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Association of Dietary Patterns with Type 2 Diabetes Mellitus among Bangladeshi Adults

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ABSTRACT

Background: Diet is a pivotal modifiable risk factor for type 2 diabetes (T2D), while lifestyle and dietary modifications are ostensible measures considering the disease association. The present study was endeavored to identify dietary patterns in Bangladesh and to evaluate the association between dietary patterns and the risk of T2D.

Methods: The investigation population (n=108) was a part of the population-based nutrition study conducted in Chattogram, Bangladesh. Dietary intake was obtained using a validated food frequency questionnaire (FFQ). Demographic, anthropometric, socioeconomic characteristics, and other covariates were collected using structured lifestyle questionnaires. Associations between dietary patterns and the risk of T2D were estimated by multivariate logistic regression analyses. Two major dietary patterns including traditional Bangladeshi and Western were identified using factor analysis. Odds ratios were calculated for the risk of T2D across quartiles of dietary pattern scores.

Results: Subsequent adjusting for the possible confounders, the highest quartile of the Western dietary pattern score had greater odds of T2D (OR=1.16; 95% CI: 1.102-1.136; P=0.02) than those did in the lowest quartile. Compared with those in the lowest quartile, subjects in the highest quartile of the traditional Bangladeshi dietary pattern score had lower odds of the T2D (OR=0.69; 95% CI: 0.562-0.874; P=0.04) than those did in the lowest quartile.

Conclusion: Traditional Bangladeshi dietary patterns had no association with the incidence of T2D and Western dietary patterns were associated with an increased risk of T2D.

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Introduction

Non-communicable diseases (NCDs) become apparent as the leading cause of human mortality and morbidity worldwide (1). Type 2 diabetes (T2D) characterized by a heterogeneous syndrome resulting from varying contributions of insulin resistance and defective insulin secretion is the prominent forms of NCDs, whereas 425 million people reported diabetes in 2017 globally, which is expected to rise to 629 million by 2045 (2). Long-

term complications of T2D include macrovascular diseases (such as atherosclerosis, myocardial infarction, stroke, etc.) and microvascular diseases (such as nephropathy, retinopathy, neuropathy, etc.). The prevalence of diabetes in Bangladesh is in increasing trend and it varies from 4.5% to 35.0% according to a recent scoping review during 1994-2013 (3).

Diet is a key modifiable risk factor for multiple chronic diseases (4) and is a leading contributor to morbidity and mortality worldwide according to the recent study carried out in 188 countries (5). Lifestyle and dietary modifications are apparent measures considering the disease association with obesity, diabetes and cardiovascular disease. Dietary management can lower blood glucose levels in those with and without T2D, but the extent to which dietary characteristics drive these effects is not understood (6).

The growing trends of T2D prevalence throughout current times have caused serious risks to public health. Dietary patterns have recently pulled prominent consideration in the evaluation of the relationship between diet and health. Recently, there has been considerable attention in nutritional epidemiology towards the associations between dietary patterns and the risk of T2D. Many epidemiological studies have shown that diet plays an important role in the development of T2D in worldwide (7-9). Previously individual nutrients or foods were used to investigate diet–disease associations, previously but foods are consumed in combination that makes it difficult to investigate the individual dietary components separately. For clarifying relationships between diet and health, dietary pattern approach was used in the field of nutritional epidemiology (10).

However, to date, data on the associations between dietary patterns and T2D in the Bangladeshi population are limited. To our knowledge, no previous epidemiological studies have reported the associations between dietary patterns and risk of T2D in Bangladesh. Studies on diabetes in Bangladesh were small-scale, confined to urban-rural communities (11) or some other specific groups, identification of the correlates of T2D (12). Therefore, in the present study, we aimed to characterize dietary patterns in Bangladeshi adults and to evaluate the associations between dietary patterns and the risk of T2D.

Materials and Methods

This study was conducted in Chattogram, Bangladesh from July 2018 to December 2019. A total of 247 study sample were collected by a stratified cluster random sampling method from general attendees at Chattogram Diabetic General Hospital, Chittagong, Bangladesh. They were interviewed face-to-face by trained interviewers using written questionnaires (13). The protocol was approved by the ethical review committee of the Diabetic Association of Bangladesh (DAB). All the study steps were performed in accordance with the Helsinki Declaration. After collection, data were checked thoroughly for consistency and completeness by calling over telephone and visiting their residents. After the exclusion of 69 participants with a family chronicle of diabetes, cardiovascular disease or stroke, 178 participants endured for this study. Moreover, we rejected 23 participants who provided missing information on dietary intake, 26 participants who did not provide blood samples, 14 participants who rendered incomplete

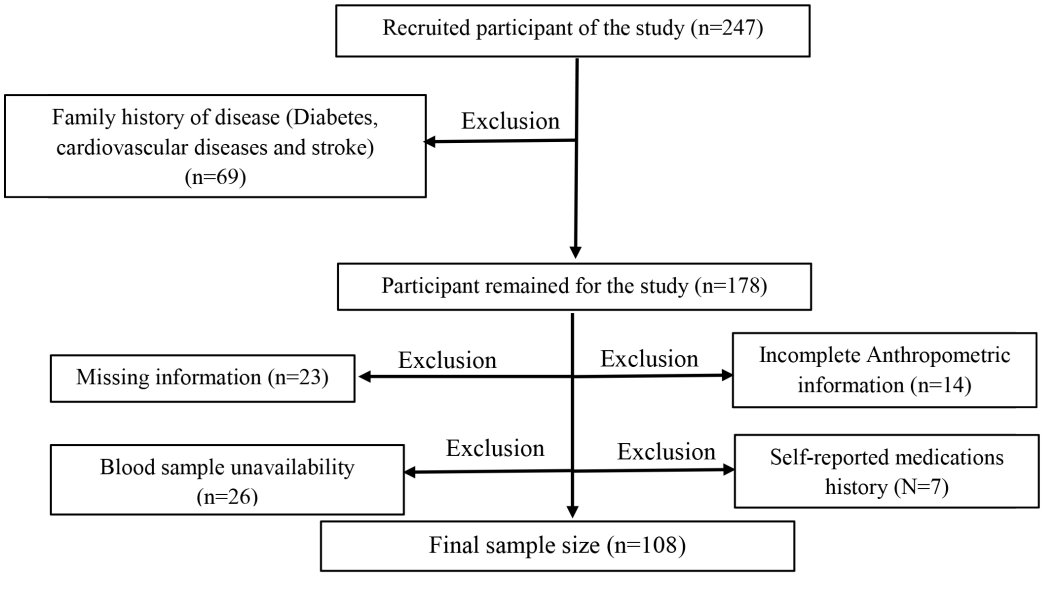

Figure 1: Screening and selection of samples.

anthropometric information and 7 participants who self-reported a history of taking medications (these medications may affect serum lipoprotein concentrations, blood pressure, and carbohydrate metabolism). Finally, 108 participants persisted for the present analysis of the associations between dietary patterns and the risk of T2D (Figure 1).

Dietary intakes of study participants were obtained by trained interviewers with a validated and reliable food frequency questionnaire (FFQ) used in previous studies in Bangladesh (13, 14). Interviewers have averaged 6 years of data collection experience, and quality of collected data was assured through standardized training exercise and variable definitions, peer review of forms prior to submission, weekly meetings to discuss issues as they came up, and rechecking when any errors were identified during data entry. The FFQ consisted of 172 food items with standard portion sizes usually consumed by Bangladeshi participants. They were asked to recall the frequency of each food item during the previous year on a daily, weekly, monthly, and yearly basis. Each food item frequency was classified into never, less than 1 time/month, 1 to 3 times/month, 1 to 2 times/week, 3 to 4 times/week, 5 to 6 times/week, 1 time/day, 2 times/day, and 3 times/day. Finally, data were converted into grams (g)/day or mL/d in the following analysis.

Then, 172 food items from the FFQ were aggregated into 27 food groups (Table 1) based on their similarity in nutrients and earlier studies to identify dietary patterns (15). Factor analysis (principal component) was conducted on the 27 food groups and obtained factors were rotated using orthogonal rotation so that the factors/dietary patterns were uncorrelated with each other and were easier to interpret. The eigenvalue and scree plot were applied to decide which factors remained (16). After evaluating the eigenvalues, the scree plot test, and interpretability, factors with an eigenvalues ≥2.0 were retained. Individual food items with a factor loading ≥|0.4| were considered to significantly contribute to the pattern in this study.

The labeling of dietary patterns was based on the interpretation of foods with high factor loadings for each dietary pattern (17). Factor scores were categorized into quartiles (Q1 represented a low intake of the food pattern; and Q4 represented a high intake of the food pattern). Two major dietary patterns were extracted: the traditional Bangladeshi dietary pattern (high in cereal, pulses, legumes, vegetables, fish and seafood, vorta/mashed vegetables, egg, street food, milk, and indigenous pitha/homemade cake) and the Western dietary pattern (high in meats, nuts, seeds and their products, processed meat, processed fish, eggs, fast foods, snacks, chocolates, ice cream, sugar-sweetened beverages, tea, and coffee).

Prior to blood pressure measurements, participants were first rested in the sitting position for five to ten minutes. Then, measurement was taken by one trained personnel with a standard mercury sphygmomanometer and the mean of three consecutive measurements was considered as the participant's blood pressure. To evaluate fasting plasma glucose (FPG), blood samples were taken from all participants after 10-12 hours overnight fasting. Samples were allowed to clot at room temperature for 1-3 h and serum was separated by centrifugation for 15 min at 3000 rpm. Finally, FPG was measured on the day of blood collection according to a standard protocol using an auto analyzer. T2D was defined as the presence of any one of the following: (i) FPG ≥7.0 mmol/L on at least two separate occasions, or an oral glucose tolerance test (OGTT) with a value ≥11.1 mmol/L (15); (ii) current use of insulin or oral hypoglycemic agents; or (iii) a positive response to the question: Have you ever been diagnosed with diabetes by a doctor?

Anthropometric measurements, including weight, height and circumferences of waist and hips, were taken with proper anthropometric techniques and calibrated instrument (18). Body mass index (BMI) and waist-to-hip ratio (WHR) were calculated. Information on physical activity was collected, using a validated questionnaire (19). All measurements were performed by trained personnel to use standardized procedures. Additional information such as age, sex, family history of diabetes, smoking, education and monthly income were obtained with a structured general questionnaire. Total energy intake was estimated through the validated semi-quantitative FFQ, expressed in kilocalorie per day (kcal/day) and categorized according to quartile. Data on physical activity expressed as metabolic equivalent hours per day (MET-h/d) (15).

To analyze the data Statistical Package for Social Sciences (SPSS software, Version 22.0 Chicago, IL, USA) was used. Participants of the study were categorized based on quartile categories of the dietary pattern scores. Results were presented as mean±SD for continuous variables and as the number of patients for categorical variables. Significant differences in general characteristics across quartile categories of the dietary pattern scores were assessed using one-way analysis of variance (ANOVA) with Tukey's post-hoc comparisons. Significant differences in categorical variables were evaluated by Chi-Square tests and logistic regression analysis model was employed to evaluate the association of dietary patterns with the risk of T2D, adjusting for potential confounders.

Table 1: Food grouping used in the dietary pattern analyses.

Food groups	Food items
Cereals and their products	Rice, plain pulao, plain khichuri, rice flaked (Chira), popcorn, noodles, instant noodles, wonton, breads, biscuit, cake, vermicelli (Semai), ruti (Rice), ruti (Wheat), wheat, barley
Pulses, legumes and their products	Bengal gram, Black gram, Green gram, Grass pea, Lentil, Pea, Soybean
Vegetables and their products	Cowpea, spinach, chilli, tomato, cabbage, amaranth, cauliflower, radish, cucumer, bean, brinjal, carrot, bitter gourd, ash gourd, bottle gourd, pointed gourd, ridge gourd, snake gourd, sponge gourd, teasle gourd, Okra/ladies finger, papaya, plantain, pumpkin
Leafy vegetables	lal shak (Amaranth, leaves, red), lau shak (Bottle gourd leaves), data shak (Amaranth, leaves, green), pui shak (Indian spinach), palong shak (Spinach) and misti alu shak (Sweet potato leaves)
Starchy roots, tubers and their products	Colocasia/Taro, sweet potato, potato, eggplant, yam
Nuts, seeds and their products	Walnut, peanuts, almonds, pistachio nuts, cashew nuts, coconut, jackfruit seeds
Fruit	Apple, pears, peach, mango, apricots, pomelo, grapes, bananas, cantaloupe, watermelon, oranges, grapefruit, strawberries, custard apple, emblic, guava, hog plum, jackfruit, jujube, lychee, pineapple, pomegranate, papaya
Pickles	Vegetable Pickles, Fruits Pickle
Meat	Red meat: beef, mutton, chevon, White meat: chicken, duck, Pigeon meat, Buffalo meat
Processed meat	Ready to fried chicken items
Fish and seafood	Fish, shrimp, sea fish, crab, shellfish
Processed fish	Salted fish, dry fish
Eggs	Duck eggs, chicken eggs (farmed), chicken eggs (native)
Milk	Liquid milk, milk powder, yoghurt, cheese, ghee, butter, payesh
Vegetable oil	Soybean oil, mustard oil, rice bran oil, rapeseed oil, palm oil, olive oil, margarine
Fast foods	Burger, fried rice, fried chicken, grilled chicken, kabab, french fries, pizza, Sandwich, chicken nuggets, faluda, lassi, borhani
Snacks	Paratha, Nan, Sweets, potato chips, singara, samosa and spring roll, shrimp roll
Chocolates	Candy, Chocolates
Honey	Honey
Sugar-sweetened beverages	Carbonated soft drinks, Non-carbonated soft drinks, fruit drinks, coconut water, sugar cane juice and fruits juice
Tea	Black Tea, Green Tea, Milk Tea, Herbal Tea
Coffee	Black Coffee, Cappuccino
Jam/Jelly	Fruit Jam, jelly, marmalade
Ice cream	Ice cream
Vorta/Mashed Vegetables and fish	Mash of different vegetables and fish
Street food	Fuchka, chotpoti, doi chira, popcorn
Indigenous Pitha/ Homemade cake	Pooli pitha, Shabji pitha, Bhapa pitha, patishapta pitha, Pakan, etc.

Model 1 was adjusted for sex (male/female) and age; Model 2 was further education level (No education, Primary education, Secondary education, Higher education), physical activity level, smoking status (Never, Former, Current), and BMI. Model 3 was additionally adjusted for total energy intake.

Results

Overall prevalence of T2D in our study population was 34.1%. General and clinical characteristics of participants with and without T2D were shown in Table 2 (n=108). There were significant differences between participants with and without T2D by age, educational level, economic income, and the prevalence of obese and hypertension ($P<0.05$). Participants with T2D had higher prevalence of obesity (25.9% vs. 12.1%) and hypertension (44.4% vs. 39.0%) than those without T2D.

Factor analysis revealed two major dietary patterns including the traditional Bangladeshi dietary pattern (high in cereal, pulses, legumes, vegetables, fish and seafood, vorta/mashed vegetables, egg, street food, milk, and indigenous pitha/homemade cake), and the Western dietary pattern (high in meats, nuts,

Table 2: General and clinical characteristics of participants with and without T2D.

Variables	Participants with T2D (n=27) (%)	Participants without T2D (n=82) (%)
Age (years)		
31-39	6 (22.2)	13 (15.85)
41-49	8 (29.6)	27 (32.9)
51-59	11 (40.7)	30 (36.6)
60+	2 (7.4)	12 (14.6)
Sex		
Male	14 (51.85)	39 (47.6)
Female	13 (48.15)	43 (52.4)
Smoking status (%)		
Never	6 (22.2)	32 (39.0)
Former	15 (55.6)	28 (34.1)
Current	6 (22.5)	22 (26.8)
Education (%)		
No education	6 (22.2)	17 (20.7)
Primary education	5 (18.5)	29 (35.4)
Secondary education	9 (33.3)	22 (26.8)
Higher education	7 (25.9)	14 (17.1)
Monthly income per person (%)		
≤20000 (BDT)	5 (18.5)	34 (41.5)
20000-30000 (BDT)	8 (29.6)	30 (36.6)
>30000 (BDT)	14 (51.9)	18 (21.9)
Body mass index		
Normal	20 (74.1)	72 (87.8)
Overweight/obese	7 (25.9)	10 (12.2)
Hypertension (%)		
Yes	12 (44.4)	32 (39.2)
No	15 (55.56)	50 (61.8)
Energy (Kcal/day)	1821.0±412.0	2168.0±312.0

T2DM: Type 2 diabetes mellitus

seeds and their products, processed meat, processed fish, eggs, fast foods, snacks, chocolates, ice cream, sugar-sweetened beverages, tea, and coffee) which explained 8.7, and 6.8% of the dietary intake variance, respectively. The factor-loading matrixes for these dietary patterns were shown in Table 3.

General characteristics of study participants across quartiles of the major dietary pattern scores were shown in Table 4. Compared with participants in the lowest quartile, those in the highest quartile of the traditional Bangladeshi dietary pattern were male, had higher physical activity, low frequency of current smoker, educational level and income. Individuals in the highest quartile of Western dietary pattern were female, high frequency of current smoker, higher educational level, income, BMI, waist circumference (WC), WHR and high prevalence of obesity, hypertension and T2D in comparison to those in the lowest quartile. Other general characteristics variables of the subjects across quartiles of dietary pattern scores had no significant difference.

The relationship between major dietary patterns and T2D risk by logistic regression analysis was shown in Table 5. After adjustment for sex, age, education level (no education, primary education, secondary education, higher education), physical activity level, smoking status (never, former, current), BMI and total energy intake, subjects in the highest quartile of the traditional Bangladeshi dietary pattern score had lower odds of the T2D (OR=0.69; 95% CI; P=0.04) than those did in the lowest quartile, whereas those in the highest quartile of the western dietary pattern score had greater odds of T2D (OR=1.16; 95% CI; P=0.02) than those did in the lowest quartile.

Discussion

The role of dietary patterns in the development of T2D among Bangladeshi has been overlooked in the previous year. To the best of our knowledge, this study is the first to elucidate the associations between major dietary patterns and the risk of T2D in Bangladesh. The result from the study revealed that the traditional Bangladeshi dietary pattern was not significantly associated with risk for T2D, while the Western dietary pattern was correlated with increased risk for T2D. In our analyses, no

Table 3: Factor-loading matrix for the two dietary patterns.

Food groups	Dietary patterns	
	Traditional Bangladeshi	Western
Cereals and their products	0.611	0.455
Pulses, legumes and their products	0.414	-
Vegetables and their products	0.407	0.218
Leafy vegetables	0.249	-
Starchy roots, tubers and their products	0.234	-
Nuts, seeds and their products	-	0.251
Fruit	0.362	0.534
Pickles	-	-
Meat	0.326	0.583
Processed meat	0.349	0.424
Fish and seafood	0.529	0.427
Processed fish	0.347	0.517
Eggs	0.386	0.378
Milk	0.360	0.311
Vegetable oil	-	-
Fast foods	-	0.407
Snacks	-	0.548
Chocolates	-	0.425
Honey	-	-
Sugar-sweetened beverages	0.312	0.498
Tea	0.32	0.38
Coffee	-	0.357
Jam/Jelly	-	-
Ice cream	-	0.276
Vorta/Mashed vegetables and fish	0.489	-
Street food	0.287	-
Indigenous Pitha/Homemade cake	0.384	-
Variance of intake explained (%)	8.7	6.8

Absolute values <0.2 were excluded for simplicity

significant association was found for the traditional Bangladeshi dietary pattern and the risk of T2DM. To our knowledge, studies evaluating the association between major dietary patterns and the risk of diabetes type 2 in Bangladesh are scarce. However, using factor analysis we derived dietary patterns to identify dietary patterns of population with the unique characteristics in dietary intakes and to evaluate their associations with the risk of T2D.

There are several possible explanations for this result. Firstly, dietary patterns characterized by higher intake of plant-based foods and lower intake of fried or high-fat foods have been associated with a lower risk of T2D populations (20-22). Vegetables are plethora of antioxidants and dietary fiber and these are responsible for decreased risk of obesity and T2D (23, 24). Secondly, traditional Bangladeshi dietary pattern contain huge amounts of whole grain. Among all food items associated with the incidence of T2D in observational studies, unambiguous evidence has emerged over the last few decades on the possible role of whole grain consumption in preventing T2D as well as many other widely chronic non-communicable diseases (25).

Thirdly, as an essential element in traditional Bangladeshi diets, legumes may lower risk of T2D and considered to be a "low glycemic index food," which means that blood sugar levels increase very slowly after they are consumed. Finally, fish plays a central role in dietary patterns in Bangladesh and it is by far the most commonly consumed animal-source food across all population groups, at an average of 19.71 kg/person/year. Higher fish intake was associated with a significantly lower risk of diabetes in analyses adjusted for age, sex, family history of diabetes, education, smoking, physical activity, dietary factors and obesity in previous studies (26, 27).

Furthermore, the lack of association between this pattern and T2D risk could also be due to reverse causal association. A Western dietary pattern (high in meats, nuts, seeds, processed meat, processed fish, eggs, fast foods, snacks, chocolates, ice cream, drinks, tea, and coffee) was significantly associated

Table 4: General characteristics of study participants across quartiles of the major dietary pattern scores.

	Dietary patterns					
	Traditional Bangladeshi			Western		
	Q1 (Lowest)	Q4 (Highest)	*P**	Q1 (Lowest)	Q4 (Highest)	*P**
Age (y)	46.5±0.3	49.2±0.2	<0.001	48.2±0.1	49.6±0.3	<0.001
BMI (kg/m^2)	23.42±1.88	24.51±2.11	0.189	24.45±1.16	25.89±2.32	<0.05
WC (cm)	88.2±4.61	88.8±6.32	0.278	89.41±4.19	89.93±4.42	<0.01
WHR	0.88±0.02	0.89±0.04	0.531	0.89 ± 0.08	0.90±0.05	0.088
Obesity (%)	11.11	13.89	0.134	9.25	15.74	<0.05
Hypertension (%)	30.5	32.4	<0.05	29.6	37.9	<0.05
T2DM (%)	21.2	22.2	<0.01	19.4	25.0	<0.01
Sex (%)			<0.001			<0.001
Male	56.6	51.1		48.5	42.7	
Female	43.4	48.9		51.5	57.3	
Smoking status (%)			<0.05			<0.05
Never	25.0	25.3		25.1	32.1	
Former	48.6	52.5		50.2	39.5	
Current	26.4	22.2		24.7	28.4	
Education (%)			<0.001			<0.001
No education	20.4	22.5		20.8	19.9	
Primary education	33.7	28.1		30.1	20.7	
Secondary education	28.9	34.8		30.8	34.2	
Higher education	17.0	14.6		18.3	25.2	
Monthly income per person (%)			0.496			<0.05
≤20000 (BDT)	37.4	43.9		42.7	35.8	
20000-40000 (BDT)	29.2	30.5		24.7	19.0	
>40000 (BDT)	33.4	28.6		32.6	45.2	
Physical activity ((MET-h/d))	9.6±4.6	10.9±4.9	0.44	10.2±3.6	10.6±4.2	0.37
Total energy	2576.3±185.9	2416.8±215.7	0.296	2196.1±2458.8	2628.2±212.6	<0.01

Categorical variables are presented as sum and percentages, and continuous variables are presented as Mean±SD. Abbreviations: BMI: Body mass index, WC: Waist circumference, WHR: Waist hip rate, T2DM: Type 2 diabetes mellitus

Table 5: Multivariable adjusted ORs and 95% CIs for T2DM across the quartile categories of dietary pattern scores in Chattogram, Bangladesh.

	Dietary patterns					
	Traditional Bengali			Western		
	Q1	Q4	*P*	Q1	Q4	*P*
Model 1	1.0	0.66	0.000	1.0	1.58	0.000
Model 2	1.0	0.58	0.000	1.0	1.32	0.000
Model 3	1.0	0.69	0.02	1.0	1.16	0.04

Model 1: Adjusted for sex and age; Model 2: further adjusted for education level (no education, primary education, secondary education, higher education), physical activity level, smoking habit (never, current, former) and body mass index (BMI); Model 3: additionally adjusted for total energy intake. Q: Quartile Q4: Highest quartile of dietary patterns; Q1: Lowest quartile of dietary patterns (reference) OR: Odds ratio, 95%CI: 95% confidence interval; T2DM: Type 2 diabetes mellitus; CI: confidence interval

with increased risk of T2D. Our findings were consistent with the previous observations (20, 28, 29). Positive association between the western dietary pattern and the risk of T2D may partly be attributed to unhealthy dietary constituents, such as processed meat and fish, fast foods and snacks and sugar-sweetened beverages in this pattern. The most important factor that increased risk of obesity and T2D is the high consumption of processed meat and fish because it contains high amounts of saturated fat and cholesterol (15).

Over consumption of red meat increased body iron level (30) and processed meat often contains high concentrations of nitrates or nitrites, and nitrosamine compounds, which are thought to increase T2D risk (31). Recently, a comprehensive meta-analysis has indicated that red meat, processed meat, eggs, and sugar-sweetened beverages were

associated with an increased risk of T2D (28) and in the European Prospective Investigation into Cancer and Nutrition-Potsdam Study, higher intakes of meat were related to risk of weight gain, a known risk factor for T2D (31).

Therefore, consumption of fast foods and snacks items in Western dietary pattern was associated with risk of T2D. As most of the fast foods are highly processed foods with high calories and low in vitamins, minerals, and fiber that break down quickly in the body, they can cause a rapid rise in blood sugar levels (32). Finally, Western dietary pattern composed of sugar-sweetened beverages (soft drinks, fruit drinks, energy and vitamin water drinks) is another risk factor for incidence of T2D, as they are the primary source of added sugars (sucrose, high-fructose corn syrup, or fruit juice concentrates) in the diet. Recent meta-analysis (33) and study (34) also revealed similar findings that sugar-sweetened beverage intake was associated with an increased risk of T2D (31).

However, our study has some potential limitations such as inability to establish the causal associations between dietary patterns and the risk of T2D, subjective decision of food grouping, self-measurement error of FFQ dietary assessment and finally, the limitation regarding the generalizability of the study; as the study sample was not necessarily representative of all the general populations in Bangladesh. Future prospective studies can be conducted with metabolomics approaches, for example by the development of biological biomarkers, measured in both plasma and urine to find association between dietary pattern and T2D.

Conclusion

The current investigation identified two major dietary patterns in Bangladesh. Western dietary pattern was associated with an increased risk of T2D, and no significant association was observed between the traditional Bangladeshi dietary pattern and T2D among Bangladeshi population. Although prospective studies are required to determine the association between dietary pattern and T2D risk, our findings have added to the developing body of literature that explicates that higher consumption of cereal, pulses, legumes, vegetables, fish and seafood, vorta/mashed vegetables, egg, street food, milk, and indigenous pitha/home-made cake are likely beneficial for the prevention of T2D, while the higher consumption of meats, nuts, seeds and their products, processed meat, processed fish, eggs, fast foods, snacks, chocolates, ice cream, sugar-sweetened beverages, tea, coffee may increase the risk of T2D.

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Conflict of Interest

None declared.

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