কার্প, ফার্মের মুরগির মাংস, রাজহাঁসের মাংস, কলিজা, মগজ, হৃৎপিণ্ড মাঝারি(৫০-১৫০মিঃগ্রাঃ)- কলা, পালংশাক, ফুলকপি, মটরশুঁটি, তিল, বাদাম, হাঁসেরমাংস, মাছের ডিম, গরুরমাংস, দেশী মুরগির মাংস কম(০-৫০মিঃগ্রাঃ)- আপেল, আনারস, আঙ্গুর, কমলা, খেজুর, নাশপতি, বাঙ্গি, আলু, গাজর, টমেটো, বেগুন, বাধাকপি, মিষ্টিকুমড়া, মূলা, শসা, ভাত, রুটি, ডিম, দই, বিভিন্ন ধরনের পানীয়

6. Food exchange list (খাদ্য বিনিময় তালিকা)

নং	খাদ্যের নাম	প্রতি পরিবেশন (গ্রাম/মিলি)	পরিমাপ	কিলোক্যালরি	শর্করা	প্রোটিন	ফ্যাট	ক্যালসিয়াম	ফসফেট	আয়রন	সোডিয়াম	পটাশিয়াম
১	ভাত	৮০	১ কাপ	৯৩	২১	১.৮	০.১	৩	৩৪	.৩	৩	২৯
২	রুটি	৩০	মাঝারি ১ টা	৭০	১৬	১.৯	০.৩	২৯	২২	.৪	৩১	৩১
৩	মুড়ি	৬৫	২ কাপ	৬৫	১৫	১.৫	.০২	৫	৩০	১.৩	২৭	২৩
৪	চিড়া	২০	১/২ কাপ	৬৯	১৫	১.৩	.২	৪	৪৮	৪	২	৩১
৫	ডাল	১৫০	১ কাপ মাঝারি ঘন	৫২	৯	৩.৬	০.১	১০	৪৭	.৯২	৫	৮৪
৬	মুরগীর মাংস	৩০	$১^{১}/_{২}$ x ১ $x^{৩}/_{৪}$	৩৩	০	৬.৮	০.৬	২	৪৯	০.২১	২৪	১১৬
৭	গরুর মাংস	৩০	$১^{১}/_{২}$ x ১ $x^{৩}/_{৪}$	৩৯	০	৬.৯	১.৩	২	৬১	০.৮	১৯	১০৭
৮	ডিম (কুসম সহ)	৫০	১ টা	৭৮	১	৬.৩	৫.৩	২৫	৮৬	০.৬	৬২	৬৩
৯	ডিম (কুসম ছাড়া)	৩৩	১ টা	১৭	০	৩.৫	০	২	৪	০.০১	৫৪	৪৭
১০	দুধ	১২০	১ কাপ	৮০	৫	৩.৮	৪.৯	১৪৪	১০৮	০.২৪	৮৮	১৬৮
১১	রুই	৩০	২" x ২" x ১"	২৯	১	৫	০.৪	১৯৫	৫৩	০.৩	৩০	৮৭
১২	ইলিশ	৩০	২" x ২" x ১"	৮২	১	৬.৫	৫.৮	৫৪	৮৪	০.৬	১৬	৫৫
১৩	পাঙ্গাস	৩০	২" x ২" x ১"	৫১	১	৪.১	৩.৬	২৭	১৫	০.৪	৩১	৫১
১৪	তেলাপিয়া	৩০	২" x ২" x ১"	২৯	০	৬	০.৫	৩	৫১	০.২	১৬	৯১
১৫	কাতলা	৩০	২" x ২" x ১"	৩৩	১	৫.৯	০.৭	১৫৯	৭১	০.৩	১৫	৪৫
১৬	চিংড়ি	৩০	মাঝারি ৬টা	৩২	০	৬.১	০.৫	১৬	৬১	০.৭	৪৫	৫৫
১৭	কাচকি	৩০	$১/_{৪}$ কাপ	২৫	১	৩.৯	০.৬	৫৬	৩.২	০.৩২	২০	২৮
১৮	আম	৩৫	১টির $১/_{৪}$ অংশ	২৬	৬	০.২	০.১	৫	৫.৬	০.৪৬	৯	৭২
১৯	আনারস	৪৫	৩" x ১ "x$১/_{২}$"	২৬	৬	০.৩	০.৩	১১	৩.১	০.৭২	১৯	৫৫
২০	আপেল	৪০	১টির $১/_{৪}$ অংশ	২৪	৫	০.১	০.২	৪	৩.৯	০.০৫	২	৫৫
২১	আমড়া	৩৫	১ টি	২৪	৬	০.৫	০.১	২০	৬.৯	০.০৫	২	৯০
২২	কমলা	৫০	১ টি	২৪	৬	০.৫	০.১	২০	৬.৯	০.০৫	২	৯০
২৩	মাল্টা	৪৫	১টির $১/_{৪}$ অংশ	২২	৫	০.৫	০.২	১৮	৭.৮	০.০৪	০	৮১
২৪	কলা	২৫	মাঝারি ১টা/ ছোট ১টা	২৩	৫	০.৩	০.২	৮	১০	০.১২	১	১১৪
২৫	পেয়ারা	৪০	১টির $১/_{৪}$ অংশ	২২	৫	০.৩	০.২	৮	১০	০.১২	১	৮৭
২৬	তরমুজ	৭৫	৪ " x ২ " x ৩"	২৪	৫	০.৪	০.৪	৬	৬.৯	০.১৩	১	৮৭
২৭	পাকাপেঁপে	৭০	৪ ১/২ " x২"x১"	২২	৫	০.৪	০.৪	১৮	৭.৭	০.১১	৮	৯৩
২৮	কাঁঠাল	৩০	মাঝারি ৩ কোয়া	২৫	৬	০.৫	০.০৪	৪	৩.৩	০.২৮	২৬	৯২
২৯	লেবু	৭০	মাঝারি ১টা	২১	৭	০.৫	০.১	২৩	১৩	০.২৪	১	৭১
৩০	পালংশাক	৭০	$৩/_{৪}$কাপ	২২	৩.৪	৩	০.৩	৯৩	৪৭	১.৫২	৭৫	৫২০
৩১	পাটশাক	৫০	$১/_{২}$ কাপ	২৪	৩.৩	২.১	০.২	৫৩	২৪	৩.৮৪	২৪	৮৯
৩২	লালশাক	৩৫	$১/_{২}$ কাপ	২৪	৩.৩	২.০	০.৩	২১৪	৪৫	১.৮৮	১২৪	১৮৪
৩৩	পুঁইশাক	১০০	$৩/_{৪}$ কাপ	২৩	২.৭	৩.০	০.৭	১২৫	৩৬	১.৪৮	৫৫	২৫৭
৩৪	লাউশাক	১২০	$১/_{২}$ কাপ	২১	১.৩	৩.২	০.৩	১০৭	৩৪	২.৬৮	৪৫	২৭৮
৩৫	কলমিশাক	১০০	$১/_{২}$ কাপ	২৩	৩.৪	১.৮	০.৩	৯৯	৩৩	১.০	৯৭	১৮৭
৩৬	কচু	১৮০	$১/_{২}$ কাপ	২৩	৪.৯	১.৮	০.২	২৬	৬০	১.৩	২	৭০৫
৩৭	শশা	২০০	১ টা	২৪	৫	১.১	০.৩	২৮	৪২	০.৩	৪	২৯৬
৩৮	বরবটি	৫০	$১/_{২}$ কাপ	২১	৪.২	১.০	০	২৫	৩০	০.২	২	১২০
৩৯	বেগুন	২০০	১ কাপ	২৩	৪.১	১.৪	০.১	৯	২৪	০.৩৫	৩।৯	১৮৯

৪০	ঢেঁড়স	১১০	১/২ কাপ	২৩	৩.৫	১.০	০.২	৭৪	২৪	০.২৪	৩২	১৫৪
৪১	ঝিঙ্গা	২৫০	১ কাপ	২২	৪.৫	০.৭	০.১	২৪	৩৪	০.৫	৪	৬৫
৪২	করল্লা	৯০	১/২ কাপ	২১	৩.৬	১.৪	০.২	১৭	৬০	০.৫	২	১৩০
৪৩	মিষ্টিকুমড়া	১২০	১/২ কাপ	২৪	৫.১	০.৬	০.১	১৪	১৩	০.৪	২৭	১২১
৪৪	লাউ	৩০০	১ কাপ	২৪	৫.০	০.৪	০.২	৪০	২০	০.৯	৪	১৭৫
৪৫	পটল	১০০	৩/৪ কাপ	২৩	৪.১	১.২	০.১	১৬	২৭	০.৩	২৭	১৪০
৪৬	কাঁচা পেঁপে	১০০	১ কাপ	২১	৪.৫	০.৬	০.২	২২	৩২	০.৭	১৮	১৭০
৪৭	কাঁচা কলা	২০	১ টি	২২	৫.৭	০.২	০.০৪	১	৬	০.১	১	৮০
৪৮	চিচিঙ্গা	১২০	১/২ কাপ	২২	৪	০.৬	০.৪	৩২	২৪	১.৮	৩১	৪২
৪৯	বাঁধাকপি	৫০	৩/৪ কাপ	২১	৪.৪	১.২	০.২	৩৮	১৯	০.৪৮	১৫	২০০
৫০	ফুলকপি	৮০	১/২ কাপ	২১	২.৯	১.৯	০.৩	২৪	৪১	০.৯	৩৮	৯৯
৫১	শিম	৬০	৩/৪ কাপ	২১	৪.৮	১.২	০.২	২৮	২৪	০.৮	২	১৮০
৫২	টমেটো	৮০	৩/৪ কাপ	২৩	৫.০	০.৯	০	৫	২৬	১	১০	২৪০
৫৩	আলু	২৫	১/৩ কাপ	২২	৪.৪	০.৬	০.২	২	১২	০.১	৩	১০৭
৫৪	বিস্কুট	২০	৮ টি	৮৫	১৫	১	৩	২৪	১৭	০.৪২	৮২	২৮
৫৫	নুডুলস	১০০	১০০	৬২	১৩	২.২	০.৫	৫	৩১	০.৩০	১৫	২৩
৫৬	রং চা	১২০	১২০	১	০.৪	০	০	০	১	০.০৩	৪	৪৫
৫৭	দুধ চা	১২০	১২০	৩১	২.২	১.৪	১.৯	৫৪	৪১	০.১১	৩৫	৯১
৫৮	কফি	১২০	১২০	৪২	২.৯	২.০	২.৫	৭৩	৫৫	০.১৫	৪৫	১১৬

7. Photograph of some foods

1. Bakorkhani

2. Paratha

3. Bread

4. Puffed rice

5. Chicken

6. Tengra fish

7. Bele fish

8. Bata fish

9. Banana

10. Guava

11. Bitter gourd

12. Red amaranth