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Original Article

Association between dietary habit and diabetic risk profiles among diagnosed Type-2 diabetic patients in a selected area of Bangladesh

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ABSTRACT

Aims: This study aimed to assess the association of dietary habits on diabetic risk profiles of patients with type-2 diabetes in a selected area, Bangladesh.
Methods: This cross sectional study was conducted among 420 type-2 diabetic patients, selected conveniently from Jahangirnagar University and nearest community, Savar, Dhaka. Five days food records were used to determine macronutrient consumption. Blood sample was taken for biochemical investigation and height, weight were taken for BMI measurement. A bivariate Pearson's r correlation analyses were used to assess the association of dietary habit and diabetic risk profiles.
Results: Out of 420 patients, 228 were male and 172 were female (mean ± SD of age, 47.5 ± 6.4 years). Mean HbA1c was 7.53 ± 0.90%. The patients with hypercholesterolemia were 64.8% and hypertriglyceridemia were 39.0%. Patients with high LDL-C were 57.1%. Mean HDL-C was 49.15 ± 12.07 mg/dl. Among 420 patients, 188 (44.8%) were overweight and 132 (31.4%) were obese. Mean daily carbohydrate, protein and fat consumption was 259.23 ± 57.19, 87.21 ± 19.08 and 65.07 ± 12.23 respectively. Study found that carbohydrate, protein and fat consumption was associated with diabetic risk profiles.
Conclusion: A large number of people's dietary habit has strong association with diabetic risk profile among type-2 diabetic patients.

1. Introduction

The worldwide increase of type-2 diabetes is becoming a major concern [1]. Diabetes mellitus (DM) is a metabolic disorder of multiple etiologies that results from chronic hyperglycemia which can disrupt carbohydrate, protein and fat metabolism [2]. DM is a disease known since ancient times, cited by both the Greeks and Egyptians in as early as 4500 BCE [3].In 2010, a study estimated 285 million people have type-2 diabetes globally, making up about 90% of all diabetes cases [4]. In the South Asian region, Bangladesh has the second largest number of diabetes patients with the prevalence rate of 11% [5].

The Diabetes Risk Profiles (DRPs) is a health and lifestyle assessment that identifies people at risk for diabetic complications. Three parameters were considered highly significant risk factors for diabetic complications: dyslipidemia (elevated LDL-cholesterol, low HDL-cholesterol, and elevated triglycerides), elevated hemoglobin A1c (HbA1c), and elevated systolic blood pressure [6]. BMI is also a significant risk factor of diabetic complications. All of these parameters are highly correlated with eating habits. It is well documented that dietary modification can improve glycemic control of diabetic patients [7].

There has long history of dietary management of diabetes mellitus, it was used in Egypt as long ago as 3500 B.C., and more than 2000 years ago in India by Sushruta and Charaka [8]. Before the discovery of insulin in 1922, several other dietary treatments had been tried to manage diabetes. These ranged from diets high in carbohydrates to replace lost sugar, to diets that virtually excluded carbohydrates by the strict use of animal foods to facilitate the substitution of fat and protein for carbohydrate. Some diets involved near starvation [9]. There are also several others ways for controlling T2DM such as oral hypoglycemic agents, insulin injection, and dietary management; however, nutritional intervention is an integral part of T2DM management. It aims to attain and maintain optimal metabolic outcomes, to prevent and treat medical complications, and to improve general health [10]. Some other studies also showing that medical nutrition therapy provided by

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dietitians improves glycemic control and also lipid profile in diabetic patients [11]. The main goals of diet control are to improve quality of life, nutritional status and risk factors and to prevent the chronic complications of diabetes [12]. In addition, healthy eating for a people with T2DM may have an effect on disease outcomes and decrease occurrence of the complications. The ADA recognizes that, the integral role of nutritional therapy in overall diabetes management and has historically recommended that each person with diabetes be actively engaged in self-management, education, and treatment planning with his or her health care provider, which includes the collaborative improvement of an individualized eating plan [13].

There are limited studies of dietary effect on diabetic risk profiles among diagnosed type-2 diabetic patients in Bangladesh. Therefore, this study aims to assess the effects of dietary habits on both glycemic control and DRFs; lipid profile, blood pressure and body mass index among people with T2DM at Jahangirnagar University Community.

2. Subjects, materials and methods

2.1. Study design and setting

The study was an analytical cross-sectional, conducted in the year 2017 and 2018 among diagnosed type-2 diabetic patients of different age and gender at Jahangirnagar University and nearest community, Savar, Dhaka. A total of 420 patients were selected conveniently. The sample size was determined by using the formula, $n = z^2pq/d^2$.

2.2. Study procedures

Data were collected face to face interview from the patients using questionnaire which mostly contain closed ended questionnaire. Patients were selected using some exclusion and inclusion criteria and ≥30 years old.

2.3. Measure

Weight, height and blood pressure were measured by using valid equipment. A fasting and a random blood samples were taken for Biochemical investigation for assessment of diabetic risk profiles, blood samples were collected and tested at Department of Public Health and Informatics, Jahangirnagar University Lab. This study adopted the BMI definition of the World Health Organization (2000) [14], Body weight was measured to the nearest 100 gm. A professional weight machine was used for body weight measurement. The height was measured in centimeter by using a measuring tape. Blood pressure (systolic and diastolic) recordings were made after the subjects had rested in the sitting position for 10 min using a validated sphygmomanometer. Three separate readings were taken and their mean was recorded. Cholesterols and triglyceride levels were also measured in all participants, using the colorimetric enzymic method in a Technicon automatic analyzer RA-1000 (Dade-Behring Marburg GmbH, Marburg, Germany) [15]. Low-density lipoprotein cholesterol is measured in mg/dl by using Friedewald equation [LDL cholesterol = TC − HDL-cholesterol − (0.20 × TGs)] [16,17]. Carbohydrates, protein and fat content were calculated by using food exchange table and food Composition Table for Bangladesh [18].

2.4. Statistical analysis

Data analysis was performed using SPSS, version 20.0. Descriptive statistics were used to describe the variables and Bivariate correlation (for binaryoutcome) was used to test the association between variables. The statistically significant result means that the P-value < 0.05.

3. Results

Table-1 showed that, 172(41.0%) were female and 248(59.0%) were male. The mean age was 47.2 ± 6.4 years. About half (n = 204) of the patients were 40–50 years age group. 53.3% of the patients were low educated and 46.3% were higher educated. In case of occupational status, 65.7% were working group and 34.3% didn't work. Also 97.1% of the patients (n = 408) were married. The mean monthly family income was 25,305 ± 11,507*BDT*.

Table-2 presented the mean HbA1c was 7.53 ± 0.90%. 49.5% had controlled and 50.5% had uncontrolled HbA1c. The patients with hypercholesterolemia were 64.8% and hypertriglyceridemia were 39.0%. Patients with high LDL-C were 57.1%. Mean HDL-C was 49.15 ± 12.07 mg/dl. Mean BMI of the patients was 27.37 ± 5.04 kg/m^2. Among 420 patients, 100 (23.8%) had ideal BMI, 188 (44.8%) were overweight and 132 (31.4%) were obese. Mean systolic and diastolic BP was 129.9 ± 15 and 85.81 ± 13.75 mm/Hg respectively. The abnormal systolic and diastolic BP was both found 172(41.0%).

Table-3 showed that, in cases of carbohydrate intake, 24(5.75%) intake lower amounts, 152 (36.2%) intake ideal amounts and 244 (58.1%) intake higher amounts. In cases of protein intake, 60(14.3%) intake lower amounts, 232 (55.2%) intake ideal amount and 128 (30.5%) intake higher amounts. Finally 8 (1.9%) patient intake lower amounts, 180 (42.9%) intake ideal amount and 232(55.2%) intake higher amount of fat than needed.

Table 1
Socio-demographic characteristics of the patients (n = 420).

Variable	Categories	Frequency	Percentage	Mean(±SD)
Gender	Male	248	59.0	
	Female	172	41.0	
Age categories	30–40 years	60	14.3	47.2(±6.4)
	40–50 years	204	48.6	
	>50 years	156	37.1	
Educational status	Low educated	224	53.3	
	High educated	196	46.7	
Occupational status	Not worked	144	34.3	
	Worked	276	65.7	
Marital Status	Unmarried	12	2.9	
	Married	408	97.1	
Monthly Family income	5000–15,000Tk	116	27.6	25,305 (±11,507)
	15,000–30,000Tk	208	49.5	
	>30,000Tk	96	22.9	

Table 2
Biochemical and physical investigation(n = 420).

Variable	Categories	Cut off point	Frequency	Percentage	Mean(±SD)
HbA1c	Controlled	<7%	208	49.5	7.53(±0.90%)
	Uncontrolled	≥7%	212	50.5	
Total Cholesterol	Normal	<200	148	35.2	213.66 (±38.49 mg/dl)
	Hypercholesterolemia	≥200	272	64.8	
Triglyceride	Normal	<150	164	39.0	173.16 (37.99 mg/dl)
	Hypertriglyceridemia	≥150	256	61.0	
HDL-C	Abnormal	<50	204	48.6	49.15 (±12.07 mg/dl)
	Normal	≥50	216	51.4	
LDL-C	Normal	<100	180	42.9	123.03 (±29.62 mg/dl)
	Abnormal	≥100	240	57.1	
BMI	Ideal	18.5–24.9	100	23.8	27.73 (±5.04 kg/m^2)
	Overweight	25.0–29.9	188	44.8	
	Obese	≥30	132	31.4	
Systolic BP	Normal	≤130	248	59	129.9 (±15.27mm/Hg)
	Abnormal	>130	172	41	
Diastolic BP	Normal	≤80	248	59.0	85.81 (±13.75mm/Hg)
	Abnormal	>80	172	41.0	

Note: HbA1c: hemoglobin A1c, LDL-C: low density lipoprotein cholesterol, HDL-C: high density lipoprotein cholesterol, BMI: Body Mass Index, M: mean, SD: standard deviation.

Table 3
dietary intake of the patients (n = 420).

Variable	Categories	Frequency	Percentage	Mean(±SD)
Carbohydrate	Low	24	5.7	259.23 (±57.19)
	Ideal	152	36.2	
	High	244	58.1	
Protein	Low	60	14.3	87.21 (±19.08)
	Ideal	232	55.2	
	High	128	30.5	
Fat	Low	8	1.9	65.07 (±12.23)
	Ideal	180	42.9	
	High	232	55.2	

A bivariate Pearson's r correlation was used to test the relationship between daily carbohydrates, protein, fat consumption and glycemic control, cholesterol, triglycerides, LDL-C, HDL-C, blood pressure, body mass index.

Table-4 displayed that mean daily carbohydrate consumption was 259.23(±57.19). The study found that carbohydrate consumption was statistically significant and positive correlation with HbA1c (r = 0.212, P = 0.030), cholesterol(r = 0.210, P = 0.032), triglyceride(r = 0.551, P = 0.001), LDL-C(r = 0.252, P = 0.010), SBP(r = 0.423, P = 0.001), DBP(r = 0.474, P = 0.001) and BMI(r = 0.644, P = 0.001) of the patients with type-2 diabetes.

Table also showed that daily protein consumption was (M ±SD = 87.21 ± 19.08). The study found that protein consumption was statistically significant and positive correlation with triglyceride(r = 0.401, P = 0.001), LDL-C(r = 0.291, P = 0.003), SBP(r = 0.197, P = 0.044), DBP(r = 0.218, P = 0.025).

Daily fat consumption was (M ±SD = 65.07 ± 12.23). The study found that, fat consumption was statistically significant and positive correlation with cholesterol(r = 0.427, P = 0.001), triglyceride(r = 0.388, P = 0.001), LDL-C(r = 0.397, P = 0.001), HDL-C(r = 0.514, P = 0.001), SBP(r = 0.282, P = 0.034), DBP(r = 0.189, P = 0.054) and BMI(r = 0.216, P = 0.027) of the patients.

4. Discussion

Caring for patients with type-2 diabetes is generally viewed as challenge as well as not easy situation as any chronic disease may affect all aspect of patient's life [19].

The present study clearly reported more male patients than females, majority of their age in both gender were between forty to fifty years old. This finding agreed with UNRWA estimation in 2007 that approximately 91% of patients with type 2 DM were above 40 years of age [20]. The study showed that almost all of the participants among both gender were married. In another study, marital status was not significantly related to diabetes mellitus (P = 0.09) [21]. Regarding the participants' educational level, the study showed that more than half of the participant were “low educated” at class of less than S.S.C. There was congruency with Sacerdote et al. (2012) study, which revealed that participants with a low educational level had a higher risk of T2DM [22]. Also the study by Luisa et al. agreed with study result that individuals with less than a high school diploma had the highest overall incidence of diabetes (10.2%), followed by those with a high school diploma (6.2%), some college (4.5%), and at least a bachelor's degree (3.4%) [23].

In the current study, Pearson's r correlation test showed that, only carbohydrates group consumption had statistically significant association with poor glycemic control. In this respect, several studies state that there was a difference between good control and poor control groups in HbA1c depending on carbohydrate intake rather than protein or fat. The intake of fruits, vegetables, legumes, yogurt and other dairy products was not associated with levels of glycemic control indices [24–26]. The study of Nanri et al. (2008) was in congruence with the current study [27].

The result of this study found that, carbohydrates and fat group consumption were statistically significant and might affect cholesterol level. However, carbohydrates group consumption was positively significant and might affect the increasing of TG and LDL level. TG and LDL level also significantly associated with protein and fat intake. The findings were supported by several other studies. As per Emad Salem Kuhail M. carbohydrates group consumption were positively significant and might affect the increasing of cholesterol, TG, LDL-C and the decrease of HDL-C. Fat group consumption also may affect cholesterol and triglyceride level [28].

Study suggests that carbohydrates, protein and fat group's intake had a positive effect in the increasing of blood pressure. In a similar context, two international studies of macro/micronutrients and blood pressure conducted in United Kingdom and USA illustrated that the reduction intake of sugar was significantly associated with reduced systolic and diastolic BP. No association was found for diet beverage consumption and BP [29,30].

Carbohydrates and fat intake had positively significant association with BMI. Protein group consumption had negative impact on

Table 4
Correlation between carbohydrates, protein, fat consumption and glycemic control, cholesterol, triglycerides, LDL-C, HDL-C, blood pressure, body mass index (n = 420).

Independent variable * Dependent variable	M (±SD)	R	p-value
Carbohydrate consumption			
CHO consumption *Glycemic Control HbA1c	259.23(±57.19) 7.53(±0.90)	0.212	0.030*
CHO consumption *Cholesterol	259.23(±57.19) 213.66(±38.49)	0.210	0.032*
CHO consumption *Triglyceride	259.23(±57.19) 173.16(±37.99)	0.551	0.001**
CHO consumption *LDL-C	259.23(57.19) 123.03(±29.62)	0.252	0.010**
CHO consumption *HDL-C	259.23(±57.19) 49.15(±12.07)	0.001	0.991
CHO consumption *SBP	259.23(±57.19) 129.9(±15.27)	0.423	0.001**
CHO consumption *DBP	259.23(±57.19) 85.81(±13.75)	0.474	0.001**
CHO consumption *Body mass index	259.23(±57.19) 27.73(±5.04)	0.644	0.001**
Protein consumption			
Protein consumption * Glycemic Control HbA1c	87.21(±19.08) 7.53(±0.90)	−0.143	0.146
Protein consumption * Cholesterol	87.21(±19.08) 213.66(±38.49)	0.048	0.626
Protein consumption * Triglyceride	87.21(±19.08) 173.16(±37.99)	0.401	0.001**
Protein consumption * LDL-C	87.21(±19.08) 123.03(±29.62)	0.291	0.003**
Protein consumption * HDL-C	87.21(±19.08) 49.15(±12.07)	−0.057	0.057
Protein consumption * SBP	87.21(±19.08) 129.9(±15.27)	0.197	0.044*
Protein consumption * DBP	87.21(±19.08) 85.81(±13.75)	0.218	0.025*
Protein consumption * Body mass index	87.21(±19.08) 27.73(±5.04)	−0.001	0.994
Fat consumption			
Fat consumption* Glycemic Control HbA1c	65.07(±12.23) 7.53(±0.90)	0.144	0.142
Fat consumption * Cholesterol	65.07(±12.23) 213.66(±38.49)	0.427	0.001**
Fat consumption *Triglyceride	65.07(±12.23) 173.16(±37.99)	0.388	0.001**
Fat consumption * LDL-C	65.07(±12.23) 123.03(±29.62)	0.397	0.001**
Fat consumption *HDL-C	65.07(±12.23) 49.15(±12.07)	−0.514	0.001**
Fat consumption * SBP	65.07(±12.23) 129.9(±15.27)	0.282	0.034*
Fat consumption * DBP	65.07(±12.23) 85.81(±13.75)	0.189	0.054
Fat consumption *Body mass index	65.07(±12.23) 27.73(±5.04)	0.216	0.027*

Note. * Correlation is significant at level $P < 0.05$, r = person test value, SD = stander deviation HbA1c = hemoglobin A1c, LDL-C = low density lipoprotein cholesterol, HDL-C = high density lipoprotein cholesterol, SBP = systolic blood pressure, DBP = diastolic blood pressure.

BMI, although that was not significant. Togo et al. (2001) illustrated that the relationships with BMI/Obesity were inconsistent with ten studies which found that intake patterns, which we categorized as fatty, sweet or energy dense were positively associated with BMI/Obesity [31]. The significant associations between diet index score and BMI/Obesity were consistently negative. In contrast to our finding, Fumeron et al. (2011) stated that total dairy product consumption, dairy (except cheese) consumption, and dietary calcium density were inversely associated with incident obesity. Cheese consumption was negatively associated with incident obesity [32].

The study findings show a positive association between dietary habits and high level of HbA1c, lipid profile, BMI and blood pressure. Individuals with type 2 DM should consult a dietician and take a balanced diet with recommended calorie and should improve their dietary habits by avoiding eating fried meals, fatty meat, junk food, adding salt on food during meals and extra oil during cooking.

5. Conclusion

The result of this study found that, dietary habit and diabetic risk profile among type-2 diabetic patients has significant correlation. Uncontrolled HbA1c was positively statistically associated with carbohydrates group consumption only. Hypercholesterolemia, hypertriglyceridemia and LDL-C level were positivity statistically associated with carbohydrates and fat consumption. HDL-C was inversely associated with fat group consumption. Regarding blood pressure and body mass index, the result showed that blood pressure was positively associated with carbohydrates and protein intake. BMI was positively associated with carbohydrates and fat intake.

Declaration

Funding

Self.

Ethical issue

This study was conducted maintaining ethical standards to the highest possible extent. Prior to the assessment, informed consent was taken from all the patients, participated in this study. This study was approved by the Department of Public Health and Informatics, Jahangirnagar University, Savar, Dhaka. The study was also followed "recommendations guiding physicians in biomedical research involving human subjects", adopted by the 18th World Medical Assembly, Helsinki, Finland, June 1964.

Conflict of interest

No conflict of interest.

Limitation

The study was not free of limitation. The population was selected conveniently, so there might be chance of bias. Limited sample size due to self funding may restrict for generalization. The limited resources such as reports, statistical data, books and journals were also limitation.

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