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Correlation of awareness of the disease with glycaemic control and diabetic complications among patients attending a tertiary care hospital

ABSTRACT

Introduction. The awareness level among diabetic patients varies across patient population based on many factors such as differences in the literacy of the study population, socioeconomic status, availability of diabetes education. Hence, it is important to study the same in our set-up to plan appropriate preventive strategies. The present research work attempted to assess the awareness level about diabetes and its complications among diabetic patients attending a tertiary care teaching hospital.

Materials and methods. This is a hospital based, cross-sectional study, done in diabetic patients attending a tertiary care teaching hospital in South India. The awareness level of the patient was assessed using a pretested questionnaire. The questionnaire had 25 questions (knowledge — 18, attitude — 4 and practice — 3) and each correct answer was given a score of 'one' and each wrong answer was given a score of 'zero'. Patients were assessed clinically for the presence of micro and macrovascular complications and basic investigations were carried out. Metabolic control is assessed by HbA_{1c} level.

Results. A total of 150 patients were included in the study. Approx. 52.6% of patients scored between 14 and 18 (sufficient awareness), 6.6% of patients had satisfactory awareness (KAP score 19–20) and 4% of patients had highly satisfactory awareness (KAP score > 20). Only eight patients had a score less than 10 (highly insufficient awareness) and 31.3% had insufficient awareness (KAP score 10–13). A positive correlation between educational qualification and awareness level was observed ($r = 0.495$, $p < 0.001$). Mean awareness score of patients who received diabetes education from physician and dietitian was significantly high when compared to other sources of patient education. Mean awareness scores were lower for those with various diabetic complications. There is a statistically significant negative correlation observed between awareness and HbA_{1c} values ($r = 0.527$, $p < 0.001$).

Conclusion. Majority of the patients had sufficient awareness about the disease and about one-third of the patients had insufficient awareness about diabetes. The awareness level of the patients about the disease had a strong influence on the metabolic control, diabetic complications and also correlated with their educational status. (Clin Diabetol 2019; 8, 3: 143–153)

Key words: awareness, diabetes, KAP score

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Introduction

India being the diabetes capital of the world, mortality and morbidity related to diabetic complications poses a great threat and burden to the economy. Chronic complications are the major outcome of type 2

diabetes mellitus, which reduces the quality of life, incur heavy burden to health care system, and increase diabetic mortality [1, 2]. Diabetes is a lifelong disease and the health care providers have almost no control over the extent to which the patients adhere to the treatment regimen. The appropriate role of the health care providers is to serve as a coach to the patient, who has primary responsibility for delivery of daily health care. Diabetes self-management education has gained importance over the past decade as research has documented the benefits of such interventions in improving glucose control and reducing diabetes related complications. The acquisition of the relevant skills for successful self-management may play a key role in tackling beliefs about health and optimizing metabolic control, risk factors, and quality of life. Hence, comprehensive patient education in diabetics is the corner stone in diabetes management. Diabetes education leads to more informed choices and beneficial changes in behavior which, in turn, improves motivation for self-care and reduces the risk of diabetic complications, thereby reducing the economic cost of diabetes [3]. Even in general population, possessing a good awareness regarding the risk factors for diabetes may help them to take appropriate preventive measures [4]. There are many studies exploring the awareness and its possible associations with metabolic control and complications. However, it is obvious that awareness varies across the patient population. Hence, it is important to study the same in our set-up, to plan appropriate preventive strategies. The present research work attempted to assess the awareness level about diabetes and its complications among patients attending a tertiary care teaching hospital and also to correlate the same with metabolic control and diabetic complications.

Materials and methods

This is a hospital based cross-sectional study, performed among diabetic patients attending a tertiary care teaching hospital in South India. The study was performed after obtaining approval from the institutional ethics committee and the written informed consent of the patients. The participants were selected through convenient sampling, with a sample size of 150 which included both inpatients and outpatients of either gender with age above eighteen years. All consecutive type 2 diabetic patients who visited the hospital during the study period were included. Patients with type 1 diabetes and gestational diabetes were excluded. Demographic details, details of diabetes such as duration, treatment and diabetes education received etc. were collected from the patients. Educational status of the patients was assessed by noting down their educational qualifications. This study was planned to assess their existing awareness on the disease which was assessed using a pretested questionnaire. Questions were made available in vernacular languages according to the patient's preferences. The questionnaire had 25 questions (knowledge — 18, attitude — 4 and practice — 3) and each correct answer was given a score of 'one' and each wrong answer was given a score of 'zero'. The maximum possible scores for knowledge, attitude and practice are 18, 4, and 3 respectively. The total number of correct answers was converted into a KAP score for each patient. The KAP score was classified into five categories and coded as:

- < 10 (≤ 40%): highly insufficient;
- 10–13 (40–52%): insufficient;
- 14–18 (56–72%): sufficient;
- 19–20 (76–80%): satisfactory;
- > 20 (> 80%): highly satisfactory.

Patients were assessed clinically and basic investigations were carried out. Metabolic control is assessed by HbA_{1c} level. Patients were also assessed for the presence of micro and macrovascular complications. Presence of peripheral neuropathy was determined by vibration test using 128 Hz tuning fork, monofilament test using 10 g monofilament, ankle reflex and power assessment. Resting tachycardia and postural hypotension were used as the indicators of autonomic neuropathy. The fundoscopic examination was carried out to look for the presence of retinopathy and the presence of macro/microalbuminuria were the indicators of nephropathy. History of coronary heart disease and cerebrovascular accidents, the presence of peripheral vascular disease and absence of peripheral pulse were the indicators of macrovascular diseases.

Statistical analysis

The analysis of the data was performed using SPSS version 11.5. Categorical variables were shown as frequencies/percentages and the continuous variables were presented as mean ± standard deviation. To compare KAP scores, Student t test and one way ANOVA were used. Correlation between two variables was performed by Pearson correlation. P value < 0.05 considered statistically significant.

Results

Table 1 summarizes the demographic characteristics of the patients. Majority of the patients were in the age group of 51–60 years (36.7%) and 61–70 years (30%). Prevalence of smoking was seen in 32 (21.3%) patients and the alcohol consumption was seen in 18 (12%) patients. All these patients who consumed alco-

Table 1. Demographic characteristics of the patients

Variables	Values
Age (years), mean ± SD	58.05 ± 10.20
Gender, n (%)	
Male	81 (54)
Female	69 (46)
Body mass index [kg/m^2], n (%)	
< 18	3 (2)
18–23	71 (47.3)
23–30	70 (46.7)
> 30	6 (4)
Duration of diabetes (years) mean ± SD	8.83 ±.5.85
Educational status, n (%)	
Illiterate	7 (4.7)
Primary school	14 (9.3)
High school	28 (18.7)
Pre-degree	37 (24.7)
Graduation	56 (37.3)
Post-graduate	5 (3.3)
Professional	3 (2)
Occupation, n (%)	
Unemployed	7 (4.7)
House wife	50 (33.3)
Daily wages	15 (10)
Service	74 (49)
Professional	4 (2.7)
Family history of diabetes, n (%)	
Yes	96 (64)
No	54 (36)
Hypertension, n (%)	
Yes	69 (46)
No	81 (54)

hol and smoking were males. Majority of the patients had the duration of diabetes between 5–10 years (50%) and 26% of patients had the duration diabetes of 11–20 years. Only 15.3% of patients were eating a diet which was rich in vegetables, avoiding sugars and fats. More than one-fourth (26.7%) of the patients were leading a sedentary life, but the majority were doing moderate exercise (38%). Majority of the patients (46%) were using both insulin and oral antidiabetic agents and 28% were on oral antidiabetic drugs and the rest were on insulin only. Adherence to the treatment regimen was reported by 86% of patients.

Table 2 shows the metabolic control (as assessed by HbA_{1c} level) and diabetic complications seen in the patients. Around 16% of patient had a good control

Table 2. Metabolic control (HbA_{1c} level) and complications of diabetes

Variables	Values
HbA_{1c} (%), n (%)	
< 6.5	24 (16)
6.5–8	40 (26.7)
8.1–10	42 (28)
> 10	44 (29.3)
Diabetic complications, n (%)	
Peripheral neuropathy	95 (63.3)
Autonomic neuropathy	35 (23.3)
Retinopathy	67 (44.7)
Nephropathy	59 (39.3)
Peripheral vascular disease	31 (20.07)
Coronary heart disease	16(10.2)
Cerebrovascular accident	5 (3.3)

Table 3. Distribution of scores for knowledge, attitude and practices among patients

Attribute	Score category	Number of patients n (%)
Knowledge	5–7	17 (11.3)
	8–10	45 (30)
	11–13	65 (43.3)
	14–16	22 (14.6)
	> 16	1 (0.6)
Attitude	1	18 (12)
	2	88 (58.7)
	3	43 (28.7)
	4	1 (0.7)
Practices	1	69 (46)
	2	67 (44.7)
	3	14 (9.3)
KAP score	< 10 (< 40%)	8 (3.3)
	10–13 (40–52%)	47 (31.3)
	14–18 (56–72%)	79 (52.6)
	19–20 (76–80%)	10 (6.6)
	> 20 (> 80%)	6 (4)

with HbA_{1c} less than 6%. Peripheral neuropathy is the most common complication (63.3%), followed by retinopathy (44.7%) and nephropathy (39.3%).

Table 3 shows the distribution of scores for knowledge, attitude and practices among the study population. The lowest KAP score for awareness was 7 and the highest score was 22. Around 52.6% of patients scored between 14 and 18 (sufficient awareness), 6.6% of patients had satisfactory awareness (KAP score 19–20)

Table 4. Correlation between educational status and awareness level

Educational status	No of patients	KAP score (mean ± SD)	Correlation coefficient	p value
Illiterate	7	11.3 ± 3.6	0.495	< 0.001
Primary school	14	10.86 ± 2.25		
High school	28	13.86 ± 3.01		
Pre degree	37	15.43 ± 2.85		
Graduate	56	15.38 ± 2.97		
Post-graduate	5	18.60 ± 1.34		
Professional	3	19.33 ± 1.15		

Pearson correlation

Table 5. Correlation between metabolic control (HbA_{1c}) and educational status

Educational status	No of patients	HbA_{1c} (mean ± SD)	Correlation coefficient	p value
Illiterate	7	8.64 ± 1.84	0.003	0.97
Primary school	14	10.24 ± 2.52		
High school	28	8.91 ± 1.94		
Pre degree	37	8.61 ± 2.09		
Graduate	56	8.73 ± 1.95		
Post-graduate	5	5.8 ± 0.37		
Professional	3	10.20 ± 1.40		

Pearson correlation

Table 6. Correlation between source of diabetes education and awareness level

Source of diabetes education	No of patients (%)	KAP score (mean ± SD)	p value
Nil	40 (26.7)	11.42 ± 2.36	< 0.001
Physician	60 (40)	15.27 ± 2.36	
Dietitian	3 (2)	10.67 ± 0.58	
Nurse	7 (4.7)	14.43 ± 1.81	
Advertisement	5 (3.3)	12.8 ± 3.27	
Physician and dietitian	35 (23.3)	18.09 ± 2.0	

ANOVA

and 4% of patients had highly satisfactory awareness (KAP score > 20). Only 8 patients had a score less than 10 (highly insufficient awareness) and 31.3% had insufficient awareness (KAP score 10–13).

Table 4 shows the correlation between educational status and awareness level. A positive correlation between educational qualification and awareness level was observed and it was statistically significant ($r = 0.495$, $p < 0.001$).

Table 5 shows that correlation between metabolic control (HbA_{1c}) and educational status of patients. There was no association between metabolic control and educational status.

Table 6 shows the correlation between the source of diabetes education and awareness level. More than one-fourth (26.7%) of patients did not receive any diabetes education. Around 40% of the patients received education from their treating physicians while 23.3% had both physician and dietitian to advise them. Remaining 3.35 of patients relied on advertisements to obtain information on diabetes. Mean awareness score of patients who received diabetes education from physician and dietitian was significantly high (18.09 ± 2.0) when compared to other groups ($p < 0.001$). Patients who received diabetes education from physicians also had comparatively higher value of awareness score with a mean score of 15.27.

Table 7 shows the correlation of awareness level and presence of complications. Mean awareness scores were lower for those with different types of complications. However, this difference is statistically significant in case of peripheral neuropathy, autonomic neuropa-

Table 7. Correlation between awareness level and presence of diabetic complications

Complications	No of patients	KAP score (mean ± SD)	p value
Peripheral neuropathy			
Yes	95	13.94 ± 3.39	0.001
No	55	15.89 ± 2.90	
Autonomic neuropathy			
Yes	35	13.06 ± 3.52	0.001
No	115	15.18 ± 3.14	
Retinopathy			
Yes	67	13.4 ± 3.37	< 0.001
No	83	15.65 ± 3.01	
Nephropathy			
Yes	59	13.71 ± 3.09	0.004
No	91	15.32 ± 3.36	
Peripheral vascular disease			
Yes	31	13.32 ± 4.0	0.01
No	119	15.04 ± 3.07	
Coronary artery disease			
Yes	16	14.13 ± 5.04	0.48
No	134	14.75 ± 3.10	
Cerebrovascular accident			
Yes	5	11.40 ± 1.34	0.03
No	145	14.80 ± 3.33	

Student t test

thy, retinopathy, nephropathy and cerebrovascular accident. The difference was not statistically significant for coronary artery disease.

Metabolic control was assessed using HbA_{1c} values and compared with the awareness level (KAP scores). There is a statistically significant negative correlation observed between awareness and HbA_{1c} values ($r = -0.527$, $p < 0.001$). Individually, knowledge, attitude and practice also have a statistically negative correlation with HbA_{1c}.

Discussion

The present study was conducted to assess the correlation of awareness of diabetes with the glycaemic control and diabetic complications among type 2 diabetic patients. Our study has shown a statistically significant positive correlation between the educational level of the patient and their awareness level about diabetes. Similar to our findings, Caliskan et al. and Yun et al. also reported that awareness among diabetics is mainly determined by their education levels [5, 6]. In our study population, only 4% were illiterates, 28% had at least high school education and 68% had a formal education level of more than high school. This represents a population of high literacy level when compared to other studies from India like Muninarayana et al. [7] with 43% illiterates reporting a formal education of more than high school. This may be due to the fact that our set up is a tertiary care centre with a paid service wherein most of the patients belong to the high socioeconomic strata.

We were not able to demonstrate a statistically significant correlation with educational level and metabolic control as well as between educational level and the prevalence of diabetic complications. This may be due to the fact that ours is a hospital based study which included even in-patients also and hence, most of the patients likely to have one or more diabetes related complications.

The common perception about dietary modification in diabetes in our study population was to avoid sugars, with 95% of patients avoiding sugar in their diet, of which, 39% of patients also claimed to avoiding fatty foods. A well-balanced diet containing vegetables and fruits, avoiding fats and sugars was taken by only 15% of patients. In a study conducted by Muninarayana et al., 93.5% participants avoided sweets and 87% avoided both sweets and fatty food [7]. Where as in a study done by Badaruddin et al. 54% totally avoided sugars in their diet and 47% considered fruits and vegetables important in their diet [8]. This shows the inadequacy of knowledge about self-care practices and

lifestyle modification, even among patients attending a tertiary care centre.

In the present study, only 38% of patients were engaged in moderate exercise. In a study done at Chandigarh by Kaur et al., only 24% of patients were performing a moderate amount of exercises [9]. Although the importance of exercise in the management of diabetes is often emphasized, the proportion of patients following a strict regimen of at least 30-minute walk for a minimum of 5 days a week was very less in our study. As this is a hospital based study, the participants may be representing a subset with complications of diabetes who were not able to follow a strict exercise regimen.

Analysis of KAP score among our patients showed that the lowest score was 7 and the highest score was 22. Only 6% had a score of more than 20 and 15% had a score of less than 10. 52% of patients scored between 14 and 18. Thus, nearly 35% of patients had insufficient awareness about their disease. Mean awareness score among our patients was 14.69 ± 3.34. Individually, the mean score for knowledge, attitude and practice were 10.8 ± 2.53, 2.18 ± 0.64 and 1.63 ± 0.65 respectively. In a study done by Upadhyay et al. in Nepal, which used a similar type of questionnaire, overall mean score (KAP) of patients was 7.78 ± 3.8, knowledge score was 4.9 ± 3.34, attitude 2.03 ± 0.95 and practice score was 0.84 ± 0.76, which was very low compared to our study [10]. Sabri et al. also used a similar type of questionnaire and demonstrated a mean KAP score as 18 ± 2 among urban patients and 13 ± 2 among rural diabetic patients [11]. The study done by Schillinger et al. used abbreviated s-TOFHILA score to assess the health literacy [12]. They showed mean KAP score as 21. Inadequate health literacy was seen in 38% of patients and 13% had marginal health literacy. The difference in findings between various studies may be due to the differences in the literacy of the study population, socioeconomic status, availability of diabetes education etc.

Though there was a positive correlation between awareness level and adherence to treatment, it was not statistically significant. This could be due to the small number patients who are non-adherent to treatment. We found a statistically significant negative correlation between awareness level and HbA_{1c}. Schillinger et al also reported a significant correlation between health literacy and diabetes control as indicated by HbA_{1c} level [12].

Among our study population, the majority of patients had peripheral neuropathy (63.3%), 44.7 % had retinopathy, 39.3% had nephropathy, 23.3% had autonomic neuropathy and 20.07% had peripheral vascular disease. Coronary artery disease was seen in 10.7% of patients and 3.3% had cerebrovascular accidents. Agrawal et al. reported the prevalence of complications among 11,157 diabetic patients, wherein retinopathy was seen in 32.5%, nephropathy in 30.2%, peripheral neuropathy in 26.8%, coronary heart disease in 25.8% and peripheral vascular disease in 28% of the patients [13]. Rani et al. showed the prevalence of diabetic retinopathy as 18% in the rural areas and 17% in the urban areas. The prevalence of referable retinopathy was 6.8% in rural areas and 4.6% in urban areas [14].

Unnikrishnan et al., showed the prevalence of microalbuminuria in diabetics as 26.9% which was comparable to our value (21%) [15]. Prevalence of coronary artery disease among diabetics as shown by Agrawal et al. was 25.8% which is very high compared to our study [13]. This may be due to the fact that our data for cardiovascular complication was purely based on patients history alone. Our study has shown a statistically significant negative correlation between awareness level and diabetic complications. Schillinger et al. showed a statistically significant association of awareness level with retinopathy and cerebrovascular accident [12]. They have found a negative correlation with regard to other diabetic complications. This difference, when compared to our study could be due to the fact that they had taken into consideration only the self-reported complications.

There were some limitations in the present study. Being a hospital based research, the study population included patients attending a tertiary care hospital and hence their awareness status may not reflect the awareness of general population in the community. Also, the complications rate in our patient population was higher, as many of the patients were referred from primary/secondary care centers. Research at the community level will put more light on the level of awareness in diabetic patient population.

To conclude, educational qualification of the patients has a significant influence on their awareness about diabetes. Majority of the patients had sufficient awareness about the disease and about one-third of the patients had insufficient awareness about diabetes. The patients with higher level of awareness about the disease had better glycaemic control. Both microvascular and macrovascular complications have shown association with the awareness level. The awareness level was better when the patient received diabetes education from physician and dietitian. A common perception about diet is to avoid sugars and very few patients are implementing balanced diet.

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Questionnaire to assess the awareness of the disease with glycaemic control and diabetic complications among diabetic patients

Questions of assessing Knowledge about diabetes (18 questions)

1. Diabetes is a disease in which the body contains:
   a) Higher level of sugar in the blood than normal
   b) Lower level of sugar in the blood than normal
   c) Either a higher or lower level of sugar in the blood than normal
   d) I don't know

2. The major cause of diabetes is:
   a) Increased availability of insulin in the body
   b) Decreased availability of insulin in the body
   c) I don't know

3. The symptom(s) of diabetes is/are:
   a) Increased frequency of urination
   b) Increased thirst and hunger
   c) Increased tiredness
   d) Slow healing of wounds
   e) All of the above
   f) I don't know

4. Diabetes if not treated can lead to:
   a) Eye problems
   b) Kidney problems
   c) Foot ulcers
   d) Heart problems
   e) All of the above
   f) I don't know

5. The most accurate method of monitoring diabetes is:
   a) Checking blood glucose levels
   b) Checking urine sugar
   c) I don't know

6. In a diabetic patient, a high blood pressure can increase or worsen the risk of:
   a) Heart attack
   b) Stroke
   c) Eye problems
   d) Kidney problems
   e) All of the above
   f) I don't know

7. A diabetic patient should measure his/her blood pressure:
   a) Once a year
   b) Once every six months
   c) Once every two months
   d) Once every month
   e) Need not check at all
   f) I don't know

8. The life style modification(s) required for diabetic patients is/are:
   a) Weight reduction
   b) Stopping smoking
   c) Stopping alcohol intake
   d) All of the above
   e) I don't know

9. A diabetic patient should have his/her eyes checked:
   a) Once a year
   b) Every six months
   c) Need not checked at all

10. Regular urine tests will help in knowing:
    a) The status of liver function
    b) The status of kidney function
    c) The control of diabetes
    d) I don't know

11. The important factors that help in controlling blood sugar are:
    a) A controlled and planned diet
    b) Regular exercise
    c) Medication
    d) All of the above
    e) I don't know

12. A regular exercise regimen will help in:
    a) Increasing blood circulation
    b) Enhancing insulin action
    c) I don't know

13. The well balanced diet includes:
    a) Green leafy vegetables
    b) Fiber rich food
    c) Low sugar, oil and fat
    d) I don't know

14. For proper foot care, a diabetic patient:
    a) Should inspect and wash the feet daily
    b) Should select the best possible footwear
    c) Should walk barefoot inside and outside the house
    d) Should not walk barefoot inside and outside the house

15. Treatment of diabetes comprises of:
    a) Antibiotic therapy
    b) Blood transfusions
    c) Substituting insulin
    d) Taking more bitter vegetables
    e) I don't know

16. Diabetes cannot be treated with:
    a) Insulin
    b) Glibenclamide
    c) Metformin
    d) Antibiotics
    e) I don't know

17. Upon control of diabetes, the medicines:
    a) Can be stopped immediately
    b) Can be stopped after one month
    c) Should be continued life-long
    d) I don't know

18. Hypoglycaemic symptoms can be managed by taking:
    a) Sugar
    b) Medicines
    c) Insulin
    d) I don't know

Questions for assessing attitude about diabetes management (4 questions)

1. Do you exercise daily?
    a) Yes
    b) No

    If yes. How often?
    a) Every day
    b) Once weekly
    c) Once monthly

2. Are you following a controlled and planned diet?
    a) Yes
    b) No

    If yes. How often?
    a) Always
    b) Sometimes or rarely

3. Do you miss taking the doses of your diabetic medications?
    a) Yes
    b) No

    If yes. How often?
    a) Occasionally
    b) Once a week
    c) Once a month

4. Are you aware of blood sugar levels falling below normal when you are taking drugs?
    a) Yes
    b) No

    If yes, did you at any time experience any of the following symptoms?
    a) Weakness
    b) Confusion
    c) Visual disturbances
    d) I don't know

Questions for assessing diabetes self-care practices (3 questions)

1. When was your blood pressure checked last?
   a) One week ago
   b) One month ago
   c) Two months ago
   d) Six months ago
   e) One year ago

2. When did you have your last eye examination?
   a) One month ago
   b) Six months ago
   c) One year ago
   d) Two years ago
   e) Not done at all

3. When was your last urine examination?
   a) One month ago
   b) Six months ago
   c) One year ago
   d) Not done at all