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Evaluation of Nutritional Status, Levels of Knowledge, Attitude, and Practice among Elderly Diabetic Patients: A Cross-Sectional Study in Indian Perspective

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A B S T R A C T

India is considered as the diabetes capital of the world. Diabetes is associated with several other co-morbidities such as kidney diseases, liver diseases, and hypertension resulting in poor quality of life. Despite the available comprehensive diabetes management plans, the lack of proper knowledge, attitude, and practices towards diabetes is the major cause of non-compliance in the diabetes patients. Therefore, this study was aimed at evaluating the prevailing knowledge, attitude, and practices along with the evaluation of the nutritional status in a cohort of Indian elderly diabetic patients (age 65-76). Nutritional status was evaluated by the WHO criteria and MNA scoring system. Demographic and anthropometric data were collected retrospectively by review of history. Knowledge, attitude, practice, and total KAP scores were evaluated by a pre-designed questionnaire-based survey. All the statistical analysis was done by SPSS version 21. Five hundred participants with diabetes were included in the study. There were 250 males (50%) and 250 female participants (50%). The mean age was 69.24 ± 2.49 years. The mean duration of diabetes was 7.84 ± 3.81 years. As per the WHO criteria, 41 (8.2%) participants were normal, 1 (0.2%) overweight, 425 (85%) pre-obese, and 33 (6.6%) obese. As per MNA scoring, 477 (95.4%) had normal nutritional status, 18 (3.6%) were at risk of malnutrition, and 5 (1%) were malnourished. The mean knowledge score was 5.34 ± 1.06, 165 (33%) had good knowledge and 335 (67%) had poor knowledge. The mean attitude score was 11.97 ± 3.96, 181 (36.2%) had good attitude and 319 (63.8%) had poor attitude. The mean practice score was 10.31 ± 1.71, 201 (40.2%) had good practice score and 299 (59.8%) had poor practice score. The total KAP score was 27.60 ± 5.39, 201 (40.2%) had good total KAP score and 299 (59.8%) had poor total KAP score. Males had better knowledge, attitude, practice, and total KAP scores as compared to females. There was no significant difference in nutritional status between males and females. Higher education, duration of diabetes, and occupation were positively associated with the KAP scores. Overall, the knowledge, attitude, and practice scores were poor in a majority of the participants suggesting strict implementation of educational programs to educate the people about diabetes knowledge to improve their attitude and practice towards diabetes.

Introduction

As per recent reports the global prevalence of diabetes in 2017 was 476.0 million with an incidence of 22.9 million. The prevalence and incidence were predicted to rise to 570.9 million and 26.6 million respectively by the year 2025. The associated mortality and disability-adjusted life-years (DALYs) were 1.37 million, and 67.9 million respectively with an estimated rise to 1.59 million, and 79.3 million by 2025, respectively (1). About 37% of global population aged more than 50 years had type 2 diabetes in the year 2017 (2). With growing economies and urbanization, the burden of diabetes has increased globally (3). Prevalence of diabetes increased in both rural and urban India from 2.4% and 3.3% in 1972 to 15.0% and 19.0% respectively in year 2015-2019 independent of genders (4).

Diabetes results in significant morbidity and affects the quality of life of the patients (5-7). Sedentary lifestyle habits, eating unhealthy foods, elevated plasma glucose levels, elevated BMI, and increase in age have been associated with poor quality of life, increase in morbidity, and premature mortality in diabetes (8-10).

Lifestyle and nutritional status influence the prevalence of glucose intolerance and complications of diabetes (6). Adults with diabetes mellitus appear to be at risk of nutritional impairment. Diabetic patients may often suffer co-morbidities and long-term vascular complications, which can further affect their nutritional status. Patient education may result in increasing satisfaction, improving quality of life, ensure continuation of care, relieve anxiety, increase in the treatment participation, independence in daily activities and reduce disease complications and costs. Diabetes care poses a significant economic burden on a country's economy (11). In many patients, despite ample clinical measures such as management of blood glucose, blood pressure, and other targets, diabetes remains uncontrolled (12). This can be attributed to lack of awareness and knowledge about diabetes among the patients (13).

Early diagnosis and proper clinical management are the keys to successful control of diabetes associated complications (14). The most important aspect of diabetes management is glycemic control. This involves a plethora of activities such as lifestyle modifications, healthy diet, nutrition, exercise, weight management, and compliance to clinical course of management. This is suggestive of the fact that awareness about diabetes control and management is of utmost importance in the control of diabetes. Proper knowledge on diabetes will enable patients to seek proper treatment and enhance self-care (15). Studies have highlighted that educated people and those who are more conscious about diabetes self-care achieve better durable diabetes control (16, 17).

There is an increasing body of evidence that patient education plays a very effective role in reducing the complications of diabetes and its management (18). Education will be effective only if we know the level of knowledge, attitude and practices about diabetes among the people. Proper knowledge, good attitude and practices on diabetes could result in better management of diabetes and control of diabetes associated complications. Although there have been several studies emphasizing on the epidemiology of diabetes, there are a very few studies on the knowledge, attitude, and practice among elderly diabetes population in India (19-21).

Evaluation of the levels of knowledge, attitude and practice among elderly diabetic patients would provide better understanding of the awareness and attitude among the diabetes

patients which ultimately would help in developing better management strategies.

Therefore, this study was conducted to evaluate the nutritional status, knowledge, attitude and practice towards diabetes in a cohort of diabetes patients in India.

Materials and Methods

Study Design

A cross-sectional study was conducted in the state of Bihar, Patna from 2017 to 2018. Fixed-point continuous sampling was adopted to recruit patients with diabetes.

Selection of participants

Patients aged between 65 to 76 years, diagnosed with diabetes mellitus for atleast 1 year, with no swallowing disability, home dwelling, not on low salt or cholesterol lowering diet, those who consciously understood and responded to the questions, willing to participate in the study by providing signed informed consent forms were included in the study. Patients inability to complete the questionnaire, refusing to participate in the survey were excluded from the study.

Tools/Questionnaire

Mini-Nutritional Assessment (MNA) Tool and a Structured Interview Schedule (SIS) containing items on demographic profile, questions pertaining to knowledge, attitude, and practice were administered to the participants.

The SIS tool consisted of both open and close-ended questions. Each participant was interviewed by the first author of the manuscript. The questionnaire consisted of 5 main categories, including demographic information, anthropometric and nutritional parameters, knowledge, attitude and practice-related information.

Knowledge, attitude, and practices were assessed by 15 (Annexure 1), 20 (Annexure 2), and 23 (Annexure 3) questions respectively. Medical history/records were reviewed retrospectively for nutritional parameters and fasting blood sugar (FBS) (mg/dl) and post-prandial blood sugar (PPBS) (mg/dl) levels.

Scoring of knowledge, attitude, practice

To evaluate knowledge, attitude and practices scores, each correct response was given point 1 and each incorrect response was given 0 point. The total KAP score was calculated by adding the knowledge, attitude, and practice scores. Mean and median scores for each category was calculated. Participant were rated to have good KAP scores if they have scores above the median value and poor if they had scores less than or equal to the median scores.

Statistical Analysis

Data analysis was performed using SPSS version 21 software (IBM Corp., Armonk, NY, USA). The continuous and categorical variables were presented as mean ± standard deviation (SD) or median (minimum, maximum) and n (%), respectively. Kolmogorov- Smirnov test was applied to test the normal distribution of the data.

Independent *t*-test was used to compare quantitative variables and Chi-square test was used for the comparisons of qualitative data. Pearson's correlation analysis was performed to investigate the correlation of Knowledge, Attitude, Practice, and total KAP scores with different studied parameters. All the statistical tests were two-sided, and p values less than 0.05 were considered statistically significant.

Results and Discussion

After inclusion and exclusion criteria, 500 individuals with diabetes were included in the study. There were 250 males (50%) and 250 female participants (50%). The mean age was 69.24 ± 2.49 years (minimum=65, maximum=76). The mean weight, height, and BMI were 69.71 ± 5.76 kg (minimum=52, maximum=89), 159.42 ± 4.74 cm (minimum=150, maximum=180), and 27.42 ± 1.83 kg/m^2 (minimum=21.93, maximum =32.82) respectively.

The mean duration of diabetes was 7.84 ± 3.81 years (minimum=2, maximum=17). About 391 (78.2%) were graduates, 24 (4.8%) were undergraduates, 79 (15.8%) had education till high school, and 6 (1.2%) were educated till middle school and below. 50% of the participants were retired and fifty percent were homemakers (Table 1).

The baseline energy levels were 189.41 ± 30.40 (minimum=1362.30, maximum= 2538.10), protein levels were 66.40 ± 12.69 (minimum=34.45, maximum=97.52), iron levels were 24.43 ± 4.60 (minimum=11.37, maximum=86.54), mean FBS and PPBS levels were 189.41±30.40 (minimum=145, maximum=295) and 267.61 ± 37.72 (minimum=163, maximum=346) respectively. As per the WHO criteria, 41 (8.2%) participants were normal, 1 (0.2%) overweight, 425 (85%) pre-obese and 33 (6.6%) obese. As per MNA scoring, 477 (95.4%) had normal nutritional status, 18 (3.6%) were at risk of malnutrition, and 5 (1%) were malnourished (Table 2).

Knowledge

The mean knowledge score was 5.34 ± 1.06 (minimum=0, maximum=15). The median knowledge score was 5. Among the participants, 165 (33%) had good knowledge and 335 (67%) had poor knowledge (Table 3).

Attitude

The mean attitude score was 11.97 ± 3.96 (minimum=0, maximum=19). The median attitude score was 13. Among the participants, 181 (36.2%) had good attitude and 319 (63.8%) had poor attitude. (Table 3).

Practice

The mean practice score was 10.31 ± 1.71 (minimum=0, maximum=23). The median practice score was 10. Among the participants, 201 (40.2%) had good practice score and 299 (59.8%) had poor practice score. (Table 3).

KAP

The total KAP score was 27.60 ± 5.39 (minimum=0, maximum=56). The median KAP score was 28. Among the participants, 201 (40.2%) had good total KAP score and 299 (59.8%) had poor total KAP score. (Table 3).

Demographic, anthropometric, nutritional characteristics, and KAP scores were compared between males and females. Males had significantly higher energy levels (1867.16 ± 276.12) as compared to females (1807.74 ± 221.86) (p=0.01). There was no significant difference in the nutritional status as per WHO and MNA scoring criteria between males and females. Males were more educated as compared to females (p<0.001). All the males were retired, and all the females were home makers (p<0.001) (Table 4.1 and 4.2).

The mean knowledge (6.64 ± 4.04 Vs. 4.04 ± 3.65), attitude (12.67 ± 3.42 Vs. 11.27 ± 4.33), practice (13.78 ± 5.74 Vs. 10.81 ± 7.51), and total KAP scores (29.09 ± 8.70 Vs. 26.12 ± 15.08) were significantly higher in males as compared to females. Among the males, 113 (45.2%) had good knowledge and 137 (54.8%) had poor knowledge and among the females,

52 (20.8%) had good knowledge and 198 (79.2%) had poor knowledge. Among the males, 112 (44.8%) had good attitude and 138 (55.2%) had poor attitude and among the females, 69 (27.6%) had good attitude and 181 (72.4%) had poor attitude. Among the males, 84 (33.6%) had good practice score and 166 (66.4%) had poor practice score and among the females, 117 (46.8%) had good practice score and 133 (53.2%) had poor practice score. Among the males, 113 (45.2%) had good total KAP score and 137 (27.4%) had poor total KAP score and among the females, 117 (46.8%) had good total KAP score and 133 (53.2%) had poor total KAP score (Table 4.3).

There was no significant difference in the knowledge, attitude, practice, and KAP scores between different groups classified as per nutritional criteria (WHO and MNA). However, duration of diabetes, education levels, and occupation significantly affected the knowledge, attitude, practice, and total KAP scores. Longer duration of diabetes, higher education, and retirement status were associated with higher knowledge, attitude, practice, and total KAP scores (Table 5).

Knowledge, Attitude, practice, and total KAP scores positively correlated with duration of diabetes and negatively correlated with FBS and PPBS (Table 6).

The present study evaluated the prevailing knowledge, attitude, and practice among elderly diabetic patients along with the assessment of their nutritional status. As per the WHO criteria, majority (85%) of the participants were pre-obese, followed by normal (8.2%), obese (6.6%), and overweight (0.2%). According to MNA scoring, majority (95.4%) of the participants had normal nutritional status, 3.6% were at risk of malnutrition, and only 1% were malnourished. There was no significant difference in the nutritional status between males and females. Males had significantly higher prevailing knowledge, attitude, practice, and KAP scores as compared to females. Duration of diabetes, higher education, retirement status, correlated well with the KAP scores.

Only 33% of the participants had good knowledge about diabetes and males had better knowledge than females. Only 36.2% of the participants a good attitude and males had better attitude than females. About only 40% of the participants had good practice scores and females had better practice scores as compared to males. Males had higher total KAP scores as compared to females.

Several studies have evaluated the prevailing knowledge, attitude, and practice among the diabetic population using different tools.

However, the findings of these studies have often been inconsistent. A study conducted to reveal the knowledge, attitude and practice related to diabetes among general public highlighted that majority of the participants had moderate to good knowledge on diabetes, there was no significant effect of gender on knowledge on diabetes, majority of the study participants had poor attitude towards diabetes (22). Most studies, however, have shown poor knowledge of diabetes in the general population (23-27). Consistent with these findings, the present study also revealed that a majority of the participants had poor knowledge (67%), poor attitude (63.8%), and poor practice (59.8%). Several studies have shown an association of levels of education with knowledge of diabetes (22,17,28,26,29).

Table.1 Demographic and anthropometric characteristics. Continuous variables were represented as mean ± SD, categorical variables were represented as frequency (%).

Characteristics	Mean ± SD; n (%)	Median (Min, Max)
Gender		
Male	250 (50)	-
Female	250 (50)	-
Age (years)	69.24 ± 2.49	69.00 (65, 76)
Weight (kg)	69.71 ± 5.76	69.00 (52, 89)
Height (cm)	159.42 ± 4.74	159.00 (150, 180)
BMI (kg/m^2)	27.42 ± 1.83	27.34 (21.93, 32.82)
Duration of DM	7.84 ± 3.81	7.00 (2,17)
Educational status		
Graduate	391 (78.2)	
Undergraduate	24 (4.8)	
High School	79 (15.8)	
Middle school and below	6 (1.2)	
Occupation		
Retired	250 (50)	
Home Maker	250 (50)	

Table.2 Nutritional characteristics. Continuous variables were represented as mean ± SD, categorical variables were represented as frequency (%).

Nutritional Characteristics	Mean ± SD	
Energy (Kcal)	1837.45 ±251.97	1782.40 (1362.30, 2538.10)
Protein (gm)	66.40 ±12.69	65.39 (34.45, 97.52)
Fat (gm)	41.41 ±8.38	41.00 (23.95, 62.64)
Iron (mg)	24.43 ±4.60	20.48 (11.37, 86.54)
Biochemical Parameters		
FBS (mg/dl)	189.41 ±30.40	185.00 (145, 295)
PPBS (mg/dl)	267.61 ±37.72	274.00 (163, 346)
Nutritional status (WHO)		
Normal	41 (8.2)	
Overweight	1 (0.2)	
Pre-obese	425 (85)	
Obese	33 (6.6)	
MNA Screening		
Normal Nutritional status	477 (95.4)	
At risk of malnutrition	18 (3.6)	
Malnourished	5 (1)	

Table.3 Knowledge, attitude, and practice scores. Scores were represented as mean ± SD

Variables	Mean ± SD; n (%)	Median (Min, Max)
Knowledge (K)	5.34 ± 1.06	5.00 (0, 15)
Attitude (A)	11.97 ± 3.96	13.00 (0, 19)
Practice (P)	10.31 ± 1.71	10.00 (0, 23)
KAP Total	27.60 ± 5.39	28.00 (0, 56)

Table.4 Comparison of demographic, nutritional and clinical characteristics between males and females. Continuous variables were represented as mean ± SD. Independent sample t test and Mann-Whitney Test were performed to compare between two groups. P values less than 0.05 were considered to be significant

Variables	Gender	Mean ± SD	Independent sample T test (p value)	Mann-Whitney Test (p value)
Age	Male	69.51 ± 2.67	0.06	0.07
	Female	68.97 ± 2.28		
Weight (kg)	Male	72.05 ± 5.65	0.08	0.07
	Female	70.36 ± 4.86		
Height (cm)	Male	162.35 ± 4.37	0.06	0.08
	Female	160.49 ± 2.95		
BMI (kg/m^2)	Male	27.32 ± 1.67	0.24	0.11
	Female	27.52 ± 1.98		
Energy (kcal)	Male	1867.16 ± 276.12	0.01	0.03
	Female	1807.74 ± 221.86		
Protein (gm)	Male	66.17 ± 12.62	0.69	0.66
	Female	66.63 ± 12.78		
Fat (gm)	Male	41.05 ± 8.17	0.35	0.48
	Female	41.76 ± 8.58		
Iron (mg)	Male	24.41 ± 12.72	0.97	0.90
	Female	24.46 ± 12.51		
Duration of DM	Male	7.90 ± 3.91	0.72	0.89
	Female	7.78 ± 3.69		
FBS (mg/dl)	Male	186.78 ± 28.17	0.05	0.11
	Female	192.02 ± 32.32		
PPBS (mg/dl)	Male	268.90 ± 37.91	0.45	0.43
	Female	266.32 ± 37.55		

Table.5 Comparison of demographic and clinical characteristics and KAP scores between males and females. Categorical variables were represented as frequency (%. Chi-Square Test and *Fisher's Exact Test were done wherever applicable. P values less than 0.05 were considered to be significant.

Nutritional Status (WHO)	Male	Female	Chi-Square test, p value
Normal	15 (6)	26 (10.4)	0.16
Overweight	1 (0.40)	0 (0)	
Pre-obese	220 (88)	205 (82)	
Obese	14 (5.6)	19 (7.6)	
MNA Screening score			
Normal Nutritional status	237 (94.8)	240 (96)	0.15
At risk of malnutrition	12 (4.8)	6 (2.4)	
Malnourished	1 (0.4)	4 (1.6)	
Educational status			
Graduate	242 (96.8)	149 (59.6)	<0.001
Undergraduate	7 (2.8)	17 (6.8)	
High School	1 (0.4)	78 (31.2)	
Middle school and below	0 (0)	6 (2.4)	
Occupation			
Retired	250 (100)	0 (0)	<0.001*
Home Maker	0 (0)	250 (100)	

Table.6 Comparison of KAP scores between males and females. Continuous variables were represented as mean ± SD. Independent sample t test and Mann-Whitney Test were performed to compare between two groups. P values less than 0.05 were considered to be significant.

Variables	Gender	Mean ± SD	Independent sample T test (p value)	Mann-Whitney Test (p value)
Knowledge score	Male	6.64 ± 4.04	<0.001	<0.001
	Female	4.04 ± 3.65		
Attitude score	Male	12.67 ± 3.42	<0.001	<0.001
	Female	11.27 ± 4.33		
Practice score	Male	13.78 ± 5.74	<0.001	<0.001
	Female	10.81 ± 7.51		
Total KAP	Male	29.09 ± 8.70	0.01	0.03
	Female	26.12 ± 15.08		

Table.7 Comparison of demographic and clinical characteristics and KAP scores among different sub-categories. Continuous variables were represented as mean ± SD, categorical variables were represented as frequency One-way ANNOVA was used to compare between different groups. P values less than 0.05 were considered to be significant.

Variables	Knowledge		Attitude		Practice		Total KAP	
	Mean±SD	P value	Mean±SD	P value	Mean±SD	P value	Mean ±SD	P value
Duration of diabetes		0.02		0.01		0.03		0.04
<5 (n=148)	3.61±0.03		7.49±1.48		6.77±1.54		15.59±3.48	
5-10 (n=227)	4.98±1.19		9.59±2.18		8.81±1.45		20.37±5.11	
>10 (n=125)	6.90±1.30		12.03±1.04		10.65±0.59		28.36±4.97	
Education		<0.001		0.02		0.03		0.01
Graduate	6.57 0.97		12.1213.75		15.08±1.34		27.77±1.10	
Undergraduate	5.25±0.02		10.5±0.37		12.17±1.53		24.92±1.08	
High School	4.49±3.94		8.67±0.23		9.30±1.60		20.49±1.46	
Middle school and below	3.83±0.81		7.5±1.89		7.67±1.17		17.0±1.59	
Nutritional status (WHO)		0.30		0.18		0.21		0.06
Normal	4.15±3.71		11.12±4.23		9.34±7.10		24.61±13.95	
Overweight	2		13		10		25	
Pre-obese	5.35±4.08		11.96±3.95		10.22±6.71		27.52±12.32	
Obese	6.82±3.81		13.15±3.71		12.52±5.91		32.49±10.03	
MNA Screening		0.28		0.17		0.16		0.10
Normal Nutritional status	5.34±4.11		11.95±4.0		10.25±6.72		27.53±12.46	
At risk of malnutrition	6.06±3.13		13.22±2.81		12.61±6.32		31.91±10.21	
Malnourished	2.80±2.18		9.6±2.51		6.6±3.2		19.0±6.93	
Occupation		<0.001		<0.001		0.03		0.01
Retired	6.64±1.04		12.6713.42		15.78±1.74		29.11±8.7	
Home Maker	4.04±1.65		9.27±1.33		10.81±1.51		26.12±15.08	

Table.8 Pearson's correlation between Knowledge, Attitude, Practice, and total KAP scores with different studied parameters. Pearson's correlation coefficient (r) were calculated, p values less than 0.05 were considered to be significant.

Variables		Age	Weight	Height	BMI	Energy	Protein	Fat	Iron	Duration of DM	FBS	PPBS
Knowledge score	R	.033	.020	.206	.072	.007	-.070	-.106*	.000	**.45***	**-0.36****	**-0.38***
	P	.461	.45	.56	.107	.871	.116	.018	.995	**.03**	**.000**	**.025**
	N	500	500	500	500	500	500	500	500	500	500	500
Attitude score	R	.039	.015	.10	.106	-.018	-.033	-.061	-.014	**0.43**	**-.220****	**-0.38****
	P	.388	.67	.017	.18	.688	.457	.176	.749	**.03**	**.000**	**.002**
	N	500	500	500	500	500	500	500	500	500	500	500
Practice score	R	-.017	.107*	.076	.070	-.021	-.025	-.047	.080	**0.30**	**-.34****	**-0.30****
	P	.711	.017	.091	.119	.646	.575	.299	.073	**0.02**	**.000**	**.004**
	N	500	500	500	500	500	500	500	500	500	500	500
Total KAP	R	.014	.175	.142	.095	-.015	-.047	-.079	.039	**0.67***	**-.213****	**-0.35****
	P	.751	.800	.10	.34	.746	.291	.077	.386	**.01**	**.000**	**.001**
	N	500	500	500	500	500	500	500	500	500	500	500

Higher education may be an indicator of good knowledge, attitude, and practice. In the present study we observed a positive association of education on knowledge, attitude and practice among the study participants. People who were graduates and above had higher knowledge, attitude, and practice scores and the participants who were educated till middle school or below had the lowest scores for knowledge, attitude, and practice. Although we did not inquire about the source of information about diabetes, we believe that higher literacy rates and social media interactions might be the reason of good knowledge, attitude, and practice among the participants. Studies have revealed that gender or age had no effect on the knowledge, attitude, and practice (22). However, several other studies have found a significant association of gender and age with knowledge, attitude, and practice (23,24,26,29). These studies have shown that males have better knowledge than females on diabetes. Consistent with these findings, in the present study we also observed that males had significantly higher knowledge, attitude, and practice towards diabetes as compared to females. This might be due to higher literacy rates in males as compared to females.

Most studies have shown that there is a gap between knowledge and attitude towards diabetes (22). However, several other studies have shown people with poor knowledge had poor attitude too (23,24,26,29). Similar to the findings of these studies, the present study also revealed that 67% participants had poor knowledge about diabetes, 63.8% participants had poor attitude, and 59.8% had poor practice towards diabetes further reinforcing the fact that knowledge, attitude, and practice go hand in hand.

It has been observed that poor attitude brings deleterious effects on diabetes management (30). Observations from the previous studies and the present study substantiate the fact that proper knowledge, attitude, and practice towards diabetes are the key components for a better management of diabetes. Therefore, it is quiet essential to focus more on the development of educational programs to enhance the knowledge, attitude, and practice in the diabetes patients.

Studies have shown education and duration of diabetes as independent predictors of patient compliance (31). In the present study also, we observed education and duration of diabetes were positively associated with the level of knowledge, attitude, and practice among the diabetic population. Duration of diabetes is controversial in terms of its association with the level of knowledge, attitude, and practice. Studies have shown that patients with longer duration of diabetes have higher knowledge and practice scores (32). Similarly, in the present study, we observed that duration of diabetes was positively correlated with the knowledge, attitude, practice, and total KAP scores. This can be explained by the fact that people with diabetes for longer durations seek more information from different sources and hence develop more knowledge which reflects in their attitude and practice towards diabetes. However, there are studies that have highlighted that duration of diabetes has no association with the knowledge, attitude, and practice scores (33). We also observed a negative correlation of knowledge, attitude, practice, and KAP scores with FBS and PPBS levels. This can be explained by the fact that people with right knowledge, good attitude, and practice have well maintained blood sugar levels. The major limitation of the study was we did not look for the socio-economic status of the participants and the sources of information.

A large majority of elderly people with diabetes have poor knowledge, attitude, and practice towards diabetes. Resources need to

be diverted to design and implement educational programs to enhance the knowledge, attitude, and practice among the diabetic population, especially in the elderly. The female population should be given special attention as they have lower knowledge, attitude, and practice towards diabetes as compared to males. There was no significant effect of nutritional status on the knowledge, attitude, and practice towards diabetes.

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Annexure.1 Questionnaire for knowledge

S.No	Knowledge about Diabetes Mellitus
1	What is diabetes mellitus?
2	Which organ malfunctions during diabetes?
3	Which Hormone is responsible for diabetes?
4	How many types of diabetes are there?
5	What are the causes of Diabetes?
6	What are the most common symptoms of diabetes mellitus?
7	What are the complications of diabetes?
8	What is the normal fasting blood glucose level?
9	What is the normal post prandial blood glucose level?
10	Which method is useful for diabetes management?
11	How many meals are preferable for diabetes?
12	What should be restricted in a diabetic diet?
13	Which cooking method should not be used for diabetics?
14	Which fruits should be avoided by diabetics?
15	Which sweetening agent should be avoided by diabetics?

Annexure.2 Questionnaire for attitude

S.No	Attitude Testing Questionnaire
1	Eating too much sugar and sweet food causes diabetes.
2	Regular check up of blood glucose is desirable for diabetics.
3	Maintaining blood glucose levels near normal can help avoid complications of diabetes.
4	Care of feet should not be done by diabetics.
5	Diabetics are prone to hypertension.
6	Diabetes can be managed by daily exercise, diet plan and medication
7	Meal should be evenly spaced through-out the day to manage sugar levels
8	Timely intake of in-between meals should be stressed to avoid hyperglycaemia.
9	Patients should avoid fasting and feasting.
10	Regulating of meals is not needed for persons taking insulin.
11	Complex carbohydrates should not be included in the diet.
12	Simple carbohydrates are good for diabetics.
13	Wheat flour should be supplemented with BRAN, Soya flour or Bengal gram flour for diabetics.
14	High fibre foods are good for diabetics.
15	Salad should be consumed before meal.
16	Honey and jaggery are harmful for diabetics.
17	Medicinal plants can be used to cure diabetes.
18	Diabetics should avoid excessive use of fats.
19	Oils containing free fatty acids are good for heart.
20	Diabetics should consume atleast 10-12 glasses of water in a day.

Annexure.3 Questionnaire for practice

S.No	Practice Testing Questionnaire
1	Do you get your blood glucose checked regularly?
2	Do you try to maintain blood glucose level near normal?
3	Do you try to maintain normal body weight?
4	Do you take care of your feet?
5	Do you follow a modified diet in diabetes?
6	Do you consume a balanced diet?
7	Are your meals evenly spaced throughout the day?
8	Do you take 5-6 small meals in a day?
9	Do you skip meals?
10	Do you follow your modified diets during parties?
11	Do you take more complex carbohydrates than simple one?
12	Are fibre rich foods a part of your daily diet?
13	Do you supplement wheat flour with bran ?
14	Do you consume sugar, jaggery and honey?
15	Do you consume lots of fats in your diet?
16	Do you consume large amount of salt in your diet?
17	Do you consume jams, squashes and pickles frequently?
18	Do you avoid fruits like mango, chickoo, grapes, etc?
19	Do you avoid vegetables like potato, sweet potato and colocassia, etc?
20	Do you drink plenty of water?
21	Do you use any medicinal plant for controlling diabetes?
22	Do you use traditional foods like methi, jamun, karela for controlling diabetes?
23	Do you exercise daily?