

# Attitude and behavior regarding millet consumption in children with type 1 diabetes mellitus



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## ABSTRACT

**Background:** Millets are highly nutritious with a low glycemic index when compared to rice and wheat in terms of proteins, minerals, vitamins, and antioxidants, still the consumption rates of wheat and rice are higher than millets. **Aims and Objectives:** The present study aimed to know the attitudes, preferences, and perceptions about millet consumption in children with type 1 diabetes mellitus (T1DM). **Materials and Methods:** Caregivers of children with T1DM of age group 2–14 years were included in the study. Data regarding the preference, attitude, frequency, benefit in controlling blood sugar levels, and barriers to millet consumption among children were collected using the open-ended questionnaire filled out by caregivers. **Results:** Out of 86 caregivers enrolled, only 35 (41%) respondents knew about millets. In the index study, they were aware of pearl millet (94%) and sorghum (26%) mainly. Only 11.6% of the respondents recorded daily consumption of millets, 15.1% consumed millets 3–4 times in a week, 39.3% did once weekly, and 33.7% rarely. The major reasons behind non-consumption were non-palatability and expensive products. Only 29.1% of the respondents knew the role of millets in controlling blood sugar levels and reducing complications. Very few (7%) subjects knew about the new millet-based biscuits and other products. **Conclusion:** To increase the consumption of healthy millets by children with T1DM, it is suggested to develop various products to enhance palatability, providing knowledge on health benefits of millets, and widespread availability of millets.

**Key words:** Millets; Type 1 diabetes; Celiac disease

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## INTRODUCTION

Millets, also known as smart food, are beneficial for mankind as well as for our planet.<sup>1</sup> The year 2023 has been celebrated as the International Year of Millets to promote their consumption by spreading awareness about millets. The findings of a review paper have provided scientific evidence which supports a millet-based diet as a solution to malnutrition in children.<sup>2</sup> Millets are rich in a wide range of nutrients and have been scientifically shown to contribute to managing type 2 diabetes,<sup>3</sup> obesity, and dyslipidemia.<sup>4</sup>

There is a rise in the incidence of type 1 diabetes mellitus (T1DM) along with other metabolic disorders such as

type 2 DM, hypertension, dyslipidemia, and obesity in children.<sup>5</sup> The metabolic disorders due to the high intake of rice and wheat-based diets have led to growing interest in millet-based diets and their positive impact on health in recent years. A systematic review and meta-analysis have shown that millets have a strong potential in managing and reducing the risk of developing diabetes as all millets had significantly ( $P < 0.01$ ) lower glycemic index (GI) than standard cereals. In addition, fasting and post-prandial blood glucose levels decreased on long-term consumption of millets in diabetic patients.<sup>6</sup> As millets have various health benefits pertaining to these diseases, there is an urgent need of awareness for doctors, paramedical staff as well as general population

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regarding better nutritional management of these above-mentioned diseases.

Although there are great health benefits of millets, there is a scarcity of literature on the attitude of people regarding the consumption of millets. To the best of our knowledge, this is the first study done to see knowledge, attitudes, perception, and practices related to millets consumption in children with T1DM and their caregivers despite increasing non-communicable diseases in India and millets having a great role in diabetes due to their low GI.

### Aims and objectives

The aim of our study was to assess the attitude, knowledge, perception and practices regarding millet consumption among children with T1DM.

## MATERIALS AND METHODS

The study was done at a tertiary care teaching hospital in Haryana where caregivers of children with T1DM of age group 2–14 years were enrolled from a pediatric endocrinology clinic. Demographic information of children along with their dietary pattern, socioeconomic status and associated diseases were noted. The information regarding attitudes and behavior regarding millet consumption in children and caregivers was sought in the form of a structured questionnaire. To ensure reliable results, the questionnaire was pre-tested and based on the comments from the pre-testing, the questionnaire was improved and finalized. It was validated to minimize subsequent errors. Participants were asked questions in their own language about their knowledge of millets, frequency of consumption among their children, awareness of nutritional benefits, perceptions, and awareness about millet-based products in the market. Barriers to the consumption of millet were also asked. Data were collected and entered into the Microsoft Excel spreadsheet which was further analyzed.

## RESULTS

The questionnaire was filled out by parents of 86 children with T1DM. Out of them 36 were male and 50 were female and the mean age was  $8\pm 2.7$  years. Out of them, 13 patients had associated celiac disease and five had hypothyroidism. The maximum of study subjects were vegetarian and 44.2% belonged to lower middle socioeconomic status followed by upper lower (26.7%) according to the modified Kuppaswamy scale (Table 1).<sup>7</sup>

Around 94% of respondents knew about pearl millet and 26% about sorghum, however, only 41% of them were

**Table 1: Baseline demographic parameters of study subjects**

Parameters	Number of participants
Mean age	$8\pm 2.7$ years
M: F ratio	1:1.3
Urban (%)	48 (55.8)
Rural (%)	38 (44.2)
Vegetarian (%)	77 (89.5)
Non-vegetarian (%)	9 (10.4)
Socioeconomic status (%)	
Lower	18 (20.9)
Upper lower	23 (26.7)
Lower middle	38 (44.2)
Upper middle	7 (8.1)
Associated diseases (%)	
Celiac disease	13 (15.1)
Hypothyroidism	5 (5.8)
Mean age of diagnosis	$6\pm 3.1$ years

aware that they are millet. Hence, they were the only parents who said “yes” to consuming millets. Twenty out of those who were aware said that they knew about millets for the last 1 or 2 years through social media.

The grain mostly consumed was wheat except for children with associated celiac disease in whom a gluten-free diet was given. Many (63.9%) of them do not know about the nutritional content of millets which makes them superior to wheat and rice. Regarding the frequency of millets consumption only 11.6% of the respondents consumed millets regularly and all of them were cases of celiac disease along with T1DM, 15.1% consumed millets 3 times in a week, 39.3% did weekly, and 33.7% consumed occasionally. Many of the respondents started giving millet to their children after the diagnosis. Only 25 respondents knew the role of millets in controlling blood sugar levels and nine agreed to the fact that millets are beneficial for health of whole family as well (Table 2).

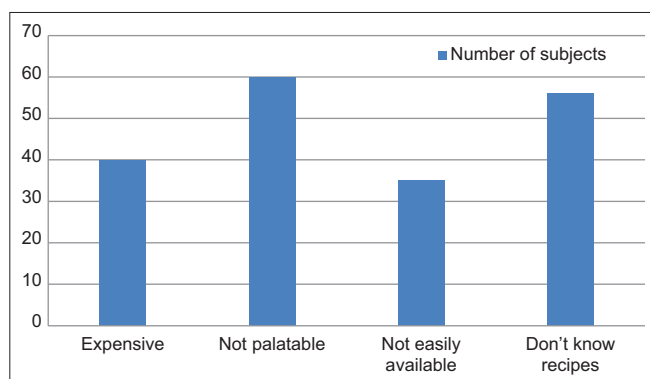
Twenty-six children consume millet with ease maximum of them have associated celiac disease and the rest does not like it. Parents want to give millet but 56 (65.1%) do not know how to make tasty recipes. Other reasons for non-consumption were the price and non-availability. Only 7% of subjects were aware of millet-based products in the market such as biscuits, noodles/pasta, etc. and mostly belonged to urban population who had searched for options for their children with celiac disease (Figure 1).

## DISCUSSION

Understanding current knowledge and use of millets is useful for researchers, food manufacturers, and health workers in better promotion of millets in our population especially children from a younger age.

**Table 2: Attitude and perception regarding millet consumption**

Parameters	Number of participants (%)
Knowledge about	
Bajra	81 (94.1)
Sorghum	22 (25.6)
Ragi	7 (8.1)
Banyard	5 (5.8)
Others	3 (3.5)
Millet consumed	
Bajra	46 (53.5)
Sorghum	7 (8.1)
Ragi	4 (4.6)
Banyard	3 (3.5)
Others	1 (1.2)
Frequency of consumption	
Daily	10 (11.6)
3 times/week	13 (15.1)
Weekly	34 (39.3)
Occasionally	29 (33.7)
Awareness of nutritional benefits	
Help in controlling blood sugar levels	25 (29.1)
Reduces complications/morbidity associated with type 1 diabetes by its long-term use	11 (12.8)
Improves family health	9 (10.5)
Consuming millets	
Before the diagnosis	8 (9.3)
After the diagnosis	60 (69.8)
Perception	
Superior than wheat and rice	10 (11.6)
Equally good	21 (24.4)
Do not know	55 (63.9)
Awareness of millet-based products in the market	
Yes	6 (7)
No	80 (93)

**Figure 1:** Barriers in routine consumption of millet by the subjects

In our study, 41% of respondents had knowledge about millets. Many knew about pearl millet and sorghum but they did not know that it comes under the category of millets. Those who were aware got this knowledge recently due to the efforts of government by celebrating 2023 as the International Year of Millets. A study done in adult diabetic subjects in Maharashtra has also shown that subjects had poor information about various millets other than bajra and jawar.<sup>8</sup> Another large sample survey involving seven cities in India revealed that people who said “yes” to consuming millets cannot even recognize

pictures of millets and they became aware mainly in the last 5 years.<sup>9</sup>

Most of the caregivers in our study were not aware of the nutritional superiority of millets over wheat and rice. A questionnaire survey done in urban areas to understand public knowledge and practices of consuming millets found that despite 91% of them being health conscious, still less than half (40%) were sure that millets were healthy.<sup>9</sup> A similar study done in Tanzania on caregivers of school-aged children also showed that around 90% of caregivers responded that school performance, intelligence, and growth of their children was their priority still they were not aware of the nutritional content of pearl millet which is helpful for their health outcome.<sup>10</sup>

The frequency of millet consumption was also found to be low in our study. Maximum patients were consuming it once a week or occasionally. Daily consumption of pearl millet or sorghum was found in children who had celiac disease as these are the gluten-free options which they can find easily. In another survey on the consumption of millet among adult females, it was found that maximum females were not consuming it daily rather maximum were consuming once to 3 times weekly.<sup>11</sup> A reasonable

proportion of people were found to be non-consumers of millets especially in Ahmedabad and Delhi.<sup>9</sup>

Only 29% of the respondents knew the role of millets in controlling blood sugar levels thus reducing complications associated with type 1 DM. Foxtail millet was found to be effective in preventing pre-diabetic subjects from entering the diabetic stage.<sup>12</sup> A meta-analysis showed that long term millet consumption leads to reduction of fasting and post-prandial blood glucose significantly in diabetic subjects and there was a significant lowering in HbA1c level in pre-diabetic individuals as well.<sup>13</sup>

Very few parents were aware that millet consumption improves overall family health. A cross-sectional study done in 150 diabetes adult patients with hypertension out of which consumed a millet diet concluded that millets had significantly reduced body mass index and lipid profile, thus improving their overall health.<sup>13</sup>

The main reason behind consumption was associated with celiac disease as millets are gluten-free and for non-consumption was non-palatability, less knowledge about recipes, and high cost. Similar results were seen in another survey which revealed that the reason of the consumption of millets was because of their health issues. Barriers to consumption were not being part of their family custom followed by not liking the taste.<sup>8,9</sup>

Another questionnaire study concluded that maximum adult females in Karnataka consumed millets thinking they are healthier, nutritious, and tasty.<sup>11</sup> Our results were different from this study as adults could eat millets thinking that they are useful for them but in children, palatability is a big issue. Mothers are not aware of tasty recipes as eating millets were not a routine in their households. In addition, millets are expensive and their consumption puts an additional burden on family which is already buying insulin injections. As taste is a subjective thing, the early introduction of millets can solve this issue.

Only 7% of subjects were aware of millet-based products in the market such as biscuits, noodles/pasta, etc. out of them mostly were associated with celiac disease. Consumption of millet-based dosa (foxtail dosa) showed better control of post-prandial glucose levels in patients with type 2 DM.<sup>14</sup> Previous literature has also recommended that food manufacturing companies could introduce a variety of millet-based snacks for better promotion.<sup>15</sup> Millets act like preventive as well as therapeutic diet, because they are rich in fiber and complex carbohydrates with low GI.

#### Limitations of the study

The limitation of our study was that it was conducted in a single centre representing results of a particular area.

## CONCLUSION

Despite millets are considered better in T1DM, there is a lack of awareness among caregivers regarding their nutritional role in their children. Early introduction to complementary feeding, improving accessibility, and spreading more awareness about nutritional content as well as tasty recipes are the key steps to increasing the consumption of millets.

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**Author's Contribution:**

**AV and KL** - Concept, design, developed study protocol, data analysis, and wrote the manuscript; **SV and SR** - supervised implementation of the study and data collection; **AK and PNK** - contributed to data analysis and writing of the manuscript.

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