

# Diabetes Knowledge among Caregivers of Pediatric Diabetic Patients in Sudan, Khartoum State

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## Abstract

**Background:** The global prevalence of type 1 diabetes has been rising, with the current estimated incidence in Sudan of 10.1 per 100,000. Type 1 diabetes often develops in children, and their caregivers' knowledge about it is crucial in managing it and preventing complications. This study was conducted to assess Sudanese diabetic patients' caregivers regarding their children's condition.

**Materials and Methods:** This was a cross-sectional hospital-based study conducted among Sudanese caregivers of pediatrics with type 1 diabetes mellitus present to the outpatient of Jaafar Bin Auf Hospital, Ahmed Qasim Hospital, and Jabber Abu-Ela center from December 2021 to march 2022. Data was collected using a structured and tested questionnaire, then entered and analyzed using SPSS V 28.

**Results and Conclusion:** Two hundred participants responded (response rate 83%), with females, predominating (n=144). Overall, the mean knowledge score of the participants was  $57 \pm 20$  out of 100. More than half 52% (n=104) had fair knowledge about diabetes, nearly one-third 33.5% (n=67) had poor knowledge, and only 14.5% (n=29) had good knowledge about diabetes. Females had significantly higher knowledge scores than males (p-value 0.03), a significant difference between educational levels was found p-value 0.01, and a significant difference was found between those who received knowledge about diabetes and those who hadn't; with those who attended courses had the highest mean score ( $84 \pm 26$ ) followed by those who obtained knowledge from doctors ( $61 \pm 19$ ) (p-value 0.001). In conclusion the study found that Sudanese caregivers of diabetic children had a fair knowledge of Type 1 diabetes. Some areas of knowledge defect include diabetes symptoms, follow-up, and complications. Females, education, and receiving knowledge from courses and doctors were associated with good knowledge. Conduction of diabetes awareness programs with more focused approaches is recommended.

**Keywords:** Caregivers, Pediatrics, Knowledge, Type 1 Diabetes Mellitus

## Introduction

The metabolic condition known as diabetes mellitus (DM), which is caused by changes in insulin secretion or insulin sensitivity, is characterized by hyperglycemia as well as impaired carbohydrate,

protein, and lipid metabolism. Type 1 diabetes mellitus (T1DM) caused by defective insulin secretion and Type 2 diabetes mellitus (T2DM) due to impaired insulin action are the two primary subtypes of DM [1-3]. Worldwide, 90% of subjects with DM have T2DM. T1DM gradually develops from birth and reaches its peak

at ages 4 to 6 and then again from 10 to 14 years [4]. There are no obvious gender differences in the incidence of childhood T1DM, even though females are more likely than males to develop autoimmune disorders [5]. Globally, the prevalence of T1DM has been rising. Rates are climbing 2% to 5% yearly across the Middle East, Europe, and Australia [6-8]. Diabetes is often asymptomatic; however, it may present with polyuria, polydipsia, and weight loss. Furthermore, the patient may show signs of dehydration such as poor skin turgor on examination [1].

The most frequent acute hyperglycemic emergency in persons with diabetes mellitus is diabetic ketoacidosis (DKA) in which the patient presents with fatigue, nausea, vomiting, and Kussmaul breathing [9]. The American Diabetes Association (ADA) states that any of the following can lead to a diabetes diagnosis: HbA1c reading of at least 6.5%; 126 mg/dL (7.0 mmol/L) or greater fasting plasma glucose (no caloric intake for at least 8 hours); a 75-g OGTT with a two-hour plasma glucose level of 11.1 mmol/L, or 200 mg/dL, or higher; a patient with symptoms of hyperglycemia (polyuria, polydipsia, polyphagia, weight loss) or hyperglycemic crisis and random plasma glucose of 11.1 mmol/L or 200 mg/dL or higher [10]. Diabetes has a complicated physiology and treatment plan that necessitate numerous interventions for effective disease control. The management of diabetes depends on patient involvement and diabetic education. Patients who can control their diet (carbohydrate and overall calorie restriction), exercise frequently (greater than 150 minutes per week), and independently monitor their blood sugar have better outcomes [11-13].

The cornerstone of treatment for T1DM is lifelong insulin administration by daily injections or an insulin pump because the condition is predominantly brought on by a lack of insulin. Ideally, Hemoglobin A1c should be less than 7% and glucose levels should be kept between 90 and 130 mg/dL. Although maintaining glucose control is important, overly aggressive treatment may result in hypoglycemia, which can have harmful or fatal consequences [14]. The degree of glucose management has a major impact on the prognosis of DM. The risk of complications from DM is greatly increased by chronic hyperglycemia. Diabetic long-term complications have been divided into microvascular (such as retinopathy, nephropathy, and neuropathy) and macrovascular categories (such as cardiovascular disease, cerebrovascular accidents, and peripheral vascular disease) [15].

Several studies assessed diabetic patients and their caregiver knowledge and hypothesized that it affects management, outcomes, complications, and their quality of life [16-21]. In Zanzibar, Salim et al. found that the majority of caregivers enrolled in their study have good knowledge about diabetes, knowledge was associated with higher education and good glycemic control [20]. Koipuram et al. reported that diabetes-related knowledge differs between males and females, males have lower risk perception, and good knowledge was associated with better physical health [17]. In Uganda, Ndahura et al. found that caregivers of type 1 diabetes patients have poor nutritional knowledge, however, despite this di-

etary diversity was maintained [18]. Alreshidi et al. found that diabetic patients and their caregivers have poor knowledge regarding DKA, and young females have better knowledge [16]. Conversely, Kaabba et al. found that majority of type-1 diabetic caregivers had knowledge and awareness regarding DKA in Riyadh, Saudi Arabia [19].

Studies have shown variability of diabetics' caregivers' knowledge, and controversial hypotheses regarding its effect on diabetic patients, moreover, up to our knowledge there is a lack of studies assessing the diabetic caregiver's knowledge in Sudan. This present study will add one piece to the whole picture by assessing Sudanese diabetic patients' caregivers regarding their children's condition.

## Materials and Methods

This study utilized a cross-sectional design and was conducted in Khartoum, Sudan. The targeted population was all Sudanese caregivers of pediatrics with type 1 diabetes mellitus present in the outpatient Ahmed Qasim Hospital, and Mohamed Alamin Hamed Hospital from December 2021 to June 2022. Adults, who were able to comprehend the questions and provide responses, and have their patients under care diagnosed by a physician were included, while medical personnel were excluded. Convenient sampling was used to approach 200 participants estimated by the equation:

$$n = N / (1 + N * MOE^2)$$

N= Total population (600 patients during the four months were estimated to attend by the statistics departments of the Two centers). MOE is the margin of error (0.05) desired by the authors. n= the sample size (estimated to be 240 by the equation above). Data was collected by a team of five authors using a structured questionnaire with an examined reliability of 0.64 Cronbach's alpha value. Data was entered and analyzed using SPSS V 28 software. Consent to participate was obtained from each participant. Each question was scored as 1 for the correct answer and 0 for the wrong answer, then summed and knowledge percent was calculated and categorized into poor (0-49%), fair (50%- 80%), and good (80%-100%). Categorical data was represented in the form of frequencies and proportions. The Analysis of Variance (ANOVA) was used as a test of significance. P value (Probability that the result is true) of <0.05 was considered statistically significant after assuming all the rules of statistical tests and level of confidence. Data was represented after analysis in form of tables, figures, and narrative review.

## Results

This study included 200 caregivers of a diabetic child (response rate 83%). The majority of participants were females (n=144) 72%, with diverse educational levels; 11% (n=22) were illiterates, 32.5% (n=65) primary 30% (n=60) secondary, and 26.5% (n=53) university and higher education. Only 13% (n=26) have diabetes, and the majority 73.5% (n=147) reported that they received knowledge about diabetes from events 3% (n=6), experience 8.5% (n=17), their doctor 60.5% (n=121), and only 1.5% (n=3) went to a course (table 1).

**Table 1: Characteristics of diabetic children's caregivers (n=200)**

Character	Category	Frequency (%)
Gender	Male	56 (28%)
	Female	144 (72%)
Educational level	Illiterate	22 (11%)
	Primary	65 (32.5%)
	Secondary	60 (30%)
	University and above	53 (26.5%)
Diagnosed with diabetes	No	174 (87%)
	Yes	26 (13%)
Received knowledge about diabetes	No	53 (26.5%)
	Yes	147 (73.5%)
Source of knowledge	Events	6 (3%)
	Experience	17 (8.5%)
	Doctor	121 (60.5%)
	Course	3 (1.5%)

Knowledge assessment revealed that less than half 46% (n=92) knew that there are two types of diabetes, and 43.5% (n=87) knew that their children have type one, however, 67% (n=134) thought that their children have a higher chance to develop diabetes if they have it. The commonest identified symptom of diabetes was excessive urination 56% (n=112), followed by fatigue 53% (n=106), thirst 42% (n=84), polydipsia and polyphagia 32 (n=64), and weight loss 29% (n=58). Regarding the management of their children's illness, more than half 57% (n=114), thought that insulin and diet modification both are important, majority 83% (n=166) knew

that mixed insulin is the type used in their children's case, and more than two-thirds knew the dose 69.5% (n=139) and the route of administration 68.5% (n=137). The majority of participants knew the symptoms of hypoglycemia 78.5% (n=157), but 58.5% (n=117) knew that they should give the child glucose immediately if he/she developed symptoms of hypoglycemia. Long-term complications known by participants were retinopathy 51% (n=102), nephropathy 50% (n=100), and neuropathy 11.5% (n=23). Only one-third 36% (n=72) knew that hemoglobin A1c is the best way to follow the control of glucose (table 2).

Table 2: Knowledge assessment of diabetic children's caregivers (n=200)

	Count (%)
How many types of diabetes (two)	92 (46%)
Which type does your child have? (type 1)	87 (43.5%)
If you have DM, your child has a higher chance to develop it (true)	134 (67%)
What are the symptoms of diabetes?	
Polydipsia and polyphagia Excessive urination Fatigue	64 (32%)
Thirst	112 (56%)
Weight loss	106 (53%)
	84 (42%)
	58 (29%)
what is important for your child's management? (Both insulin and diet)	114 (57%)
what Insulin type is used for your child? (Mixed)	166 (83%)
Do you know the dose? (yes)	139 (69.5%)
The route of administration? (subcutaneous)	137 (68.5%)
What are the symptoms of hypoglycemia? (sweating, confusion, and shivering)	157 (78.5%)
What is the immediate management of hypoglycemia? (give glucose)	117 (58.5%)
What are the long-term complications of diabetes Retinopathy	
Neuropathy	102 (51%)
Nephropathy	23 (11.5%)
	100 (50%)
What is the best way to check diabetes? (Hb A1c)	72 (36%)
Knowledge score	57± 20

Overall, the mean knowledge score of the participants was 57± 20 out of 100 (table 2). More than half 52% (n=104) had fair knowledge of diabetes, One-third 33.5% (n=67) had poor knowledge, and only 14.5% (n=29) had good knowledge about diabetes (figure 1).

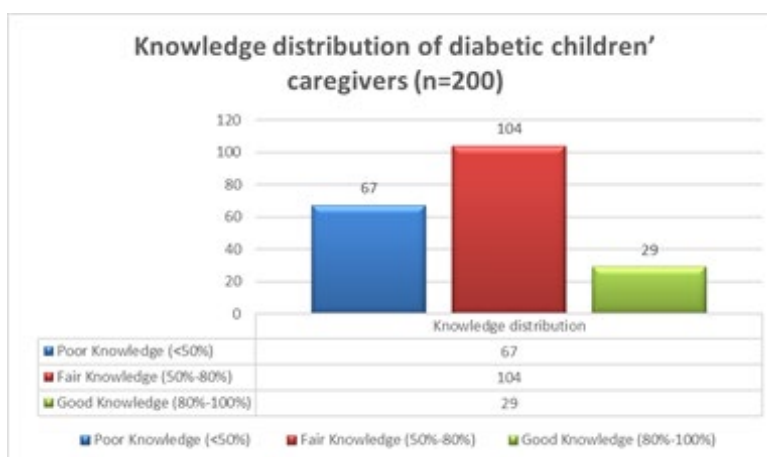


Figure 1: Knowledge distribution of diabetic children's caregivers (n=200)

Analysis of Variance was conducted to compare knowledge levels across participants' characteristics, females had significantly higher knowledge scores than males (59± 18 Vs. 52± 24, p-value 0.03). A significant difference between educational levels was found (the

highest score by university 64± 18, followed by primary 56± 21, and the least scores by illiterates 49± 22, p-value 0.01). No statistically significant difference between diabetic caregivers and nondiabetic caregivers was found (p-value 0.7). Final-

ly, a significant difference was found between those who received knowledge about diabetes and those who hadn't ( $60 \pm 19$  Vs.  $47 \pm 18$ ,  $p$ -value 0.001), and a significant difference between different sources of knowledge; with those who attended courses had the highest mean score ( $84 \pm 26$ ) followed by those who obtained knowledge from doctors ( $61 \pm 19$ ), from their experience ( $58 \pm 13$ ), and the least mean score among those who attended events about diabetes ( $40 \pm 21$ ) ( $p$ -value 0.001) as shown in (table 3).

## Discussion

The incidence rate of type I diabetes was estimated to be 10.1 per 100,000 as diabetes has sophisticated physiology, its management depends on many factors necessitating good involvement of the patients and their caregivers, thus this study was conducted to assess Sudanese diabetic patients' caregivers about their children condition [22]. With a response rate of 83%, the study included two hundred caregivers of a diabetic child (72% females and 28% males). Participants were found to have a fair knowledge of diabetes; one-third of them had poor knowledge about type I diabetes the rest two-thirds had fair to good knowledge about type I diabetes. This comes similar to Salim et al. findings in Zanzibar they also found that nearly two-thirds of diabetic children's caregivers have good knowledge about type I diabetes [20].

In general, participants have poor knowledge about diabetes symptoms, on the other hand, the majority of participants knew the symptoms of hypoglycemia and more than knew how to manage it. Poor knowledge of diabetes symptoms often leads to a state of acute hyperglycemia which will precipitate diabetic ketoacidosis (DKA) [9], and this is why a considerable proportion of children with diabetes present with DKA at the first time they get diagnosed with diabetes as reported by Shaltout et al. in Kuwait [9,23]. More than half of the participants that both insulin and diet modification are important, the majority knew the type of insulin prescribed to their children, the appropriate dose, and the route of administration. Similarly, Alnaim et al. showed that caregivers of diabetic patients in Saudi Arabia had good knowledge about Insulin dosage and administration [21]. The importance of proper insulin knowledge comes with the fact that in Sudan, poor compliance to insulin proper use is the leading precipitating factor for DKA [24].

Maintaining glucose levels within the recommended range is the mainstay of preventing complications [14]. In our study, only one-third knew that diabetes control is followed by hemoglobin A1c concentration and consistently poor knowledge about long-term complications. Stallwood et al. found that good caregiver knowledge is associated with lower Hb A1c levels [25]. In this study, upon comparing the knowledge of males and females, findings were similar to what Koipuram et al. and Dos Santos et al reported; as females showed higher knowledge levels than males [17,26]. Good knowledge about diabetes among caregivers was associated with education and receiving knowledge from trusted sources such as doctors and courses. Many studies showed that education was associated with better knowledge about diabetes among caregivers [18,20-21].

## Conclusion

In conclusion, the study found that Sudanese caregivers of diabetic children had a fair knowledge of Type 1 diabetes. The study defined some areas of knowledge defect such as diabetes symptoms, follow-up, and complications. We also found females, education, and receiving knowledge from courses and doctors were associated with good knowledge levels. Thus, the study recommends the conduction of diabetes awareness programs, however, more focused approaches are more effective; such as applying the awareness programs in the clinics rather than public campaigns.

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