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The Level of Diabetes Knowledge and Related Factors among Patients with Diabetes Mellitus in Hyderabad, India

Swathi Yalamala[1] · Eunyoung, E. Suh[2]

[1]MSN, RN, College of Nursing, Seoul National University, Seoul, Korea
[2]Professor, College of Nursing, Research Institute of Nursing Science, Seoul National University, Seoul, Korea

Purpose: The study was aimed to investigate the level of diabetes knowledge and related factors among patients with Diabetes Mellitus (DM) in Hyderabad, India. **Methods:** This descriptive study was conducted at CARE Hospital, Nizam's Institute of Medical Sciences Hospital, and Magna Hospital in Hyderabad from July to August in 2014. A convenient sample of 200 hospitalized adult patients with DM was recruited. The Michigan Diabetes Knowledge Test with 23 multiple choice items to measure general, insulin, and total DM knowledge was used. Each correctly answered item earns 1 point. Descriptive statistics, independent t-test and one-way ANOVA with SPSS/WIN 23.0 program were used for analysis. **Results:** The average age of the 200 study participants was 57.3 years; half of them were female and 81% were married. General DM knowledge was 7.64±2.69 out of 14, insulin knowledge was 3.48±1.92 out of 9, and total DM knowledge was 11.12±4.11 out of 23. Men scored higher than women in general DM knowledge (p=.004), insulin knowledge (p=.062), and total DM knowledge (p=.005). Moreover, significant differences in general, insulin, and total DM knowledge were found in education, incomes, and marital status. The knowledge scores of those performing exercises, having regular physician visits, and having prior diabetes education were significantly higher than those of non-exercisers. **Conclusion:** The knowledge scores of diabetes patients in India were reported to be low, but several related factors found in this study warranted a development of diabetes self-management program in the future.

Key Words: Diabetes mellitus, Knowledge, Nursing, India

INTRODUCTION

Diabetes mellitus has become the fourth leading cause of death in many developed countries and will be one of the most challenging global health problems in the 21st century [1]. In 2010, it is appraised that 285 million people had diabetes globally. In addition, it is estimated that it will rise to 439 million by 2,030 representing 7.7% of the total adult population worldwide aged 20~79 years [2,3]. In the year 2012, International Diabetes Federation predicted that the total number of diabetic patients in China is estimated to be 92.3 million, which ranks the first in terms of the size of diabetic population worldwide and India followed with 61.3 million, ranking the second [4].

Hyderabad is the capital and the largest city of the southern Indian states of Telangana; it has a population of 6.8 million, among which 2.1 million people were diabetic [5]. Additionally, neighboring cities like Bangalore and Chennai that have a similar lifestyle still have less diabetic cases than Hyderabad does. Moreover, undiagnosed diabetes represents about 50% of all diabetes cases in the general population of southern India [6]. Age of more than 50 years, sedentary lifestyle, and no exercise are the possible reasons for the increasing diabetic cases in India [7]. Medication alone is not helpful for the patients to manage their problem unless they strictly follow the non-pharmacological measures like lifestyle changes. Adequate patient knowledge may lead to better therapeutic outcomes in

Corresponding author: Eunyoung, E. Suh https://orcid.org/0000-0002-2866-0911
College of Nursing, Seoul National University, 103 Daehack-ro, Jonro-gu, Seoul 03080, Korea.
Tel: +82-2-740-8484, Fax: +82-2-740-8484, E-mail: esuh@snu.ac.kr

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diabetes patients [5]. It is important that the patient learn about diabetes, the signs and symptoms of disease progress, treatments of diabetes, regular check-ups, early detection of complications of diabetes, and how to change lifestyles, such as exercise and diet, to manage diabetes. It is helpful to know the patients' level of diabetes knowledge prior to providing diabetes education [8]. Knowledge of diabetes is essential for primary health care professionals and diabetic patients in order to prevent co-morbidities [9]. The prevalence of diabetes increased rapidly in past decades, especially in the urban areas in India. However, the level of knowledge and its related factors have not been studied well in India. Therefore, assessing the level of knowledge of people regarding diabetes would be useful for formulating plans on educating people with a low knowledge level. The purpose of the study, thus, was to investigate the level of diabetes knowledge and related factors in patients with DM in Hyderabad, India

METHODS

1. Research Design and Settings

Descriptive research design was used to conduct a survey at CARE Hospital, Nizam's Institute of Medical Sciences (NIMS Hospital), and Magna Hospital in Hyderabad, India, between July 1, 2014 and mid-August 2014.

2. Participants

A convenience sample of 200 hospitalized patients with DM was recruited. In order to estimate the sample size, G*Power 3.1.10 was used. The effect sizes reported in a previous study were 0.48 for t-test and 0.3 for the F-test [10], which are similar to those of our study. The result of power analysis indicated that our present study needed a total of 196 patients, with 98 men and women each, because diabetes prevalence is similar in men and women in Hyderabad. Considering the dropouts, 200 patients, including 100 men and women each were recruited. Inclusion criteria were patients who 1) were diagnosed with either type I or type II, 2) agreed to participate in this study (oral and written consent), 3) were aged 20 years or more, 4) could understand English or Telugu (regional language in Hyderabad) and 5) had no speech and hearing difficulties.

3. Data Collection

The research department and ethics committees of the three hospitals reviewed the proposal and the questionnaire and we received approval from the head of the department of endocrinology and metabolism of the hospitals. Potential participants were contacted in the waiting area in the hospitals. Those who met the inclusion criteria were asked to participate in the study. As they agreed to participate in the study, a written consent was obtained by the investigator before the survey began. Data were collected from participants via face to face to face interview which took about 20 minutes.

4. Instruments

The questionnaire in this study consisted of three parts: 1) demographics (gender, age, marital status, education level, religion, income, types of DM, types of treatment, duration of diagnosis, co-morbidity, height, and body weight); 2) characteristics related to diabetes self-management like regular exercises, regular physician visits to check diabetes, and attending educational classes for self-care; and 3) the brief Diabetes Knowledge Test (DKT), developed by Michigan Diabetes Research Training Center with the author's permission. The DKT was translated into Telugu and back translated into English for comparison by two bilingual nurse researchers. In this study, both English and Telugu forms were used. The DKT consists of 23 knowledge test items, which are multiple choice questions asking of general knowledge of diabetes. Fourteen questions assess general DM knowledge and nine questions assess insulin knowledge. Each correctly answered question earns 1 point; total score ranges 0 to 23. The KR-20 was 0.882 indicating the DKT was valid and reliable [11].

5. Data Processing and Statistical Analysis

Data were analyzed using SPSS/WIN 23.0 program. Descriptive statistics, in terms of mean, standard deviation, and frequencies, were used for analyzing general DM knowledge, insulin knowledge, and total DM knowledge. Furthermore, independent t-test was used to compare the means of two groups and one-way Analysis of Variance (ANOVA) was used to compare the means when there were more than two groups.

6. Ethical Consideration

This study was conducted after receiving the Institutional Review Board approvals from three hospitals of CARE Hospital, NIMS Hospital, and Mana Hospital (#1035/03/03) in Hyderabad. After study participants signed on the consent form, they received a copy of the consent with

their signature, which described the purpose and the process of the study, any possible harm, and freedom for withdrawal of the study. The data were coded without any identifiable information, and saved in secure place where only researchers had an access to.

RESULTS

1. Demographic Characteristics

The study sample comprised 200 hospitalized diabetic patients with 100 (50.0%) men and 100 (50.0%) women. More than half (57.0%, n=114) were 41~60 years of age and 52 (26.0%) were over 61 years of age. One hundred sixty-two (81.0%) patients were married and 114 (57.0%) had secondary school education of 12 years or less. One hundred four (52.0%) patients were Hindus, and Christians (30.5%) and Muslims (17.5%) followed. Ninety-four (47.0%) participants had monthly income levels from 1,000 ~10,000 INR (Indian Rupee) (Table 1).

One hundred thirty (65.0%) participants had type I diabetes, and the others (35.0%) had type II. One hundred (50.0%) patients were on insulin, 69 (34.5%) on oral hypoglycemic agents, and 31 (15.5%) on combined insulin and hypoglycemic agents. Half of the participants (50.0%) were diagnosed diabetes within the past 6~10 years. One hundred ninety-eight (98.0%) participants had at least one disease associated with diabetes; 55 (27.5%) of them had coronary artery disease, 41 (20.5%) had renal disease, and 102 (51.0%) had other diseases. Ninety-two participants (46.0%) were normal weight, 87 (43.5%) were overweight and 21 (10.5%) had obesity (Table 1).

Eighty-three (41.5%) had a family history of diabetes. Only 69 (34.5%) participants performed regular exercises, and 131 (65.5%) did not exercise. One hundred fifty-five (77.5%) of the participants regularly visit physician to check diabetes and only 25 (12.5%) of the participants attended educational classes for diabetes self-care (Table 3).

Table 1. Demographic and Disease related Characteristics of the Participants (*N*=200)

Characteristics	Categories	n (%) or M±SD
Gender	Men	100 (50.0)
	Women	100 (50.0)
Age (year)		57.3±3.7
	20~40	34 (17.0)
	41~60	114 (57.0)
	>61	52 (26.0)
Marital status	Married	162 (81.0)
	Single	17 (8.5)
	Widow/divorced	21 (10.5)
Education	Secondary or 12 years	114 (57.0)
	Diploma	40 (20.0)
	University or more	46 (23.0)
Religion mean	Hindu	104 (52.0)
	Christian	61 (30.5)
	Muslim	35 (17.5)
Income (INR) †	1000~10,000	94 (47.0)
	11,000~20,000	62 (31.0)
	≥21,000	44 (22.0)
Type of diabetes	Type 1	130 (65.0)
	Type 2	70 (35.0)
Type of treatment	Insulin	100 (50.0)
	Oral hypoglycemic agents	69 (34.5)
	Insulin & oral (combined)	31 (15.5)
	Diet	0 (0.0)
Duration of diabetes (year)	<5	47 (23.5)
	6~10	100 (50.0)
	11~15	30 (15.0)
	>15	23 (11.5)
Co-morbidity	Coronary heart disease	55 (27.5)
	Renal disease	41 (20.5)
	Other disease	102 (51.0)
	No associated disease	2 (1.0)
Family history of DM	Yes	142 (71.0)
	No	58 (29.0)
BMI	Normal weight (18.0~22.9)	92 (46.0)
	Over weight (23.0~27.9)	87 (43.5)
	Obesity (≥28)	21 (10.5)

DM=diabetes mellitus; BMI=body mass index; †1,000 INR=14.5 USD.

2. Diabetes Knowledge Scores by Demographic Characteristics

In terms of the gender, general DM knowledge for men was 8.19±2.80 and 7.09±2.47 for women (t=2.90, p=.004), insulin knowledge was 3.74±2.08 for men and 3.23±1.73 for women (t=1.80, p=.062), and total DM knowledge was 11.93±4.25 for men and 10.32±3.81 for women (t=2.81, p=.005) (Table 2).

General DM knowledge was the highest in the age group of 20 to 40 years (8.35±2.47), as was insulin knowledge (3.61±1.77) and total DM knowledge (11.97±3.82). However, there were no statistically significant differences between age groups in general DM knowledge (p=.081), insulin knowledge (p=.356), and total DM knowledge (p=.121) (Table 2).

In terms of education level, patients with university or higher educational degree reported the highest general DM

knowledge (10.17±1.78), insulin knowledge (5.06±1.80), and total DM knowledge (15.23±2.87). One-way ANOVA revealed that in relation to level of education, there were statistically significant differences in general DM knowledge (F=80.23, $p<.001$), insulin knowledge (F=50.08, $p<.001$) and total DM knowledge scores (F=100.78, $p<.001$). Scheffé post-hoc comparisons showed that participants with higher educational degree reported higher knowledge scores (Table 2).

Patients with income more than 21,000 INR reported the highest knowledge scores than other groups: general DM knowledge (10.29±1.54), insulin knowledge (4.90±1.70), and total DM knowledge (15.20±2.61). One-way ANOVA revealed that there were statistically significant differences between the income groups, such as in general DM knowledge (F=74.58, $p<.001$), insulin knowledge (F=41.69, $p<.001$), and total DM knowledge (F=86.89, $p<.001$). In addition, Scheffé post-hoc comparisons supported the group differences (Table 2).

Lastly, participants who did not marry reported highest knowledge scores, but there were no significant group differences, such as general DM knowledge ($p=.083$), insulin knowledge ($p=.231$), and total DM knowledge ($p=.093$).

3. Diabetes Knowledge Scores according to the Diabetes related Characteristics

Three types of diabetes knowledge were analyzed according to the types of diabetes. Independent t-test results showed that there was no statistically significant difference found between types of diabetes for all knowledge types: general diabetes knowledge (t=1.62, $p=.014$), insulin knowledge (t=1.84, $p=.060$), and for total diabetes knowledge (t=0.15, $p=.850$) (Table 2).

In terms of the duration of diabetes, general DM knowledge and total DM knowledge scores were the highest (8.27±2.47, 11.72±3.93 respectively) in patients diagnosed with DM equal or less than 5 years ago, whereas insulin knowledge was the highest in patients having DM for 11 to 15 years (7.13±2.11). One-way ANOVA test revealed that there were no statistically significant differences in diabetes knowledge scores according to the duration of

Table 2. Comparison of Knowledge Scores according to Demographic Characteristics of the Participants (*N*=200)

Characteristics	Categories	General DM knowledge		Insulin knowledge		Total DM knowledge	
		M±SD	t or F (*p*)	M±SD	t or F (*p*)	M±SD	t or F (*p*)
Total sample		7.64±2.69		3.48±1.92		11.12±4.11	
Gender	Men	8.19±2.80	2.90	3.74±2.08	1.80	11.93±4.25	2.81
	Women	7.09±2.47	(.004)	3.23±1.73	(.062)	10.32±3.81	(.005)
Age (year)	20~40	8.35±2.47	2.44	3.61±1.77	1.74	11.97±3.82	2.12
	41~60	7.69±2.68	(.081)	3.59±1.86	(.356)	11.28±4.07	(.121)
	>61	7.05±2.78		3.15±2.14		10.21±4.29	
Marital status	Married	7.57±2.75	2.42	3.51±1.91	1.41	11.08±4.17	2.33
	Single	8.94±2.43	(.083)	3.94±1.67	(.231)	12.88±3.40	(.093)
	Widow/divorced	7.09±2.11		2.90±2.16		10.00±3.86	
Education	≤Secondary	6.10±2.25[a]	80.23	2.53±1.59[a]	50.08	8.64±3.11[a]	100.78
	Diploma	9.10±1.41[b]	(<.001)	4.37±1.21[b]	(<.001)	13.47±2.23[b]	(<.001)
	≥University	10.17±1.78[c]	a<b<c†	5.06±1.80[c]	a<b<c†	15.23±2.87[c]	a<b<c†
Income (INR)‡	1000~10,000	5.91±2.17	74.58	2.41±1.51	41.69	8.32±3.00	86.89
	11,000~20,000	8.37±2.14	(<.001)	4.09±1.72	(<.001)	12.46±3.27	(<.001)
	>21,000	10.29±1.54		4.90±1.70		15.20±2.61	
Type of diabetes	Type 1	7.41±2.66	1.62	3.66±1.78	1.84	11.08±3.97	0.15
	Type 2	8.05±2.71	(.014)	3.14±2.14	(.060)	11.20±4.38	(.850)
Duration of diabetes (year)	<5	8.27±2.47	2.50	3.44±2.00	1.21	11.72±3.93	1.82
	6~10	7.72±2.87	(.062)	3.56±1.96	(.304)	11.28±4.34	(.142)
	11~15	7.13±2.11		3.79±1.54		10.93±3.33	
	>15	6.56±2.72		2.69±1.84		9.26±3.97	
Family history of DM	Yes	8.07±2.64	1.92	3.81±1.71*	2.01	11.89±3.87*	2.24
	No	7.33±2.69	(.054)	3.24±2.03	(.032)	10.58±4.20	(.023)

DM=diabetes mellitus; †Scheffé test, ‡1,000 INR=14.5 USD.

DM diagnosis (Table 2).

In terms of the family history, however, patients who had a family history of DM reported significantly higher knowledge scores than the others. Independent t-test showed that there was a statistically significant difference between family history of all knowledge types: general DM knowledge (t=1.92, p=.054), insulin knowledge (t=2.01, p=.032) and total DM knowledge (t=2.24, p=.023) (Table 2).

4. Diabetes Knowledge Scores according to Diabetes Self-management

Patients who were doing the regular physical exercises reported higher knowledge scores in all three types than the others: general DM knowledge (t=8.12, p<.001), insulin knowledge (t=3.71, p<.001) and total DM knowledge (t=7.02, p<.001) (Table 3).

Patients who had regular physician visits reported higher knowledge levels in all three types than the others: general DM knowledge (t=5.41, p<.001), insulin knowledge (t=3.63, p<.001), and total DM knowledge (t=5.24, p<.001) (Table 3). For those who attended educational classes for diabetic self-care, general DM knowledge (t=5.24, p<.001), insulin knowledge (t=5.02, p<.001), and total DM knowledge (t=5.86, p<.001) were reported to be significantly higher than those who did not attend (Table 3).

5. DM Knowledge Test Items with Low Scores

Among the 23 items on DKT, the item asking on diabetic ketoacidosis (Question 15) indicated the least scores. Majority of the patients answered it incorrectly (96.5%). Next, 88.5% patients incorrectly answered the item on glycosylated hemoglobin (hemoglobin A1) (Question 5). Thirdly, 84.5% and 82.0% patients answered two items on insulin reactions incorrectly (Question 19 and Question 23 respectively). Lastly, 74.5% of the patients incorrectly answered the question on increased blood glucose level (Question 10).

DISCUSSION

Diabetes education is required for better clinical outcomes of the patients and their quality of life [12]. The importance of education for patients especially by nurses has been highlighted by several studies [13-15]. For this reason, it is now generally accepted the fact that diabetic patients need knowledge on their disease and its management to exercise good metabolic control. However, these studies have shown that there is a significant lack of knowledge and skill in 50 to 80% of patients with diabetes [16].

The overall scores of the total knowledge in this study were low. Men scored higher than women in general DM knowledge (8.19 vs. 7.09), insulin knowledge (3.74 vs. 3.23), and total DM knowledge (11.93 vs. 10.32) [17]. In this study, men were better educated than women because parents do not value on girls and their education much in India [17]. In most families, boys receive education but girls do not [17]. Right from the birth, parents value boys over girls, since girls have to leave their family as they get married. For this reason, parents prefer to send boys to school but not girls [17,18]. India's gender segregated society negatively influences the low female literacy rate. Due to strong stereotypes of female and male roles, the sons are considered useful and are hence educated [17,18].

Statistically significant difference was found in educational levels and income groups; in this study, 114 (57.0%) patients had secondary or 12 years of education and 94 (47.0%) patients' income was from 1,000 to 10,000 INR.

The findings of this study were similar to those of the

Table 3. Comparison of Knowledge Scores according to Diabetes Self-management of the Participants (*N*=200)

Variables	Categories	n (%)	General DM knowledge		Insulin knowledge		Total DM knowledge	
			M±SD	t (p)	M±SD	t (p)	M±SD	t (p)
Total sample			7.64±2.69		3.48±1.92		11.12±4.11	
Regular exercises	Yes	69 (34.5)	9.49±1.89	8.12	4.17±1.97	3.71	13.66±3.22	7.02
	No	131 (65.5)	6.66±2.54	(<.001)	3.12±1.81	(<.001)	9.78±3.90	(<.001)
Regular physician visit to check diabetes	Yes	155 (77.5)	8.16±2.48	5.41	3.74±1.94	3.63	11.90±3.96	5.24
	No	45 (22.5)	5.84±2.64	(<.001)	2.60±1.60	(<.001)	8.44±3.45	(<.001)
Attending educational class for DM self-care	Yes	25 (12.5)	10.12±1.92	5.24	5.20±1.97	5.02	15.32±3.47	5.86
	No	175 (87.5)	7.28±2.6	(<.001)	3.24±1.79	(<.001)	10.52±3.84	(<.001)

DM=diabetes mellitus.

previous studies that used Fitzgerald diabetes knowledge tools and reported that low literary rates, low self-care, and low family income were related to the lack of knowledge on diabetes [10,19]. Our study was like previous studies that were conducted in the urban Australian community, reported that diabetic patients with less than primary schooling had a lower score than that of patients with primary schooling [20]. Another study supported by the findings of the present study done at Michigan, reported that years of formal education were associated with knowledge of the disease [21].

Men achieved significantly higher in knowledge score than women and this finding was consistent with many other studies done in other countries, like Pakistan [8,22], Nepal [5], and the Philippines [23] that had a similar socioeconomic status and literacy levels of the citizens. Another study conducted in four provinces of Kenya also demonstrated that men have a higher diabetic knowledge than women [24].

When the findings of the present study compare to those of the previous study that used the same tool (Michigan DKT), the previous study reported a higher score on knowledge than did our study, due to the fact that its population received diabetes education and had higher literacy rates [25]. The main socio-demographic factors affecting diabetes knowledge according to this study were low family income and low level of education. These results are consistent with previously reported results by other researchers [20,26]. Low levels of education and limited family income are barriers to positive diabetes outcomes including self-management [27,28]. Furthermore, lower education could be a barrier to effective communication between clinician and patients, which demands the development of strategies for effective communication for diabetes medical treatment and self-management [29].

There were statistically significant differences found in diabetes knowledge scores according to family history, regular exercise, regular diabetes checkups, and attended educational classes for diabetes self-care. In our study only 25.0% of the patients they attended diabetes education classes, when we compared this with the study conducted in the urban Australian community [20], approximately two-third of the patients reported attending diabetes education programs.

The majority of the patients incorrectly answered questions on diabetic ketoacidosis, glycosylated hemoglobin, and insulin reaction in the DKT. Nurses are responsible for providing information about diabetes to help the patient live a quality life. Educating patients is an important role of the nurse. The roles of nurses in the management of diabetes include teaching patients in various clinical settings such as acute, elderly, and long-term care facilities. Understanding health behaviors in this group and creating appropriate health-promotion interventions will allow nurses to play their part in limiting the burden of DM.

The smaller size of the sample in this study limits the generalization of the findings. A larger sample is required for future studies. Another limitation is that the sample of the present study was restricted to few hospitalized diabetic patients in Hyderabad only, which might make the sample not entirely representative of the overall diabetic patients in India. Recruiting sample not only from inpatient but from outpatient clinics will enhance the generalizability of the findings of future studies. Additionally, another limitation is that we used only the knowledge questionnaire; it is required to include attitude, practice, and behavior etc., in future studies.

CONCLUSION

In conclusion, the diabetic patients participated in this study had lacked knowledge about their disease, which in result may disrupt their participation in the management of the disease. Health care providers should focus on improving patients' knowledge about diabetes through diabetes education, nutrition clinic for outpatients, and dietary counseling for inpatients. Nurses specialized in diabetes care need to focus more on patients to get them educated with self-management skills of the disease.

CONFLICTS OF INTEREST

The authors declared no conflict of interest.

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