Urban diabetes: a cross-sectional study in a ward of Dhaka metropolitan city

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Abstract

A cross-sectional study was conducted among the inhabitants of the Ward 27 (Bashaboo) of Dhaka Metropolitan City. Out of 52000 people (+20 years, according to the voter list), a total of 450 subjects were selected for interview by purposive sampling. Subjects were categorized as nondiabetic, NDM (n=166) and diabetic, DM (n= 284) groups. The DM group was further categorized after data collection into previously diagnosed diabetes mellitus, DMPD (n= 117) and newly diagnosed diabetes mellitus, DMND (167). Sociodemogrphic, clinical, anthropometric, biochemical, and dietary data were collected using standardized protocols. The findings showed that majority of the respondents were female (60.3%) and belonged to middle income group (Tk 5000-14999) (62.4%). The main clinical complications of the respondents were hypertension (DMPD=26% and DMND=21%), vertigo (DMPD=22% and DMND=27%), joint pain (DMPD=22% and DMND=21%), back pain (DMPD=18% and DMND=20%) and cataract (DMPD=12% and DMND=12%). The level of plasma triglyceride, plasma cholesterol and urine μ-albumin were significantly higher among the newly diagnosed DM subjects. The group of middle aged and middle income subjects had significantly higher level of these parameters. The data, therefore, indicate that diabetic related complications among DMND subjects were relatively higher compared to DMPD subjects thus pointing to the notion of a positive effect of a controlled life-style among DMPD patients as per the medication guideline.

Key Word: Urban diabetes mellitus, Diabetes morbidity, Sedentary life

Introduction

Diabetes mellitus (DM) is closely linked to diet and nutrition with respect to its causation and management[1,2]. Being a global health problem, DM afflicts large numbers of people of all social condition throughout the world. With increasing global trend of urbanization DM prevalence is going up day by day in urban area of Bangladesh too.

Some population-based studies conducted in Bangladesh at different time points have revealed an increasing trend of diabetes prevalence ranging from 1.5 to 3.8% in the rural communities[3-5] though urban population has been found higher trend of DM compared to rural communities. Since, the focus in these surveys was not designed exclusively for the urban middle class, a large portion of urban middle to poor neighborhood remained unstudied. These populations by themselves remained undiagnosed due to lack of proper health consciousness and ignorance.

On the other hand, in South-East Asia, only a few small-scale studies have been conducted to evaluate the long term complications of type-2 diabetes mellitus (T2DM). A previous study conducted in Bangladesh revealed that, every 2nd T2DM patient has hypertension, every 3rd has BMI>25, more than every 4th patient has retinopathy, every 5th has nephropathy and every 6th has neuropathy, all of which are significantly related to poor control of glycaemia and blood pressure[6].

Several studies revealed that disease morbidity and mortality are inversely related with socio-economic status[7,8]. The purpose of this study was to investigate the prevalence of DM and DM-related health morbidity in urban middle to poor population by cross-sectional survey method.

Methods and materials

Study population: The study was carried out in Ward 27 (Bashaboo), eastern area of Dhaka Metropolitan City. The ward is mainly dwelled by middle to poor income groups along with several slum areas. The

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study area has a population of 52,000 over the age of 20 years according to local voter list.

Sample selection criteria: People who came to the Ward Community Field Clinics with physical and clinical complications were included in the study provided they had their names in the voter list of the ward. Physicians clinically examined them and recommended for inclusion.

Sample size and sampling: With the desired precision of 0.05, statistical confidence level of 95% (Z= 1.96) and expected prevalence of 0.5, the sample size was calculated with the formula, $n=Z^2pq/d^2$. A total 450 subjects were selected for interview by purposive sampling i.e., subjects who came to the community clinic and scrutinized to match the selection criteria were including in the study after receiving a duly signed consent letter.

Data collection: A structured questionnaire which was validated in a pilot study in a different area of the city. The study variables are socio-demographic (Sex, Age, Occupation, Education, Income per month), anthropometric (Ht. Wt, BMI, Hip-waist ratio), biochemical (Fasting glucose, Postprandial glucose, Lipid profiles, Urinary μ-albumin), clinical (Blood pressure, CHD, Obesity), dietary (Energy-yielding nutrients, Diabetes-related nutrients, Food groups).

Based on fasting plasma glucose (FPG), the participants were classified into two groups. Those with FPG ≤ 6.0 mmol/L were considered as normal serum glucose tolerance (NGT) subjects and those with FPG>6.0 mmol/L were considered as abnormal glucose tolerance (AGT) subjects. All DM subjects identified were tested further with oral glucose tolerance (OGT) test according to WHO criteria[9]. Subjects were categorized as non-diabetes mellitus, NDM (n=166) and diabetes mellitus, DM (n=284) groups. After data collection, DM group was further categorized into DM previously diagnosed, DMPD (n= 117) and DM newly diagnosed, DMND (n=167).

Blood pressure was measured thrice and taking the mean to rule out hypertension among the study subjects. Who were taking antihypertensive drug was taken as hypertensive subjects. Serum and urine samples were collected by a standard protocol for biochemical analysis. Plasma glucose was measured by glucose oxidase–peroxidase method using Technicon M-II auto analyzer. To measure total lipid profile of blood[10], Cholesterol, TG and HDL-cholesterol were estimated by Hitachi-704 auto-analyzer using enzymatic method[11]. When the measurements of total Cholesterol, HDL-cholesterol and TG (<400mg/dl) were available, the value of LDL-cholesterol was calculated as: LDL-cholesterol = Total Cholesterol – (HDL-cholesterol + TG/5). Urine μ-albuminuria was tested by enzymatic method. All biochemical examination was done at the Immunology department of BIRDEM.

Individual anthropometric data was recorded meticulously for each subject. The nutritional status of the subjects was determined on their body mass index (BMI) into three categories according to WHO (1995)[12] classification. On the other hand, Physical Activity Level (PAL) of the DM respondents was determined from the day-to-day activity description of each individual subject recorded in the questionnaire for three consecutive days. To calculate the PAL value of the subjects, their day-to-day activity values in terms of energy cost were taken from FAO/WHO/UNU 2001[13] Report. All activity values were summed up to get the PAL of an individual subject. Finally data was analyzed by a SPSS software package[14] (SPSS Inc.)

Results

Screening of DM: Subjects were screened according to the plasma glucose level along with the clinical sign and symptoms of DM. Out of 450 respondents, 284 subjects were found diabetic (Table 1) off which 167 were newly diagnosed and 117 were previously diagnosed subjects. It also showed that plasma postprandial glucose load was higher among the DMPD subjects. Percentage of the subjects with weight loss and general weakness were almost similar. While the data in Table 2 showed that DM is a disease of post forties among the studied population.

Table 1: Major and minor screening parameters for DM and NDM

Parameters	NDM		DMPD		DMND	
Major index	**% (count)**	**P. Level**	**% (count)**	**P. Level**	**% (count)**	**P. Level**
Fasting plasma glucose (mmol/ dl)	37 (166)	**4.7 ± 0.6**	26 (117)	**8.3 ± 3.0**	37 (167)	**8.1 ± 3.0**
Postprandial plasma glucose (mmol/ dl)	-	-	26 (117)	11.5 ± 3	37 (167)	10.8± 4
Minor index present	**% (count)**		**% (count)**		**% (count)**	
Polyuria	9.1 (15)		43.3 (51)		37.7 (63)	
Polydipsia	18.2 (30)		47.8 (55)		46.7 (78)	
Polyphagia	10.6 (18)		22.4 (26)		28.7 (48)	
Weight loss	24.2 (40)		31.3 (37)		36.5 (61)	
General weakness	65.2 (108)		80.6 (94)		76.0 (127)	

NDM, No Diabetes Mellitus; DMPD, Diabetes Mellitus previously diagnosed; DMND, Diabetes Mellitus newly diagnosed

Table 2: Age-wise frequency distribution of NDM and DM

Age range	Glucose Level ≤ 6.00 mmol/dl, Non-Diabetic, % (count)	Glucose Level ≥ 6.00 mmol/dl Diabetic, % (count)
20-39 Yrs	59.0 (98)	22.2 (64)
40-59 Yrs	28.9 (48)	55.1 (157)
60 ≥ Yrs	12.1 (20)	22.7 (63)
Total	100 (166)	100 (284)

Table 3: Frequency distribution of DM subjects by socio-demographic profile (n=284)

Characters	DMPD* (n= 117)	DMND* (n=167)	Total
Sex			
Male	40.2 (47)	39.5 (66)	39.7 (113)
Female	59.8 (70)	60.5 (101)	60.3 (171)
Age			
20-39 Yrs	6.0 (7)	28.7 (48)	22.2 (55)
40-59 Yrs	70.1 (82)	49.1 (82)	55.1 (164)
60+ Yrs	23.9 (28)	22.2 (37)	22.6 (53)
Level of education			
Illiterate	10.3 (12)	15.6 (28)	14.1 (40)
Primary	29.9 (35)	20.4 (34)	23.1 (69)
Secondary &	32.5 (38)	38.3 (64)	18.3 (86)
≥ Secondary	26.5 (31)	25.7 (43)	26.1 (74)
Occupation			
Retired	9.3 (11)	13.8 (23)	12.4 (34)
Business	19.6 (23)	11.4 (19)	13.7 (42)
Service	16.1 (19)	22.2 (37)	6.8 (56)
Labour	7.4 (9)	1.8 (3)	2.0 (12)
Student	-	2.4 (4)	2.4 (4)
Household activities	47.6 (56)	48.5 (81)	48.3 (137)
Monthly family income			
Tk 1000-4999	14.5 (17)	15.0 (25)	14.8 (42)
Tk 5000-14999	61.5 (72)	62.9 (105)	62.4 (177)
Tk 15000^{+}	23.9 (28)	22.2 (37)	22.6 (65)

DMPD = Diabetes Mellitus of previously diagnosed; DMND = Diabetes Mellitus of newly diagnosed

Socio-demographics: Table 3 shows all the socio-demographic characteristics of the DM subjects only in terms of percentage distribution in parentheses. Near about 50% of the respondents were found to be engaged in household activities because majority of them (60.3%) were female subjects. According to monthly family income, the middle income group was dominant (Table 3).

Diabetes related morbidity: The diabetes exposure among diabetic subjects generates a number of other clinical complications which intern aggravates the diabetic complications further. Figure 1 showed some of these clinical complications of the study subjects. Vertigo and back pain were cited by higher percentage of DMND subjects.

Plasma and urine analysis for biochemical parameters showed (Table 4) that majority of the diabetic subjects showed normal level of the analyzed biochemical markers except blood sugar. However, the level of plasma triglyceride, plasma cholesterol and urine μ-albumin were significantly higher among the newly diagnosed DM subjects.

Nutritional status: The nutritional status of the subjects was determined by their body mass index (BMI) into three categories according to WHO (1995)[12] classification (Figure 2). The figure showed that most of the over weight subjects was suffering from diabetes. About 45% DMPD and 40% DMND subjects was found to be overweight. Similarly the tendency of underweight subjects to become diabetic was found lower (11% and 7%).

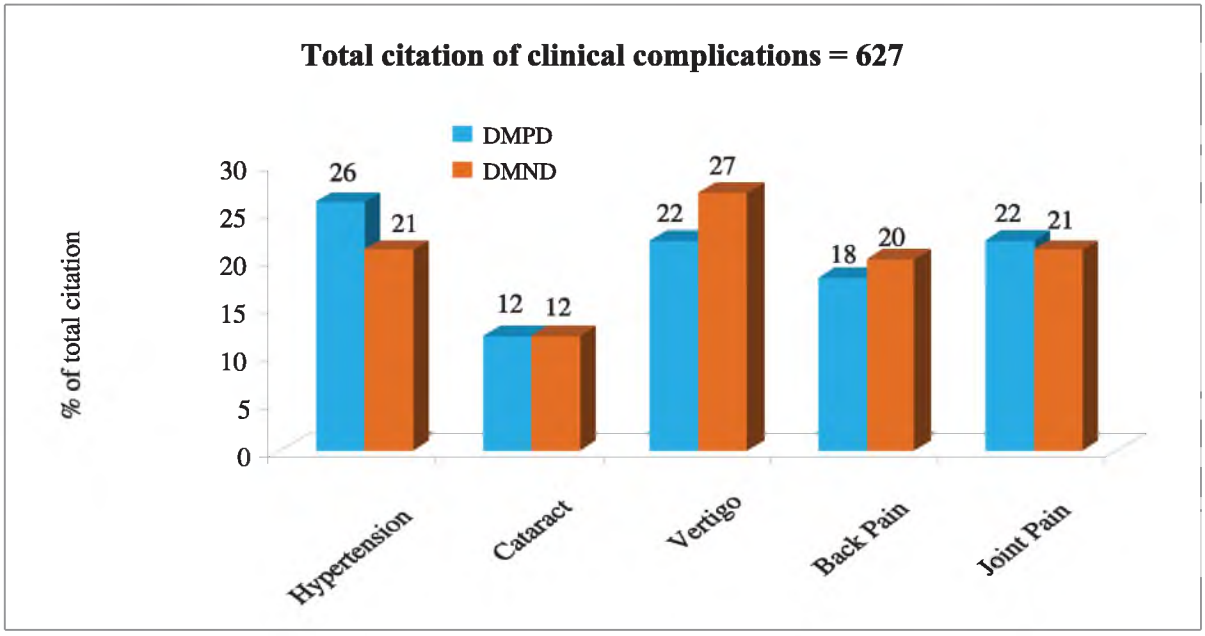

Figure 1: Clinical complication (% of citation) among DM subjects (n=284).

Table 4: Distribution of DM subjects by biochemical parameters (n=284)

Parameters	Subjects with normal level		Subjects with risk level	
	%(count)	S. Value	%(count)	S. Value
S. Triglyceride (g/dl)	55.1 (157)	150 mg/dl	44.9 (127)	>150 mg/dl
S. Cholesterol, total (g/dl)	63.7 (181)	200 mg/dl	36.3 (103)	>200 mg/dl
S HDL-cholesterol (g/dl)	81.6 (232)	40 mg/dl	18.4 (52)	<40 mg/dl
S LDL-cholesterol (g/dl)	78.2 (222)	150 mg/dl	21.8 (62)	>150mg/dl
U μ-albumin (mg/l)	86.3 (244)	0-30 mg/L	13.7 (40)	>0-30 mg/L

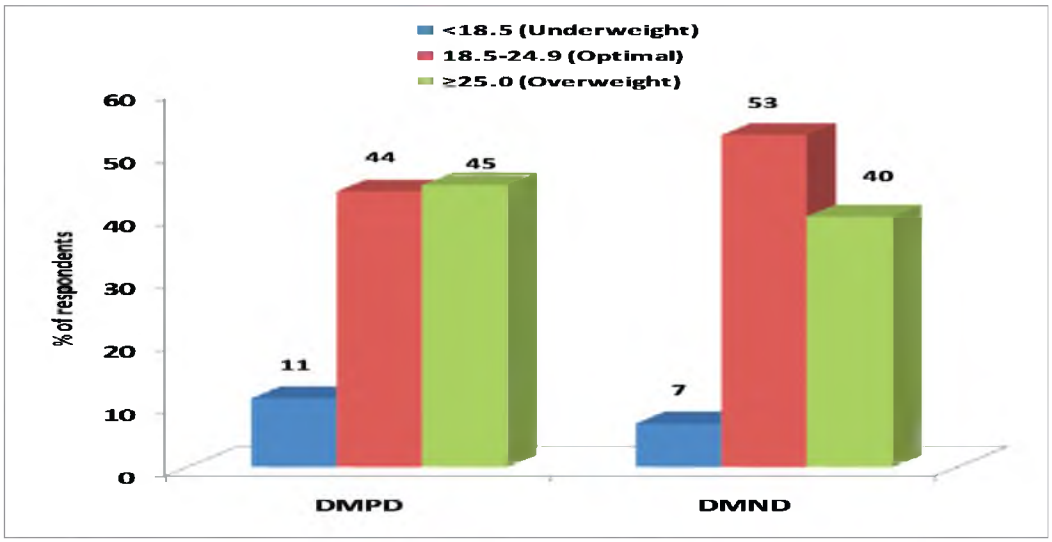

Figure 2: Nutritional status DM subjects by their BMI percentages (n= 284).

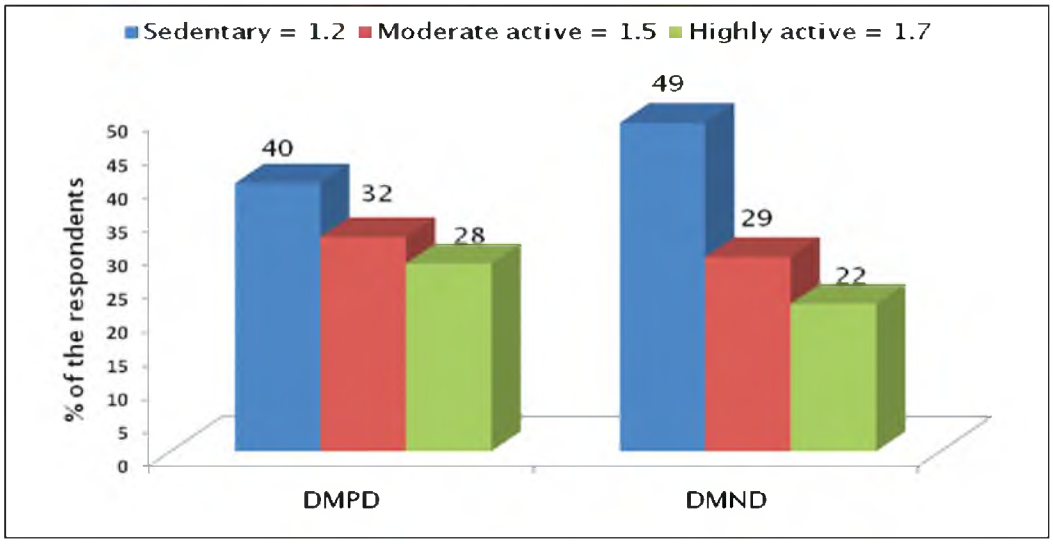

Figure 3: PAL features of the DM subjects (n= 284).

PAL profile: Figure 3 described the distribution of the study subjects according to their PAL categories. Majority of the subjects, both DMPD and DMND, were found in sedentary group in terms of their PAL level.

Consumption behaviour: The mean daily consumption of foods from different food groups related to the total amount of food eaten is presented in Table 5. The table shows a higher trend of carbohydrate rich food like cereal, root and tuber, and fruits among DMND compared to DMPD. Milk consumption was found higher and meat consumption was lower among DMPD therreby indicating the improved KAP of diabetes dietary among them compared to DMND.

The calculated intake of energy and key nutrients by subjects are listed in Table 6. The nutrient profile reflected the food consumption behavior shown in Table 5 in terms of nutrients. Since majority of the respondents belonged to low to middle income groups, intake of energy and other nutrients were found low as per recommended daily requirements.

Table 5: Food consumption profile (g/day) of the respondents (Mean ± SD)

List of foods	DMPD (n= 117)	DMND (n=167)
Cereal	254 ± 115	330 ± 129
Root & tubers	72 ± 41	75 ± 82
All pulses	10 ± 5	10 ± 4
Green vegetables	60 ± 34	73 ± 31
Yellow vegetables	50 ± 26	51 ± 47
Nonleafy vegetables	71 ± 48	64 ± 43
Fruits	112 ± 80	116 ± 94
Meats	108 ± 35	117 ± 42
Eggs	88 ± 69	79 ± 68
Fish	72 ± 41	75 ± 54
Milk product	51 ± 39	32 ± 17
Fats & oil	20.0 ± 0.00	20.0 ± 0.00

Table 6: Nutrient intake profile (g/day) of the respondents (Mean ± SD)

List of nutrient	DMPD (n= 117)	DMND (n=167)
Energy (Kcal)	1567 ± 456	1631 ± 558
Protein (gm)	56 ± 29	57 ± 32
Fat (gm)	33 ± 9	36 ± 15
Carbohydrate (gm)	261 ± 85	269 ± 101
Fiber (gm)	1.5 ± 1.1	1.6 ± 1.5
Retinol Equivalent	901 ± 841	706 ± 809
Vitamin B_1 (mg)	0.9 ± 0.3	1.0 ± 0.4
Vitamin B_2 (mg)	0.7 ± 0.4	0.6 ± 0.5
Vitamin B_5 (mg)	15 ± 6	16 ± 7
Vitamin C (mg)	60 ± 75	56 ± 56
Calcium (mg)	566 ± 543	569 ± 561
Iron (mg)	19 ± 15	16 ± 14
Zinc (mg)	6.7 ± 2.7	7.1± 3.8

Discussion

WHO[12] estimated that 175.4 million people are currently suffering DM and related complications. In this context Bangladeshi population is no exception in this phenomenon. About 90% - 95% of all diabetes patients in Bangladesh are suffering from Type 2 diabetes. The onset of the disease is often insidious and asymptomatic[14].

The present study recorded the pattern of urban type 2 diabetes mellitus related morbidity among low to middle income group in ward of Dhaka Metropolitan City. The DM respondents were evaluated to possess a number of clinical and biochemical complications. However, DMND subjects were suffering relatively more from these complications than DMPD subjects. This might be due to the fact that DMND subjects were not aware of their DM condition before the study participation. They were assumed to live on a lifestyle conditions favorable to DM progression and related complications. Result of the current study supported to this notion by showing that the percentage of overweight was 5% higher in case of DMPD than DMND. Nearly 50% of DMND subjects were lead

sedentary life style. Lack of urban open space tends to lead to lower physical activity worldwide. The onset of diabetes occurs when body weight reaches at a critical mass (over weight). The risk related to higher BMI was less significant in rural than urban subjects[5].

Their nutritional status revealed that a high number of them were overweight (41.5%). Most of them consumed rice, wheat and other cereals which are main source of carbohydrate. The respondents consumed high intake of fat and protein and thus imbalanced their daily dietary composition. However, the energy intake of the respondents was found much lower in both DM groups than the recommendation (2003 Kcal by BIRDEM diabetes food chart). The consumption profile of energy from respective energy-yielding nutrients (carbohydrate 60%, fat 25%, and protein 15%), also remained imbalanced. When compared, DMND subjects were found to consume relatively higher but statistically insignificant energy and nutrients (Table 5). But in general, the DM respondents were found energy deficient due low intake of fat and protein.

The data suggested that the prevalence of diabetes in the study area was very high. DM itself might cause along with other socioeconomic and dietary factors DM related complications. The underlying cause might lie in their imbalance food habit and PAL activity. Experts concluded that low Glycemic Index (GI) foods or diets favorably affect several biological markers like plasma glucose, insulin, HbA1c, lipids, adipocyte metabolism as well as satiety and control of food intake. DM subjects in this study showed to consume relatively high GI foods like potato. So consumption of low GI foods should be increased for chronic benefits. Individual PAL must not be sedentary type to cope the effects of diabetes.

References:

1. Gopalan C. Nutrition research in South-East Asia: the emerging agenda of the future, New Delhi WHO 1994.
2. West KM and Kalbfleisch JM, Glucose Tolerance, nutrition and diabetes in Uruguay, Venezuela, Malaya and East Pakistan. Diabetes 1966; 15: 9-18.
3. Mahtab H, Ibrahim M, Banik NG, Gulshan-E-Jahan and Ali SMK. Diabetes detection survey in a rural and semiurban community in Bangladesh Tohoku J Exp Med 1983;141: 211-271.
4. Sayeed MA, Khan A R, Banu A, Hussain MZ. Prevalence of Diabetes and Hypertension in a Rural Population of Bangladesh. Diabetes care 1995; 18(4): 555-558.
5. Sayeed MA, Hussain MZ, Banu A, Ali L, Rumi MAK, Azad Khan AK. Effect of socioeconomic risk factor on difference between rural and urban in the prevalence of diabetes in Bangladesh. Diabetes Care 1997; 20: 551-555.
6. Sayeed M A , Mahtab H, Latif ZA, Khanam PA, Ahsan KA, Banu A, Khan AKA. Waist – to height ratio is a Better Obesity Index than Body Mass Index and waist – to hip Ratio for Predicting Diabetes, Hypertension and lipidemia. Bangladesh Med. Res. Coune. Bull. 2003; 29(1): 1 – 10.
7. Feldman, Jacob J. Diane M. Makuc, Joel C. Kleinman, and Joan Cornoni-Huntley. National Trends in Educational Differentials in Mortality. American Journal of Epidemiology 1989;129:919-33.
8. Hulshof KF, Löwik MR, Kok FJ, Wedel M, Brants HA, Hermus RJ, ten Hoor F. Diet and other life-style factors in high and low socio-economic groups (Dutch Nutrition Surveillance System. Eur J Clin Nutr 1991 Sep; 45(9):441-450.
9. WHO Expert committee on Diabetes Mellitus, Technical report series 727, WHO, Geneva (1985).
10. Harbour Branch Foundation, Inc. Technical Report No.11. Operation, Methods and Quality Control of Technicon Auto Analyzer II Systems for Nutrient Determination in Seawater.1997.
11. Lipid-Atherosclerosis Laboratory Services Guide. Revised 3/2014.
12. BIRDEM; Microvascular complications in Bangladeshi Type-2 Diabetic Individuals: Diabetic Care and Complication Study DCCS.2003.
13. Human Energy requirement. Report of a joint FAO/WHO/UNU Expert Consultations, Rome. 17-24 October 2001; FAO Food and Nutrition Technical Report Series-1.
14. WHO. Physical status: The use and interpretation of anthropometry. Report of a WHO expert committee. 1995, WHO Technical Report Series No. 854. Geneva.