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ORIGINALDATA

Effectiveness of Educational Intervention in Improving the Knowledge, Attitudes, Perceptions, and Practices of Diabetes Patients towards Diabetes in Selangor, Malaysia

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■ Abstract

Introduction: Diabetes has become a major public health concern in Malaysia, and its prevalence keeps increasing every year. Improper knowledge of diabetes could lead to uncontrolled diabetes management and further complications from diabetes such as retinopathy, nephropathy, and neuropathy. Therefore, an educational intervention study was conducted to evaluate the effectiveness of educational intervention in improving the knowledge, attitude, perception, and practice of diabetic patients towards diabetes. **Patients-Methods:** A total of 82 diabetic patients were randomly divided into control and intervention groups, and the data was collected using a structured questionnaire. **Results:** The results showed that the diabetic patients' knowledge, attitude, perception, and practice were significantly associated with their age and type of diabetes. The respondents' knowledge of diabetes and its complications significantly improved after a month of intervention, from 82.93% and 70.73% at baseline to 97.22% and 100% after intervention for foot problems and eye diseases, respectively. **Conclusion:** This study concluded that the effective implementation of educational interventions has improved the knowledge, attitude, perception, and practice of diabetic patients towards diabetes. Further, awareness about a healthy diet and foot examination is needed to prevent future complications related to diabetes.

Keywords: Educational Intervention, Health, Lifestyle, Chronic Illness, Medical Conditions.

1. Introduction

Diabetes, also known as diabetes mellitus (DM), is a group of metabolic disorders defined as a raised blood glucose level in the body [1,2]. It is a chronic health condition that requires long-lasting continuous medical care and self-management education beyond glycaemic control to prevent further complications among diabetic patients [3]. In Malaysia, DM has been increasing and is a growing concern among the public. According to National Diabetes Registry Report 2019, Selangor has the highest diabetic population with a total of 232, 054 out of 1,614,363 registered diabetic patients in Malaysia [4]. In concordance with the increase in DM prevalence, the number of diagnosed diabetic patients who are unaware of their condition has also increased significantly to 9.4% in 2019 from 8.3% in 2015. This increase in the prevalence of diabetes was due to poor health literacy, awareness, an imbalanced diet, and an increasingly sedentary lifestyle among Malaysians [5,6].

Diabetes mellitus could lead to complications such as diabetic neuropathy, nephropathy, and retinopathy if left uncontrolled. Thus, proper knowledge and self-management education are fundamental in all diabetic patients for proper, as well as controlled diabetes management. Over the past two decades, several studies proved that the risk of complications among diabetics can decrease with the help of health literacy as well as a promising educational intervention [7-11]. However, the National Health and Morbidity Survey (NHMS) 2019 and several studies conducted in Selangor showed that the majority of Malaysians (87.3%) have poor health literacy, especially the elderly [5,8], rural [12,13], and less educated populations [14,15]. This led to inadequate knowledge in managing medical

issues and glycaemic control in diabetes management. Moreover, a study conducted at Universiti Kebangsaan Malaysia (UKM) reported that both non-diabetics and type 2 DM patients (T2DM) scored badly in the basic knowledge of diabetes due to inadequate educational materials such as reliable books, newspapers, or even online resources [16]. Earlier studies have revealed that people with diabetes mellitus living in several areas of Selangor, Klang, and Sungai Buloh, had a big misconception about diabetes. All these are due to the lack of proper knowledge and awareness of diabetes [17,18]. For instance, there are misconceptions that diabetes is caused by the kidneys failing to secrete sugars from urine and that traditional medicine is better and more effective than pharmacological treatment in treating diabetes [18,19].

Many studies on estimating health literacy and awareness among diabetes have been conducted in Malaysia, however, limited studies were found on the educational intervention of diabetes [17,19-21]. Furthermore, studies focusing on diabetes knowledge, attitudes, and practice (KAP) in both the general public and diabetic patients recommended a well-structured educational intervention should be initiated [17,19-21]. Among the limited studies found, such studies only focused on specific populations which are T2DM patients and predictors of diabetes foot complications but none have been conducted on the KAP and perception of diabetes among the diabetic population [22-24]. The current study aimed to provide one month of educational intervention every day online due to the COVID-19 pandemic situation, as well as to assess the effectiveness of online educational intervention in improving diabetic patients' knowledge, attitude, perception, and practice on diabetes at a private medical centre in Kuala Lumpur, Malaysia.

Abbreviations:

ANOVA	Analysis of Variance
BMI	Body Mass Index
DM	Diabetes Mellitus
IMU JC	International Medical University Joint Committee on Research and Ethics
KAP	Knowledge, Attitudes, and Practice
MoH	Ministry of Health
NDRR	National Diabetes Registry Report
NHMS	National Health and Morbidity Survey
SPSS	Statistical Package for Social Sciences
T2DM	Type 2 Diabetes Mellitus
UKM	Universiti Kebangsaan Malaysia
UMMC	Universiti Malaya Medical Centre

2. Methodology

2.1 Study Design, Setting, and Population

An interventional study was conducted among the diabetic population of Selangor, Malaysia from July to October 2021. The recommended sample size of the diabetes population in Selangor for this study was 384 participants [25], however only 82 patients responded to this online study. The sample size was calculated using the Raosoft® sample size calculator for a finite diabetic population of 232, 054. This study included diabetic patients of any gender or race who were over the age of 18, lived in Selangor, had no visual or cognitive impairment, and were able to understand the online questionnaire.

The study was conducted via online mode due to the increasing number of COVID-19 cases and the movement restrictions. The data of diabetic patients who seek medical treatment at the Universiti Malaya Medical Centre (UMMC) was selected using a convenience sampling method due to COVID-19 restrictions. The study was carried out at UMMC and via online mode where a poster with a QR code embedded with the study questionnaire was prepared and displayed in the consulting room, patients' waiting area, the dispensing area with the help of working pharmacist to ease the process of diabetic patients' participation in this study.

2.2 Ethical Approval

Before the start of the study, ethical approvals were obtained from the International Medical University Joint Committee on Research and Ethics (IMU-JC) (BP I-01-2021(14)) and UMMC (MREC ID 202157-10117).

2.3 Study Instruments and Data Collection

A questionnaire on diabetes was prepared in both English and Malay languages; the prepared questionnaire was validated before the implementation of the study. The questionnaire was divided into 4 sections, which consisted of a total of 38 questions. The first section of the questionnaire had 5 questions on the demographic information of the participants. The second section consists of 14 questions on the understanding of the participants on the basic knowledge of diabetes. There were 8 questions in the third section related to the participant's perspective on lifestyle changes in diabetes management. Meanwhile, the last and fourth sections had 11 questions relating to the management of diabetes control involving participant's attitudes and practices. A study information sheet and consent form were attached to the survey instrument so that participants could give their consent before being enrolled in the study. The participants were then randomised into two groups, the control and intervention groups, using a simple random sampling technique and an online computer randomizer.

The assessment of knowledge, attitude, and perception is essential as it plays a direct role in the quality of life of diabetic patients. The intervention group was given online educational materials obtained from reputable sources such as the Ministry of Health (MoH),

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the World Health Organisation, and the American Diabetes Association, as well as Lembaga Pharmacy Malaysia, via WhatsApp. The intervention was carried out for a month. The reliability and reproducibility of the items are analysed using Cronbach-alpha and the value was 0.876. After a month, the effectiveness of the online educational intervention in improving the diabetic patients' knowledge, attitude, perception, and practice of diabetes was assessed by comparing the initial and final assessments, as well as with the control group. The control group did not receive any intervention, however, their KAP at baseline and final (after a month) were assessed and compared within the group and also with the intervention group.

2.4 Statistical Analysis

All collected data were analysed using Statistical Package for Social Sciences (SPSS) version 26.0. Descriptive statistics were used to analyse the demographic data. A t-test was conducted to compare the means of two groups whereas a one-way analysis of variance (ANOVA) was used to compare the means in more than two groups. T-tests and ANOVA were also used to analyse the differences in knowledge, attitude, perception, and practice among the participants toward diabetes across various sociodemographic groups. P-values of < 0.05 were considered statistically significant.

3. Results

A total of 82 respondents were enrolled and further allocated into control (n=41) and intervention groups (n=41) using the simple random sampling technique. Forty-one respondents in the control group completed the study successfully. There were 5 dropouts from the intervention group, and finally, 36 out of 41 respondents completed the study.

3.1 Demographics of the Participants

The majority of the total respondents (53 out of 82 respondents, 64.63%) were between the age of 45-54, which consisted of 34 respondents (82.93%) from the control group and 19 respondents (46.34%) from the intervention group. Most of the respondents from both the control group (n=28, 68.29%) and the intervention group (n=24, 58.54%) were female. The sample consisted of 73.17% from the control group and 60.98% from the intervention group who were Chinese. More than half of the respondents in each control (75.61%) and intervention (68.29%) group had a tertiary-level education (college or university).

Around 75% of the respondents from the control group reported having Type 2 diabetes and 51% from the intervention group reported having Type 1 diabetes. Most of the respondents had a normal BMI of 18.5-24.9 with 15 (36.59%) from the control group and 14 (34.15%) from the intervention group. The majority of respondents in the control group (n=33, 80.49%) and more than half of the respondents in the intervention group (n=22, 53.66%) had a normal blood pressure of less than 120/80 mmHg. Most had a normal fasting blood sugar level of 4-7 mmol/L and post-prandial blood sugar level of 4-9 mmol/L in both control (n=38, 92.68%) and intervention (n=29, 70.73%) groups respectively. In the intervention group, there was an equal response rate (n=28, 68.29%) of most respondents with normal fasting blood sugar level of 4-7 mmol/L and post-prandial blood sugar level of 4-9 mmol/L. In this study, 48.78% of the patients from the control group had an elevated random blood sugar level of more than 8 mmol/L, whereas 39.02% from the intervention group had a normal random blood sugar level of 4-7 mmol/L. The gender-wise distribution of the respondents' demographic is shown in Table 1.

Table 1: Gender-wise Distribution of Demographic Characteristics of the Respondents.

Demographic characteristics	Control group (n=41)						Intervention group (n=41)					
	Male (n=13)		Female (n=28)		Total		Male (n=17)		Female (n=24)		Total	
	n	%	n	%	n	%	n	%	n	%	n	%
Age (in years)												
18-24	0	0.00	1	3.57	1	2.44	1	5.88	3	12.50	4	9.76
25-34	1	7.69	2	7.14	3	7.32	2	11.76	4	16.67	6	14.63
35-44	0	0.00	1	3.57	1	2.44	1	5.88	4	16.67	5	12.20
45-54	12	92.31	22	78.57	34	82.93	8	47.06	11	45.83	19	46.34
55-64	0	0.00	2	7.14	2	4.88	3	17.65	1	4.17	4	9.76
≥65	0	0.00	0	0.00	0	0.00	2	11.76	1	4.17	3	7.32
Race												
Malay	2	15.38	6	21.43	8	19.51	2	11.76	6	25.00	8	19.51
Chinese	7	53.85	18	64.29	25	60.98	11	64.71	14	58.33	25	60.98
Indian	4	30.77	4	14.29	8	19.51	4	23.53	4	16.67	8	19.51
Education level												
Primary	1	7.69	0	0.00	1	2.44	1	5.88	2	8.33	3	7.32
High school	2	15.38	3	10.71	5	12.20	3	17.65	3	12.50	6	14.63
College/university	9	69.23	22	78.57	31	75.61	12	70.59	16	66.67	28	68.29

Graduate school	1	7.69	3	10.71	4	9.76	1	5.88	3	12.50	4	9.76
Type of diabetes												
Type 1 diabetes	2	15.38	7	25.00	9	21.95	5	29.41	16	66.67	21	51.22
Type 2 diabetes	10	76.92	21	75.00	31	75.61	12	70.59	7	29.17	19	46.34
Gestational diabetes	1	7.69	0	0.00	1	2.44	0	0.00	1	4.17	1	2.44
BMI												
<18.5	5	38.46	3	10.71	8	19.51	3	17.65	6	25.00	9	21.95
18.5-24.9	3	23.07	12	42.86	15	36.59	5	29.41	9	37.50	14	34.15
25-29.9	4	30.77	8	28.57	12	29.27	6	35.29	6	25.00	12	29.27
30-34.9	1	7.69	5	17.86	6	14.63	3	17.65	3	12.50	6	14.63
35-39.9	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Comorbidities												
Hypertension	1	7.69	2	7.14	3	7.32	3	17.65	3	12.50	6	14.63
Kidney failure	0	0.00	0	0.00	0	0.00	1	2.44	0	0.00	1	2.44
Hyperlipidemia	0	0.00	0	0.00	0	0.00	1	2.44	0	0.00	1	2.44
Hypothyroidism	0	0.00	1	3.57	1	2.44	0	0.00	0	0.00	0	0.00
None	12	92.31	25	89.29	37	90.24	12	70.59	21	87.50	33	80.49
Blood pressure												
<120/80	10	76.92	23	82.14	33	80.49	7	41.18	15	62.50	22	53.66
120/80-139/89	2	15.38	5	17.86	7	17.07	8	47.06	7	29.17	15	36.59
140/90-159/99	1	7.69	0	0.00	1	2.44	2	11.76	2	8.33	4	9.76
Random blood sugar level (mmol/L)												
4-7	5	38.46	10	35.71	15	36.59	8	47.06	10	41.67	16	39.02
>7-8	3	23.08	3	10.71	6	14.63	5	29.41	7	29.17	12	29.27
>8	5	38.46	15	53.57	20	48.78	6	35.29	7	29.17	13	31.71
Fasting blood sugar level (mmol/L)												
4-7	13	100.00	25	89.29	38	92.68	12	70.59	16	66.67	28	68.29
>7-8	0	0.00	1	3.57	1	2.44	3	17.65	2	8.33	5	12.20
>8	0	0.00	2	7.14	2	4.88	2	11.76	6	25.00	8	19.51
Post-prandial blood sugar level (mmol/L)												
4-9	10	76.92	19	67.86	29	70.73	13	76.47	15	62.50	28	68.29
>9	3	23.08	9	32.14	12	29.27	4	23.53	9	37.50	13	31.71

3.2 Assessment of Knowledge of Diabetes among the Study Participants

The assessment of knowledge on diabetes using the structured questionnaire among the respondents revealed that at baseline, most of the respondents in the control group agreed that eating more sugar is one of the causes of diabetes (n=28, 68.29%), followed by lack or defect of insulin (n=25, 60.98%). Unlike the control group, most of the respondents in the intervention group agreed that lack or defect of insulin was one of the causes of diabetes (n=26, 63.41%), followed by eating more sugar (n=25, 60.98%). After a month, more respondents (n=29, 70.73%) in the control group agreed eating more sugar was the cause of diabetes. After the intervention, more respondents (n=32, 88.88%) in the intervention group agreed lack or defect of insulin, followed by eating more sugar (66.67%) as the causes of diabetes. The most common complication reported by the patients in both control (n=31, 75.61%) and intervention (n=34, 82.93%) groups during the baseline of the study was a foot problem, followed by an eye problem. After a month, the response rate in the control group was similar in mentioning foot problems as the common complication of diabetes, whereas the response rate increased to 97.22% (n=35) among the intervention group. The response to the question 'eye disease as the common complication of diabetes' dropped from 19 (46.34%) to 18 respondents (43.90%) after a month and the result was significantly different (p=0.00). however, the response has increased from 97.22% to 100% among the intervention group. The details are presented in Table 2.

3.3 Perception of Lifestyle Changes in Diabetes among the Study Participants

Most of the diabetic patients in both control and intervention groups agreed that (n=38, 92.68%) diabetic patients should control their weight. There was no change in the response rate among the control

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Table 2: Distribution of Basic Knowledge of Diabetes among the Respondents at Baseline and Post-intervention.

Type of group	**Control group (n=41)**						**Intervention group (n=41)**					
Time / Description of items	**Baseline (n=41)**			**After a month (n=41)**			**Baseline (n=41)**			**After a month (n=36)#**		
Gender	Male n (%)	Female n (%)	Total n (%)	Male n (%)	Female n (%)	Total n (%)	Male n (%)	Female n (%)	Total n (%)	Male n (%)	Female n (%)	Total n (%)
Responses	13	28	41	13	28	41	17	24	41	15	21	36
Q1: As per your knowledge what causes diabetes? (Multiple responses possible)												
(a) Contact with another diabetic	1 (7.69)	3 (10.71)	4 (9.76)	1 (7.69)	3 (10.71)	4 (9.76)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
(b) Eating more sugar	10 (76.92)	18 (64.29)	28 (68.29)	9 (69.23)	20 (71.43)	29 (70.73)	11 (64.71)	14 (58.33)	25 (60.98)	11 (73.33)	13 (61.90)	24 (66.67)
(c) Lack or defect of insulin	8 (61.54)	17 (60.71)	25 (60.98)	7 (53.85)	16 (57.14)	23 (56.10)	9 (52.94)	17 (70.83)	26 (63.41)	12 (80.00)	20 (95.24)	32 (88.88)
(d) Genetics or hereditary	7 (53.85)	20 (71.43)	27 (65.85)	6 (46.15)	21 (75.00)	27 (65.85)	14 (82.35)	14 (58.33)	28 (68.29)	14 (93.33)	17 (80.95)	31 (86.11)
(e) Do not know	0 (0.00)	0 (0.00)	0 (0.00)	1 (7.69)	0 (0.00)	1 (2.44)	0 (0.00)	4 (16.67)	4 (9.76)	0 (0.00)	0 (0.00)	0 (0.00)
(f) Other	1 (7.69)	0 (0.00)	1 (2.44)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (4.76)	1 (2.78)
Q2: Which age groups are most commonly affected by diabetes? (Multiple responses possible)												
(a) Children (0-12 years)	2 (15.38)	1 (3.57)	3 (7.32)	3 (23.08)	1 (3.57)	4 (9.76)	3 (17.65)	9 (37.50)	12 (29.27)	6 (40.00)	12 (57.14)	18 (50.00)
(b) Adolescent (13-18 years)	1 (7.69)	5 (17.86)	6 (21.43)	2 (15.38)	5 (17.86)	7 (17.07)	4 (23.53)	6 (25.00)	10 (24.39)	9 (60.00)	12 (57.14)	21 (58.33)
(c) Adults (19-64 years)	9 (69.23)	16 (57.14)	25 (60.98)	9 (69.23)	16 (57.14)	25 (60.98)	11 (64.71)	16 (66.67)	27 (65.85)	9 (60.00)	12 (57.14)	21 (58.33)
(d) Senior adults (≥65 years)	10 (76.92)	19 (67.86)	29 (70.73)	10 (76.92)	19 (67.86)	29 (70.73)	11 (64.71)	18 (75.00)	29 (70.73)	11 (73.33)	19 (90.48)	30 (83.33)
(e) Do not know	0 (0.00)	1 (3.57)	1 (2.44)	0 (0.00)	1 (3.57)	1 (2.44)	0 (0.00)	2 (8.33)	2 (4.88)	0 (0.00)	1 (4.76)	1 (2.78)
Q3: Which sexes are affected by diabetes?												
(a) Males only	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
(b) Females only	0 (0.00)	1 (3.57)	1 (2.44)	0 (0.00)	1 (3.57)	1 (2.44)	0 (0.00)	1 (4.17)	3 (7.32)	0 (0.00)	0 (0.00)	0 (0.00)
(c) Both	13 (100.00)	25 (89.29)	38 (92.68)	13 (100.00)	25 (89.29)	38 (92.68)	16 (94.12)	21 (87.50)	37 (90.24)	15 (100.00)	21 (100.00)	36 (100.00)
(d) Do not know	0 (0.00)	2 (7.14)	2 (4.88)	0 (0.00)	2 (7.14)	2 (4.88)	1 (5.88)	2 (8.33)	3 (7.32)	0 (0.00)	0 (0.00)	0 (0.00)
Q4: How long it takes to cure diabetes?												
(a) Cures by itself	1 (7.69)	2 (7.14)	3 (7.32)	0 (0.00)	2 (7.14)	2 (4.88)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
(b) Short, cured with treatment	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (5.88)	0 (0.00)	3 (7.32)	0 (0.00)	0 (0.00)	0 (0.00)
(c) Lifelong, controlled with treatment	10 (76.92)	24 (85.71)	34 (82.93)	10 (76.92)	23 (82.14)	33 (80.49)	15 (88.24)	22 (91.67)	37 (90.24)	13 (86.67)	21 (100.00)	34 (94.44)
(d) Do not know	2 (15.38)	2 (7.14)	4 (9.76)	3 (23.08)	2 (7.14)	5 (12.20)	0 (0.00)	1 (4.17)	3 (7.32)	0 (0.00)	0 (0.00)	0 (0.00)
(e) Others	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	2 (13.33)	0 (0.00)	2 (5.56)
Q5: Which of the following best characterizes the diabetes condition?												
(a) High blood sugar	10 (76.92)	18 (64.29)	28 (68.29)	10 (76.92)	20 (71.43)	30 (73.17)	13 (76.47)	20 (83.33)	33 (80.49)	12 (80.00)	19 (90.48)	31 (86.11)
(b) High urine sugar	1 (7.69)	5 (17.86)	6 (21.43)	1 (7.69)	4 (14.29)	5 (12.20)	3 (17.65)	4 (16.67)	7 (17.07)	2 (13.33)	0 (0.00)	2 (5.56)
(c) Low blood sugar	0 (0.00)	2 (7.14)	2 (4.88)	0 (0.00)	1 (3.57)	1 (2.44)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)

(d) Low urine sugar	0 (0.00)	1 (3.57)	1 (2.44)	0 (0.00)	1 (3.57)	1 (2.44)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (4.76)	1 (2.78)
(e) Do not know	2 (15.38)	2 (7.14)	4 (9.76)	2 (15.38)	2 (7.14)	4 (9.76)	1 (5.88)	0 (0.00)	3 (7.32)	1 (6.67)	1 (4.76)	2 (5.56)
(f) Other	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Q6: What do you think are the most common symptoms of diabetes mellitus? (Multiple responses possible)												
(a) Weight gain or loss	8 (61.54)	18 (64.29)	26 (63.41)	8 (61.54)	18 (64.29)	26 (63.41)	10 (58.82)	20 (83.33)	30 (73.17)	14 (93.33)	19 (90.48)	33 (91.67)
(b) Frequent urination	10 (76.92)	16 (57.14)	26 (63.41)	10 (76.92)	16 (57.14)	26 (63.41)	13 (76.47)	18 (75.00)	31 (75.61)	14 (93.33)	19 (90.48)	33 (91.67)
(c) Frequent hunger	4 (30.77)	13 (46.43)	17 (41.46)	4 (30.77)	12 (42.86)	16 (39.02)	6 (35.29)	15 (62.50)	21 (51.22)	8 (53.33)	15 (71.43)	23 (63.88)
(d) Frequent thirst	7 (53.85)	19 (67.86)	26 (63.41)	7 (53.85)	19 (67.86)	26 (63.41)	10 (58.82)	21 (87.50)	31 (75.61)	13 (86.67)	19 (90.48)	32 (88.88)
(e) Asymptomatic	0 (0.00)	3 (10.71)	3 (7.32)	1 (7.69)	2 (7.14)	3 (7.32)	1 (5.88)	2 (8.33)	3 (7.32)	0 (0.00)	3 (14.29)	3 (8.33)
(f) Do not know	2 (15.38)	4 (14.29)	6 (21.43)	3 (23.08)	3 (10.71)	6 (21.43)	1 (5.88)	1 (4.17)	2 (4.88)	0 (0.00)	0 (0.00)	0 (0.00)
Q7: What are the common complications resulting from diabetes mellitus? (Multiple responses possible)												
(a) Heart disease	4 (30.77)	12 (42.86)	16 (39.02)	5 (38.46)	12 (42.86)	17 (41.46)	13 (76.47)	16 (66.67)	29 (70.73)	13 (86.67)	17 (80.95)	30 (83.33)
(b) Kidney disease	6 (46.15)	12 (42.86)	18 (43.90)	6 (46.15)	12 (42.86)	18 (43.90)	15 (88.24)	21 (87.50)	36 (87.80)	13 (86.67)	19 (90.48)	32 (88.88)
(c) Eye disease	6 (46.15)	13 (46.43)	19 (46.34)	6 (46.15)	12 (42.86)	18 (43.90)	10 (58.82)	19 (79.17)	29 (70.73)	15 (100.00)	21 (100.00)	36 (100.00)
(d) Stroke	4 (30.77)	10 (35.71)	14 (34.15)	5 (38.46)	10 (35.71)	15 (36.59)	11 (64.71)	9 (37.50)	20 (48.78)	9 (60.00)	15 (71.43)	24 (66.67)
(e) Foot problems	8 (61.54)	23 (82.14)	31 (75.61)	8 (61.54)	23 (82.14)	31 (75.61)	15 (88.24)	19 (79.17)	34 (82.93)	15 (100.00)	20 (95.24)	35 (97.22)
(f) Death	5 (38.46)	11 (39.29)	16 (39.02)	5 (38.46)	11 (39.29)	16 (39.02)	7 (41.18)	12 (50.00)	19 (46.34)	7 (46.67)	11 (52.38)	18 (50.00)
(g) Do not know	3 (23.08)	1 (3.57)	4 (9.76)	3 (23.08)	1 (3.57)	4 (9.76)	1 (5.88)	1 (4.17)	2 (4.88)	0 (0.00)	0 (0.00)	0 (0.00)
Q8: What measures can prevent diabetes? (Multiple responses possible)												
(a) Healthy diet	13 (31.71)	25 (89.29)	38 (92.68)	13 (31.71)	25 (89.29)	38 (92.68)	17 (100.00)	22 (91.67)	39 (95.12)	15 (100.00)	21 (100.00)	36 (100.00)
(b) Regular exercise	9 (69.23)	23 (82.14)	32 (78.05)	9 (69.23)	23 (82.14)	32 (78.05)	14 (82.35)	20 (83.33)	34 (82.93)	13 (86.67)	20 (95.24)	33 (91.67)
(c) Weight control	10 (76.92)	23 (82.14)	33 (80.49)	10 (76.92)	23 (82.14)	33 (80.49)	11 (64.71)	16 (66.67)	27 (65.85)	13 (86.67)	18 (85.71)	31 (86.11)
(d) Quit smoking	8 (61.54)	14 (50.00)	22 (53.66)	8 (61.54)	15 (53.57)	23 (56.10)	6 (35.29)	11 (45.83)	17 (41.46)	9 (60.00)	12 (57.14)	21 (58.33)
(e) Do not know	0 (0.00)	1 (3.57)	1 (2.44)	0 (0.00)	1 (3.57)	1 (2.44)	0 (0.00)	1 (4.17)	1 (2.44)	0 (0.00)	0 (0.00)	0 (0.00)
(f) Cannot be prevented	0 (0.00)	2 (7.14)	2 (4.88)	1 (7.69)	2 (7.14)	3 (7.32)	1 (5.88)	3 (12.5)	4 (9.76)	1 (6.67)	4 (19.05)	5 (13.89)
Q9: What are the management options available for controlling diabetes? (Multiple responses possible)												
(a) Medications	10 (76.92)	20 (71.43)	30 (73.17)	10 (76.92)	22 (78.57)	32 (78.05)	14 (82.35)	21 (87.50)	35 (85.37)	14 (93.33)	21 (100.00)	35 (97.22)
(b) Insulin	9 (69.23)	22 (78.57)	31 (75.61)	9 (69.23)	23 (82.14)	32 (78.05)	14 (82.35)	23 (95.83)	37 (90.24)	14 (93.33)	20 (95.24)	34 (94.44)
(c) Healthy diet	11 (64.71)	24 (85.71)	35 (85.37)	11 (64.71)	25 (89.29)	36 (87.80)	14 (82.35)	20 (83.33)	34 (82.93)	15 (100.00)	21 (100.00)	36 (100.00)
(d) Regular exercise	10 (76.92)	21 (75.00)	31 (75.61)	10 (76.92)	21 (75.00)	31 (75.61)	14 (82.35)	20 (83.33)	34 (82.93)	15 (100.00)	20 (95.24)	35 (97.22)
(e) Weight control	10 (76.92)	20 (71.43)	30 (73.17)	11 (64.71)	20 (71.43)	31 (75.61)	12 (70.59)	18 (75.00)	30 (73.17)	14 (93.33)	19 (90.48)	33 (91.67)
(f) Quit smoking	6 (46.15)	14 (50.00)	20 (48.78)	7 (53.85)	15 (53.57)	22 (53.66)	5 (29.41)	14 (58.33)	19 (46.34)	8 (53.33)	12 (57.14)	20 (55.55)

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(g) Do not know	1 (7.69)	0 (0.00)	1 (2.44)	1 (7.69)	0 (0.00)	1 (2.44)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
(h) Cannot be treated	0 (0.00)	2 (7.14)	2 (4.88)	0 (0.00)	1 (3.57)	1 (2.44)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (4.76)	1 (2.78)
(i) Other	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Q10: Do you think that the complications of diabetes can be prevented by undergoing any routine investigation?												
Yes	12 (70.59)	21 (75.00)	33 (80.49)	12 (70.59)	22 (78.57)	34 (82.93)	14 (82.35)	23 (95.83)	37 (90.24)	14 (93.33)	21 (100.00)	35 (97.22)
No	0 (0.00)	1 (3.57)	1 (2.44)	0 (0.00)	0 (0.00)	0 (0.00)	1 (5.88)	0 (0.00)	1 (2.44)	0 (0.00)	0 (0.00)	0 (0.00)
Do not know	1 (7.69)	6 (21.43)	3 (7.32)	1 (7.69)	6 (21.43)	7 (17.07)	2 (11.76)	1 (4.17)	3 (7.32)	1 (6.67)	0 (0.00)	1 (2.78)
Q11: If yes, which investigations should be done? (Multiple responses possible)												
(a) Blood sugar	12 (70.59)	20 (71.43)	32 (78.04)	12 (70.59)	21 (75.00)	33 (80.49)	14 (82.35)	24 (100.00)	38 (92.68)	13 (86.67)	21 (100.00)	34 (94.44)
(b) Monitoring blood pressure	6 (46.15)	14 (50.00)	23 (56.10)	9 (69.23)	14 (50.00)	23 (56.10)	8 (47.06)	14 (58.33)	22 (53.66)	13 (86.67)	20 (95.24)	33 (91.67)
(c) Eye examination	2 (15.38)	6 (21.43)	8 (19.51)	2 (15.38)	6 (21.43)	8 (19.51)	17 (100.00)	24 (100.00)	41 (100.00)	13 (86.67)	20 (95.24)	33 (91.67)
(d) Foot examination	7 (53.85)	10 (35.71)	17 (41.46)	7 (53.85)	10 (35.71)	17 (41.46)	7 (41.18)	15 (62.50)	22 (53.66)	12 (80.00)	20 (95.24)	32 (88.88)
(e) Do not know	0 (0.00)	2 (7.14)	2 (4.88)	0 (0.00)	1 (3.57)	1 (2.44)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Q12: Are you aware of a condition in which the blood sugar falls below normal?												
Yes	6 (46.15)	14 (50.00)	20 (48.78)	7 (53.85)	14 (50.00)	21 (51.22)	13 (76.47)	20 (83.33)	33 (80.49)	14 (93.33)	21 (100.00)	35 (97.22)
No	7 (53.85)	14 (50.00)	21 (51.22)	6 (46.15)	14 (50.00)	20 (48.78)	4 (23.53)	4 (16.67)	8 (19.51)	1 (6.67)	0 (0.00)	1 (2.78)
If yes, mention one most common symptoms of this condition	Out of 20 responses yes, only 17 responded by mentioning one most common symptoms of this condition.			All 20 respondents who answered yes mentioned one most common symptoms of the condition.			Out of 33 responses yes, only 32 responded by mentioning one most common symptoms of this condition.			Out of 35 responses yes, only 34 responded by mentioning one most common symptoms of the condition.		
Hypo	0 (0.00)	0 (0.00)	0 (0.00)	3 (23.08)	0 (0.00)	3 (7.32)	2 (11.76)	3 (12.5)	5 (12.20)	1 (6.67)	1 (4.76)	2 (5.56)
Dizzy	3 (23.08)	6 (21.43)	9 (21.95)	3 (23.08)	6 (21.43)	9 (21.95)	3 (17.65)	3 (12.5)	6 (14.63)	5 (33.33)	3 (14.29)	8 (22.22)
Cold sweating	0 (0.00)	1 (3.57)	1 (2.44)	0 (0.00)	1 (3.57)	1 (2.44)	0 (0.00)	5 (20.83)	5 (12.20)	1 (6.67)	5 (23.81)	6 (16.67)
Shaking/ Palpitation/ Shivering	1 (7.69)	1 (3.57)	5 (12.20)	1 (7.69)	4 (14.29)	5 (12.20)	6 (35.29)	6 (25.00)	12 (29.27)	1 (6.67)	7 (33.33)	8 (22.22)
Blurred vision	0 (0.00)	2 (7.14)	2 (4.88)	0 (0.00)	2 (7.14)	2 (4.88)	2 (11.76)	2 (8.33)	4 (9.76)	3 (20.00)	2 (9.52)	5 (13.89)
Feeling lethargic or weak	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	2 (13.33)	3 (14.29)	5 (13.89)
Q13: Do you know how to prevent or manage this condition?												
Yes	5 (38.46)	9 (32.14)	14 (34.15)	6 (46.15)	9 (32.14)	15 (36.59)	13 (76.47)	21 (87.50)	34 (82.93)	14 (93.33)	21 (100.00)	35 (97.22)
No	8 (61.54)	19 (67.86)	27 (65.85)	7 (53.85)	19 (67.86)	26 (63.41)	4 (23.53)	3 (12.5)	7 (17.07)	1 (6.67)	0 (0.00)	1 (2.78)
If yes, please mention how to prevent or manage it.	All 14 respondents who responded yes, did mention how to manage this condition.			All 15 respondents who responded yes, did mention how to manage this condition.			Out of 34 responses yes, only 32 responded on how to manage this condition.			Out of 35 responses yes, only 32 responded on how to manage the condition.		
(ai) Adjust, insulin, food, lifestyle for better control	2 (15.38)	3 (10.71)	5 (12.20)	2 (15.38)	2 (7.14)	4 (9.76)	7 (41.18)	5 (20.83)	12 (29.27)	2 (13.33)	2 (9.52)	4 (11.11)

(aii) Consume 15g glucose or sugary drinks	2 (15.38)	6 (21.43)	8 (19.51)	3 (23.08)	6 (21.43)	9 (21.95)	5 (29.41)	11 (45.83)	16 (39.02)	9 (60.00)	15 (71.43)	24 (66.67)
(aiii) Check blood glucose regularly	1 (7.69)	1 (3.57)	2 (4.88)	1 (7.69)	1 (3.57)	2 (4.88)	1 (5.88)	3 (12.5)	4 (9.76)	2 (13.33)	2 (9.52)	4 (11.11)

#There are 5 dropouts from the intervention group.

group after a month, however, the response rate increased in the intervention group after a month of intervention and everyone in this group agreed that diabetic patients should control their weight. The majority of the respondents in both control (n=37, 90.24%) and intervention (n=41, 100%) groups during baseline agreed that dietary modification was useful for diabetes control. However, a significantly lower response was noted in both control (n= 36, 87.80%) and intervention (n=35, 97.22%) groups after a month of intervention. The description of the perception of lifestyle changes in diabetes among the respondents in the control and intervention groups during baseline and post-intervention is shown in Table 3.

Table 3: Respondents' Responses on the Perception of Lifestyle Changes in Diabetes.

Type of group	**Control group (n=41)**						**Intervention group (n=41)**					
Time	**Baseline (n=41)**			**After a month (n=41)**			**Baseline (n=41)**			**After a month (n=36)**		
Sex	Male n (%)	Female n (%)	Total n (%)	Male n (%)	Female n (%)	Total n(%)	Male n (%)	Female n (%)	Total n (%)	Male n (%)	Female n (%)	Total n (%)
Res-ponse	13	28	41	13	28	41	17	24	41	15	21	36
Question 1: Regular exercise helps in keeping diabetes under control.												
Agree	13 (100.00)	26 (92.86)	39 (95.12)	13 (100.00)	24 (58.54)	37 (90.24)	17 (100.00)	24 (100.00)	41 (100.00)	15 (100.00)	21 (100.00)	36 (100.00)
Dis-agree	0 (0.00)	1 (3.57)	1 (2.44)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Do not know	0 (0.00)	1 (3.57)	1 (2.44)	0 (0.00)	4 (9.76)	4 (9.76)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Question 2: People with diabetes should control their weight.												
Agree	12 (92.31)	26 (92.86)	38 (92.68)	13 (100.00)	25 (89.29)	38 (92.68)	15 (88.24)	23 (95.83)	38 (92.68)	15 (100.00)	21 (100.00)	36 (100.00)
Dis-agree	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (3.57)	1 (2.44)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Do not know	1 (7.69)	2 (7.14)	3 (7.32)	0 (0.00)	2 (7.14)	2 (4.88)	2 (11.76)	1 (4.17)	3 (7.32)	0 (0.00)	0 (0.00)	0 (0.00)
Question 3: Dietary modification is useful for keeping diabetes under control.												
Agree	12 (92.31)	25 (89.29)	37 (90.24)	12 (92.31)	24 (85.71)	36 (87.80)	17 (100.00)	24 (100.00)	41 (100.00)	15 (100.00)	20 (95.24)	35 (97.22)
Dis-agree	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Do not know	1 (7.69)	3 (10.71)	4 (9.76)	1 (7.69)	4 (14.29)	5 (12.20)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (4.76)	1 (2.78)
Question 4: Diabetic patients should abstain from any kind of addiction. (Example: Addiction to alcohol, smoking, sugary food, and sedentary lifestyles).												
Agree	12 (92.31)	26 (92.86)	38 (92.68)	12 (92.31)	25 (89.29)	37 (90.24)	17 (100.00)	23 (95.83)	40 (97.56)	14 (93.33)	20 (95.24)	34 (94.44)
Dis-agree	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Do not know	1 (7.69)	2 (7.14)	3 (7.32)	1 (7.69)	3 (10.71)	4 (9.76)	0 (0.00)	1 (4.17)	1 (2.44)	1 (6.67)	1 (4.76)	2 (5.55)
Question 5: People with diabetes should monitor their own blood glucose at home.												
Agree	12 (92.31)	26 (92.86)	38 (92.68)	12 (92.31)	25 (89.29)	37 (90.24)	17 (100.00)	24 (100.00)	41 (100.00)	15 (100.00)	21 (100.00)	36 (100.00)
Dis-agree	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Do not know	1 (7.69)	2 (7.14)	3 (7.32)	1 (7.69)	3 (10.71)	4 (9.76)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)

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Question 6: Diabetics can lead near normal life with sugar controlled.												
Agree	12 (92.31)	27 (96.43)	39 (95.12)	12 (92.31)	26 (92.86)	38 (92.68)	15 (88.24)	23 (95.83)	38 (92.68)	14 (93.33)	21 (100.00)	35 (97.22)
Dis-agree	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (5.88)	1 (4.17)	2 (4.88)	1 (6.67)	0 (0.00)	1 (2.78)
Do not know	1 (7.69)	1 (3.57)	2 (4.88)	1 (7.69)	2 (7.14)	3 (7.32)	1 (5.88)	0 (0.00)	1 (2.44)	0 (0.00)	0 (0.00)	0 (0.00)
Question 7: Once diabetes in controlled, eating restrictions (sugar) are no longer required.												
Agree	2 (15.38)	8 (28.57)	10 (24.39)	0 (0.00)	2 (7.14)	2 (4.88)	1 (5.88)	2 (8.33)	3 (7.32)	0 (0.00)	3 (14.29)	3 (8.33)
Dis-agree	10 (76.92)	16 (57.14)	26 (63.41)	12 (92.31)	22 (78.57)	34 (82.93)	16 ((94.12)	22 (91.67)	38 (92.68)	15 (100.00)	18 (85.71)	33 (91.67)
Do not know	1 (7.69)	4 (14.29)	5 (12.20)	1 (7.69)	4 (14.29)	5 (12.20)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Question 8: Insulin is the last treatment option for diabetes; hence, diabetes should be avoided as far as possible.												
Agree	7 (53.85)	15 (53.57)	22 (53.66)	7 (53.85)	13 (46.43)	20 (48.78)	10 (58.82)	15 (62.50)	25 (60.98)	12 (80.00)	16 (76.19)	28 (77.78)
Dis-agree	1 (7.69)	2 (7.14)	3 (7.32)	3 (23.08)	3 (10.71)	6 (14.63)	4 (23.53)	8 (33.33)	12 (29.27)	2 (13.33)	5 (23.81)	7 (19.44)
Do not know	5 (38.46)	11 (39.39)	16 (39.02)	3 (23.08)	12 (42.86)	15 (36.59)	3 (17.65)	1 (4.17)	4 (9.76)	1 (6.67)	0 (0.00)	1 (2.78)

3.4 Attitude and Practice towards Diabetes among the Study Participants

There were 10 respondents (24.40%) in the intervention group at baseline who mentioned not taking part in any moderate physical activity for more than 30 minutes, however, it was decreased to 3 (8.33%) after a month of intervention. At baseline, 14 respondents in the control group (31.15%) and 12 respondents in the intervention group (29.27%) did get their blood sugar level examined by the laboratory at least once in the past month. However, the response dropped among the control group to 8 (19.51%) whereas it increased from 12 to 15 (41.67%) in the intervention group after a month of intervention. There was 73.17% of the respondents control group did not undergo an eye examination in the past 1 year, however, 53.66% of respondents in the intervention group did undergo an eye examination in the past 1 year. During the baseline of the study, the majority of the respondents in both control (n=38, 92.68%) and intervention (n=30, 73.17%) groups did not undergo any foot examination in the past 1 year, whereas a significant number of respondents underwent foot examination during the intervention period, hence the value dropped from 30 to 26 (72.22%). The details are presented in Table 4.

Table 4: Distribution of Responses on Attitude and Practice towards Diabetes Control among the Respondents.

Type of group	**Control group (n=41)**						**Intervention group (n=41)**					
Time	**Baseline (n=41)**			**After a month (n=41)**			**Baseline (n=41)**			**After a month (n=36)**		
Sex	Male n (%)	Female n (%)	Total n (%)	Male n (%)	Female n (%)	Total n(%)	Male n (%)	Female n (%)	Total n (%)	Male n (%)	Female n (%)	Total n (%)
Res-ponse	13	28	41	13	28	41	17	24	41	15	21	36
Question 1: For the past month, about how often have you taken part in any moderate physical activity lasting more than half an hour (such as yoga, light sports, physical exercise, gardening, taking long walks)?												
Once a week	4 (30.77)	11 (39.29)	15 (36.59)	6 (46.15)	12 (42.86)	18 (43.90)	1 (5.88)	3 (12.50)	4 (9.76)	5 (33.33)	5 (23.81)	10 (27.78)
2-5 days a week	2 (15.38)	6 (21.43)	8 (19.51)	2 (15.38)	8 (33.33)	10 (24.40)	8 (47.06)	14 (58.33)	22 (53.66)	2 (13.33)	16 (76.19)	18 (50.00)
More than 5 days a week	1 (7.69)	4 (14.29)	5 (12.20)	1 (7.69)	3 (10.71)	4 (9.76)	0 (0.00)	1 (4.17)	1 (2.44)	1 (6.67)	0 (0.00)	1 (2.78)
Two to three times a month	1 (7.69)	3 (10.71)	4 (9.76)	0 (0.00)	1 (3.57)	1 (2.44)	2 (11.76)	2 (8.33)	4 (9.76)	1 (6.67)	3 (14.29)	4 (11.10)
Rarely or never	5 (38.46)	4 (14.29)	9 (21.95)	4 (30.77)	4 (14.29)	8 (19.51)	6 (35.29)	4 (16.67)	10 (24.40)	2 (13.33)	1 (4.76)	3 (8.33)
Other	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
If never or rarely, please state the reason.												
Response	Among 9, only 8 responded.			Only 5 out of 8 responded.			9 out 10 responded.			2 out 3 responded.		

MCO	5 (38.46)	3 (10.71)	8 (19.51)	3 (23.08)	1 (3.57)	4 (9.76)	2 (11.76)	2 (8.33)	4 (9.76)	0 (0.00)	0 (0.00)	0 (0.00)
Working	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (3.57)	1 (2.44)	2 (11.76)	0 (0.00)	2 (4.88)	1 (6.67)	0 (0.00)	1 (2.78)
Old or immobile	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (5.88)	1 (4.17)	2 (4.88)	1 (6.67)	0 (0.00)	1 (2.78)
Surgery	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (4.17)	1 (2.44)	0 (0.00)	0 (0.00)	0 (0.00)
Question 2: How often have you got your blood sugar examined in a laboratory in the last 1 month?												
More than once	2 (15.38)	6 (21.43)	8 (19.51)	1 (7.69)	6 (21.43)	7 (17.07)	4 (23.53)	4 (16.67)	8 (19.51)	3 (20.00)	6 (28.57)	9 (25.00)
Once	7 (53.85)	7 (25.00)	14 (31.15)	4 (30.77)	4 (14.29)	8 (19.51)	6 (14.63)	6 (25.00)	12 (29.27)	6 (40.00)	9 (42.86)	15 (41.67)
Not measured	4 (30.77)	15 (53.57)	19 (46.34)	8 (69.23)	18 (64.29)	26 (63.41)	7 (17.07)	14 (58.33)	21 (51.22)	2 (13.33)	10 (24.39)	12 (33.33)
Question 3: Do you use any device to monitor your blood sugar level at home?												
Yes	5 (38.46)	16 (57.14)	21 (51.22)	5 (38.46)	17 (60.71)	22 (53.66)	13 (76.47)	22 (91.67)	35 (85.37)	12 (80.00)	21 (100.00)	33 (91.67)
No	8 (69.23)	12 (42.86)	20 (48.78)	8 (69.23)	11 (39.29)	19 (46.34)	4 (23.53)	2 (8.33)	6 (14.63)	0 (0.00)	3 (14.29)	3 (8.33)
Question 4: If yes, how often do you check your blood sugar level at home?												
Response	Out of 21, 20 responded.			22 out of 22 responded.			35 out of 35 responded.			33 out of 33 responded.		
Once a week	1 (7.69)	2 (7.14)	3 (7.32)	1 (7.69)	3 (10.71)	4 (9.76)	3 (17.65)	2 (8.33)	5 (12.20)	1 (6.67)	3 (14.29)	4 (11.11)
2-5 days a week	4 (30.77)	7 (25.00)	11 (26.83)	1 (7.69)	4 (14.29)	5 (12.20)	3 (17.65)	3 (12.50)	6 (14.63)	3 (20.00)	4 (19.05)	7 (19.44)
More than 5 days a week	0 (0.00)	1 (3.57)	1 (2.44)	3 (23.08)	1 (3.57)	4 (9.76)	5 (29.41)	13 (54.17)	18 (43.90)	5 (33.33)	11 (52.38)	16 (44.44)
Two to three times per month	0 (0.00)	4 (14.29)	4 (9.76)	0 (0.00)	5 (17.86)	5 (12.20)	2 (11.76)	1 (4.17)	3 (7.32)	2 (13.33)	3 (14.29)	5 (13.89)
Rarely or never	0 (0.00)	1 (3.57)	1 (2.44)	0 (0.00)	4 (14.29)	4 (9.76)	0 (0.00)	3 (12.50)	3 (7.32)	0 (0.00)	1 (4.76)	1 (2.78)
If rarely or never, state the reason.												
Response	1 out of 1 responded.			Only 1 out of 4 responded.			2 out 3 only responded.			None out of 1 responded.		
Go pharmacy check	0 (0.00)	1 (3.57)	1 (2.44)	0 (0.00)	1 (3.57)	1 (2.44)	0 (0.00)	1 (4.17)	1 (2.44)	0 (0.00)	0 (0.00)	0 (0.00)
Scared	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (4.17)	1 (2.44)	0 (0.00)	0 (0.00)	0 (0.00)
Question 5: How often have you measured your weight in the last 1 month?												
More than once	6 (46.15)	14 (50.00)	20 (48.78)	8 (69.23)	14 (50.00)	22 (53.66)	9 (52.94)	13 (54.17)	22 (53.66)	3 (20.00)	17 (80.95)	20 (55.56)
Once	3 (23.08)	7 (25.00)	10 (24.40)	2 (15.38)	6 (21.43)	8 (19.51)	7 (41.18)	9 (37.50)	16 (39.02)	7 (46.67)	7 (33.33)	14 (38.89)
Not measured	4 (30.77)	7 (25.00)	11 (26.83)	3 (23.08)	8 (33.33)	11 (26.83)	1 (5.88)	2 (8.33)	3 (7.32)	1 (6.67)	1 (4.76)	2 (5.56)
Question 6: Have you modified your diet as per doctor's or dietician's advice following diagnosis of your disease?												
Yes	7 (53.85)	11 (39.29)	18 (43.90)	5 (38.46)	10 (35.71)	15 (36.59)	13 (76.47)	20 (83.33)	33 (80.49)	11 (73.33)	21 (100.00)	32 (88.89)
No	6 (46.15)	17 (60.71)	23 (56.10)	8 (69.23)	18 (64.29)	26 (63.41)	4 (23.53)	4 (16.67)	8 (19.51)	1 (6.67)	3 (14.29)	4 (11.11)
If yes, are you following the doctor's or dietician advice as stated?												
Response	Out of 18, 16 responded.			Out of 15, 8 responded.			32 out of 33 responded.			30 out 32 responded.		
Yes	7 (53.85)	8 (33.33)	15 (36.59)	3 (23.08)	3 (10.71)	6 (14.63)	13 (76.47)	17 (70.83)	30 (73.17)	10 (66.67)	20 (95.23)	30 (83.33)
No	0 (0.00)	1 (3.57)	1 (2.44)	0 (0.00)	2 (7.14)	2 (4.88)	0 (0.00)	2 (8.33)	2 (4.88)	0 (0.00)	0 (0.00)	2 (5.56)
If no, please state the reason.												
Response	1 out of 1 responded.			2 out of 2 responded.			2 out 2 responded.			2 out of 2 responded		

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Unable to control food craving	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (3.57)	1 (2.44)	0 (0.00)	2 (8.33)	2 (4.88)	0 (0.00)	0 (0.00)	0 (0.00)
Hard to predict new food's carbs	0 (0.00)	1 (3.57)	1 (2.44)	0 (0.00)	1 (3.57)	1 (2.44)	0 (0.00)	1 (4.17)	1 (2.44)	0 (0.00)	0 (0.00)	0 (0.00)
Never consulted a dietician.	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	2 (9.52)	2 (5.56)
Question 7: Did you ever forget to take any drugs prescribed by your doctor?												
Yes	2 (15.38)	5 (17.86)	7 (17.07)	2 (15.38)	7 (25.00)	9 (21.95)	1 (5.88)	7 (29.17)	8 (19.51)	3 (20.00)	5 (23.81)	8 (22.22)
No	11 (84.62)	23 (82.14)	34 (82.93)	11 (84.62)	21 (75.00)	32 (78.05)	16 (94.12)	17 (70.83)	33 (80.49)	8 (53.33)	20 (95.23)	28 (77.78)
If yes, mention how many times in the last 1 month?												
Response	7 out 7 responded.			9 out of 9 responded.			8 out of 8 responded.			6 out of 8 responded.		
1-2 days per week	2 (15.38)	1 (3.57)	3 (7.32)	2 (15.38)	1 (3.57)	3 (7.32)	1 (5.88)	3 (12.50)	4 (9.76)	3 (20.00)	0 (0.00)	3 (8.33)
3-4 days per month	0 (0.00)	3 (10.71)	3 (7.32)	0 (0.00)	3 (10.71)	3 (7.32)	0 (0.00)	1 (4.17)	1 (2.44)	0 (0.00)	2 (9.52)	2 (5.56)
More than 4 days per month	0 (0.00)	1 (3.57)	1 (2.44)	0 (0.00)	3 (10.71)	3 (7.32)	0 (0.00)	3 (12.50)	3 (7.32)	0 (0.00)	1 (4.76)	1 (2.78)
Question 8: Did you undergo any eye examination in the past 1 year?												
Yes	3 (23.08)	8 (33.33)	11 (26.83)	3 (23.08)	6 (21.43)	9 (21.95)	8 (47.06)	14 (58.33)	22 (53.66)	6 (40.00)	17 (80.95)	23 (63.88)
No	10 (76.92)	20 (71.43)	30 (73.17)	10 (76.92)	22 (78.57)	32 (78.05)	9 (52.94)	10 (41.67)	19 (46.34)	5 (33.33)	8 (38.10)	13 (36.11)
Question 9: Did you undergo any foot examination in the past 1 year?												
Yes	1 (7.69)	2 (7.14)	3 (7.32)	2 (15.38)	0 (0.00)	2 (4.88)	3 (17.65)	8 (33.33)	11 (26.83)	2 (13.33)	8 (38.10)	10 (27.78)
No	12 (92.31)	26 (92.86)	38 (92.68)	11 (84.62)	28 (100.00)	39 (95.12)	14 (82.35)	16 (66.67)	30 (73.17)	9 (60.00)	17 (80.95)	26 (72.22)
Question 10: Did you always wear covered shoes when outdoors?												
Yes	5 (38.46)	20 (71.43)	25 (60.98)	6 (46.15)	20 (71.43)	26 (63.41)	8 (47.06)	15 (62.50)	23 (56.10)	7 (46.67)	20 (95.24)	27 (75.00)
No	8 (69.23)	8 (33.33)	16 (39.02)	7 (53.85)	8 (33.33)	15 (36.59)	8 (47.06)	9 (37.50)	18 (43.90)	4 (26.67)	5 (23.81)	9 (25.00)

The correlation between control and intervention groups' respondents' knowledge, attitudes, perception, and practice was analysed using interferential analysis. The correlation of respondents' perception of lifestyle changes in diabetes among the control and intervention groups at baseline and post-intervention was analysed. The correlation analysis of the intervention group is presented in Table 5. Also, the correlation of respondents' attitudes and practices towards diabetes among the control and intervention groups at baseline and post-intervention was analysed. The correlation analysis of the intervention group is presented in Table 6.

Table 5: Correlation between the Intervention Group's Perceptions of Lifestyle Changes in Diabetes at Baseline and Post-intervention.

		Correlation at post-intervention							
	Q.No	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**
Baseline	Q1	-	-	0.32	0.16	-	0.18	0.00*	0.01*
	Q2	0.08	0.08	0.16	0.66	0.08	0.47	0.00*	0.50
	Q3	-	-	0.32	0.16	-	0.18	0.00*	0.01*
	Q4	0.32	0.32	-	0.57	0.32	0.74	0.00*	0.07
	Q5	-	-	0.32	0.16	-	0.18	0.00*	0.01*
	Q6	0.10	0.10	0.53	1.00	0.10	0.74	0.00*	0.23
	Q7	0.00*	0.00*	0.00*	0.00*	0.00*	0.00*	0.10	0.00*
	Q8	0.00*	0.00*	0.00*	0.01*	0.00*	0.00*	0.01*	0.01*

*Correlation is significant at the 0.05 level (2-tailed)

Table 6: Correlation of Baseline and Post-intervention Attitudes and Practices towards Diabetes Control among Intervention Group Respondents.

		Correlation at post-intervention									
	Q.No	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**	**Q9**	**Q10**
Baseline	Q1	0.03*	0.01*	0.00*	0.85	0.00*	0.00*	0.00*	0.00*	0.00*	0.00*
	Q2	0.48	0.10	0.00*	0.13	0.00*	0.00*	0.00*	0.00*	0.00*	0.00*
	Q3	0.00*	0.00*	0.26	0.00*	0.01*	0.42	0.00*	0.07	0.00*	0.41
	Q4	0.08	0.00*	0.00*	0.50	0.00*	0.00*	0.00*	0.00*	0.00*	0.00*
	Q5	0.00*	0.00*	0.00*	0.00*	0.66	0.00*	0.12	0.11	0.211	0.01*
	Q6	0.00*	0.00*	0.26	0.00*	0.01*	0.42	0.00*	0.07	0.00*	0.37
	Q7	0.06	0.06	0.00*	0.00*	0.02*	0.00*	0.71	0.00*	0.41	0.00*
	Q8	0.00*	0.00*	0.00*	0.00*	1.00	0.00*	0.02*	0.20	0.06	0.02*
	Q9	0.02*	0.02*	0.00*	0.00*	0.07	0.00*	0.60	0.00*	1.00	0.00*
	Q10	0.00*	0.00*	0.00*	0.00*	0.70	0.00*	0.01*	0.52	0.03*	0.05

*Correlation is significant at the 0.05 level (2-tailed)

4. Discussion

4.1 Demographics of the Participants

The study aimed to analyse the diabetic patients' knowledge, attitude, perception, and practice of diabetes which showed there is a significant difference between the age groups (p=0.00) of the respondents and the type of diabetes (p=0.01). Most of the respondents in this study were in the age range of 45-54 (64.63%) and had Type 2 diabetes mellitus (60.96%). These results are consistent with the National Diabetes Registry Report (NDRR) 2020 which reported most of the diabetic patients enrolled in the registry are Type 2 diabetic (99.33%) and in the age range of 50-54 (17.16%), followed by 55-59 (16.59%) and 45-49 (14.00%) [27].

4.2 Assessment of Knowledge of Diabetes among the Study Participants

A previous study by Chinnappan et al., reported that 45.35% of the respondents agreed that eating more sugar may lead to diabetes, followed by 32.35% who mentioned lack or defect of insulin may cause diabetes [20]. Another study conducted by Thabit MF mentioned 59.3% of Type 2 diabetic patients answered that diabetes is caused by a deficiency of insulin resistance and only 25.51% answered due to lifestyle habits involving sugar intake [28]. Unlike the previous studies, our findings found that 68.29% and 70.73% of respondents answered eating more sugar and lack or defect of insulin cause diabetes respectively. This shows the respondents' knowledge of what causes diabetes has improved after a month of intervention.

A study by Chinnappan et al., reported most of the participants agreed diabetes is a lifelong problem, can be controlled with treatment (81.50%), and is best characterised as high blood sugar (71.00%). This finding coincides with our study where about 81% and 73% of the respondents agreed with both statements [20]. Moreover, the interventional group respondents of our study have better knowledge of the course of diabetes and its best characteristics. After a month of intervention, the knowledge of respondents has improved in mentioning diabetes is lifelong, controlled with treatment (94.44%), and is best characterised by high blood sugar (86.11%). This shows that the educational intervention has improved the respondents' knowledge of the course of diabetes and its characteristics.

Majority of the respondents in this study reported foot problems as the major complication of diabetes (control group=75.61%, intervention group= 82.93%) and followed by eye disease (control group=46.34%, intervention group= 70.73%). A study conducted by Lee et al reported that 66.8% of the diabetic participants answered eye problems, followed by foot problems (65.3%) as diabetes-related complications. The respondents in this study have a better understanding of the common complications of diabetes [29]. Furthermore, this indicates that the educational intervention increased the understanding among the respondents in this study on the common diabetes-related complications and causes of diabetes as a result of the increases in response rate after a month of intervention.

Unlike previous studies which showed a poor response (29.4% and 50%) to recognizing hypoglycaemia symptoms [30,31], our study showed 51.22% of respondents from the control group and 97.22% from the intervention group are aware of hypoglycaemia and know how to manage it. It has increased from 82.93% to 97.22% among the patients in the intervention group in understanding how to manage hypoglycaemia after the intervention. Most of the respondents from the group (66.67%) stated consumption of 15g glucose powder or packet drinks (150-200 ml of fruit juice such as orange juice) helps a lot whenever they encounter hypoglycaemia to manage glucose levels in the body. This proves that the current educational intervention significantly improved their knowledge of how to manage hypoglycaemia.

4.3 Perception of Lifestyle Changes in Diabetes among the Study Participants

The majority of the respondents in both control and intervention groups (92.68% and 100%, respectively)

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agreed weight control is important to keep diabetes under control. Earlier studies by Salleh et al., in Malaysia, Shiferaw, and Asmelash et al., in Africa found that 94.2%, 64.6%, and 56.6% of the respondents believed weight control helps in diabetes management specifically glycaemic control respectively [32-34]. This was evident that the respondents in this study were more aware of weight management for diabetes control.

The majority of the respondents in the control and intervention groups (90.24% and 100%, respectively) agreed dietary modification is useful in maintaining diabetes under control. This is in contrast to a previous study by Lee et al., which stated that 61.7% of the participants agreed that a diabetes diet and healthy eating help in diabetes management. This shows more respondents in this current study agreed proper diet is important to keep diabetes conditions under control [29]. This finding is consistent with a study conducted by Zainudin et al., in Singapore which found that there was inadequate understanding of diet among diabetic patients [35]. Therefore, this emphasises the importance of awareness of diet among the diabetic population as the response rate has dropped in both groups despite the implementation of educational intervention.

A study in Africa by Shiferaw et al., stated most of the participants (77%) believed eating low-sugar snacks helps in preventing diabetes in the future [33]. Another study in Africa by Asmelash et al., found that most of the patients had good perception and practice on not adding sugar into their diet (80.6%) [32]. As compared to the previous studies done in Africa, the majority of our respondents (92.68%) in the intervention group agreed that diabetic patients can lead a normal life with sugar controlled and disagreed sugar restriction is no longer required once diabetes is under control. More respondents agreed that diabetic patients can lead a normal life with sugar control (97.22%) after a month of intervention. The study intervention provided satisfactory knowledge of the sugar control measures among diabetic patients.

4.4 Attitude and Practice towards Diabetes among the Study Participants

At baseline, only 36.59% of the control group's respondents did moderate physical activity for more than 30 minutes once a week, while more than half of the respondents (53.66%) in the intervention group did moderate physical activity for more than 30 minutes in 2 to 5 days a week during baseline. However, after a month, 43.9% of the respondents in the control group did physical activity moderately once a week, whereas, among the intervention group, it reduced from 53.66% to 50%. This is in contrast to a previous study by Alsous et al., where 62.3% of the patients did regular exercise [36]. Another study conducted by Rahaman et al., found that 60% of the patients exercise regularly daily [37]. Compared to these previous studies, there was a lack of physical activity among the respondents in this study.

The present study also shows that 92.68% of the respondents from the control group and 73.17% from the intervention group did not undergo any foot examination in the past 1 year. According to a study done in Dhaka by Rahaman et al., less than 50% of the respondents underwent regular foot examination, whereas Kamaru et al., reported 49.4% of diabetic elderlies in the "Universiti Kebangsaan Malaysia" (UKM) medical centre had a poor practice of foot care [37,38]. A finding from Saudi Arabia highlighted that 43.3% of the patients never did a foot examination [39]. Another finding from Egypt mentioned that there were 45.2% of Type 1 diabetic patients and 45.7% of Type 2 diabetic patients did not undergo regular foot inspection [40]. This indicates more respondents in this study did not undergo foot examination regularly as compared to the previous studies. Hence, more awareness programs and implementation of foot examinations on diabetic patients should be conducted in more hospitals.

Previous studies conducted by Addoor et al., in Melaka and Tajunisah et al., in Kuala Lumpur showed that only a few of the respondents (38.5%) did an ophthalmological evaluation once a year and 43.8% did not know how frequently they should go for an eye check-up respectively [41,42]. Nevertheless, a lesser proportion of patients (26.83%) from the control group in this study underwent eye examination as compared to the previous studies. On the other hand, 53.66% of respondents in the intervention group went for an eye examination in the past 1 year. After a month of intervention, more respondents in the intervention group went for an eye examination (63.88%). This shows that the educational intervention may help the respondents in realising the importance of eye examination in diabetes.

4.5 Limitations

There are a few limitations in this study. Firstly, the small sample size of the population may not be sufficient to provide reliable and consistent results. Furthermore, the results presented from this study cannot be generalised as the study was conducted in a single centre, and the data of patients was derived from diabetic patients who are living in Selangor only. The response biases of the self-reported questionnaire could also limit the generalisability and accuracy of the results. Due to the COVID-19 movement restrictions and also enforcement of social distancing, the researcher used a convenience sampling method to recruit the sample size and a simple random sampling technique to randomise the participants. This approach may not be suitable to generalise the responses of the respondents on diabetes.

4.6 Conclusion

Overall, the knowledge, attitudes, perceptions, and practices towards diabetes among the diabetic population in Selangor have improved much after the intervention, which is evident that the online intervention provided in this study was effective and well-received by the respondents. This study recommends that the effective implementation of

educational intervention is needed to improve the health and well-being of diabetic patients. It also helps to reduce the economic burden of the patients by being aware and preventing further complications of diabetes. Nonetheless, further awareness of diet and foot examination is needed to improve the knowledge, health, and well-being of the patients.

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