# ɴPAKISTAN JOURNAL OF
# ɴUTRITION

# Pattern of Dietary Intake among Newly Diagnosed Type 2 Diabetic Subjects with Hypercholesterolemia

Shirin Jahan Mumu[1], Farzana Saleh[2], Fadia Afnan[2], Afroza Akhter[1] and Kazi Rumana Ahmed[3]
[1]Department of Epidemiology and Biostatistics,
Bangladesh Institute of Health Sciences, Dhaka 1207, Bangladesh
[2]Department of Community Nutrition, Bangladesh Institute of Health Sciences, Dhaka 1207, Bangladesh
[3]Department of Health Education and Health Promotion, Bangladesh Institute of Health Sciences,
Dhaka 1207, Bangladesh

**Abstract:** Understanding the pattern of dietary intake of the diabetic subjects with hypercholesterolemia may help to develop specific intervention for this group of subjects. The aim of this study was to assess the dietary intake of Bangladeshi type 2 diabetic subjects with hypercholesterolemia. It was a descriptive cross-sectional survey. One hundred eleven newly diagnosed type 2 diabetic subjects (male 61%, female 39%, age 45±9 years, BMI 24±4.8 Kg/m$^2$, mean ±SD) with hypercholesterolemia (fasting plasma total cholesterol >200 mg/dl) were selected from the Out-Patient Department of BIRDEM by purposive sampling method. The daily intake of macro- and micro-nutrients was assessed by 24 h recall method and seven-day food frequency questionnaire was used for identifying the dietary sources. Average total energy intake was 1300 kcal/day and total carbohydrate, protein and fat consumption was 216.63 g/day, 57.19 g/day and 42.59 g/day respectively. Total fat consumption was 29.3% of total energy intake, with saturated fatty acid 5%, monounsaturated fatty acid 11.51% and polyunsaturated fatty acid 9.71% of total energy. Dietary cholesterol intake was 96.31 mg/day. Total intake of fat, saturated fatty acid and cholesterol were higher compared to MUFA, PUFA and fiber intake. About 9% of patients did not include vegetables for a single time in their meal and dietary fiber intake was very low (4 g/day). Based on these preliminary findings, it may be suggested that active and effective dietary intervention is essential for preventing diabetes and hypercholesterolemia.

**Key words:** Dietary pattern, diabetes, type 2 diabetes, hypercholesterolemia

## INTRODUCTION
The numbers of diabetic patients are increasing disproportionately in developing countries due to rapid transition from traditional life style to a westernized and urbanized culture. Hypercholesterolemia appears to be a very important component of the accelerated atherogenesis and cardiovascular disease that occurs in patients with diabetes. The relationship between type 2 diabetes mellitus and dietary intake and physical activity has been examined in some studies (Le *et al.*, 2005). In several dietary intervention studies recommended that nutrition therapy and lifestyle changes as the initial treatment for dyslipidemia (Marian *et al.*, 2002). Three published studies from a large randomized trial found that dietary interventions with prepared meal plans led to weight loss, improvements in blood lipid and glucose profiles and other indicators of risk for cardiovascular disease, diabetes and other chronic conditions (Marian *et al.*, 2002). Dietary pattern of the study subjects are strongly related with blood lipids levels, as well as with the prevalence and the management of dyslipidemia (Denke, 1995; Trichopoulou *et al.*, 1995; De Lorgeril *et al.*, 1999; Pitsavos *et al.*, 2002 and Trichopoulou *et al.*, 2003). Reduction of saturated fat intake (<7% of total energy

intake) and cholesterol intake (<200 mg/day) are strongly recommended for diabetic patients (ADA, 2007 and NCEP, 2002). Monounsaturated and polyunsaturated fatty acids lower LDL cholesterol levels when substituted for saturated fatty acid in the diet. Intervention studies showed that high carbohydrate and high monounsaturated fat diets improved insulin sensitivity and glucose disposal (Rudel *et al.*, 1995). Dietary measures comprise the first line intervention for control of dyslipidemia in diabetic subjects. Understanding dietary pattern of the diabetic subjects with hypercholesterolemia may help to develop specific intervention for this group of subjects. The aim of this study was to assess the dietary pattern in newly diagnosed type 2 Bangladeshi diabetic subjects.

## MATERIALS AND METHODS
**Subjects and methods:** One hundred and eleven type 2 diabetic subjects (male 61%, female 39%, age 45±9 years, mean ±SD) with hypercholesterolemia (fasting serum total cholesterol >200 mg/dl[7]) were recruited from the Out-Patient Departments of a central hospital of DAB. It was a descriptive cross sectional survey and purposive sampling method was used for selection of subjects. Detailed socioeconomic and anthropometry

data of the study subjects were recorded. A biochemical report of the patients was collected from the patient guidebook.

**Dietary assessment:** The daily intake of macro and micronutrients was assessed by 24-h recall method. Seven day food frequency questionnaire was used for identifying the dietary sources. Nutrient composition of different food items was taken from the nutrient composition table of Helen Keller International, US Department of Agriculture and USDA Home and Garden Bulletin No. 72 and The Tables for East Asian Foods of the FAO of the United Nations Organization. There are 42 food items that patients had taken during the study period. From these food items 35 items were used to calculate fatty acid intake. This was due to the unavailability of the data.

**Data editing and statistical analysis:** Data editing was carried out by checking and verifying the completed questionnaire at the end of interview and also at the end of the whole survey and before analysis. The data analysis was done by using Statistical Package for Social Science (SPSS) (Windows version 10.0).

## RESULTS

A total of 111 newly diagnosed type 2 diabetic subjects with hypercholesterolemia were included in this study. The characteristics of the study subjects are displayed in Table 1. Age (mean±SD) of the study subjects was 45±8.66 and among them 68 were male and 43 were female. Body Mass Index (BMI) and Total Cholesterol (TC) of the study subjects was (mean±SD) 24.28±3.17 and 231.36±29.40 respectively.

Table 2 describes the frequency of weekly consumption of different types of food items. About 20% subjects consumed egg 7 or more time and 73% subjects' intake beef 1-3 times in a week. On the other hand 9% subjects did not take green vegetables in a week.

At diagnosis average total energy intake was 1300 kcal/day and total carbohydrate, protein and fat

Table 1: Characteristics of the study subjects (n = 111)

| Variables | |
|---|---|
| Age | 45.49±8.66 |
| Sex | |
| Male | 68 (61%) |
| Female | 43 (39%) |
| Height (cm) | 159.44±8.57 |
| Weight (Kg) | 61.67±8.87 |
| BMI (Kg/m$^2$) | 24.28±3.17 |
| SBP | 122.47±15.65 |
| DBP | 80.15±9.74 |
| FSG (mmol/l) | 9.29±3.72 |
| TC (mg/dl) | 231.36±29.40 |

Results are expressed as Number (%), mean±SD. SBP=Systolic blood pressure, DBP = Diastolic blood pressure, FSG = Fasting blood glucose, TC = Total cholesterol

Table 2: Weekly consumption of food items (n = 111)

| | Frequency of consumption, time per week | | | |
|---|---|---|---|---|
| | -------------------- Number (Percentage) ---------------------- | | | |
| Food items | 0 (%) | 1-3 (%) | 4-6 (%) | 7 or more (%) |
| Egg | 14 (12.6) | 60 (54.1) | 13 (11.7) | 24 (21.6) |
| Egg yolk | 29 (26.1) | 51 (45.9) | 11 (9.9) | 20 (18) |
| Egg white | 20 (18) | 54 (48.6) | 13 (11.7) | 24 (21.6) |
| Fish | 6 (5.4) | 50 (45) | 15 (13.5) | 40 (36) |
| Beef | 26 (23.4) | 81 (73) | 4 (3.6) | |
| Chicken | 9 (8.1) | 94 (84.7) | 8 (7.2) | |
| Milk fat | 96 (86.5) | 11 (9.9) | 2 (1.8) | 2 (1.8) |
| Butter | 104 (93.7) | 3 (2.7) | | 4 (3.6) |
| Green vegetable | 10 (9) | 35 (31.5) | 17 (15.3) | 49 (44.1) |
| Sweet fruit | 15 (13.5) | 52 (46.8) | 26 (23.4) | 18 (16.2) |
| Leafy vegetable | 13 (11.7) | 11 (9.9) | 15 (13.5) | 72 (64.9) |
| Shrimp | 67 (60.4) | 39 (35.1) | 4 (3.6) | 1 (0.9) |

Table 3: Macro and micronutrient intake of the study subjects (n = 111)

| Variables | |
|---|---|
| Energy (g/day) | 1301.27 (1000-2835.54) |
| CHO (g/day) | 216.63±57.47 |
| Protein (g/day) | 57.19±15.85 |
| Fat (g/day) | 42.59±13.17 |
| Fiber (g/day) | 4.08 (0.27-18.81) |
| Calcium (mg/day) | 336.08 (73.78-1948.16) |
| Iron (mg/day) | 23.87 (0.60-70.37) |
| Thiamine (mg/day) | 1.29 (0.12-3.18) |
| Riboflavin (mg/day) | 0.84 (0.0-2.20) |
| Vit-C (mg/day) | 82.31 (1.95-683.50) |
| Retinol (mg/day) | 1215.93 (66.79-25528.90) |

Results are expressed as mean±SD and median (range)

consumption was 216 g/day, 57.19 g/day and 42.59 g/day respectively. The average daily intake of selected nutrients by the subjects was shown in Table 3.

Significantly higher intakes of first class protein (p<0.04) were observed in male compared to female subjects (Table 4). Total fat consumption was 29.3% of total energy intake, with polyunsaturated fatty acid 9.71%, monounsaturated fatty acid 11.51% and saturated fatty acid 5% of total energy. Dietary cholesterol intake was 96.31mg/day. The average daily intake of different fatty acids by the subjects was shown in Table 5.

The percentage of subjects that met the guideline (ADA, 2007 and NCEP, 2002) regarding total fat intake (≤30% of total energy intake) was 60.4% and the percentage of subjects that consumed more than 35% of energy intake by total fat was 25.2%. Similarly, 82.9% subject subjects consumed less than 7% of energy by saturated fatty acid and 13.5% and 3.6% subjects consumed 10% and 12% of energy by saturated fatty acid respectively. About 77% subjects met the recommended cholesterol intake (<200 mg/day) and 11.7% took more than 300 mg/day. More than half percent of subjects consumed less than 9% energy of polyunsaturated fatty acid (Table 6).

## DISCUSSION

Diabetic hypercholesterolemia is an important cause of accelerated atherogenesis and cardiovascular diseases

Table 4: First and Second class protein intake of the study subjects (n = 111)

| Variables | Male (n = 68) | Female (n = 43) | Total (n = 111) | t/p |
|---|---|---|---|---|
| First class protein (g/day) | 21.94 (0.00-119.13) | 8.30 (0.00-88.00) | 17.40 (0.00-119.13) | 2.1/0.04 |
| Second class protein (g/day) | 35.46 (0.00-94.31) | 30.82 (0.00-81.68) | 33.87 (0.00-94.31) | 1.4/0.13 |

Results are expressed as median (range)

Table 5: Fatty acid intake of the study subjects (n = 111)

| Variables | |
|---|---|
| Total fat (g/day) | 41.99±12.63 |
| (% of energy) | (29.3) |
| Polyunsaturated fatty acids (g/day) | 13.84±4.27 |
| (% of energy) | (9.71) |
| Monounsaturated fatty acids (g/day) | 16.38±4.97 |
| (% of energy) | (11.51) |
| Saturated fatty acids (g/day) | 7.69±2.83 |
| (% of energy) | (5.31) |
| Cholesterol (mg/day) | 96.31   (0.0-2101.34) |
| (% of energy) | (134.71) |

Results are expressed as mean ±SD and median (range)

Table 6: Proportion of subjects that meet recommendations for the consumption of fat (n = 111)

| | Subjects Number (%) | Recommended consumption of fat* |
|---|---|---|
| Total fat | | |
| ≤30 En% | 67 (60.4) | <30 En% |
| ≤35 En% | 16 (14.4) | |
| ≥35 En% | 28 (25.2) | |
| Saturated fat | | |
| ≤7 En% | 92 (82.9) | <7 En% |
| ≤10 En% | 15 (13.5) | |
| ≤12 En% | 4 (3.6) | |
| Polyunsaturated fat | | |
| ≤9 En% | 57 (51.4) | ~10 En% |
| 9-11 En% | 22 (19.8) | |
| ≥11 En% | 32 (28.8) | |
| Monounsaturated fat | | |
| ≤9 En% | 38 (34.2) | NSR |
| 9-11 En% | 23 (20.7) | |
| ≥11 En% | 50 (45) | |
| Cholesterol | | |
| ≤200 mg/day | 86 (77.5) | 200 mg/day |
| ≤300 mg/day | 12 (10.8) | |
| ≥300 mg/day | 13 (11.7) | |

*American Diabetes Association, 2007. NSR = No Specific Recommendation. En% = % of energy intake

in patients with diabetes. This type of hypercholesterolemia is characterized by high levels of triglycerides (hypertriglycerides), high levels of small LDL particles and low levels of HDL. Dietary pattern of the diabetic subjects with hypercholesterolemia may help to develop specific intervention for this group of subjects. The aim of the study was to assess the dietary practices in newly diagnosed type 2 diabetic subjects with hypercholesterolemia.

Dietary intake appears to be one of the most important factors related to diabetes (Van Dam *et al.*, 2002a; Feskens *et al.*, 1995). Very limited data exists on the dietary pattern of people with diabetes in Bangladesh. The daily energy intake {median (range)} of the subjects
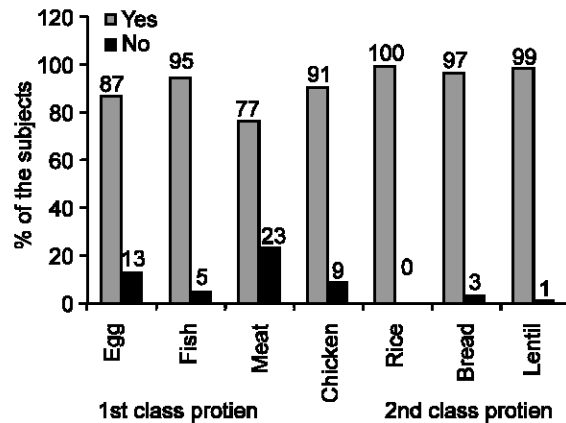


Fig 1:  Intake of First and Second class protein by the study subjects

was 1301 (1000-2835) kcal. The intake of carbohydrate, protein and fat were 216±57, 57±16 and 42±13 g/day respectively. Daily carbohydrate intake was higher than the recommended value (up to 50% of total daily energy intake) in 99% subjects. The present study also showed that animal protein intake was lower compared to second class protein. In comparison with Vietnamese studies (Le *et al.*, 2005) animal protein intake was lower in present study. Moreover, more than 70% subjects met 15-20% energy from total protein in the study.

The development of diabetes is associated with unfavorable intake of total fat and saturated fat (Harding *et al.*, 2001; Hu *et al.*, 2001 and Salmeron *et al.*, 2001). In this study about 40% subjects intake >30% energy from total fat and more than 10% subjects intake >10% energy from saturated fat. According to ADA, saturated fat should be limited in <7% of total energy for diabetic patient (ADA, 2007). A study conducted by Van Dam *et al.* (2002b) found that there was modest increase in risk of type 2 diabetes with a higher intake of saturated fat. For diabetic patient cholesterol intake should minimize in 200 mg/day (ADA, 2007). In this study, >20% of patients consumed cholesterol 300 mg/day. Similar result was found in a study conducted by Larr *et al.* (2004) where unfavorable fat consumption was found in newly diagnosed type 2 diabetic subjects.

In this study mean percentage of MUFA and PUFA intake was 11.51% and 9% of total energy. More than half of the subjects did not intake the recommended intake (NCEP, 2002) of MUFA and PUFA. Kris-Etherton *et al.* (1999) showed that high MUFA diets lowered total cholesterol by 10% and LDL cholesterol by 14%.

In this study about 9% of patients did not include vegetables for a single time in their meal and dietary fiber intake was very low (4g/day). Chandelia *et al.* (2000) showed that high fiber diet reduced total triglyceride and LDL-cholesterol and can help to achieve the glycemic control. Individuals at high risk for type 2 diabetes are encouraged to achieve the recommendation of dietary fiber of 14 gm fiber/1000 Kcal (ADA, 2007).

In present study total intake of fat, saturated fatty acid and cholesterol were higher compared to MUFA, PUFA and fiber intake. A healthy lifestyle that includes physical activity, moderate intake of fat, carbohydrate, increasing intake of fiber seems to be helpful in the prevention of diabetes and hypercholesterolemia in general population and also to prevent further complications in diabetic subjects. Based on these preliminary findings, we may suggest that active and effective dietary intervention is essential for preventing diabetes and hypercholesterolemia.

## REFERENCES

American Diabetic Association (ADA), 2007. Nutrition recommendations and interventions for diabetes. Diabetes Care, 30: 48S-65S.

Chandelia, M.U., L. Abhimany, K. Dieter, M. Bergmann, M. Scott, Grundy and Brinkley, 2000. Beneficial effects of high dietary fiber intake in patients with type 2 diabetes. New Eng. J. Med., 342: 1392-1398.

De Lorgeril, M., P. Salen, J-L. Martin, I. Monjaud, J. Delaye and N. Mamelle, 1999. Mediterranean diet, traditional risk factors and the rate of cardiovascular complications after myocardial infarction. Final report of the Lyon Diet Heart Study. Circulation, 99: 779-785.

Denke, M., 1995. Cholesterol lowering diets. A review of evidence. Arch Int. Med., 155: 17-26.

Feskens, E.J.M., S.M. Virtanen, L. Rasanen, J. Tuomlilehto, J. Stengard, J. Pekkanen, A. Nissinen, and D. Kromhout, 1995. Dietary factors determining diabetes and impaired glucose tolerance: A 20-year follow-up of the Finish and Dutch cohorts of the seven countries study. Diabetes Care, 18: 1104-1110.

Harding, A.H., L.A. Sargeant and A. Welch, 2001. Fat consumption and HbA (1c) levels: the EPIC-Norfolk study. Diabetes Care, 24: 1911-1916.

Hu, F.B., J.E. Manson and M.J. Stampfer, 2001. Diet, lifestyle and the risk of type 2 diabetes mellitus in women. N. Engl. J. Med., 345: 790-797.

Kris-Etherton, P.M., T.A. Pearson, Y. Wan, R.L. Hargrove, K. Moriarty and V. Fishell, 1999. High-monounsaturated fatty acid diets lower both plasma cholesterol and triacylglycerol concentrations. Am. J. Clin. Nutr., 70: 1009-1015.

Larr, F.A.V.D., E.H.V.D. Lisdonk and P.L.B.J. Lucassen, 2004. Fat intake in patients newly diagnosed with type 2 diabetes: a 4-year follow-up study in general practice. Br. J. Clin. Pract., 54: 177-182.

Le Nguyen Trung Duc Son, Tran Thi Minh Hanh, Kaoru Kusama, Daisuke Kunii, Tohru Sakai, Nguyen Thi Kim Hung and Shigeru Yamamoto, 2005. Anthropometric characteristics, dietary patterns and risk of type 2 diabetes mellitus in Vietnam. J. Am. College Nutr., 24: 229-234.

Marian, L.N., L.M. Debra, R.K. Alan, J.B. Matt and J.C. Lawrence, 2002. Diet and exercise habits of patients with diabetes, dyslipidemia, cardiovascular disease or hypertension. J. Am. Coll. Nutr., 21: 394-401.

National Cholesterol Education Program (NCEP), 2002. Third report of the Expert Panel on Detection, Evaluation and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III). National Heart, Lung and Blood Institute, 2002. (NIH publication no. 02-5215).

Pitsavos, C., D.B. Panagiotakos, C. Chrysohoou, J. Skoumas, I. Papaioannou, C. Stefanadis and P. Toutouzas, 2002. The effect of Mediterranean diet on the risk of the development of acute coronary syndromes in hypercholesterolemic people: a case-control study (CARDIO2000). Coron Artery Dis, 13: 295-300.

Rudel, L.L., J.S. Parks and J.K. Sawyer, 1995. Compared with dietary monounsaturated and saturated fat, polyunsaturated fat protects African green monkeys from coronary artery atherosclerosis. Arterioscler Thromb Vasc Biol, 97 (suppl 7): S82-S87.

Salmeron, J., F.B. Hu and J.E. Manson, 2001. Dietary fat intake and risk of type 2 diabetes in women. Am. J. Clin. Nutr., 73: 1019-1026.

Trichopoulou, A., T. Costacou, C. Bamia and D. Trichopoulos, 2003. Adherence to a Mediterranean diet and survival in a Greek population. N. Engl. J. Med., 348: 2599-2608.

Trichopoulou, A., A. Kouris-Blazos, M. Wahlqvist, C. Gnardellis, P. Lagiou, E. Polychronopoulos, T. Vassilakou, L. Lipworth and D. Trichopoulos, 1995. Diet and overall survival in elderly people. Br. Med. J., 311: 1457-1460.

Van Dam, R.M., E.B. Rimm, W.C. Willet, M.J. Stampfer and F.B. Hu, 2002a. Dietary fat and meat intake in relation to risk of type 2 diabetes in men. Diabetes Care, 25: 417-424.

Van Dam, R.M., E.B. Rimm, W.C. Willet, M.J. Stampfer and F.B. Hu, 2002b. Dietary patterns and risk for type 2 diabetes mellitus in U.S. men. Annu. Int. Med., 136: 201-209.