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Association of Knowledge & Life Style Modification with Control of HbA1c Level in Patients with Type-2 Diabetes Mellitus

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Abstract **Original Research Article**

Background: Diabetes mellitus is a major public health problem associated with significant morbidity and mortality. Adequate knowledge and lifestyle modification play an important role in achieving optimal glycemic control and preventing diabetes-related complications. This study aimed to determine the association between knowledge and lifestyle modification with control of HbA1c among patients with Type 2 Diabetes Mellitus. ***Methods:*** This descriptive cross-sectional study was conducted in the Department of Medicine, Combined Military Hospital (CMH), Sylhet over a period of 06 months. A total of 150 patients with Type 2 Diabetes Mellitus were selected by purposive and convenient sampling methods. Data were collected using a structured questionnaire regarding sociodemographic profile, clinical characteristics, diabetes-related knowledge and lifestyle modification practices. Glycemic control was assessed by HbA1c level. Statistical analysis was performed using SPSS version 25.0. ***Results:*** The majority of patients were male (66.7%) and aged ≤40 years (41.3%). Most patients had uncontrolled HbA1c levels (84.0%). Knowledge regarding HbA1c was low, as only 20.0% knew that HbA1c reflects long-term blood glucose control. Regular physical exercise was reported by 52.7% of patients, while only 13.3% monitored blood glucose regularly. Significant associations were found between controlled HbA1c and knowledge about HbA1c (p=0.004), diabetic diet adherence (p=0.048), regular physical exercise (p=0.021) and self-monitoring of blood glucose (p=0.043). ***Conclusion:*** Poor diabetes-related knowledge and inadequate lifestyle modification were significantly associated with uncontrolled HbA1c levels among patients with Type 2 Diabetes Mellitus.

Keywords: Type 2 Diabetes Mellitus, HbA1c, Knowledge, Lifestyle Modification, Glycemic Control.

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INTRODUCTION

Diabetes mellitus (DM) is defined as a heterogenous metabolic disorder characterized by persistent hyperglycemia. Hyperglycemia in DM alters pathways & causes pathophysiological changes in vital organs leads to both microvascular (Retinopathy, Nephropathy & Neuropathy) & macrovascular (Myocardial infarction, stroke, peripheral vascular disease, etc.) complications [1]. Uncontrolled diabetes mellitus adversely affect the quality of life & impose financial burden to family as well as country. Based on International Diabetes Federation (IDF) It is estimated that 589 million people have diabetes in the world during 2025. In Bangladesh over 10 million people have diabetes & prevalence rate is 13.2 %. Bangladesh is highlighted as a hotspot for diabetes due to large percentage of adults are unaware that they have the disease [2]. Several factors promote the occurrence of DM like genetic & epigenetic factors, sedentary life style, lack of exercise, excessive intake of sugar & sugar loaded drinks, unhealthy dietary habits.

Type 2 Diabetes Mellitus (T2DM) is the most common form of diabetes and accounts for the majority of diabetes-related morbidity and mortality worldwide [3]. Proper glycemic control is essential to prevent both acute and chronic complications of the disease [4]. Glycated hemoglobin (HbA1c) is considered one of the most reliable indicators of long-term glycemic control, reflecting the average blood glucose level over the previous two to three months [5]. Maintaining HbA1c within the recommended range significantly reduces the risk of diabetic complications and improves overall

prognosis [6].

Patient knowledge regarding diabetes plays an important role in disease management. Adequate knowledge of diabetes, risk factors, dietary control, physical activity, medication adherence, self-monitoring of blood glucose and regular follow-up can positively influence glycemic control [7]. Patients who are aware of the importance of lifestyle modification are more likely to adopt healthy behaviors and maintain better metabolic control [8]. Lifestyle modification, including diabetic diet, weight reduction, regular exercise, smoking cessation and compliance with treatment, is considered the cornerstone of diabetes management [9].

Despite advancements in treatment strategies, poor glycemic control remains a major challenge in developing countries due to inadequate knowledge, poor adherence to lifestyle changes, low health education and limited access to healthcare facilities [10]. Assessment of patients' knowledge and lifestyle practices is therefore important to identify gaps in diabetes care and improve disease outcomes through appropriate educational interventions [11].

The objective of this study was to determine the association between knowledge & life style modification in management of HbA1c among patients with type 2 diabetes mellitus.

METHODOLOGY & MATERIALS

This descriptive cross-sectional study was conducted in the Department of Medicine, Combined Military Hospital (CMH) Sylhet over a study period of 06 months. The main outcome variable was glycemic control measured by HbA1c (controlled: <7%), while the independent variables were knowledge related to diabetes and complications including HbA1c testing, SMBG and regular follow-up, as well as lifestyle modification related to meal planning, weight control and medication adherence. Presence of comorbidities such as dyslipidemia was considered a confounding variable. The study population included both out-patient department (OPD) and admitted patients in Medicine & Endocrinology departments in CMH Sylhet with diabetes mellitus. A sample size of 150 patients was recruited using purposive and convenient sampling method. Inclusion criteria were diagnosed case of Type 2 Diabetes Mellitus, age ≥18 years, duration of diabetes at least 6 months, having a recent HbA1c report, ability to understand and respond to the study questionnaire and willingness to participate and provide informed consent. Exclusion criteria included patients with Type 1 diabetes mellitus or gestational diabetes, newly diagnosed diabetes (<6 months), patients with transfusion-dependent hemoglobinopathies, patients with cognitive impairment or unable to respond and individuals unwilling to participate. Data were collected using a prescribed data collection sheet and analysis was performed by computer-based program SPSS version 25.0. Ethical clearance was taken from the relevant body and informed verbal and written consent was obtained prior to inclusion in the research.

RESULTS

Table I: Distribution of Sociodemographic Characteristics of the Study Population (n=150)

Characteristics	Frequency (n)	Percentage (%)
Age group (years)		
≤40	62	41.3
41–50	44	29.3
51–60	27	18.0
>60	17	11.3
Sex		
Male	100	66.7
Female	50	33.3
Marital Status		
Married	150	100.0
Unmarried	0	0.0
Widow / Divorced	0	0.0
Educational Status		
Illiterate	4	2.7
Primary	21	14.0
Secondary	60	40.0
Higher Secondary	47	31.3
Graduate or above	18	12.0
Occupation		
Housewife	24	16.0
Service holder	56	37.3
Day labourer	44	29.3

Business	26	17.3
Monthly Income (BDT)		
Less than 10,000	17	11.3
10,000–20,000	45	30.0
More than 20,000	88	58.7
Place of Residence		
Urban	80	53.3
Rural	70	46.7

Table I summarizes the sociodemographic characteristics of the study population. A total of 150 patients with type 2 diabetes mellitus were included in this study. Regarding sociodemographic characteristics, the majority of patients were aged ≤40 years (41.3%), followed by 41–50 years (29.3%), 51–60 years (18.0%) and >60 years (11.3%). Male patients predominated (66.7%) compared to females (33.3%). All patients were married (100.0%). In terms of educational status, the largest proportion had secondary education (40.0%), followed by higher secondary (31.3%), primary (14.0%), graduate or above (12.0%) and illiterate (2.7%). Regarding occupation, service holders constituted the highest percentage (37.3%), followed by day labourers (29.3%), businessmen (17.3%) and housewives (16.0%). Most patients had a monthly income of more than 20,000 BDT (58.7%), while 30.0% earned between 10,000–20,000 BDT and 11.3% earned less than 10,000 BDT. Regarding place of residence, 53.3% lived in urban areas and 46.7% in rural areas.

Table II: Distribution of Clinical Information of the Study Population (n=150)

Variables	Frequency (n)	Percentage (%)
BMI (kg/m²)		
Normal	61	40.7
Overweight	63	42.0
Obese	26	17.3
Duration of diabetes (years)		
<10 Years	123	82.0
10–20 Years	24	16.0
>20 Years	3	2.0
Current treatment		
MNT	5	3.3
OHA	126	84.0
Insulin	5	3.3
Both Insulin & OHA	14	9.3
HbA1c status		
Controlled (<7%)	24	16.0
Uncontrolled (≥7%)	126	84.0
Time since last HbA1c test		
Within ≤3 months	16	10.7
>3 months ago	134	89.3
Diabetes-related complications		
Yes	69	46.0
No	81	54.0
Type of Complication		
Peripheral neuropathy only	42	60.9
Nephropathy only	9	13.0
Nephropathy + Peripheral neuropathy	7	10.1
Nephropathy + Peripheral neuropathy + Retinopathy	11	16.0

Table II presents the clinical information of the study population. Regarding BMI, the majority of patients were overweight (42.0%), followed by normal weight (40.7%) and obese (17.3%). Regarding duration of diabetes, most patients had diabetes for less than 10 years (82.0%), while 16.0% had diabetes for 10–20 years and only 2.0% for more than 20 years. In terms of current treatment, the majority were on oral hypoglycemic agents (OHA) alone (84.0%), followed by both insulin and OHA (9.3%), while only 3.3% were on insulin alone and 3.3% on medical nutrition therapy (MNT) alone. Regarding glycemic control, only 16.0% of patients had controlled HbA1c (<7%), while the vast majority (84.0%) had uncontrolled HbA1c (≥7%). Concerning the time since the last HbA1c test, 89.3% of patients had their test more than 3 months ago, compared to only

10.7% within the last 3 months. Regarding diabetes-related complications, 46.0% of patients had at least one complication, while 54.0% had none. Among the 69 patients with complications, peripheral neuropathy alone was the most common (60.9%), followed by combined nephropathy, peripheral neuropathy and retinopathy (16.0%), nephropathy alone (13.0%) and combined nephropathy with peripheral neuropathy (10.1%).

Table III: Distribution of Knowledge about Diabetes & HbA1c among the Study Population (n=150)

Variables	Frequency (n)	Percentage (%)
Know what diabetes is	112	74.7
Know diabetes is controllable but not curable	37	24.7
Know risk factors of diabetes	30	20.0
Know sugary and fatty food increase blood sugar	115	76.7
Knowledge about blood sugar control measures	148	98.7
Knowledge about monitoring of blood sugar	25	16.7
Know HbA1c indicates long-term blood sugar level	30	20.0
Know uncontrolled diabetes damages organs	55	36.7

Table III shows the distribution of knowledge about diabetes and HbA1c among the study population. The majority of patients knew what diabetes is (74.7%) and knew that sugary and fatty foods increase blood sugar levels (76.7%). Almost all patients had knowledge about blood sugar control measures (98.7%). However, only 24.7% knew that diabetes is controllable but not curable and only 20.0% knew the risk factors of diabetes. Knowledge about monitoring of blood sugar was low (16.7%) and only 20.0% knew that HbA1c indicates long-term blood sugar level. Regarding complications, 36.7% knew that uncontrolled diabetes damages the eyes, kidneys, nerves and heart.

Table IV: Distribution of Lifestyle Modification Practice among the Study Population (n=150)

Variables	Frequency (n)	Percentage (%)
Follow diabetic diet plan		
Yes	88	58.7
No	59	39.3
Don't know	3	2.0
Engage in regular physical exercise		
Yes	79	52.7
No	71	47.3
Duration of exercise		
<30 minutes	45	30.0
≥30 minutes	34	22.7
No exercise	71	47.3
Monitor blood glucose regularly		
Yes	20	13.3
No	130	86.7
Source of information about diabetes		
Doctor	150	100.0
Media	0	0.0
Internet	0	0.0
Others	0	0.0

Table IV presents the lifestyle modification practices among the study population. Regarding dietary habits, 58.7% of patients followed a diabetic diet plan, while 39.3% did not and 2.0% were unsure. In terms of physical activity, 52.7% engaged in regular physical exercise, while 47.3% did not. Among those who exercised, 30.0% exercised for less than 30 minutes and only 22.7% exercised for 30 minutes or more; the remaining 47.3% performed no exercise. Regarding self-monitoring of blood glucose, only 13.3% monitored their blood glucose regularly, while 86.7% did not. Concerning the source of diabetes information, all patients (100.0%) relied solely on doctors, with no patients reporting media, internet, or other sources.

Table V: Association of Knowledge and Lifestyle Modification with HbA1c Status among the Study Population (n=150)

Variables	Controlled HbA1c (<7%) (n=24)	Uncontrolled HbA1c (≥7%) (n=126)	p-value
Knowledge about HbA1c	10 (33.3%)	20 (66.7%)	0.004
Follow diabetic diet plan	18 (20.5%)	70 (79.5%)	0.048
Regular physical exercise	18 (22.8%)	61 (77.2%)	0.021
Monitor blood glucose regularly	8 (40.0%)	12 (60.0%)	0.043

Table V shows the association of knowledge and lifestyle modification with HbA1c control among the study population. Among patients who had knowledge about HbA1c, 33.3% achieved controlled HbA1c compared to 66.7% who remained uncontrolled (p=0.004). Regarding dietary practice, among those who followed a diabetic diet plan, 20.5% had controlled HbA1c versus 79.5% with uncontrolled HbA1c (p=0.048). In terms of physical activity, among patients who engaged in regular exercise, 22.8% achieved glycemic control compared to 77.2% who did not (p=0.021). Regarding self-monitoring of blood glucose, among those who monitored regularly, 40.0% had controlled HbA1c versus 60.0% with uncontrolled HbA1c (p=0.043).

DISCUSSION

This study evaluated the association of knowledge and lifestyle modification with HbA1c control among patients with Type 2 Diabetes Mellitus. The findings demonstrated that poor glycemic control remains highly prevalent and inadequate diabetes-related knowledge and suboptimal lifestyle practices were significantly associated with uncontrolled HbA1c levels.

In the present study, the majority of patients were male (66.7%) and belonged to the younger age group of ≤40 years (41.3%). Similar male predominance was also reported by Hossain *et al.,* and Roy *et al.,* among Bangladeshi diabetic patients [12,13]. Most participants had secondary or higher secondary education, which may influence awareness and self-care practices related to diabetes management.

Regarding glycemic status, 84.0% of patients had uncontrolled HbA1c (≥7%), while only 16.0% achieved adequate glycemic control. Comparable findings were observed by Hossain *et al.,* who reported poor glycemic control among a large proportion of Bangladeshi adults with Type 2 Diabetes Mellitus [14]. Wondm *et al.,* also demonstrated that inadequate self-care activities were strongly associated with poor glycemic outcomes [15]. The high percentage of uncontrolled diabetes in the present study may be explained by poor lifestyle adherence, inadequate self-monitoring and insufficient diabetes knowledge.

Knowledge regarding diabetes and HbA1c was unsatisfactory in several domains. Although 74.7% of patients knew what diabetes is and 76.7% understood that sugary and fatty foods increase blood sugar levels, only 20.0% knew the risk factors of diabetes and only 20.0% knew that HbA1c reflects long-term blood glucose control. Similar observations were reported by Jabeen *et al.,* who found limited awareness regarding HbA1c among hospitalized diabetic patients [16]. Roy *et al.,* also reported inadequate self-care knowledge among patients with Type 2 Diabetes Mellitus [13]. Ferreira *et al.,* emphasized that diabetes-related knowledge plays a major role in future disease management and prevention of complications [17].

Lifestyle modification practices in the current study were also inadequate. Only 58.7% of patients followed a diabetic diet plan and 52.7% engaged in regular physical exercise. Moreover, only 13.3% monitored blood glucose regularly. These findings are consistent with the study conducted by Hossain *et al.,* where many diabetic patients failed to maintain recommended lifestyle practices [14]. Alfulayw *et al.,* identified noncompliance with medication and lifestyle modification as major contributors to poor diabetes control [18]. Similarly, Ong-Artborirak *et al.,* reported that better self-care behaviors and health literacy were associated with improved glycemic control among older adults with diabetes [19].

The present study demonstrated significant associations between knowledge, lifestyle modification and HbA1c control. Patients who had knowledge about HbA1c showed significantly better glycemic control (p=0.004). Likewise, adherence to diabetic diet (p=0.048), regular physical exercise (p=0.021) and self-monitoring of blood glucose (p=0.043) were significantly associated with controlled HbA1c levels. Similar findings were reported by Ahmed *et al.,* who found that nutrition knowledge and dietary practices positively influenced diabetes self-management behavior among Bangladeshi adults [20]. Hossain *et al.,* also demonstrated that diabetes self-care management was significantly associated with glycemic control [12].

Several intervention-based studies further support the findings of the current study. Margarita *et al.,* and Marsinova Bakara *et al.,* reported that diabetes self-management education significantly improved patient knowledge and reduced HbA1c levels [21,22]. Ağralı and Akyar also observed significant improvement in HbA1c following health literacy-based educational intervention [23]. Furthermore, Yang *et al.,*[18]

concluded in a meta-analysis that lifestyle interventions effectively reduced HbA1c levels among overweight and obese patients with Type 2 Diabetes Mellitus [24].

CONCLUSION

The present study demonstrated that inadequate knowledge regarding diabetes and poor lifestyle modification practices were significantly associated with uncontrolled HbA1c levels among patients with Type 2 Diabetes Mellitus. Better awareness about HbA1c, adherence to diabetic diet, regular physical exercise and self-monitoring of blood glucose were associated with improved glycemic control.

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