Influence of Knowledge, Attitude & Adherence of Non-Pharmacological Treatment in the Management of Type2 Diabetes Mellitus Cases in Rural Areas in Bangladesh

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Abstract:

Background: *Diabetes mellitus is a chronic metabolic disorder affecting millions worldwide, with high blood sugar levels leading to complications such as cardiovascular disease, kidney failure, and vision loss. Effective management of Type 2 Diabetes Mellitus (T2DM) often requires a combination of pharmacological and non-pharmacological approaches.*

Methods: *This cross-sectional observational study was conducted in Rajapur Upazila of Jhalokathi district and Bhandaria Upazila of Pirojpur district under the guidance of the Department of Biomedical Engineering and Public Health at the World University of Bangladesh. A total of 150 T2DM patients aged 20–90 years were included. Participants were divided into three groups: non-pharmacological intervention only, combined non-pharmacological and pharmacological intervention, and pharmacological intervention only.*

Results: *The mean age of participants was 52.35 ± 12.06 years, with 124 (82.67%) having uncontrolled FBS (>6.4 mmol/L). Post-intervention, smoking reduced from 6% to 4.67%, 86.67% adopted dietary changes, 80% started walking, and 8.67% began exercising. Group A1/B1 (non-pharmacological) and A2/B2 (combined) showed significant FBS, 2HABF, and HbA1C reductions (p < 0.001), while A3/B3 (pharmacological-only) showed modest improvements. S. Creatinine changes were non-significant across groups, highlighting the effectiveness of lifestyle interventions in improving glycemic control.*

Conclusion: *The six-month lifestyle intervention program demonstrated significant benefits in managing T2DM, with marked improvements in glycemic control and lifestyle behaviors. The findings highlight the feasibility and effectiveness of non-pharmacological interventions, particularly in resource-limited rural settings. Further research with extended follow-up is recommended to validate these results and support sustainable diabetes management strategies.*

Keywords: *Type 2 Diabetes Mellitus, lifestyle intervention, glycemic control, rural Bangladesh, non-pharmacological treatment.*

1. INTRODUCTION

Diabetes mellitus is a chronic condition that affects millions of people worldwide. It is characterized by high blood sugar levels that can lead to serious complications.[1] Such as heart disease, kidney failure, nerve damage, and vision loss. According to the International Diabetes Federation (IDF), it is estimated that 387 million adults have diabetes with either Type 1 or Type 2 diabetes mellitus, and this number is predicted to rise to 392 million by 2035.[1,2] This predicted rise is mainly due to globalization and urbanization. Urbanization is mainly affected by modifications in life style with physical inactivity and a secondary lifestyle from various epidemiological and interventional studies have revealed that the majority of chronic illnesses such as diseases that affect the cardiovascular system such as hypertension, cancer, and Type 2 diabetes mellitus result from lifestyle behaviors and habits that are caused by improper eating

habits, eating unhealthy foods, and lack of physical activity.[3] In primary and specialist health facilities, the majority of the consultations are related to highly preventable lifestyle. Diabetes mellitus can be caused by genetic factors, environmental factors, or both.[4] However there is growing evidence that lifestyle factors such as diet, physical activity, stress management, and sleep quality play a crucial role in the prevention and management of diabetes mellitus.[5] Lifestyle medicine is a medical specialty that focuses on using lifestyle interventions to treat and prevent chronic diseases, such as diabetes mellitus.[6] Lifestyle medicine is based on the principle that most chronic diseases are caused or influenced by unhealthy behaviors that can be modified by the individual.[7] Lifestyle medicine aims to empower patients to take charge of their own health and well-being by adopting healthy habits and behaviors that can improve their blood sugar control and reduce their risk of complications.[8]

Lifestyle medicine provides evidence-based guidance to help diabetes patients make sustainable lifestyle changes that improve their health. It focuses on lowering blood sugar levels, enhancing insulin sensitivity, maintaining a healthy weight, reducing stress, improving sleep quality, and preventing complications through diet, physical activity, and behavioral modifications.[9] While not a replacement for conventional treatment, it complements medical therapies to enhance their effectiveness and overall patient well-being.

Lifestyle medicine can also improve the quality of life and well-being of patients with diabetes mellitus by reducing their symptoms, increasing their energy levels, boosting their self-esteem and enhancing their social relationships.[10] Diabetes mellitus is a risk factor for cardiovascular disease, a common cause of blindness due to diabetic retinopathy, and amputation of the lower limbs following diabetic neuropathy, diabetic foot ulcers, and other life-threatening complications like end-stage kidney disease.[4] Globally diabetes mellitus is the second leading cause of blindness and renal disease.[5] Therefore, it is very important to prevent diabetes mellitus as it causes immense loss of working hours due to the impact they have on the economy and the individual and ultimately the nation as a whole.[6] This is worst in low and middle income countries with the proper health care system and lack of health insurance for the entire populace where people have to pay out of pocket.[7,8]

2. OBJECTIVE

The objective of this study was to find out the prevalence and role of lifestyle medicine in the management of Type 2 Diabetes Mellitus.

3. METHODOLOGY & MATERIALS

This cross-sectional observational study was conducted in Rajapur Upazila of Jhalokathi district and Bhandaria Upazila of Pirojpur district under the guidance of the Department of Biomedical Engineering and Public Health at the World University of Bangladesh. The study spanned six months, from July to December 2023, and included 150 individuals diagnosed with Type 2 Diabetes Mellitus, aged 20 to 90 years. Participants were randomly selected from healthcare centers, and eligibility was determined based on inclusion and exclusion criteria. The inclusion criteria consisted of individuals with Type 2 Diabetes Mellitus who were willing to participate in a lifestyle intervention program, while the exclusion criteria ruled out non-diabetic individuals and diabetic patients unable to adhere to the lifestyle intervention.

Data collection focused on demographic and socio-economic variables, as well as factors such as diet, stress, smoking habits, and physical exercise. Confounding variables, including health education, knowledge, and self-management capability, were also considered. Laboratory test results were used for screening and analysis, including fasting blood sugar (FBS), postprandial blood sugar, HbA1c, and serum creatinine levels. The data collection process followed a strict protocol to ensure completeness and accuracy, with all records verified and summarized in a master sheet for analysis.

The data were analyzed using SPSS software, employing descriptive statistics to interpret findings and determine relationships between variables. A quality assurance strategy was implemented, including protocol development, data validation checks, and continuous monitoring and auditing to maintain reliability. Ethical approval was obtained from the Research Ethical Committee of the World University of

Bangladesh, and all participants provided informed consent before the study began.
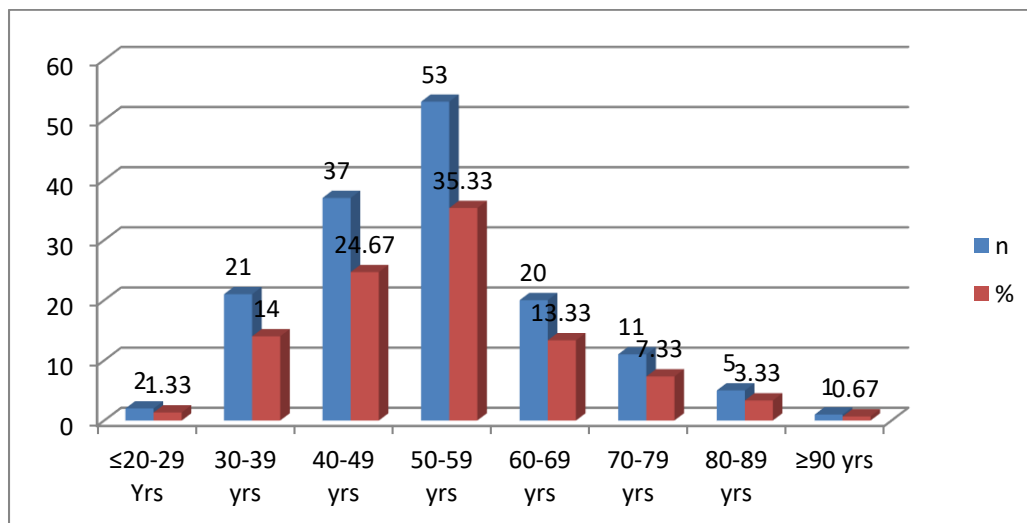
4. RESULTS
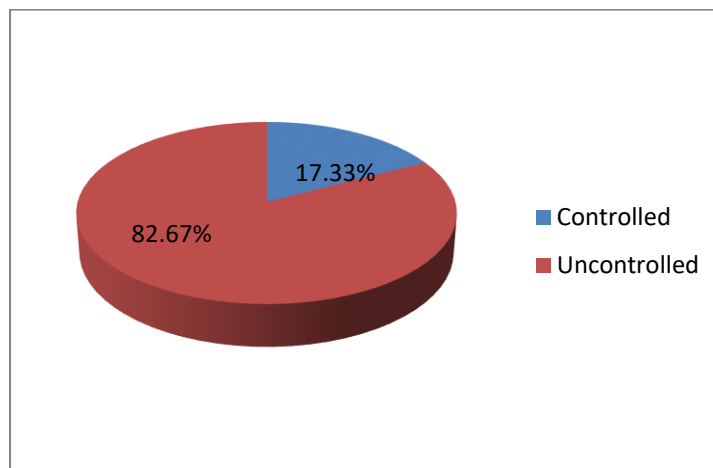
Figure 1. *Prevalence of Diabetes of our study patients (N=150)*

Figure 1 shows the diabetes prevalence of our study patients. Majority 124 (82.67%) patients were uncontrolled (FBS >6.4) compared to 26 (17.33%) were controlled (FBS <6.4).

Figure 2. *Age distribution of our study patients (N=150)*

Figure 2 shows the age distribution of our study patients. Majority 53 (35.33%) patients were in 50-59 years age group, then 2 (1.33%) were in ≤20-29 years, 21 (14.00%) were 30-39 years, 37 (24.67%) were 40-49 years, 20 (13.33%) were 60-69 years, 11 (7.33%) were 70-79 years, 5 (3.33%) were 80-89 years and 1 (0.67%) were ≥90 years old respectively. And the mean age were 52.35 ± 12.06 years.

Table I. *Distribution of our study patients by education (N=150)*

Education	n	%
Illiterate	8	5.33
Primary	38	25.33
SSC	83	55.33
HSC	12	8.00
Honors	6	4.00
Masters	3	2.00
Total	150	100

Table I shows the distribution of our study patients by education. Majority 83 (55.33%) were SSC, then 8 (5.33%) were illiterate, 38 (25.33%) were primary, 12 (8.00%) were HSC, 6 (4.00%) were honors and 3 (2.00%) were masters respectively.

Table II. *Distribution of our study patients by BMI & comorbidities (N=150)*

BMI	n	%	p Value
10-19	28	18.67	
20-29	116	77.33	
≥30	6	4.00	
Mean ± SD	22.46 ± 3.39		$< 0.001^s$
Min - Max	14.37 - 35.41		
DM	150	100	
HTN	39	26.00	

Table II shows the distribution of our study patients by BMI & comorbidities. The majority 116 (77.33%) patients BMI were 20-29, then 28 (18.67%) were between 10-19 and 6 (4.00%) were ≥30. BMI Mean ± SD were 22.46 ± 3.39 (p = <0.001s). 39 (26.00%) patients had HTN respectively.

Table III. *Distribution of our study patients by systemic disease (N=150)*

Disease	n	%
PUD	148	98.67
Weakness	24	16.00
Arthritis	94	62.67
G.W	82	54.67
Sleep	7	4.67
Appetite	2	1.33
Malaise	6	4.00
Obesity	3	2.00
Neuropathy	60	40.00
Stroke	1	0.67
Insomnia	1	0.67

Table III shows the distribution of our study patients by systemic disease. The majority 148 (98.67%) patients had PUD, then 24 (16.00%) had weakness, 94 (62.67%) had arthritis, 82 (54.67%) had G.W, 6 (4.00%) had malaise, 60 (40.00%) had neuropathy, 3 (2.00%) had obesity and 1 (0.67%) had both stroke and insomnia respectively.

Table IV. *Comparison of lifestyle behavior between pre intervention and post intervention in our study patients (N=150)*

Lifestyle	Pre intervention (n=150)	Post intervention (n=150)
Dietary habit	0 (0.00%)	130 (86.67%)
Walking	0 (0.00%)	120 (80.00%)
Exercise	0 (0.00%)	13 (8.67%)
Smoking	9 (6.00%)	7 (4.67%)
Alcohol	0 (0.00%)	0 (0.00%)

Table IV shows comparison of lifestyle behavior between pre intervention and post intervention in our study patients. 9 (6.00%) patients had smoking habit in pre intervention, then 130 (86.67%) got dietary habit, 120 (80.00%) got walking habit, 13 (8.67%) started exercise and 7 (4.67%) had smoking in post intervention.

Table V. *Comparison of laboratory test for group A1(<50yrs) & B1(>50 yrs) given only non pharmacological intervention & no medicine (N=50)*

Test Name	Pre intervention (n=50)	Post intervention (n=50)	P Value
FBS	8.57 ± 2.55	6.32 ± 0.72	$<0.001^s$
2HABF	12.00 ± 2.78	8.85 ± 1.10	$<0.001^s$
HBA1C	7.58 ± 1.15	6.72 ± 0.41	$<0.001^s$
S. Creatinine	1.04 ± 0.12	1.07 ± 0.11	0.196^{ns}

Table V shows comparison of laboratory test for group A1(<50yrs) & B1(>50 yrs) between pre intervention and post intervention given only non-pharmacological intervention & no medicine. Pre intervention FBS Mean ± SD were 8.57 ± 2.55 mm1/l compared to 6.32 ± 0.72 mmo1/1 in post intervention (p = <0.001s), then 2HABF were 12.00 ± 2.78 mmo1/1 compared to 8.85 ± 1.10 mmo1/1 (p = <0.001s), HBA1C were 7.58 ± 1.15 % compared to 6.72 ± 0.41 % (p = <0.001s) and S. Creatinine were1.04 ± 0.12 mg/d1 in pre intervention compared to 1.07 ± 0.11 mg/d1 in post intervention (p = 0.196ns).

Table VI. *Comparison of laboratory test for group A2(<50 yrs) & B2(>50 yrs) given both non pharmacological & medicine (N=50)*

Test name	Pre intervention (n=50)	Post intervention (n=50)	P Value
FBS	9.07 ± 3.31	6.47 ± 1.00	<0.001[s]
2HABF	12.62 ± 3.45	9.06 ± 1.43	<0.001[s]
HBA1C	7.56 ± 1.59	6.86 ± 0.56	0.004[s]
S. Creatinine	1.08 ± 0.18	1.07 ± 0.12	0.745[ns]

Table VI shows comparison of laboratory test for group A2(<50 yrs) & B2(>50 yrs) between pre intervention and post intervention given both non pharmacological & medicine. Pre intervention FBS Mean ± SD were 9.07 ± 3.31 mmo1/1 compared to post intervention 6.47 ± 1.00 mmo1/1 (p = <0.001s), then 2HABF were 12.62± 3.45 mmo1/1 compared to 9.06 ± 1.43 mmo1/1 (p = <0.001s), HBA1C were 7.56 ± 1.59 % compared to 6.86 ± 0.56 % (p = 0.004s) and S. Creatinine were 1.08 ± 0.18 mg/dl in pre intervention compared to 1.07 ± 0.12 mg/dl in post intervention (p = 0.745ns).

Table VII. *Comparison of laboratory test for group A3(<50 yrs) & B3(>50 yrs) given only medicine with no non pharmacological intervention (N=50)*

Test name	Pre intervention (n=50)	Post intervention (n=50)	P Value
FBS	7.79 ± 1.72	7.07 ± 1.83	0.045[s]
2HABF	11.12 ± 1.96	10.24 ± 2.06	0.031[s]
HBA1C	7.22 ± 0.84	6.58 ± 0.59	<0.001[s]
S. Creatinine	1.09 ± 0.18	1.06 ± 0.18	0.407[ns]

Table VII shows comparison of laboratory test for group A3(<50 yrs) & B3(>50 yrs) between pre intervention and post intervention given only medicine with no non pharmacological intervention. Pre intervention FBS Mean ± SD were 7.79 ± 1.72 mmo1/1 compared to 7.07 ± 1.83 mmo1/1 in post intervention (p = 0.045[s]), then 2HABF were 11.12 ± 1.96 mmo1/1 compared to 10.24 ± 2.06 mmo1/1 (p = 0.031[s]), HBA1C were 7.22 ± 0.84 % compared to 6.58 ± 0.59 % (p = <0.001[s]) and S. Creatinine were 1.09 ± 0.18 mg/dl in pre intervention compared to 1.06 ± 0.18 mg/dl in post intervention (p = 0.407[ns]).

5. DISCUSSION

Effective management of Type 2 Diabetes Mellitus in rural areas requires closing knowledge gaps, fostering positive attitudes, and promoting adherence to non-pharmacological treatments through a culturally sensitive and community-oriented approach. Raising awareness about diabetes and the importance of lifestyle modifications is fundamental, as lack of knowledge hinders self-management. Educational initiatives tailored to rural populations can enhance understanding, while addressing cultural beliefs and values fosters acceptance of lifestyle changes. A positive mindset significantly improves adherence, emphasizing the need for comprehensive support and culturally respectful communication.

In our study we found the diabetes prevalence of our study patients majority 124 (82.67%) were uncontrolled (FBS >6.4) compared to 26 (17.33%) were controlled (FBS <6.4). A balanced and healthy diet that manages carbohydrate intake is crucial. In our study majority 53 (35.33%) patients were in 50-59 years age group, then 2 (1.33%) were in ≤20-29 years, 21 (14.00%) were 30-39 years, 37 (24.67%) were 40-49 years, 20 (13.33%) were 60-69 years, 11 (7.33%) were 70-79 years, 5 (3.33%) were 80-89 years and 1 (0.67%) were ≥90 years old. And the mean age were observed 52.35 ± 12.06 years. Rahul A et al. shows 60.99 ± 9.6 years in a similar study.[11]

Majority of our study patients 83 (55.33%) were SSC, then 8 (5.33%) were illiterate, 38 (25.33%) were primary, 12 (8.00%) were HSC, 6 (4.00%) were honors and 3 (2.00%) were masters. The majority 116 (77.33%) patients

BMI were 20-29, then 28 (18.67%) were between 10-19 and 6 (4.00%) were ≥30. BMI Mean ± SD were 22.46 ± 3.39. 39 (26.00%) patients had HTN respectively. Rahul A found 25 ± 4 BMI in intervention group.[11] The majority 148 (98.67%) patients had PUD, then 24 (16.00%) had weakness, 94 (62.67%) had arthritis, 82 (54.67%) had G.W, 6 (4.00%) had malaise, 60 (40.00%) had neuropathy, 3 (2.00%) had obesity and 1 (0.67%) had both stroke and insomnia respectively.

Distrust in healthcare providers suggests a perception of ineffectiveness in the care received [12]. Continual trust is crucial for patient-centered healthcare.[13,14] Participants noted limited time with doctors at busy health facilities, making personalized care unlikely. Patients preferred returning to doctors who were familiar and spent more time with them. However, the interviews revealed a lack of attention to individual patient needs, particularly evident in the absence of discussions about medication adherence. Inadequate adherence to medications is frequently indicative of a deficiency in integrated and patient-centered care.[15,16]

In our study 9 (6.00%) patients had smoking habit in pre intervention, then 130 (86.67%) got dietary habit, 120 (80.00%) got walking habit, 13 (8.67%) started exercise and 7 (4.67%) had smoking in post intervention. Adherence to non-pharmacological treatments is a key determinant of successful diabetes management. Adherence involves consistently following recommended lifestyle changes. Barriers to adherence in rural areas may include limited access to healthcare resources, financial constraints, and cultural factors. Tailoring interventions to overcome these barriers is essential.[17,18] Engaging the community in diabetes management programs can foster a supportive environment. Peer support and community-based initiatives can encourage individuals to make and sustain positive lifestyle changes.[19]

In our study we showed the comparison of laboratory test for group A1(<50yrs) & B1(>50yrs) between pre intervention and post intervention given only non-pharmacological intervention & no medicine. Pre intervention FBS Mean ± SD were 8.57 ± 2.55 mm1/l compared to 6.32 ± 0.72 mmo1/1 in post intervention (p = <0.001^s), then 2HABF were

12.00 ± 2.78 mmo1/1 compared to 8.85 ± 1.10 mmo1/1 (p= <0.001^s), HBA1C were 7.58 ± 1.15 % compared to 6.72 ± 0.41 % (p = <0.001^s) and S. Creatinine were

1.04 ± 0.12 mg/d1 in pre intervention compared to 1.07 ± 0.11 mg/d1 in post intervention (p = 0.196^{ns}). A significant limitation of the study is the potential for measurement error due to the self-reporting nature of health-related habits, making them susceptible to social desirability bias. Regarding the sustainability of the intervention, the 6-month evaluation period is relatively brief and requires additional follow-up assessments. Instead of using HbA1c, a more robust measure of glycemic control, we opted for Fasting and Postprandial blood glucose. This choice was influenced by the poor frequency of HbA1c monitoring in our setting, and the former may be a more practical outcome measure.[20] Additionally, there is a growing acknowledgment of postprandial blood glucose as a significant measure of the overall glycemic burden and a more reliable predictor of complications related to cardiovascular disease.[21]

Our study was done on a small sample, an imbalance of some baseline variables was noted between the three groups and we have tried to adjust for this difference in our analysis. We found comparison of laboratory test for group A2(<50yrs) & B2(>50yrs) between pre intervention and post intervention given both non pharmacological & medicine. Pre intervention FBS Mean ± SD were 9.07 ± 3.31 mmo1/1 compared to post intervention 6.47 ± 1.00 mmo1/1 (p = <0.001^s), then 2HABF were 12.62± 3.45 mmo1/1 compared to 9.06 ± 1.43 mmo1/1 (p = <0.001^s), HBA1C were 7.56 ± 1.59 % compared to 6.86 ± 0.56 % (p = 0.004^s) and S. Creatinine were 1.08 ± 0.18 mg/dl in pre intervention compared to 1.07 ± 0.12 mg/dl in post intervention (p = 0.745^{ns}). And laboratory test for group A3(<50yrs) & B3(>50yrs) between pre intervention and post intervention given only medicine with no non pharmacological intervention. Pre intervention FBS Mean ± SD were 7.79 ± 1.72 mmo1/1 compared to 7.07 ± 1.83 mmo1/1 in post intervention (p = 0.045^s), then 2HABF were 11.12 ± 1.96 mmo1/1 compared to 10.24 ± 2.06 mmo1/1 (p = 0.031^s), HBA1C were 7.22 ± 0.84 % compared to 6.58 ± 0.59 % (p = <0.001^s) and S. Creatinine were 1.09 ± 0.18 mg/dl in pre

intervention compared to 1.06 ± 0.18 mg/dl in post intervention (p = 0.407^{ns}).

Recognizing and respecting cultural norms is crucial. Dietary habits, physical activity preferences, and health beliefs may vary widely. Tailoring interventions to align with local customs can enhance acceptability.[22-24] In rural settings, family and community support play a crucial role. Involving family members in education and support programs can create a more conducive environment for lifestyle changes.[25] Establishing a system for regular monitoring and follow-up is essential.[26] This can include regular health check-ups, telehealth consultations, and ongoing support to address challenges and reinforce positive behaviors.[27,28]

6. LIMITATIONS OF THE STUDY

In our study, there was small sample size and absence of control for comparison. Therefore, in future further study may be under taken with a large sample size. Potential limitations include reliance on self-reported data and the short duration of the intervention.

7. CONCLUSION

In conclusion, this study evaluated the effectiveness of a six-month lifestyle intervention program for individuals with Type 2 Diabetes Mellitus, focusing on dietary habits, physical activity, psychosocial factors, and glycemic control. The program showed significant improvements in participants' dietary patterns, activity levels, and glycemic control, demonstrating its feasibility and acceptability. Monthly health assessments highlighted consistent adherence to the intervention. Despite these positive outcomes, limitations such as reliance on self-reported data and the short intervention duration should be considered. Future research with extended follow-up and objective lifestyle and glycemic assessments is recommended to strengthen these findings.

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