Original Article

Modifiable Factors Associated with Uncontrolled Type 2 Diabetes Mellitus: Experience in a Tertiary Care Hospital of Bangladesh

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Abstract

Background: *Diabetes mellitus is a non-communicable disease with increasing prevalence worldwide. The present study was done to identify the modifiable factors that were associated with the poor glycemic control in Bangladeshi type 2 diabetic patients attending in a tertiary care hospital.*

Methods: *This cross-sectional study was conducted in the Department of Medicine, Sir Salimullah Medical College & Mitford Hospital (SSMC & MH), Dhaka from July 2014 to June 2015. A total of 140 adult type 2 diabetes mellitus patients were included in this study. Of them 70 patients had uncontrolled diabetes mellitus with glycated haemoglobin ≥ 7% (group 1) and 70 patients with controlled diabetes mellitus (HbA_1c< 7%) (group 2).*

Results: *The present study demonstrated statistically significant difference regarding the mean age of both group 1 and group 2 [59.26±12.88 years and 55.24±11.52 years respectively (p <0.05)] and mean duration of diabetes [10.44±8.46 years and 5.96±6.39 years (p=0.0006) respectively]. Moderate physical activity was significantly (p=0.018) associated with good glycaemic control (group 1= 15.7% and group 2= 32.9%). Mean body mass index (BMI) of both group 1 and group 2 were almost equal (23.73±4.72 Kg/ m^2 and 23.87±4.86 Kg/ m^2 respectively) with no statistical significance and waist hip ratio was 0.98±0.07 and 0.95±0.09 respectively which was statistically significant (p=0.013). Poor economic conditions were significantly associated with uncontrolled blood glucose (p <0.05). Poor glycemic control was also significantly associated with smoking (p=0.00038) and frequent visit with specialist physician (p=0.011). Proper counseling was frequently associated with poor glycaemic control. Most of the patients in group 1 were irregular in dietary habit (58.6%) and exercise (67.1%) and intake of refined sugar (60%) were major contributory factors of poor glycaemic control.*

Conclusions: *Low socioeconomic condition, smoking and intake of refined sugar were the significant modifiable factors that contributed to poor glycaemic control of diabetes. Irregular dietary habits and exercise and proper follow up with specialist physician were more frequent with poor blood glucose control. Proper counseling about diabetes and its management was another modifiable factor. Central obesity and longer duration of diabetes were predisposed to uncontrolled diabetes.*

Key words: *Diabetes mellitus, glycated haemoglobin (HbA_1c), uncontrolled blood glucose.*

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Introduction

Diabetes mellitus (DM) is a non-communicable disease which occurs when the body cannot produce enough insulin or cannot use insulin effectively or both. The prevalence of type 2 diabetes mellitus (T2DM) is increasing all over the world day by day. There were 382 million people living with diabetes worldwide in 2012, which will be increased up to 592 million by 2035.[1-3] In Bangladesh, current prevalence is 5-7% which will be increased 13% if no urgent action is taken.[1,2] The major risk factors in the development of T2DM are family history, obesity, race/ethnicity, age increment (≥ 40 years), previous identified impaired fasting glucose or impaired glucose tolerance, hypertension (HTN), hyperlipidemia and history of gestational DM.[4] There are some factors that are

associated with increasing insulin resistance like older age, female sex, overweight or obese, high wealth index and positive family history of diabetes.[5] There are some modifiable factors that may predispose to poor blood glucose control also. So, early identification of modifiable factors and systematic follow up of treatment are the basic strategies for controlling the disease. The exponential increase in the number of people with diabetes puts an enormous burden on both healthcare authorities and health care providers. The prevention and control programmes of DM are needed to stem the rising epidemic of disease and its complications.[6] This study was designed to identify the modifiable factors that are associated with poor glycemic control in selected Bangladeshi T2DM subjects.

Methods

A cross sectional study was conducted among 140 adult males and females who were admitted in the Department of Medicine, Sir Salimullah Medical College & Mitford Hospital from July 2014 to June 2015. Patients were diagnosed case of DM for more than six months without any comorbidity unrelated to DM. The patients were divided into two groups on the bases of glycated haemoglobin (HbA_1c) levels. Patients with HbA_1c ≥7% were in group 1 (uncontrolled group) and HbA_1c <7% were in group 2 (controlled group). Group 1 consisted of 70 patients and group 2 consisted of 70 patients.

Data were analyzed by computer with the help of Statistical Package for Social Sciences (SPSS) version 22.0. Statistical analysis were done by using appropriate statistical tool like 'chi-square' test, student's 't' test as applicable. Statistical significance was set at 0.05 level.

Ethical approval from the ethical approval committee of Sir Salimullah Medical College was obtained prior to the commencement of the study. Informed written consent was taken from the participants after explanting all the facts to the subjects in case of primary data collection. They were assured of confidentiality and for the purpose of data analysis no individual data had been reported rather de-identified data had been preceded for analysis.

According to the statement of Economic Social Stratification of Bangladesh**,** socioeconomic condition of Bangladesh was classified as lower class whose monthly income 10,000 taka or less, middle class whose income in between 10,000 to 1, 99,000 taka and higher class were more than 2, 00,000 taka par month.[7]

Results

Total patient were 140 including 64 females. Most of the study subjects belonged to 51-60 years & 61-70 years age groups and mean ages for group 1 and group 2 being 59.26±12.88 years and 55.24±11.52 years respectively with statistical significant difference ($p< 0.05$). The mean duration of diabetes was 10.44±8.46 years and 5.96±6.39 years in group 1 and group 2 respectively with significant p value (< 0.05). Regarding physical activities of the patients, sedentary worker (51.4% in group 1 and 35.7% in group 2) and no physical activities (28.6% in both groups) showed no statistical significant difference between two groups. Moderate worker (15.7% in group 1 and 32.9% in group 2) showed the statistical significant difference in both groups ($p < 0.05$) but heavy worker showed no significant difference in both groups (4.3% in group 1 and 2.9% in group 2).

Body mass index (BMI) of the both groups were almost equal (23.73±4.72 Kg/m^2 and 23.87±4.86 Kg/m^2 respectively) and mean wrist hip ratio (WHR) were more in group 1 (0.98±0.07 cm) than in group 2 (0.95±0.09 cm). Table I showed mean height, weight, BMI, waist and hip circumference and WHR of the study subjects. Most of the patient belongs to middle and lower class group with significant p value ($p< 0.05$).

Table I Comparison of clinical characteristics of study participants (N=140)

Demographic characteristics	Group		p-value
	Group 1(n = 70)	Group 2(n = 70)	
Mean height (cm)	159.20±10.07	155.48±9.15	0.097
Mean weight (Kg)	60.21±13.39	57.33±10.66	0.162
Mean BMI (Kg/m^2)	23.73±4.72	23.87±4.86	0.859
Mean waist circumference (cm)	92.40±11.22	89.37±13.55	0.152
Mean hip circumference (cm)	93.96±10.12	93.36±8.75	0.709
Mean WHR	0.98±0.07	0.95±0.09	0.014

Economic classes of group 1 and group 2 were lower class (11% and 4% respectively), middle class (50% and 30% respectively) and higher class (3% and 2% respectively), with significant p value ($p< 0.05$).

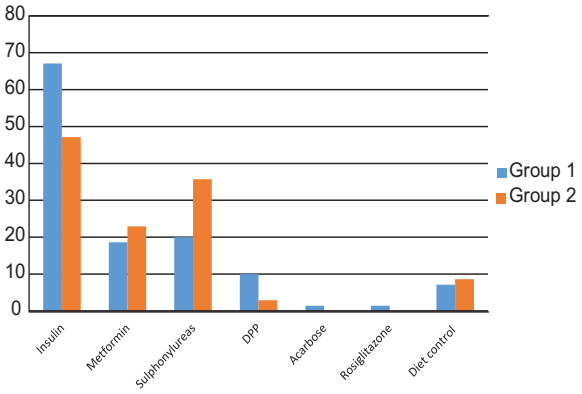
Smoking (37.1% in group 1 and 11.4% in group 2) was significantly associated with poor glycaemic control of diabetes than nonsmoker (55.7% in group 1 and 88.6% in group 2) (P value < 0.05). Table II showed association of the habits with glycaemic controls.

Most of the patients were first diagnosed as diabetes by classical features of diabetes like increase thirst, polyuria and weight loss (50% in group 1 and 40% in group 2). They were first seen by local general physician (55.7% in group 1 and 51.4% in group 2) in both groups. However the results have no statistical significant difference. Both groups were almost equally counseled about diabetes (58.6% in group 1 and 61.4% in group 2). Despite of proper counseling, the level of awareness varies from average (42.9% in group 1 and 40% in group 2) to poor (45.7% in group 1 and 50% in group 2) in both groups. Table III showed the pre diabetes assessment of study participants.

Table II Association of habits with glycaemic control of study participants (N=140)

Habit	Group 1 n=70 (%)	Group 2 n=70 (%)	P-value
Smoking			
Non smoker	39 (55.7)	62 (88.6)	
Ex-smoker	5 (7.1)	0 (0)	0.0234
Smoker	26 (37.1)	8 (11.4)	
Betel leaf chewer			
Not user	43 (61.4)	48 (68.6)	
Ex-user	0	0	0.3734
Current user	27 (38.6)	22 (31.4)	
Alcohol consumption			
Regular	0 (0)	0 (0)	
Irregular	1 (1.4)	0 (0)	0.3173
Non-consumption	69 (98.6)	70 (100)	

Most of the patient of group 1 showed irregular in maintaining dietary modification (58.6%), exercise (67.1%) and majority used refined sugar (60%). In group 1, they monitored blood glucose levels more at laboratory (30%) than local pharmacy (18.6%) but in group 2, they monitored at laboratory (50%) than at home (10%). Table IV showed the maintenance of the blood glucose in diabetic patients.



[DPP- Dipeptidyl peptidase 4 inhibitors]

Figure 1 *Anti-diabetic management of study participants (N=140)*

Insulin, sulphonylureas and metformin were frequently used anti diabetic drugs in both groups. Figure 1 showed the anti-diabetic management pattern of diabetes in study subjects.

Table III Pre diabetes assessment of study participants (N=140)

	Group 1 n=70 (%)	Group 2 n=70 (%)	p-value
First diagnosis			
Classical	35 (50)	28 (40)	
Non-classical	5 (7.1)	2 (2.9)	0.388
During health checkup	18 (25.7)	28 (40)	
With complication	12 (17.1)	12 (17.1)	
First advice taken			
Non-medical person	0 (0)	9 (12.9)	
Local GP	39 (55.7)	36 (51.4)	0.207
Local Diabetes specialist	11 (15.7)	17 (24.3)	
Specialist/ Endocrinologist	20 (28.6)	8 (11.4)	
Proper counseling			
Done	41 (58.6)	43 (61.4)	0.726
Not done	29 (41.4)	27 (38.6)	
Regular specialist follow up			
Yes	36 (51.4)	36 (51.4)	1.0
No	34 (48.6)	34 (48.6)	
Knowledge about diabetes			
	Good	8 (11.4)	7 (10)
Average	30 (42.9)	28 (40)	0.708
Poor	32 (45.7)	35 (50)	

Table IV Maintenance of diabetes mellitus of study participants (N=140)

	Group 1 n= 70 (%)	Group 2 n= 70 (%)	p-value
Maintain regular diabetic chart			
Regular	29 (41.4)	37 (52.9)	0.177
Irregular	41 (58.6)	33 (47.1)	
Take refine sugar			
Yes	42 (60)	29 (41.4)	0.028
No	28 (40)	41 (58.6)	
Regular exercise			
Regular	23 (32.9)	27 (38.6)	0.478
Irregular	47 (67.1)	43 (61.4)	
Blood glucose monitoring			
Regular	40 (57.4)	41 (58.6)	0.865
Irregular	30 (48.6)	29 (41.4)	
Place at monitoring			
Home	6 (8.6)	7 (10)	
Local Pharmacy	13 (18.6)	0 (0)	0.303
Laboratory	21 (30)	35 (50)	
Different place	30 (42.9)	28 (40)	

Discussion

The present study intended to find out the modifiable factors that were association with poor glycemic controls of T2DM in Bangladesh which will reduce the diabetes related complication and thus reduce the financial burden of the patients.

Total 140 patients were included in this study, among them the mean age and range of age were showed the similar results with other study.[8] Regarding duration of diabetes, longer duration of diabetes were significantly associated with poor control of blood sugar ($p < 0.05$). This finding was consistent with other study too.[9] Regarding physical activity, in moderate activity group showed the statistical significant p value (<0.05). These results were similar to other studies in Bangladesh.[10,11]

The mean BMI of both groups showed almost similar in both groups and the BMI value ranged from 12.5 to 41.85 Kg/m^2. In other study, they found that these values ranged from 18.9 to 41.2 $Kg/m^2$and these results almost similar to study results.[9] The only difference was the lower limits of BMI which was 12.5 Kg/m^2in our study. The mean waist hip ratio was more in group 1 than in group 2. The waist circumference was a better predictor of insulin resistance in type 2 diabetes than BMI.[12] So, study results were similar to that study. In other study, they also showed the similar results in waist hip ratio.[13]

Regarding economic status of patient, middle and lower income class were significantly associated with poor control of blood glucose ($p < 0.05$). In other studies, they had shown the same result in Bangladesh.[10, 14, 15]

Regarding the adoption of habits harmful to health, smoking was significantly associated with poor control of blood glucose ($p < 0.05$). Smoking is injurious to health. Cessation of smoking may help to build a healthy life thus indirectly maintain blood glucose level, a modifiable factor for poor glycaemic control. Betel nut chewing and consumption of alcohol were not significantly associated with poor control of diabetes. Other studies showed the similar inference about smoking.[16, 17]

Regarding the first diagnosis of diabetes, most of the patients in both groups were first diagnosed by classical presentation followed by during routine examination. Another study showed the similar results regarding first presentation of diabetes mellitus.[18] The first advice was taken from local general physicians were more frequent in both group than local diabetic specialist but the results were not statistically significant. The finding was similar to other study.[19] There were significant number of patients of both groups who were properly counseled about diabetes and its management. The finding was similar to the finding of other study.[9] Most of the patient of both group were frequently follow up with endocrine specialist regularly. This result was similar to the results of other study.[16] Most of the study subjects had average to poor knowledge about the disease in both group. These results were similar to the finding of other studies.[6, 20] Among newly diagnosed T2DM patients in Bangladesh, similar results regarding knowledge of diabetes.[21] The percentage of respondents with good knowledge on diabetes (45.6%) was much higher.[20, 22] It should be noted that our study focused only on three domains of basic knowledge on the disease. Only 43.2% participants had heard about diabetes (58.4% in urban areas).[23] A study conducted in Singapore among the general population found that they had an acceptable level of knowledge on diabetes.[24] On the other hand,

among a semi-urban Omani population found their level of knowledge on diabetes to be suboptimal.[25]

For regular maintenance of diabetes, most of the patients of group 1 were frequently associated with irregular in maintaining diet, exercise and use refined sugar. In other study stated the similar results.[16] Regarding blood glucose monitoring, in group 1, they preferred at laboratory and local pharmacy to monitor blood glucose levels. The International Diabetes Management Practice Study (IDMPS) found that self-monitoring of blood glucose (SMBG) and short disease duration were predictors of HbA_{1c} <7% in patients with type 2 diabetes from Asia, Latin America and Eastern Europe.[26]

Regarding diabetes management, majority of patient of both group were on insulin, metformin and sulphonylureas as either monotherapy or combined therapy and only a fewer on diet adjustment therapy. But significant numbers were using insulin with other medication with poor glycemic control. Most of the uncontrolled patient switch to insulin from oral agent. This finding showed the similar inference with other study.[16]

Conclusion

Moderate physical activities, low socioeconomic condition, smoking and intake of refined sugar were the significant modifiable factors that contribute to poor control of diabetes. Irregular dietary habits and exercise and proper follow up to specialist physician more frequent with poor blood glucose control. Proper counseling about diabetes and its management was another modifiable factor. Central obesity and longer duration of diabetes were the main predisposing factors for uncontrolled blood glucose.

Limitation

This study was conducted in small sample in single center which is the limitation of the study. So, for further recommendation, multicenter study with large sample size is emphasized.

Conflict of interest: Nothing to declare.

References

1. International Diabetes Federation (IDF) [Internet] Country estimates tables 2011. IDF diabetes Atlas. 6th edition. 2012. Available from: http://www.idf.org/sites/default/files/ EN-6E-Atlas-Full-opdf [Accessed 7th June 2013].
2. World Health Organization. Prevention of diabetes mellitus. Report of a WHO study Group. Geneva: World Health Organization; 1994. No-844.
3. Hunt KJ, Schuller KL. The increasing prevalence of diabetes in pregnancy. Obstet Gynecol Clin North Am 2007; 34: 173-99, vii.
4. Snacks FM, Svetlery LP, Vollmen WM, Appel LJ, Bray GA, Harsha D et al, Effect of blood pressure of reduced dietary sodium and the dietary approaches to stop hypertension (DASH) diet. N. Eng. J. Med 2001; 344: 3-10.
5. Saquib N, Saquib J, Ahmed T, Khanam MA, Cullen MR. Cardiovascular diseases and type 2 diabetes in Bangladesh: a systemic review and meta-analysis of studies between 1995 and 2010. BMC Public Health 2012; 12: 434.
6. Sultana Z, Ali ME, Akhter MA, Uddin MS, Haque MM. A study of evaluation for the Management of Diabetes in Bangladesh. Pharmacology & Pharmacy 2013, 4, 355-61.
7. Economic Social Stratification of Bangladesh, May 14, 2008.
8. Siddiqui SRA, Rahman MZ, Alam ASMT, Hoque M. Glycemic Control in Type 2 Diabetes Mellitus Patients Chattagram Maa-O-Shishu Hospital Medical College Journal 2013; 12: DOI: 10.11566/cmosh.2013.1201.4
9. Nemeh AA, Yousef SK, Aysha MA. Glycemic control and its determinants among patients with type 2 diabetes mellitus attending a teaching hospital. Journal of Diabetes Metabolism 2011; 2:4 http://dx.doi.org.10.4172/2155-6156.10000129.
10. Sayeed MA, Mahtab H, Khanam PA, Latif ZA, Ali SMK, Banu A et al. Diabetes and impaired fasting glycaemia in a rural population of Bangladesh. Diabetes Care 2003; 26: 1034-39.
11. Sayeed MA, Hossain MZ, Banu A, Rumi MAK, Azad Khan AK. Prevalence of diabetes in a suburban population of Bangladesh. Diabet Res ClinPract 1997; 34: 149-55.
12. Liao YL, Hsu SCH, Waist circumference is a better predictor than body mass index of insulin resistance in type 2 diabetes. Int J Diabetes &Metab 2011; 19:35-40
13. Kahlon AS, Pathak R. Patterns of glycemic control using glycosylated hemoglobin in diabetics. J Pharm Bioallied Sci. 2011; 3: 324-28.
14. Sayeed MA, Ali L, Rumi MA, Banu A, Khan AKA. Effect of socioeconomic risk factors on the difference in prevalence of diabetes between rural and urban populations in Bangladesh. Diabetes Care 1997; 20: 551-55.
15. Rahim MA, Rahman MM, Nahar Q. Prevalence and risk factors of type 2 diabetes in an urbanizing rural community of Bangladesh. Bangladesh Med Rs Counc Bull 2007; 33: 48-54.

16. Ahmad A, Othman I, Zain AZM, Chowdhury EH. Recent Advances in Insulin Therapy for Diabetes Int J Diabetes Clin Res 2014; 1:1 ISSN: 2377-3634.

17. Khattab M, Khader YS, Al-Khawaldeh AK, KamelAjlouni. Factors associated with poor glycemic control among patients with type 2 diabetes. Journal of Diabetes and its Complications 2010; 24: 84-89.

18. McCulloch DK, Nathan DM, Wolfedorf JI, Mulder J. Clinical presentation and diagnosis of diabetes mellitus in adults. UpToDate April 2016.

19. Assunçãoa MCF, Santosb IS, Vallec NCJ. Blood glucose control in diabetes patients seen in primary health care centers. Rev Saudi Publica 2005; 39: 183-90.

20. Sanal TS, Nair NS, Adhikari P. Factors associated with Poor Control of type2 diabetes mellitus: A systematic review and Meta-analysis. Journal of Diabetology 2011; October 2011; 3:1.

21. Saleh F, Mumu SJ, Ara F, Begum HA, Ali L. Knowledge and self-care practices regarding diabetes among newly diagnosed type 2 diabetics in Bangladesh: a cross-sectional study. BMC Public Health 2012; 12:1112.

22. Mohan D, Raj D, Shanthirani C, Datta M, Unwin N, Kapur A et al. Awareness and knowledge of diabetes in Chennai—the Chennai urban rural epidemiology study [CURES-9]. J Assoc Physicians India 2005; 53:283–87.

23. Deepa M, Bhansali A, Anjana R, Pradeepa R, Joshi S, Joshi P et al. Knowledge and awareness of diabetes in urban and rural India: the Indian Council of Medical Research India Diabetes Study (Phase I). Indian Council of Medical Research India Diabetes 4. Indian J Endocrinol Metabol 2014; 18:379.

24. Wee H, Ho H, Li S. Public awareness of diabetes mellitus in Singapore. Singap Med J 2002; 43:128–34.

25. Al Shafaee MA, Al-Shukaili S, Rizvi SG, Al Farsi Y, Khan MA, Ganguly SS et al. Knowledge and perceptions of diabetes in a semi-urban Omani population. BMC Public Health 2008; 8:249

26. Chan JC, Gagliardino JJ, Baik SH, Chantelot JM, Ferreira SR, Hancu N et al. Multifaceted determinants for achieving glycemic control: the International Diabetes Management Practice Study (IDMPS). Diabetes Care 2009; 32, 227–33.