

IMPACT OF EDUCATIONAL INTERVENTION ON MILLET CONSUMPTION IN TYPE 2 DIABETES PATIENTS: A PRE-POST STUDY

Ms. Shruti Handge ¹, Ms. Datta Patel ²

¹Master of Science in Clinical Nutrition and Nutraceuticals, School of Sports Exercise and Nutrition Sciences, D.Y. Patil Deemed to be University, Nerul, Navi Mumbai, Maharashtra, India

² Head, Department of Nutrition & Dietetics. D Y Patil School of Medicine & Hospital Program Coordinator, Sports & Exercise Science, School of Medicine Editor, DY Patil Journal of Health Sciences Hon. Treasurer IAPEN INDIA, Association for Parenteral & Enteral Nutrition Joint Program Officer, Diabetes Nutrition Core Group, IAPEN INDIA

ABSTRACT

Background: Diabetes has become a major health crisis worldwide, ranking among the top causes of death alongside heart disease, respiratory problems, and cancer. The World Health Organization reports that noncommunicable diseases like diabetes were responsible for 74% of global deaths in 2019, with diabetes alone claiming 1.6 million lives, making it the ninth leading cause of death globally. Despite these statistics, awareness and consumption of beneficial foods like millet, which have a low glycemic index and offer potential benefits for diabetic patients, remain limited.

Objective: To evaluate the effectiveness of educational interventions on promoting millet consumption among type 2 diabetes patients using a pre-and post-study design. To assess the awareness of millets, deliver educational interventions on their benefits for diabetes management, and identify barriers and facilitators to millet consumption. The study also focuses on analysing the gap in understanding regarding millet consumption among individuals with type 2 diabetes Mellitus.

Methodology: This interventional cohort study was conducted at D.Y. Patil Hospital Nerul, Navi Mumbai, over six months with a 30-day follow-up period. A convenience sample of 100 type 2 diabetes patients, both inpatients and outpatients, participated. Data were collected using pre- and post-intervention questionnaires, and an educational tool titled "Millet SMART," along with a take-away brochure. The pre-intervention questionnaire gathered baseline data, followed by an educational session, and post-intervention data collection via telephonic interviews.

Results: The study involved 100 type 2 diabetes patients, with an even gender distribution and a majority aged between 56-65 years. Initially, 69% of participants were unfamiliar with millets, and 68% had never consumed millet-based foods. Post-intervention, familiarity with millets rose to 67%, and millet consumption significantly increased. Preferences for millet included flour (33%), millet-based products (20%), and whole grains (10%).

Motivations for millet consumption were primarily health benefits (39%) and taste preferences (20%). Despite the increase in millet consumption, barriers such as time constraints (11%), limited availability (10%), and lack of preparation knowledge (5%) were noted, alongside taste concerns (18%). Satisfaction levels were high regarding satiety (50%) and affordability (35%), although taste satisfaction was mixed. Importantly, the intervention led to a significant reduction in mean blood glucose levels, from 157.48 mg/dl pre-intervention to 125.83 mg/dl post-intervention ($p < 0.001$). Additionally, 57% of participants expressed intent to continue millet consumption. These findings indicate that educational interventions can effectively increase millet consumption and improve glycemic control among type 2 diabetes patients.

Conclusion: The study concluded that educational interventions significantly enhance millet consumption and improve blood sugar levels among type 2 diabetes patients. The substantial reduction in mean blood glucose levels post-intervention underscores the potential impact of incorporating millet into dietary practices for diabetes management. However, the study also identified barriers to millet adoption, such as time constraints, limited availability, and lack of knowledge on preparation, highlighting the complexity of implementing dietary changes. Addressing these barriers is critical to ensuring the sustainability and effectiveness of such interventions. The findings suggest that integrating nutritional education into diabetes management strategies can promote healthier dietary habits and improve overall patient outcomes. Nevertheless, further research with larger sample sizes and longer follow-up periods is necessary to confirm the long-term benefits and broader implications of millet consumption on diabetes management.

Keyword: Diabetes, millet consumption, type 2 diabetes, educational interventions, glycemic control, barriers, facilitators, awareness, blood glucose levels, dietary practices, nutritional education.

1. INTRODUCTION

Diabetes is now one of the leading causes of death worldwide, along with heart disease, respiratory issues, and cancer. It has become a serious health catastrophe. According to the World Health Organization, noncommunicable diseases like diabetes accounted for 74% of all deaths worldwide in 2019. Diabetes alone claimed 1.6 million lives, ranking it as the ninth most common cause of death worldwide. Serious problems from having diabetes damage not only the individual but also families, communities, and healthcare systems financially. Since 1990, the prevalence of diabetes has been rising consistently in India, with a discernible uptick around 2000. India's diabetes prevalence increased significantly from 7.1% to 8.9% between 2009 and 2019, a major increase in the number of persons living with the condition.

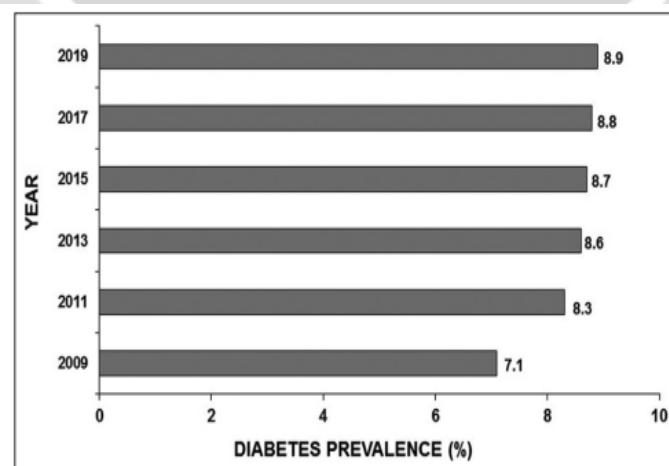


FIGURE 1.1: Trends In Type 2 Diabetes Mellitus Prevalence In India(1)

Furthermore, data from nationwide surveys indicates that diabetes is growing increasingly prevalent in India. Urine testing in the first trial, which took place in Mumbai in 1963 and encompassed more than 18,000 participants, revealed that 1.5% of them had diabetes.. Additionally, Type 2 Diabetes Mellitus (T2DIABETES) is a common metabolic issue worldwide, often caused by two main factors: the pancreas not producing enough insulin and cells in the body becoming less sensitive to insulin. According to the World Health Organization (WHO), diabetes is a chronic condition where blood sugar levels remain high, leading to damage in various parts of the body like the heart, blood vessels, eyes, kidneys, and nerves as time goes on.(1)

The causes of diabetes are thought to be complex. While factors like genetics, age, ethnicity, and family history play a role and can't be changed, many lifestyle choices also contribute. These include things like not getting enough exercise, being overweight or obese, and eating unhealthy foods with lots of refined grains, fats, sugars, and sugary drinks while not eating enough fruits and vegetables. Smoking, drinking too much alcohol, exposure to pollutants, stressful situations, not getting enough sleep, and the kind of environment we live in also play a part in increasing diabetes risk. (2)

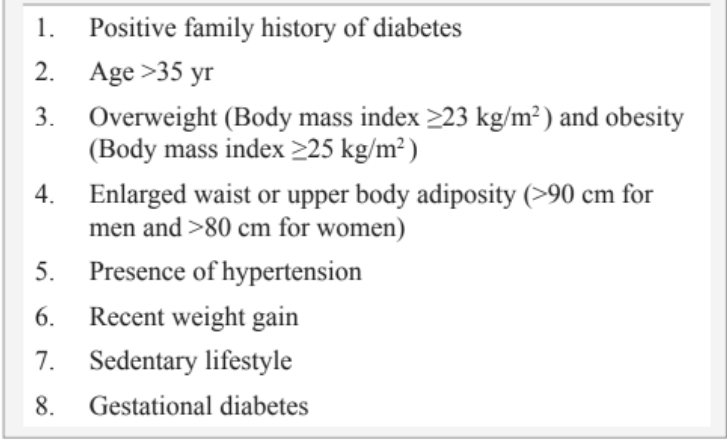
- 
1. Positive family history of diabetes
 2. Age >35 yr
 3. Overweight (Body mass index ≥ 23 kg/m²) and obesity (Body mass index ≥ 25 kg/m²)
 4. Enlarged waist or upper body adiposity (>90 cm for men and >80 cm for women)
 5. Presence of hypertension
 6. Recent weight gain
 7. Sedentary lifestyle
 8. Gestational diabetes

FIGURE 1.2 : Major Risk Factors For Type 2 Diabetes Mellitus In Indians (4)

Additionally, Symptoms and issues commonly associated with diabetes encompass frequent urination, increased thirst, fatigue, unintentional weight loss, changes in vision, yeast infections, leg discomfort, ulcers, urinary tract infections, skin problems, difficulty breathing, erectile dysfunction, mental confusion, tingling sensations, chest pain, dry mouth, and stroke.(3) Numerous studies have indicated a lack of awareness about diabetes and its complications, particularly among people living in rural areas. It is crucial to urgently educate the population about diabetes and the severe outcomes associated with this long-term condition.(4)

Furthermore, the American Diabetes Association highlights the need of empowering people with diabetes to take charge of their own diet by equipping them with the necessary knowledge and abilities about diabetes care, nutrition, drugs, and handling complications. Nonetheless, a study found that people with a high risk of Type 2 Diabetes Mellitus had a poor comprehension of nutritional principles. More specifically, compared to females, men tended to eat more fried items and red meat. In addition, the proportion of men who regularly ate rice was noticeably higher than that of women. It emphasizes how important it is to raise nutritional knowledge and education, particularly among people who are at risk of diabetes. (5)

Conversely, because of their short growth seasons and high output, millets, a varied group of small-seeded grasses grown all over the world for fodder and human use, do particularly well in semi-arid climates in Asia and Africa. India and Nigeria are the leading producers of millet, with eight prevalent kinds grown primarily in rain-fed environments. These grains are high in dietary fiber and non-starchy polysaccharides, which are carbohydrates that help lower cholesterol, avoid constipation, and control the release of glucose after digestion. Because of its high nutritional content, regular millet eating has been associated with a lower incidence of diabetes, duodenal ulcers, and cardiovascular disorders.

Additionally, millets are abundant in essential vitamins and minerals, serving as a valuable source of energy, protein, and fatty acids. A variety of millet species, including proso millet, foxtail millet, barnyard millet, finger millet, sorghum, and pearl millet, provide special health advantages for managing and preventing diabetes. For example, sorghum's slow-digesting starch and low glycemic index help manage type 2 diabetes, and pearl millet improves insulin sensitivity and reduces triglyceride levels. Finger millet and barnyard millet contribute to lower glycemic responses through their high fiber content and alpha-amylase inhibition properties, aiding in starch digestibility reduction and glucose absorption. Furthermore, foxtail millet and proso millet exhibit anti-hyperglycemic activity, potentially valuable for managing diabetes.(6)

This study investigates how an educational intervention can influence millet consumption among individuals with Type 2 Diabetes Mellitus. It seeks to address gaps in knowledge and behavior regarding millet's benefits for managing diabetes.

2. METHODOLOGY

2.1- Study Design- The study was an interventional cohort study

2.2- Study Setting/site- The study was conducted in the D.Y. Patil Hospital Nerul, Navi Mumbai.

2.3- Study Duration- The study was for 6 months, focusing on diabetes type 2 patients with a follow-up period of 30 days. The ethical clearance was obtained from the institutional ethical committee prior to data collection

2.4-Study Population- The study involves type 2 diabetes patients at Dy Patil Hospital, both inpatients and outpatients.

2.5- Sampling Procedure- The study was conducted by convenience sampling.

2.6- Sample Size- The sample size was 100 participants

2.7- Selection Criteria

Inclusion criteria	Exclusion criteria
Type 2 diabetes individuals	Type 1 diabetes individuals
	Gestational diabetes
	Any other disease condition

2.8. Development Of Tools

The study utilized the following equipment and materials to conduct the research.

a) Questionnaire -

Pre Educational Intervention Questionnaire

This questionnaire focuses on gathering information about participants' dietary habits, particularly with diabetes management and their consumption of millet-based foods.

- **Comprehensive Understanding:** By collecting data on various aspects such as medical history, dietary habits, and consumption patterns of millet, the questionnaire provides a comprehensive understanding of participants' health status and dietary choices.

- **Personalized Insights:** Gathering information about individual dietary plans and preferences allows for personalized insights into how millet-based foods are integrated into different diabetes management strategies.
- **Health Monitoring:** Monitoring blood glucose levels and duration of diabetes diagnosis helps in assessing the current health status of participants and understanding the potential impact of millet consumption on their blood sugar levels over time.
- **Dietary Recommendations:** By inquiring about dietary advice and changes recommended for diabetes management, the questionnaire sheds light on the importance of dietary interventions in diabetes care and the role of millet in this context.
- **Variety of Millet Consumption:** Understanding the frequency and types of millet consumed provides valuable data on the diversity of millet-based foods in participants' diets.
- **Motivations for Consumption:** Investigating the reasons behind choosing millet-based foods provides valuable insights into participants' motivations, whether driven by health benefits, taste preferences, cultural traditions, or other factors.
- **Educational Opportunities:** By analyzing participants' responses, the questionnaire can identify gaps in knowledge or misconceptions about millet and diabetes management, paving the way for targeted educational interventions or nutritional guidance.

Post Educational Intervention Questionnaire

- **Behavioural Assessment:** Determines if participants have changed their millet consumption habits after the intervention, providing valuable data on the impact of educational interventions on dietary choices.
 - **Identifying Barriers:** Identifies specific obstacles or challenges hindering changes in millet consumption, facilitating targeted interventions to address these and improve adherence to dietary recommendations.
 - **Addressing Misconceptions:** Identifies misconceptions or concerns about millets that may hinder participants from incorporating them into their diets, allowing for tailored educational initiatives to address these misconceptions and promote acceptance.
 - **Tracking Consumption Changes:** Documents changes in millet consumption habits, including preferred forms of millet post-intervention, providing quantitative data on dietary shifts and preferences.
 - **Satisfaction Assessment:** Evaluates participant satisfaction with meals incorporating millets across various markers such as satiety, taste, cooking convenience, and affordability, informing future program adjustments or recommendations.
 - **Health Outcomes Monitoring:** Assesses whether participants have noticed changes in blood sugar levels since incorporating millet into their diets, providing preliminary insights into the potential impact of millet consumption on diabetes management.
- Explores participants' intentions to continue including millets in their diets for managing Type 2 Diabetes, offering insights into the sustainability of dietary changes and long-term adherence to millet consumption.

b) Educational Tool

- The educational tool titled "Millet SMART" offers comprehensive guidance on millets, focusing on their types, nutritional benefits, and culinary uses.
- **Types of Millets:** It showcases various millet types with their names in English and another language.
- **Key Nutritional Benefits:** Highlights millets' low glycemic index, high fiber content, rich nutrient profile, and antioxidant properties, aiding in blood sugar control, weight management, and combating oxidative stress.
- **Incorporating Millets:** Provides practical tips for incorporating millets into daily meals, emphasizing a gradual transition, mixing grains, and experimenting with flavors.
- **Nutritional Value :** Offers detailed nutritional information for a standard serving size of millets, including energy, protein, carbs, fats, minerals, and vitamins.
- Presents a variety of breakfast, Lunch, Dinner dishes made with millets, offering nutritious and delicious alternatives.
- Overall, the "Millet SMART" tool equips individuals with valuable knowledge and practical ideas to incorporate millets into their diet, promoting overall health and well-being.

c) Take Away Brochure

- The "Managing Diabetes with Millets: A Guide to Nutritious Choices" brochure offers invaluable insights into harnessing the nutritional benefits of millets for individuals managing diabetes.
- Type of Millets: It provides a comprehensive overview of various types of millets, emphasizing their low to moderate glycemic index, which ensures a gradual rise in blood sugar levels.
- Nutritional Benefits: Highlighting millets' nutritional richness, the brochure underscores their richness in fiber, iron, magnesium, phosphorus, and B vitamins.
- Cooking Methods: Moreover, it outlines practical cooking methods such as boiling, steaming, and baking, which retain millet's nutrients and natural flavors while offering versatile serving options.
- Meal Planning Tips: The brochure's meal planning tips facilitate the seamless incorporation of millets into daily diets, suggesting innovative uses in main courses, salads, and breakfast recipes.
- Recipes: Further enhancing its utility, the brochure presents detailed recipes ranging from Foxtail Millet Khichdi to Ragi Idli, each crafted to tantalize taste buds while aligning with dietary requirements for managing diabetes.
- Overall, this brochure serves as an indispensable resource, empowering individuals with diabetes to make informed dietary choices and embrace the wholesome benefits of millet.

2.9.Method Of Data Collection

- The research was conducted at D.Y. Patil Hospital in Nerul, Navi Mumbai.
- Patients admitted to the hospital who met the specified criteria were enrolled in the study.
- Each patient received consent forms along with an informative sheet detailing the study's purpose, duration, location, benefits, and other relevant information.
- The investigator used a pre-intervention questionnaire to collect information on anthropometric measurements, medical data, diet, and millet consumption.
- Using an educational tool, study participants got an educational intervention.
- A takeout brochure with information on the health advantages of millet, serving sizes, incorporation techniques, nutritional value, and recipes was also given to participants.
- A telephone interview was used for a follow-up after 30 days to collect information for a post-intervention questionnaire regarding millet consumption and blood sugar levels.
- SPSS was used to code and analyze all of the gathered data.
- To reach a decision, the results and outcomes were discussed.
- The final report was prepared.

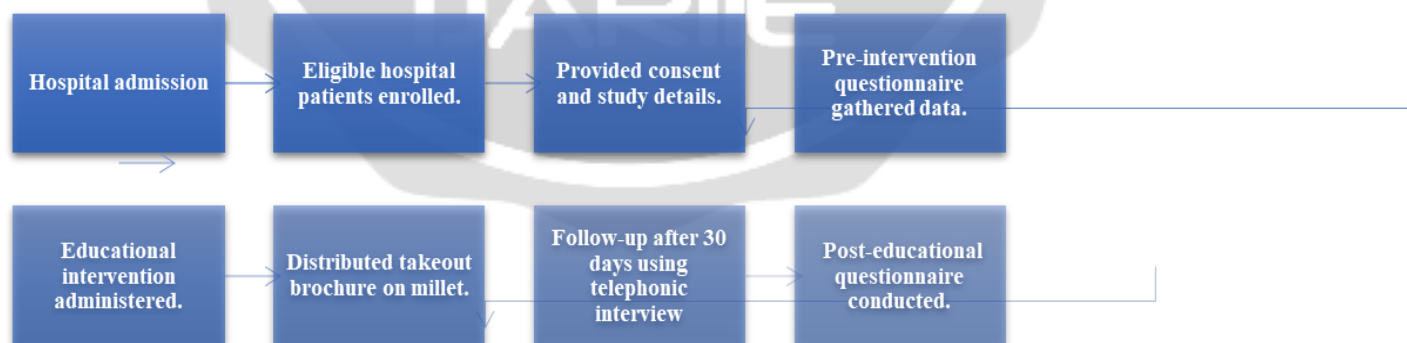


FIGURE 2.1 :- Method of Data Collection

2.10.Method Of Data Collection Relevant To The Objective

The information was collected with the help of a post-educational questionnaire, which comprised data on anthropometric measurements, medical history, dietary patterns, and millet consumption. An educational tool containing information on millet health benefits, serving sizes, methods of incorporation, and nutritive value was utilized to educate the patients.

Additionally, a detailed take-home brochure containing millet information and detailed recipes was provided. After 30 days, information was gathered through a post-educational questionnaire via telephonic interview containing information on millet consumption and blood sugar levels.

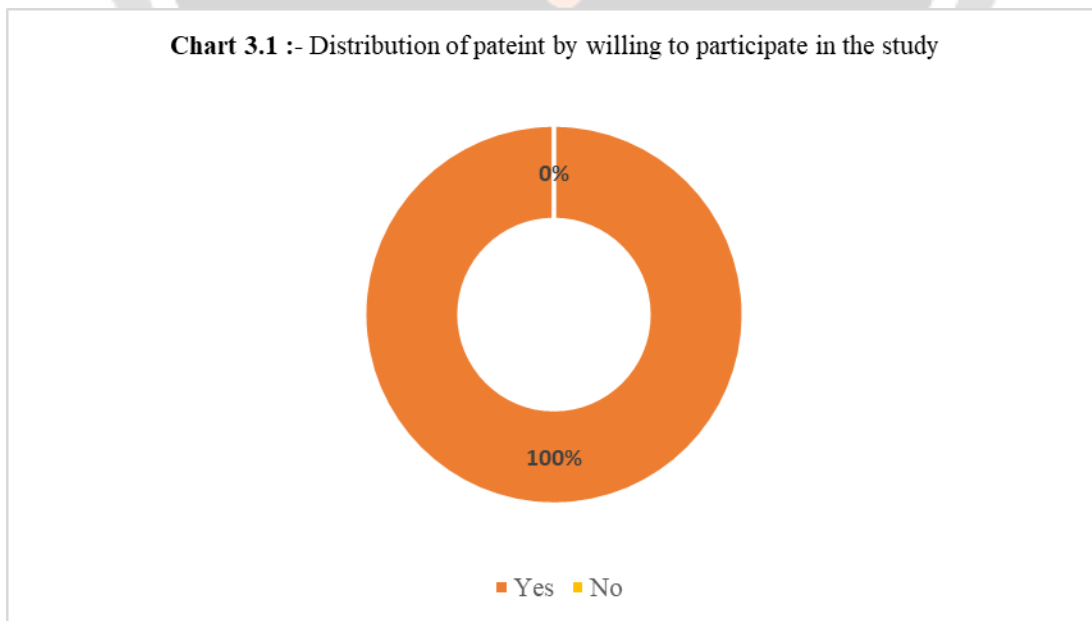
2.11.Data Analysis Plan And Methods

The data analysis includes a total of 100 pre- and post-intervention questionnaires. To provide a reasonable conclusion for the research, statistical analysis was conducted.The data analysis employed frequency and percentage calculations. Using the Pair T-test, the association between two variables was determined. A significance threshold of 0.05 for the P value was utilized.IBM SPSS software (version 4) and Microsoft Excel Windows 10 applications were used to do all of this.

3. RESULT AND DISCUSSION

Table 3.1 :- Distribution of patients by willing to participate in the study

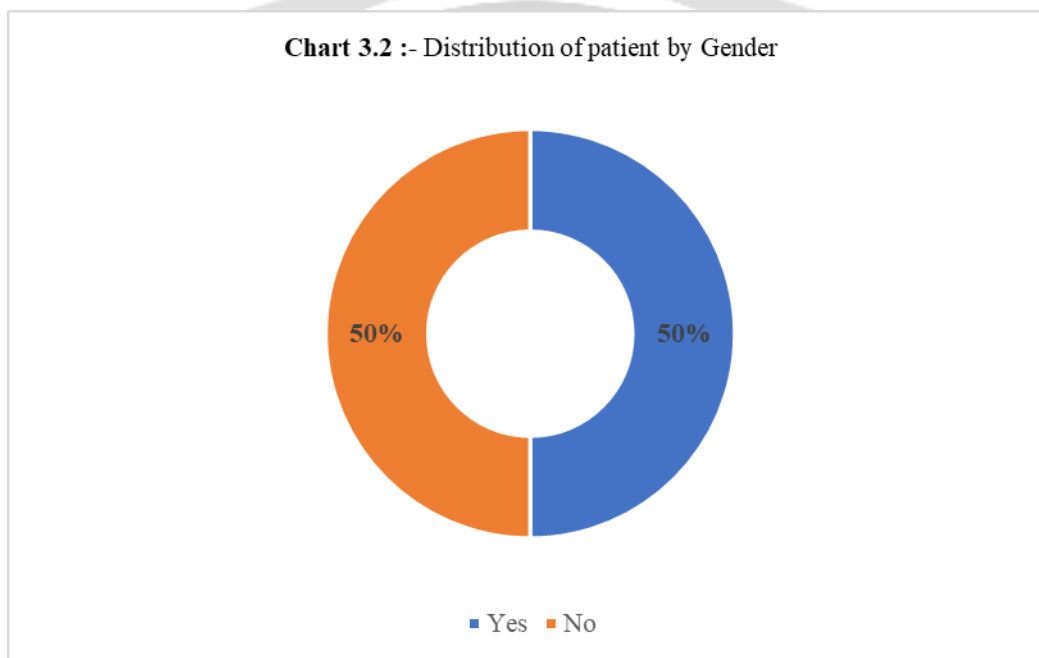
	Frequency (N)	Percentage (%)
Yes	100	100
No	0	0
Total	100	100%



The Table Presents The Distribution Of Patients Based On Their Willingness To Participate In The Study Assessing The Impact Of Educational Interventions On Promoting Millet Consumption Among Type 2 Diabetes Patients. Notably, 100% Of The Respondents Expressed Willingness To Participate, Indicating A High Level Of Engagement And Interest In The Educational Intervention Program. This Suggests A Favorable Environment For Implementing Educational Initiatives Aimed At Promoting Millet Consumption Within This Population.

Table 3.2 :- Distribution Of Patient By Gender

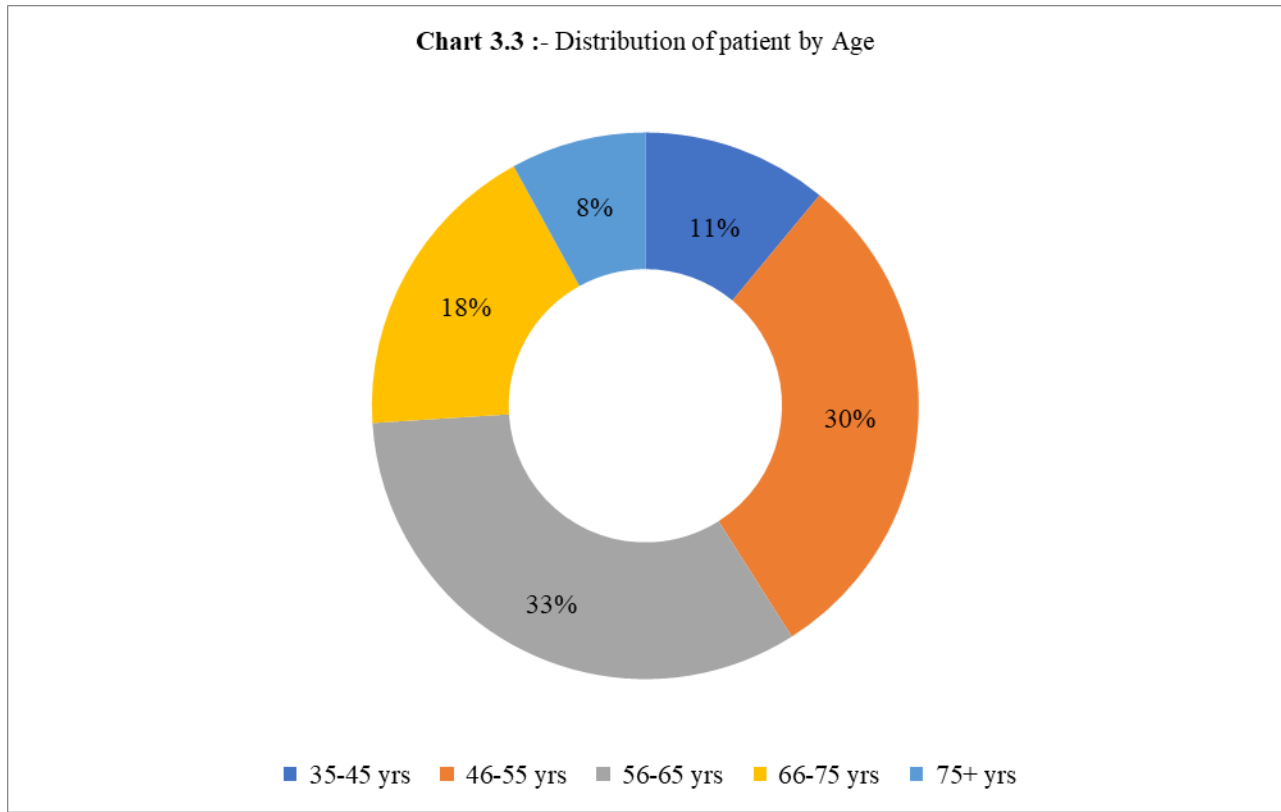
	Frequency (N)	Percentage (%)
Male	50	50
Female	50	50
Total	100	100%



The Table Illustrates The Distribution Of Patients By Gender In A Study Examining The Impact Of Educational Interventions On Promoting Millet Consumption Among Individuals With Type 2 Diabetes. The Data Reveal A Balanced Representation, With 50% Male And 50% Female Participants, Totalling 100% Of The Study Population.

Table 3.3 :- Distribution Of Patient By Age

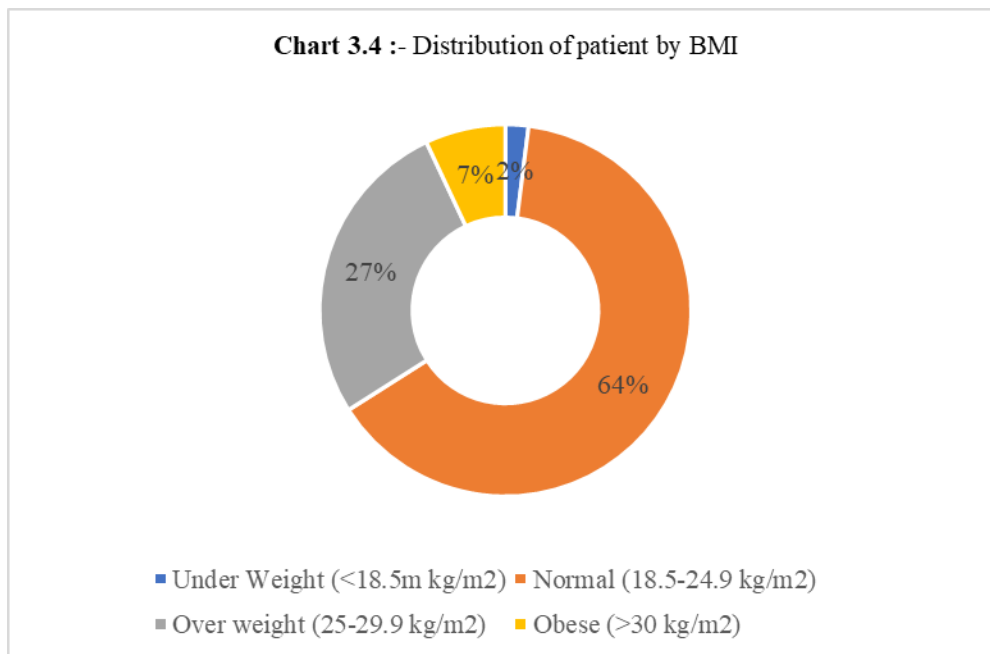
	Frequency (N)	Percentage (%)
35-35 Years	11	11
46-55 Years	30	30
56-65 Years	33	33
66-75 Years	18	18
75+ Years	8	8
Total	100	100%



The Distribution Of Participants Across Age Categories In The Study Indicates Distinct Patterns. Among The Sample Population, Individuals Aged 35-45 Years Constitute 11%, While Those Aged 46-55 Years Comprise The Largest Segment At 30%, Emphasizing The Significance Of This Age Group. Moreover, Participants Aged 56-65 Years Represent 33% Of The Total, Indicating A Substantial Presence In The Study. In Contrast, Older Adults Aged 66-75 Years Contribute 18%, And Those Aged 75 Years And Above Constitute 8% Of The Participants. This Distribution Underscores The Importance Of Understanding The Diverse Perspectives And Needs Of Individuals Across Different Age Brackets In The Context Of Promoting Millet Consumption Among Type 2 Diabetes Patients.

Table 3.4 :- Distribution Of Patient By BMI

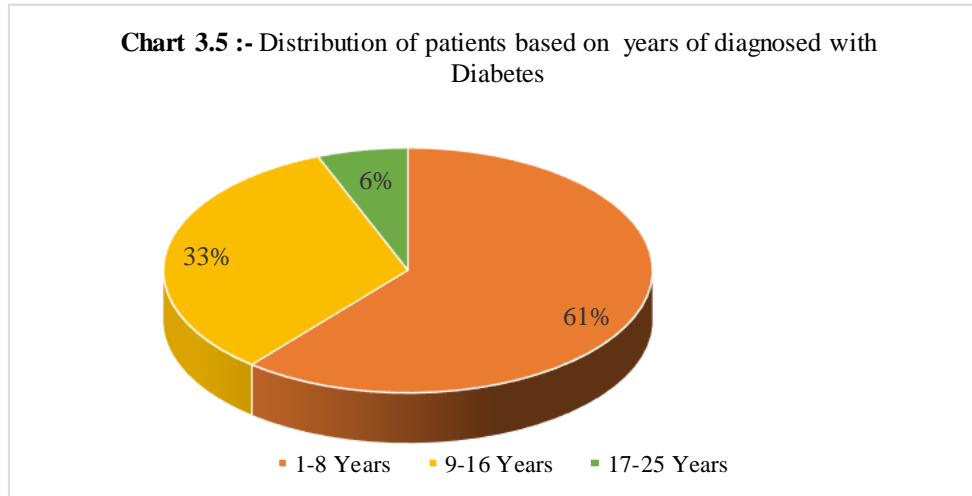
	Frequency (N)	Percentage (%)
Under Weight (<18.5m Kg/M2)	2	2
Normal (18.5-24.9 Kg/M2)	64	64
Over Weight (25-29.9 Kg/M2)	27	27
Obese (>30 Kg/M2)	7	7
Total	100	100%



The Study's Participants Are Distributed Across Different Body Mass Index (Bmi) Categories, With 64% Falling Into The "Normal" Range, 27% Categorized As "Overweight," And 7% As "Obese." Those Classified As "Underweight" Represent 2% Of The Sample. This Diversity Underscores The Importance Of Tailored Interventions To Address The Unique Dietary Needs Of Individuals With Varying Body Weights, Particularly Focusing On Promoting Millet Consumption Among Overweight And Obese Participants.

Table 3.5 :- Distribution Of Patients Based On Years Of Diagnosed With Diabetes

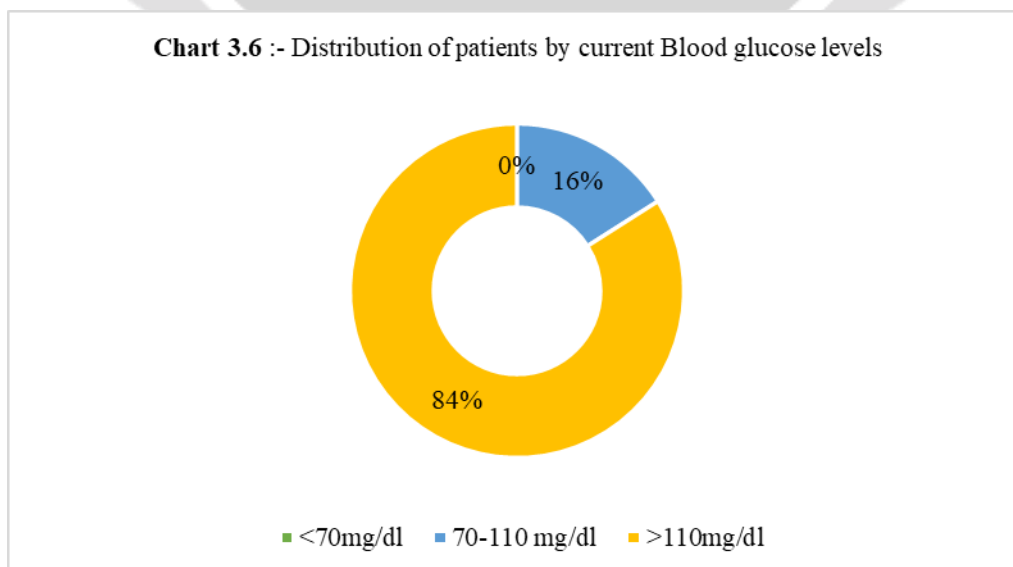
	Frequency (N)	Percentage (%)
1-8 Years	61	61
9-16 Years	33	33
17-25 Years	6	6
Total	100	100%



The Table Illustrates The Distribution Of Participants Based On The Number Of Years Diagnosed With Diabetes. The Majority (61%) Were Diagnosed Within The Last 1-8 Years, Indicating A Recent Diagnosis For A Significant Portion Of The Sample. Another 33% Reported Being Diagnosed Within 9-16 Years, With Only 6% Diagnosed For 17-25 Years. This Diverse Distribution Enables Insights Into Participants' Varying Stages Of Diabetes Management Experience, Crucial For Assessing Intervention Effectiveness And Identifying Barriers And Facilitators To Millet Consumption.

Table 3.6 :- Distribution Of Patients By Current Blood Glucose Levels

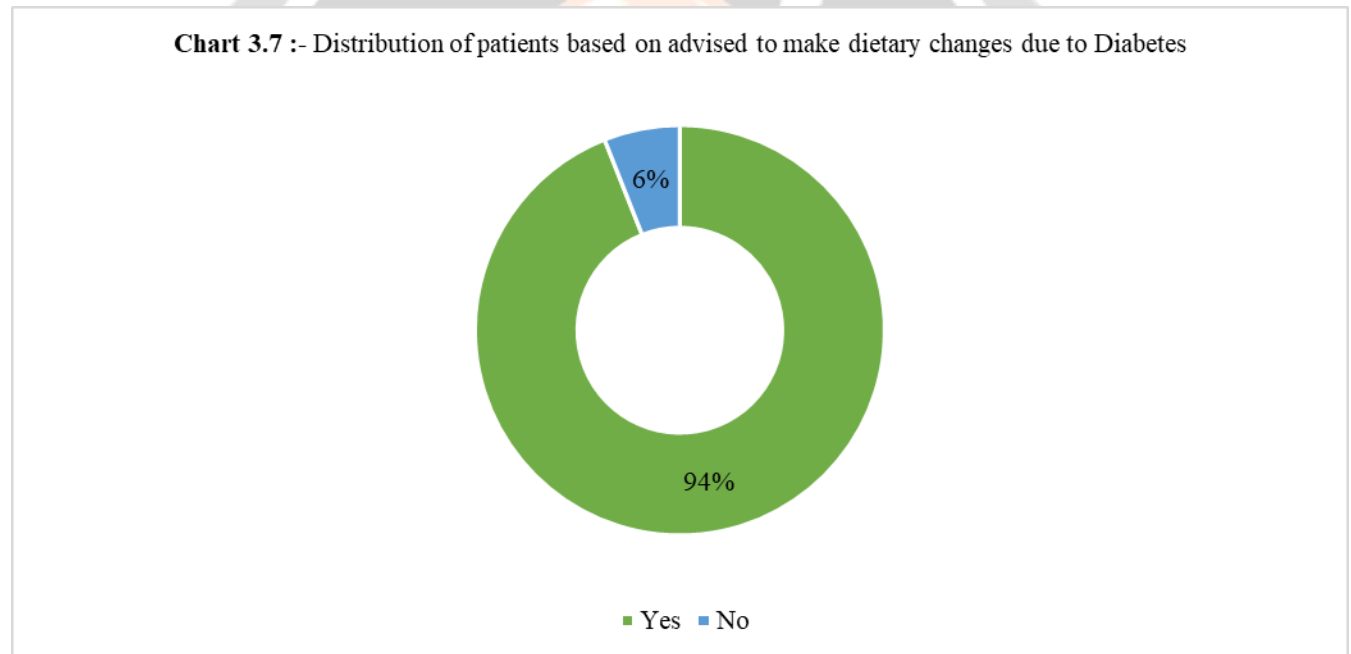
	Frequency (N)	Percentage (%)
<70 Mg/Dl	0	0
70-110 Mg/Dl	16	16
>110 Mg/Dl	84	84
Total	100	100%



The Table Presents The Distribution Of Patients By Current Blood Glucose Levels. Notably, 84% Of Participants Have Blood Glucose Levels Above 110 Mg/Dl, While 16% Fall Within The 70-110 Mg/Dl Range, And None Are Below 70 Mg/Dl. This Distribution Indicates A Predominance Of Participants With Elevated Blood Glucose Levels, Emphasizing The Importance Of Interventions Targeting This Population To Manage Diabetes Effectively. Additionally, It Underscores The Need To Raise Awareness Of Millet's Potential Benefits In Diabetes Management Among Individuals With Higher Blood Glucose Levels.

Table 3.7 :- Distribution Of Patients Based On Advised To Make Dietary Changes Due To Diabetes

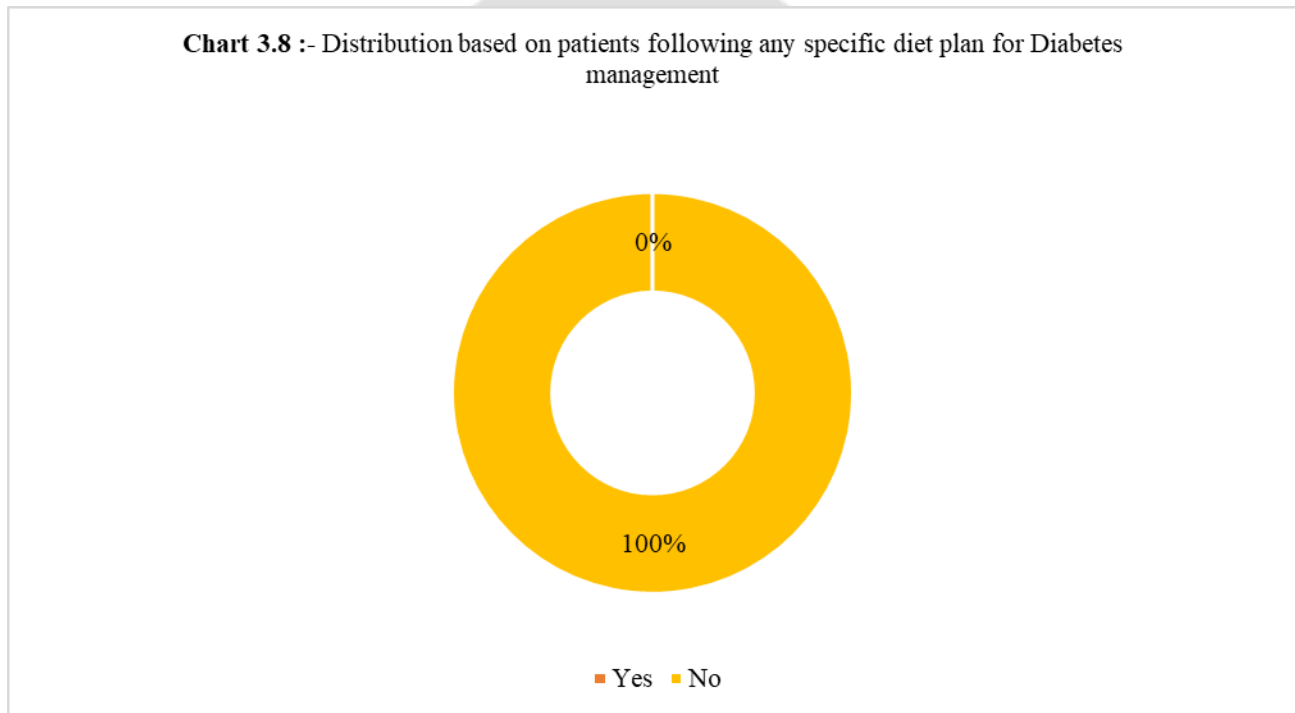
	Frequency (N)	Percentage (%)
Yes	94	6
No	6	94
Total	100	100%



The Table Illustrates The Distribution Of Patients Based On Whether They Were Advised To Make Dietary Changes Due To Diabetes. Remarkably, 94% Of Participants Reported Being Advised To Make Dietary Changes, While Only 6% Were Not Advised To Do So. This Distribution Highlights The Significant Proportion Of Type 2 Diabetes Patients Receiving Dietary Recommendations, Indicating A Recognition Of The Importance Of Dietary Management In Diabetes Care. However, Despite The Majority Receiving Advice, There Remains A Smaller Group Not Receiving Such Guidance, Suggesting A Potential Gap In Healthcare Delivery.

Table 3.8 :- Distribution Based On Patients Following Any Specific Diet Plan For Diabetes Management

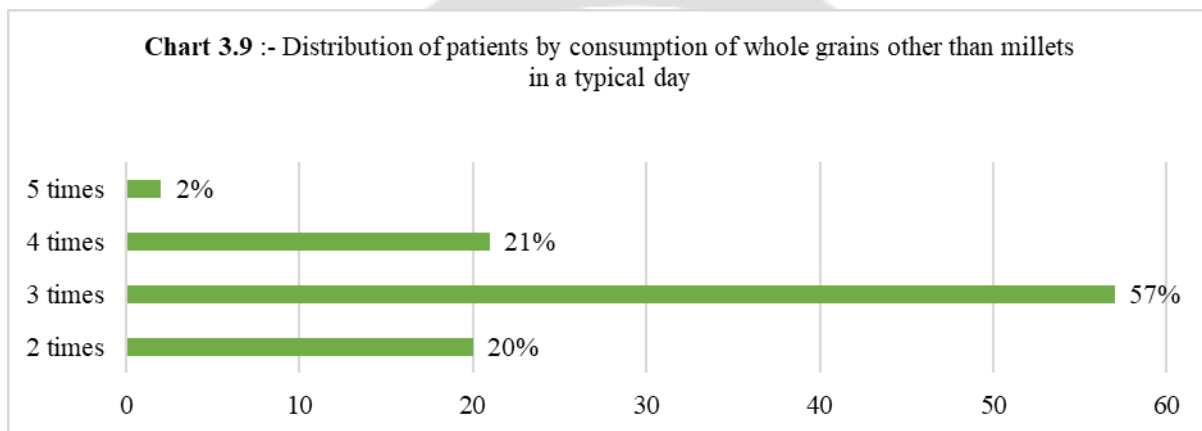
	Frequency (N)	Percentage (%)
Yes	0	0
No	100	100
Total	100	100%



The Table Illustrates The Distribution Of Patients Based On Whether They Follow Any Specific Diet Plan For Diabetes Management. Notably, 100% Of Participants Reported Not Following Any Specific Diet Plan, With None Indicating Adherence To Such Plans. This Distribution Highlights A Significant Gap In Dietary Management Practices Among Type 2 Diabetes Patients, With The Entire Sample Population Lacking Adherence To Structured Dietary Guidelines For Diabetes Management.

Table 3.9 :- Distribution Of Patients By Consumption Of Whole Grains Other Than Millets In A Typical Day

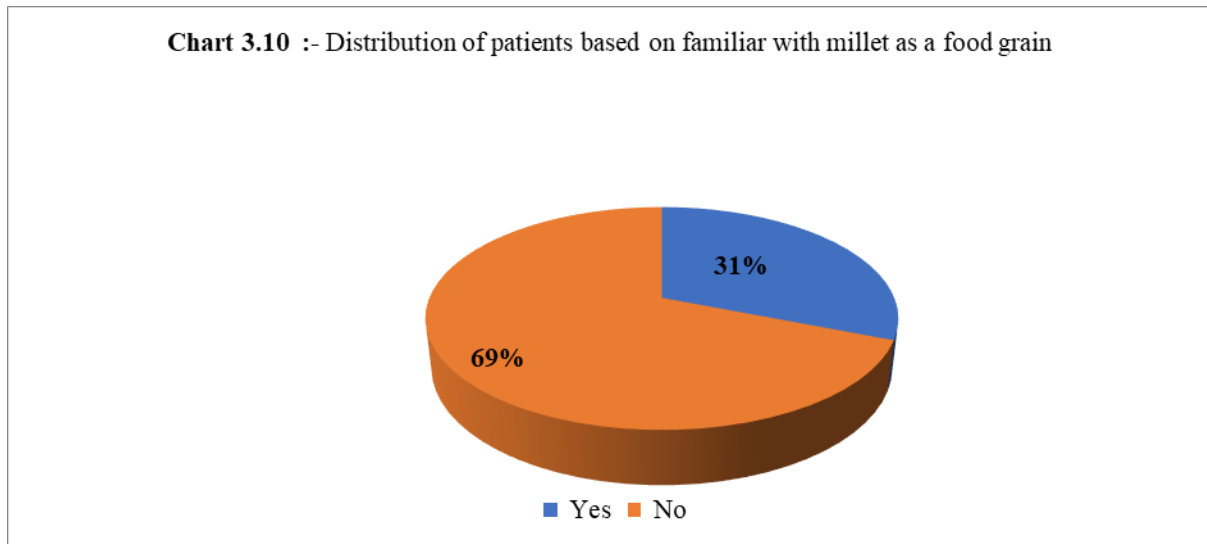
	Frequency (N)	Percentage (%)
2 Times	20	20
3 Times	57	57
4 Times	21	21
5 Times	2	2
Total	100	100%



The Table Shows The Distribution Of Patients Based On The Frequency Of Consuming Whole Grains Other Than Millet On A Typical Day. Among The Participants, 57% Consume Whole Grains Three Times A Day, While 20% And 21% Consume Them Two And Four Times A Day Respectively. Only 2% Reported Consuming Whole Grains Five Times A Day. This Variation In Consumption Patterns Highlights The Importance Of Understanding Dietary Habits In Promoting Millet Consumption And Addressing Barriers To Dietary Behavior Change Among Type 2 Diabetes Patients.

Table 3.10 :- Distribution Of Patients Based On Familiar With Millet As A Food Grain

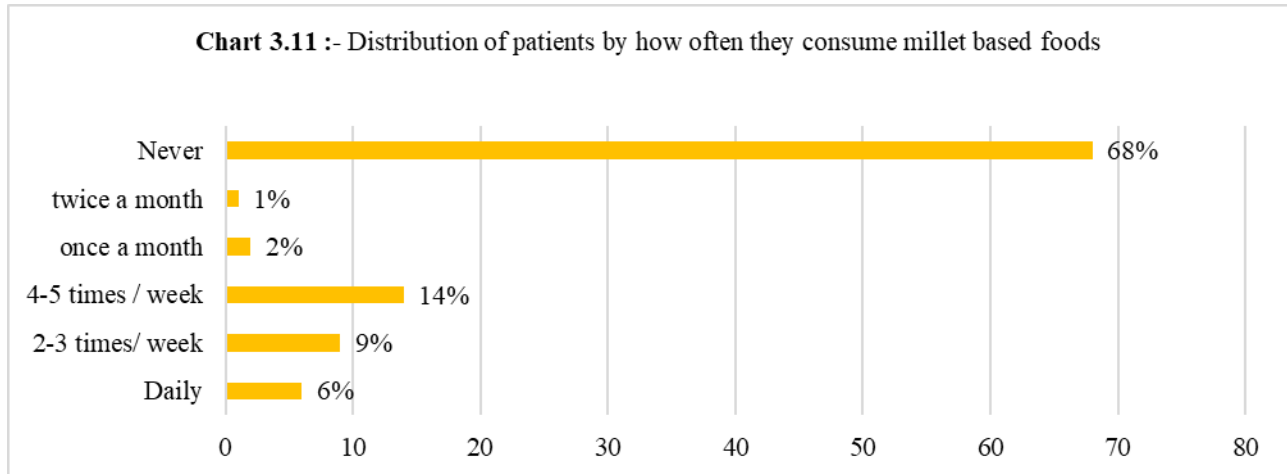
	Frequency (N)	Percentage (%)
Yes	31	31.0
No	69	69.0
Total	100	100%



The Table Displays The Distribution Of Patients Based On Their Familiarity With Millet As A Food Grain. Remarkably, 69% Of Participants Reported Not Being Familiar With Millet, While 31% Indicated Familiarity With This Food Grain. This Distribution Underscores A Notable Lack Of Awareness Regarding Millet Among The Majority Of Type 2 Diabetes Patients. Such Findings Highlight A Crucial Opportunity For Educational Interventions Aimed At Increasing Awareness About Millet's Potential Benefits In Diabetes Management. By Addressing This Knowledge Gap, Interventions Can Enhance Patients' Understanding Of Millet As A Dietary Option, Thereby Promoting Its Consumption And Potentially Improving Diabetes Management Outcomes.

Table 3.11 :- Distribution Of Patients By How Often They Consume Millet Based Foods

	Frequency (N)	Percentage (%)
Daily	6	6
2-3 Times / Week	9	9
4-5 Times / Week	14	14
Once A Month	2	2
Twice A Month	1	1
Never	68	68
Total	100	100%



The Table Shows The Distribution Of Patients Based On How Often They Consume Millet-Based Foods. Remarkably, 68% Reported Never Consuming Millet-Based Foods, While 14%, 9%, And 6% Consume Them 4-5 Times, 2-3 Times, And Daily Respectively. A Smaller Proportion Reported Consuming Millet-Based Foods Once A Month (2%) Or Twice A Month (1%). These Findings Underscore A General Lack Of Regular Millet Consumption Among Type 2 Diabetes Patients,

Table 3.12 :- Distribution Of Patients Based On Millet Varieties Being Consumed

Pearl Millet (Bajra)		
	Frequency (N)	Percentage (%)
Yes	28	28
No	4	4
Na	68	68
Total	100	100%

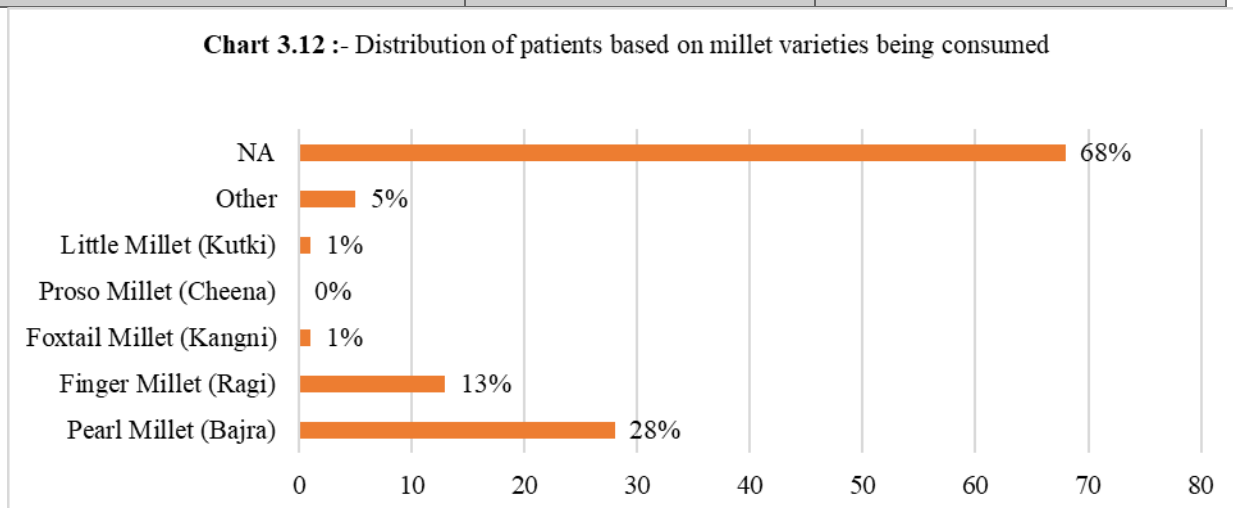
Finger Millet (Ragi)		
	Frequency (N)	Percentage (%)
Yes	13	13
No	19	19
Na	68	68
Total	100	100%

Foxtail Millet (Kangni)		
	Frequency (N)	Percentage (%)
Yes	1	1
No	31	31
Na	68	68
Total	100	100%

Proso Millet (Cheena)		
	Frequency (N)	Percentage (%)
Yes	0	0
No	32	32
Na	68	68
Total	100	100%

Little Millet (Kutki)		
	Frequency (N)	Percentage (%)
Yes	1	1
No	31	31
Na	68	68
Total	100	100%
Other		
	Frequency (N)	Percentage (%)
Yes	5	5
No	27	27
Na	68	68
Total	100	100%

Chart 3.12 :- Distribution of patients based on millet varieties being consumed



The Table Presents The Distribution Of Patients Based On The Varieties Of Millet Consumed Among Type 2 Diabetes Patients. Across Different Millet Varieties, The Majority Of Respondents Ranging From 68% Indicated "Na" Or Not Applicable, Suggesting A Prevalent Lack Of Consumption Knowledge. Among Specific Millet Types, Pearl Millet (Bajra) Had The Highest Consumption Rate At 28%, Followed By Finger Millet (Ragi) At 13%, Foxtail Millet (Kangni) At 1%, And Little Millet (Kutki) And Proso Millet (Cheena) At Negligible Percentages. Additionally, 5% Of Respondents Reported Consuming Other Millet Varieties. These Findings Underscore A General Lack Of Knowledge And Consumption Of Various Millet Types Among Type 2 Diabetes Patients.

Table 3.13 :- Distribution Of Patients Based On Types Of Millet-Based Dishes They Consume

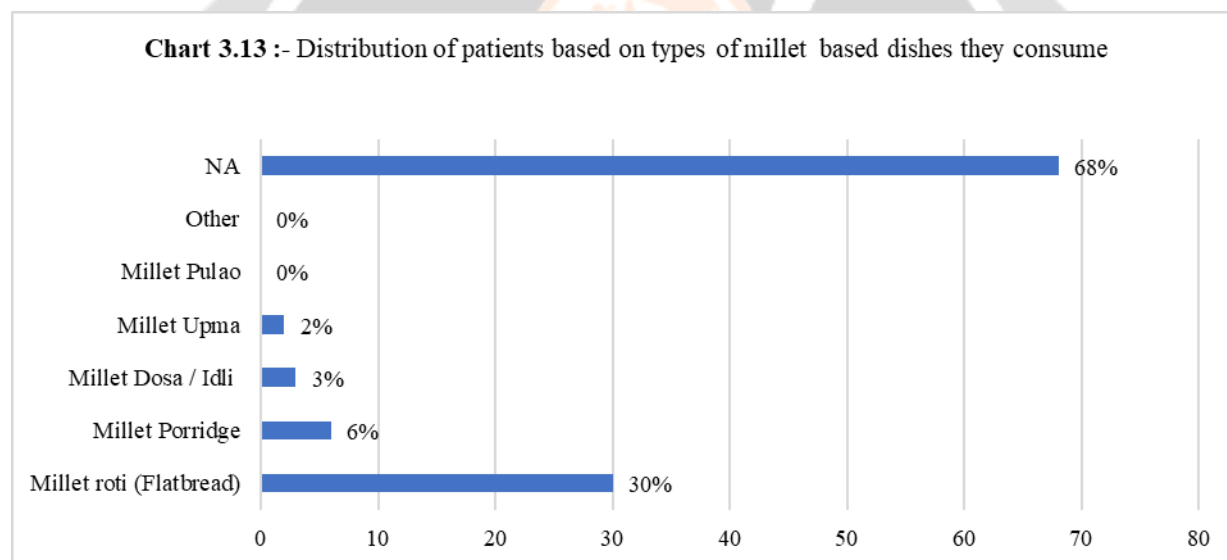
Millet Roti (Flatbread)		
	Frequency (N)	Percentage (%)
Yes	30	30
No	2	2
Na	68	68
Total	100	100%

Millet Porridge		
	Frequency (N)	Percentage (%)
Yes	6	6
No	26	26
Na	68	68
Total	100	100%

Millet Dosa / Idli		
	Frequency (N)	Percentage (%)
Yes	3	3
No	29	29
Na	68	68
Total	100	100%

Millet Upma		
	Frequency (N)	Percentage (%)
Yes	2	2
No	30	30
Na	68	68
Total	100	100%

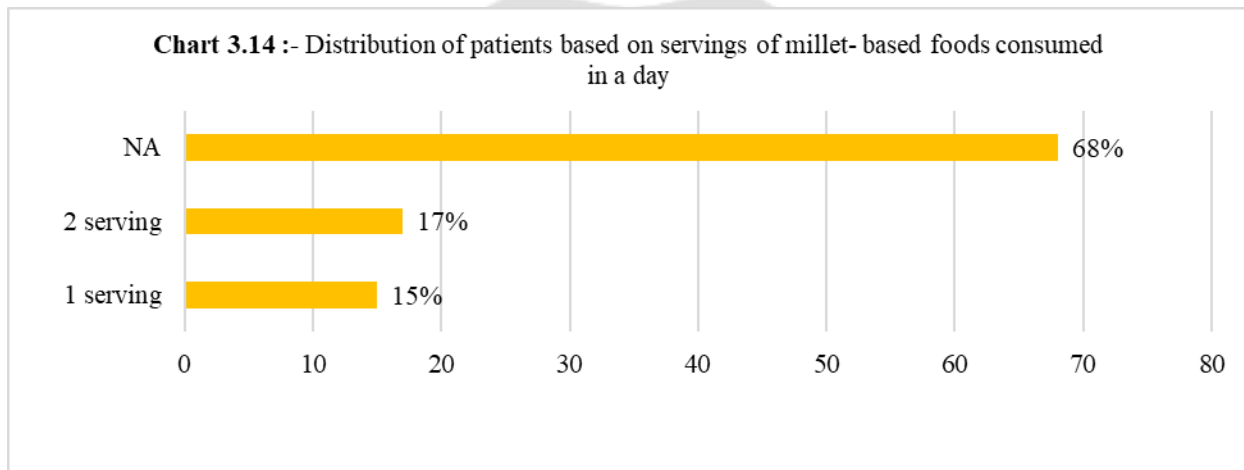
Millet Pulao		
	Frequency (N)	Percentage (%)
Yes	0	0
No	32	32
Na	68	68
Total	100	100%
Other		
	Frequency (N)	Percentage (%)
Yes	0	0
No	32	32
Na	68	68
Total	100	100%



The Table Presents The Distribution Based On The Types Of Millet-Based Dishes Consumed Among Type 2 Diabetes Patients. Across Various Millet-Based Dishes, The Majority Of Respondents Ranging From 68% Indicated "Na" Or Not Applicable, Not Consuming Any Of These Millet-Based Dishes Suggesting A Widespread Lack Of Consumption. Among Specific Millet Dishes, Millet Roti (Flatbread) Had The Highest Consumption Rate At 30%, Followed By Millet Porridge At 6%, Millet Dosa/Idli At 3%, Millet Upma At 2%, And Millet Pulao And Other Millet-Based Dishes At Negligible Percentages. These Findings Underscore A General Lack Of Consumption Of Various Millet-Based Dishes Among Type 2 Diabetes Patients.

Table 3.14 :- Distribution Of Patients Based On Servings Of Millet- Based Foods Consumed In A Day

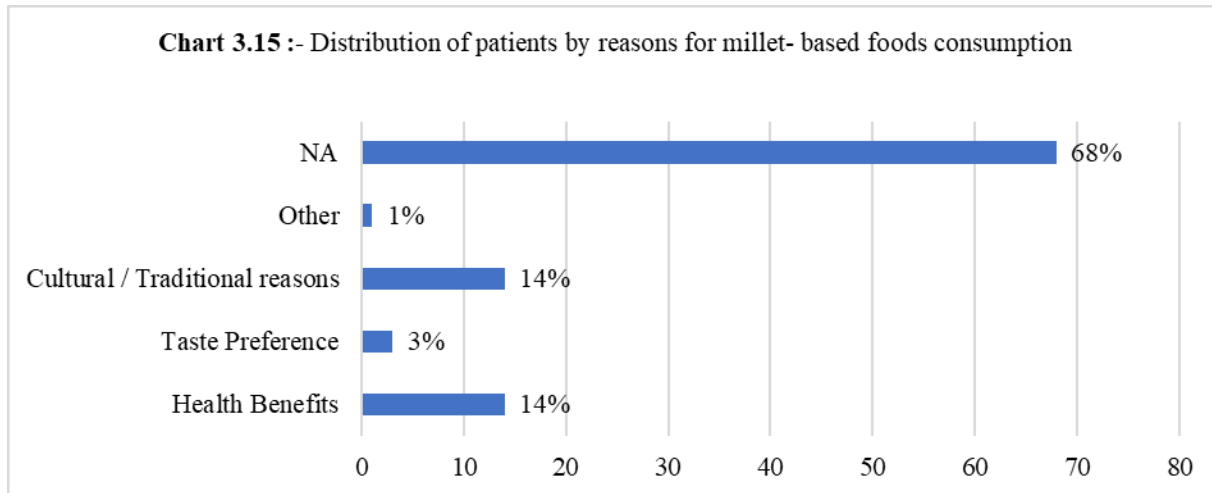
	Frequency (N)	Percentage (%)
1 Serving	15	15
2 Serving	17	17
Na	68	68
Total	100	100%



The Table Illustrates The Distribution Of Patients Based On The Servings Of Millet-Based Foods Consumed In A Day. Among The Respondents, 68% Indicated "Na" Or Not Applicable, Suggesting A Prevailing Lack Of Consumption Of Millet-Based Foods. Of Those Who Reported Consumption, 15% Indicated Consuming One Serving Per Day, While 17% Reported Consuming Two Servings Per Day. These Findings Reveal A Moderate Level Of Millet Consumption Among The Surveyed Patients, With A Notable Proportion Not Consuming Millet-Based Foods At All.

Table 3.15 :- Distribution Of Patients By Reasons For Millet- Based Foods Consumption

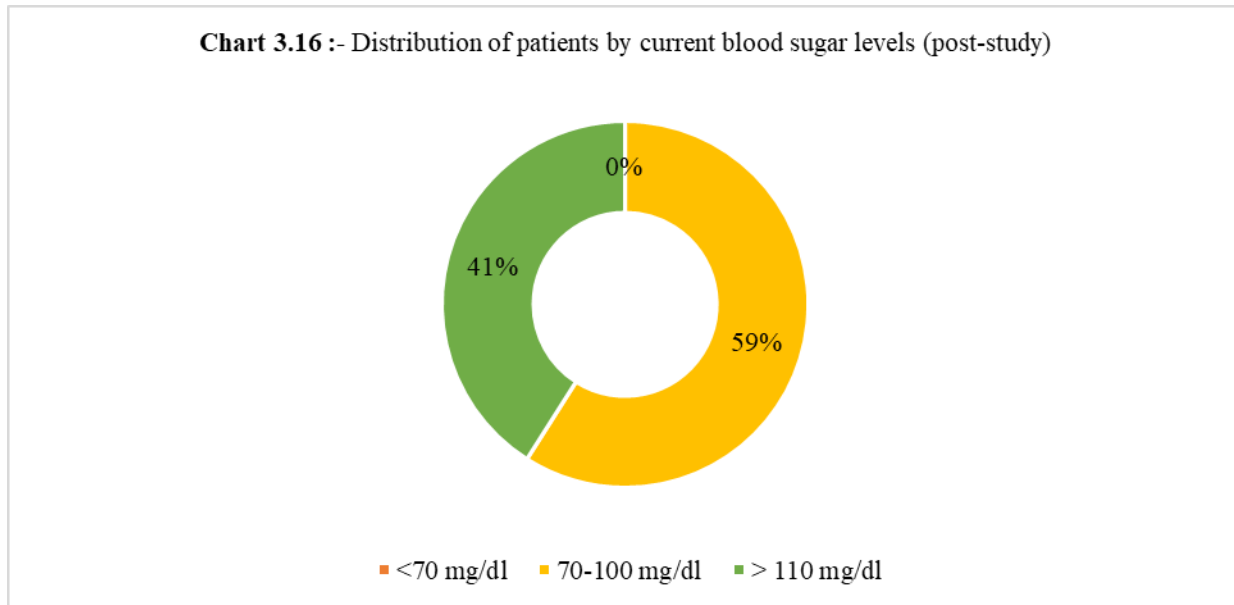
	Frequency (N)	Percentage (%)
Health Benefits	14	14
Taste Preference	3	3
Cultural / Traditional Reasons	14	14
Others	1	1
Na	68	68
Total	100	100%



The Table Presents The Distribution Of Patients Based On The Reasons For Consuming Millet-Based Foods. Among The Respondents, 68% Indicated "Na" Or Not Applicable, Suggesting A Prevailing Lack Of Awareness. Of Those Who Provided Reasons, 14% Cited Health Benefits And Cultural/Traditional Reasons Each, Indicating The Perceived Health Benefits And Cultural Significance Associated With Millet Consumption. Taste Preference Was Mentioned By 3% Of Respondents, While 1% Cited Other Reasons. These Findings Suggest That Health Benefits And Cultural/Traditional Reasons Are Significant Motivators For Consuming Millet-Based Foods Among Type 2 Diabetes Patients.

Table 3.16 :- Distribution Of Patients By Current Blood Glucose Levels (Post-Study)

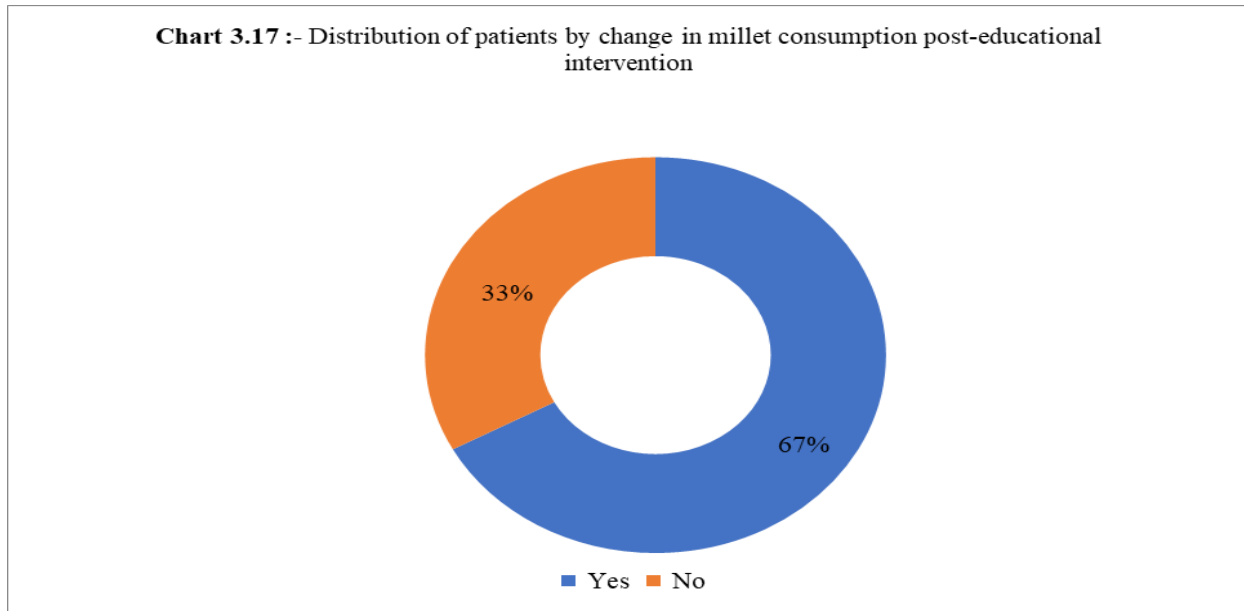
	Frequency (N)	Percentage (%)
<70 Mg/Dl	0	0
70-110 Mg/Dl	59	59
>110 Mg/Dl	41	41
Total	100	100%



The Distribution Of Type 2 Diabetes Patients By Their Current Blood Glucose Levels Post-Study Reflects The Impact Of The Educational Intervention On Glycemic Control. Notably, None Of The Participants Reported Hypoglycemia (<70 Mg/Dl), Indicating The Intervention's Safety. A Majority (59%) Achieved Optimal Levels (70-110 Mg/Dl), Suggesting Effectiveness In Blood Sugar Management. However, 41% Still Had Elevated Levels (>110 Mg/Dl), Highlighting Ongoing Challenges. This Underscores The Need For Sustained Support And Tailored Interventions To Further Improve Glycemic Control, Emphasizing The Importance Of Continued Efforts In Promoting Millet Consumption And Dietary Modifications For Better Diabetes Management.

Table 3.17 :- Distribution Of Patients By Change In Millet Consumption Post-Educational Intervention

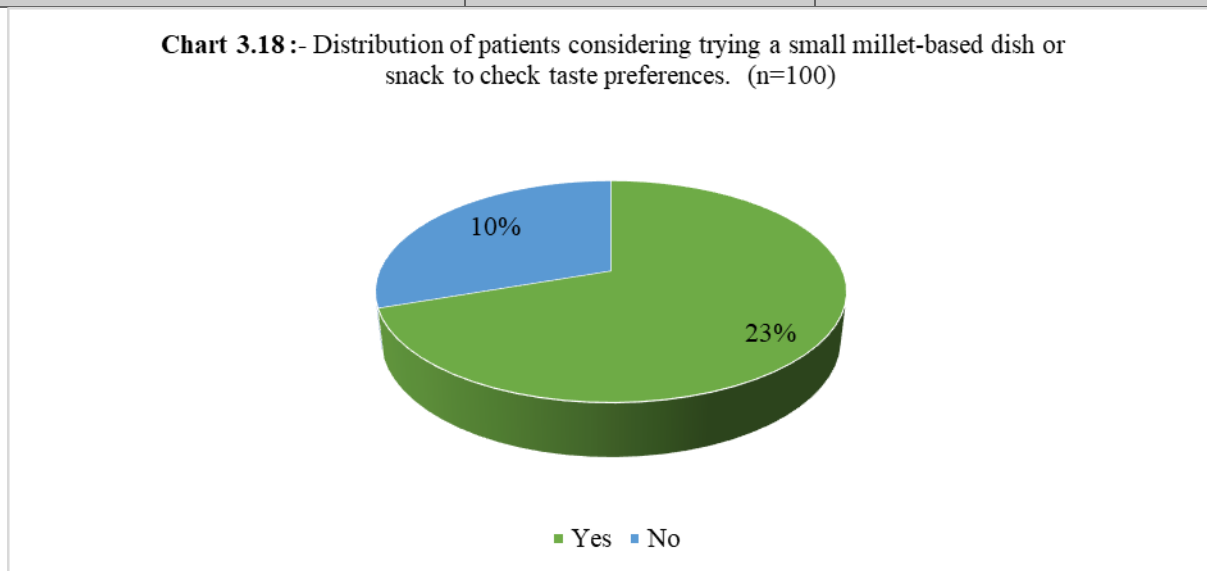
	Frequency (N)	Percentage (%)
Yes	67	67
No	33	33
Total	100	100%



The Distribution Of Patients By Change In Millet Consumption Post-Educational Intervention Indicates A Significant Increase In Millet Consumption Among Type 2 Diabetes Patients. Among The 100 Patients Studied, 67% Reported Consuming Millet After The Intervention, Compared To 33% Who Did Not. This Increase Highlights The Effectiveness Of The Educational Interventions In Promoting Millet Consumption Within This Population.

Table 3.18 :- Distribution Of Patients Considering Trying A Small Millet-Based Dish Or Snack To Check Taste Preferences.

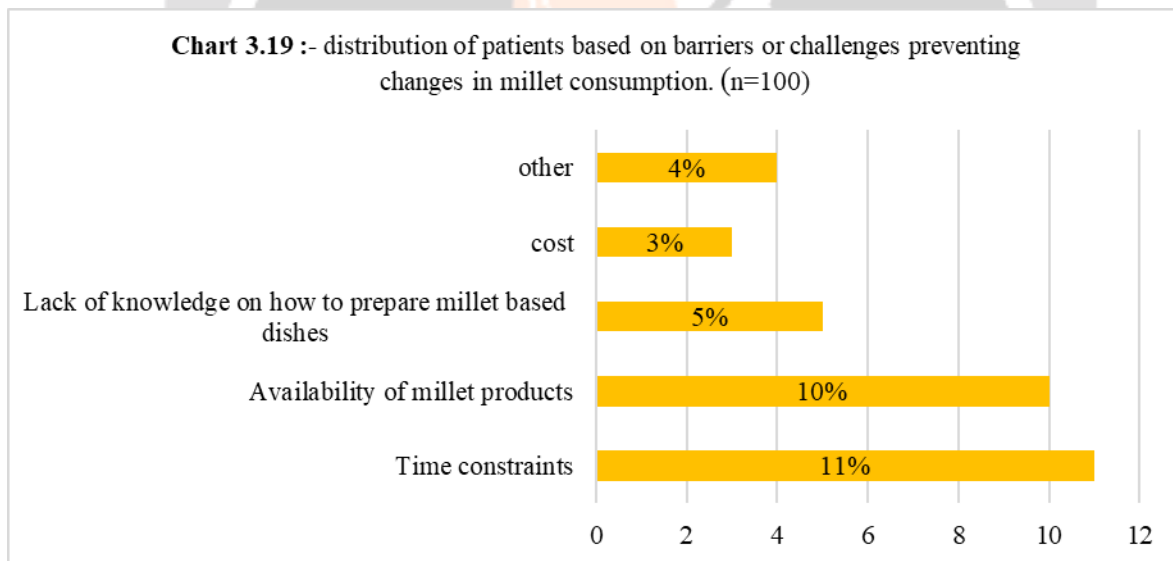
	Frequency (N)	Percentage (%)
Yes	23	23
No	10	10
Total	33	33%



Among The 33 Patients Who Reported No Change In Millet Consumption, It Was Observed That 23% Expressed Willingness To Try A Small Millet-Based Dish Or Snack, Indicating A Potential Openness To Exploring Millet As A Dietary Option Despite Not Currently Consuming It. However, 10% Indicated They Were Not Interested, Suggesting Some Resistance Or Lack Of Willingness Towards Trying Millet-Based Foods Among This Subgroup.

Table 3.19 :- Distribution Of Patients Based On Barriers Or Challenges Preventing Changes In Millet Consumption.

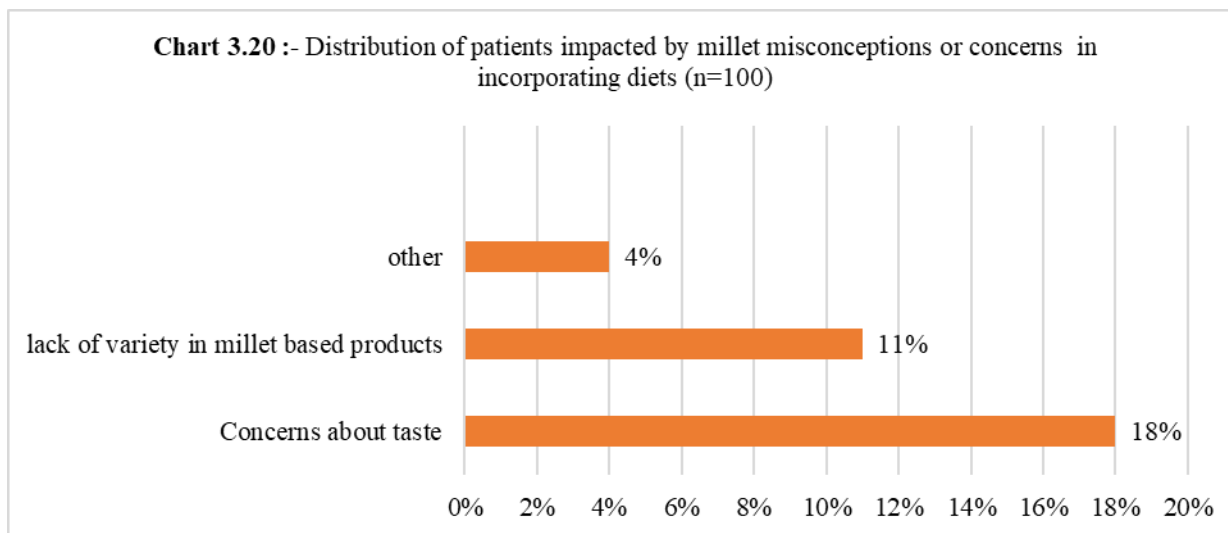
	Frequency (N)	Percentage (%)
Time Constraints	11	11
Availability Of Millet Products	10	10
Lack Of Knowledge On How To Prepare Millet Based Dishes	5	5
Cost	3	3
Other	4	4
Total	33	33%



Among The 33 Patients Surveyed Those Said No Change In Millet Consumption, Various Obstacles To Incorporating Millet Into Their Diet Were Identified. Time Constraints Emerged As The Most Commonly Reported Barrier, With 11% Citing This Challenge. Availability Of Millet Products Followed Closely Behind, With 10% Expressing Difficulty In Accessing Millet-Based Options. Additionally, 5% Reported A Lack Of Knowledge On How To Prepare Millet-Based Dishes, Suggesting A Need For Further Education On Cooking Techniques. Cost Was Identified As A Barrier By 3%, Highlighting Financial Constraints As A Limiting Factor In Adopting Millet Consumption. Moreover, 4% Cited Other Unspecified Barriers.

Table 3.20 :- Distribution Of Patients Impacted By Millet Misconceptions Or Concerns In Incorporating Diets.

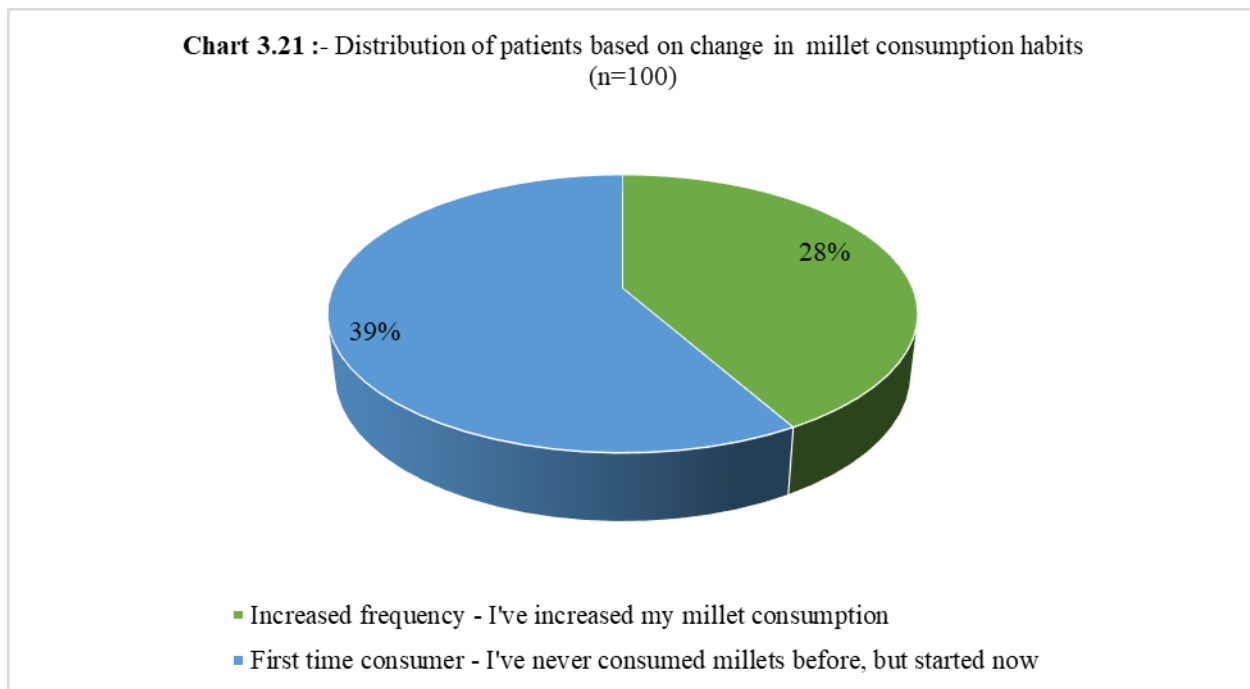
	Frequency (N)	Percentage (%)
Concerns About Taste	18	18
Lack Of Variety In Millet-Based Products	11	11
Other	4	4
Total	33	33%



The Table Presents The Distribution Of Patients Impacted By Millet Misconceptions Or Concerns In Incorporating Diets. Among The 33 Patients Who Reported No Change In Millet Consumption, Various Misconceptions And Concerns Regarding Millet Incorporation Into Their Diets Were Identified. Concerns About Taste Were The Most Prevalent, With 18% Expressing Reservations Regarding The Taste Of Millet-Based Foods. Additionally, 11% Reported A Lack Of Variety In Millet-Based Products, Indicating A Perceived Limitation In Options Available For Consumption. Furthermore, 4% Cited Other Unspecified Concerns Or Misconceptions.

Table 3.21 :- Distribution Of Patients Based On Change In Millet Consumption Habits

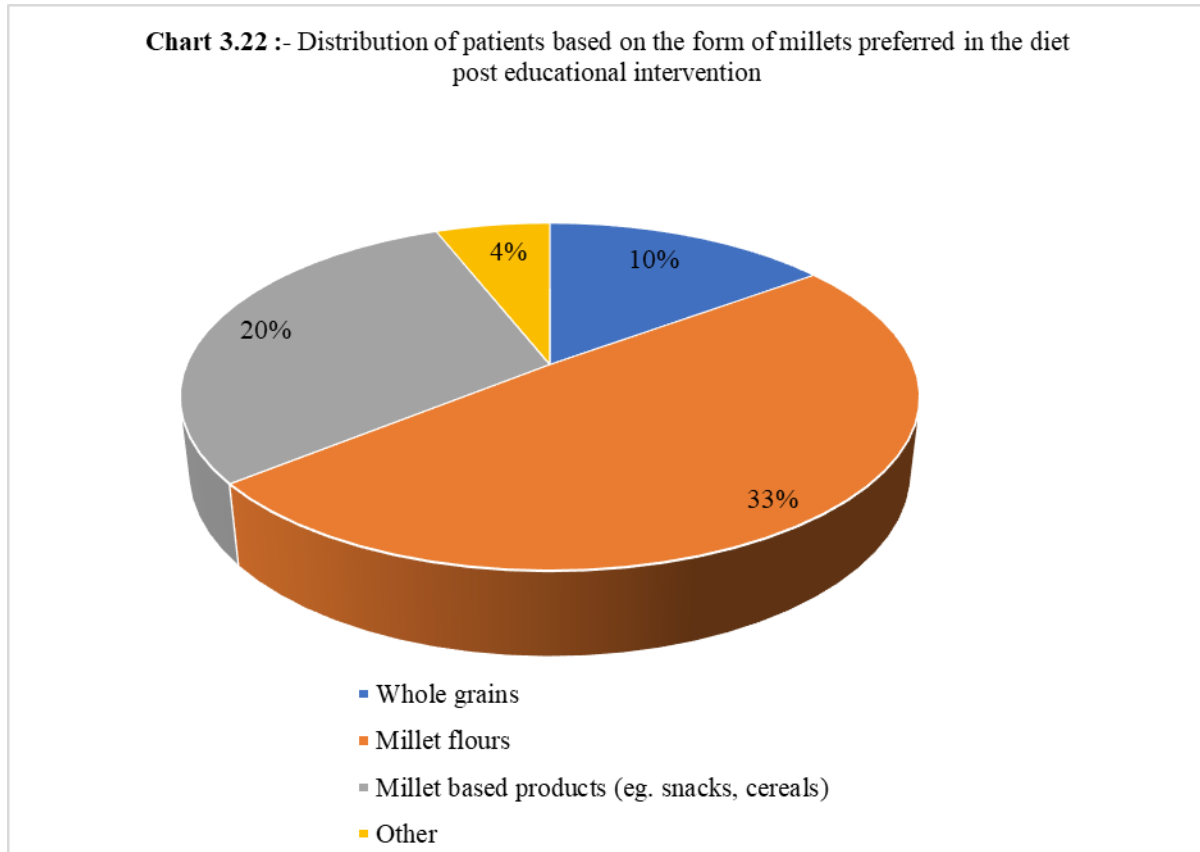
	Frequency (N)	Percentage (%)
Increased Frequency - I've Increased My Millet Consumption	28	28
First Time Consumer- I've Never Consumed Millets Before, But Started Now	39	39
Total	67	67%



The Table Provides Insights Into The Impact Of Educational Interventions On Millet Consumption Habits Among Patients With Type 2 Diabetes. Among The 67 Patients Who Reported A Change In Millet Consumption, Two Distinct Patterns Emerged. Firstly, 28% Indicated An Increased Frequency In Millet Consumption, Suggesting That The Educational Interventions Were Effective In Encouraging Existing Millet Consumers To Incorporate This Grain More Frequently Into Their Diets. Secondly, 39% Reported Becoming First-Time Consumers Of Millets, Signifying A Significant Proportion Of Individuals Who Had Never Consumed Millets Before But Began Doing So After The Intervention. This Finding Highlights The Success Of The Educational Interventions In Not Only Encouraging Greater Consumption Among Existing Consumers But Also In Introducing Millets To A New Segment Of Patients With Type 2 Diabetes.

Table 3.22 :- Distribution Of Patients Based On The Form Of Millets Preferred In The Diet Post Educational Intervention

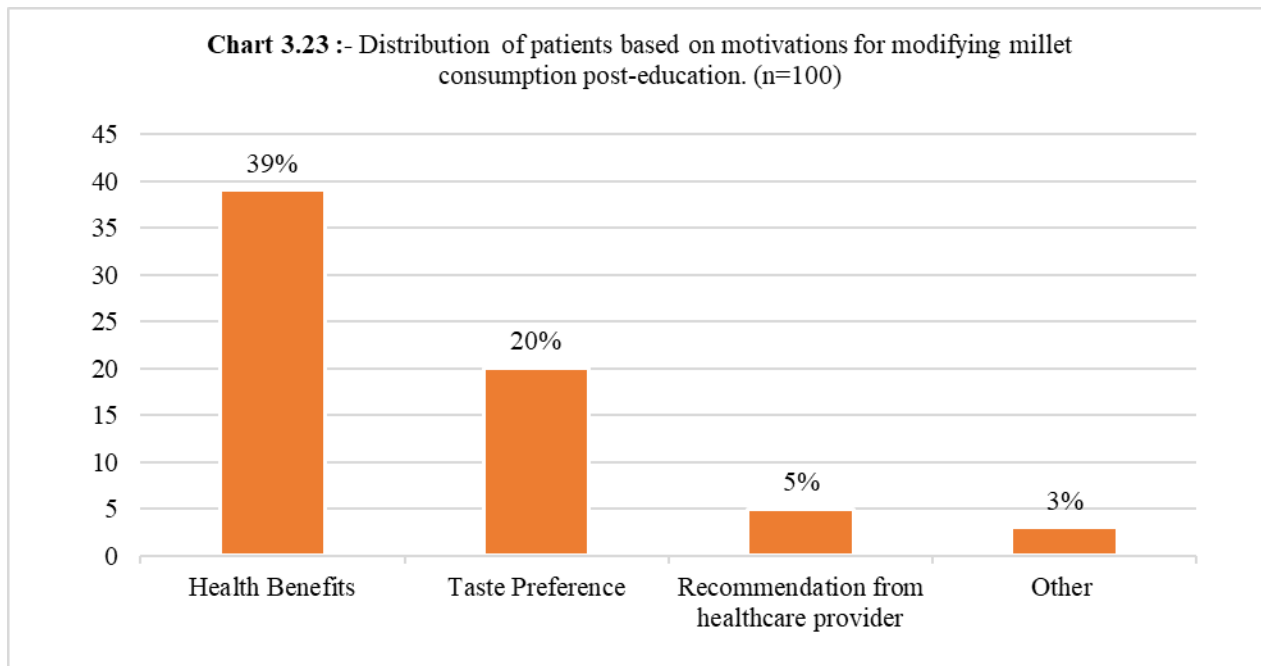
	Frequency (N)	Percentage (%)
Whole Grains	10	10
Millet Flour	33	33
Millet Based Products (Eg Snacks, Cereals)	20	20
Other	4	4
Total	67	67%



The Table Illustrates The Distribution Of Patients Based On The Form Of Millets Preferred In Their Diet. Among The 67 Patients Who Reported A Change In Millet Consumption, Several Preferences Regarding The Form Of Millets In Their Diet Post-Intervention Were Identified. Millet Flour Emerged As The Most Preferred Form, With 33% Indicating A Preference For Incorporating Millet Flour Into Their Diet. This Suggests A Notable Preference Towards Using Millet Flour As A Versatile Ingredient In Various Recipes. Additionally, 20% Preferred Millet-Based Products Such As Snacks And Cereals, Indicating A Preference For Convenient And Ready-To-Consumable Options. 10% Favored Whole Grains, Reflecting A Preference For Incorporating Intact Millet Grains Into Their Meals. Furthermore, 4% Expressed Preferences For Other Forms Of Millets

Table 3.23 :- Distribution Of Patients Based On Motivations For Modifying Millet Consumption Post-Education.

	Frequency (N)	Percentage (%)
Health Benefits	39	39
Taste Preference	20	20
Recommendation From Healthcare Provider	5	5
Other	3	3
Total	67	67%



The Table Presents The Distribution Of Patients Based On Motivations For Modifying Millet Consumption Following Educational Interventions. Among The 67 Patients Who Reported A Change In Millet Consumption, Several Motivations For Modifying Millet Consumption Post-Education Were Identified. Health Benefits Emerged As The Primary Motivation, With 39% Expressing A Desire To Incorporate Millet Into Their Diet Due To Its Perceived Health Benefits. This Finding Suggests A Strong Recognition Among Patients Of The Positive Impact Millet Can Have On Their Health, Particularly In Managing Type 2 Diabetes. Additionally, 20% Cited Taste Preference As A Motivating Factor, Indicating That Enjoyment Of Millet-Based Foods Played A Significant Role In Their Decision To Modify Consumption Habits. Furthermore, 5% Reported Receiving Recommendations From Healthcare Providers, Underscoring The Importance Of Professional Guidance In Influencing Dietary Choices. Lastly, 3% Cited Other Unspecified Motivations For Modifying Millet Consumption.

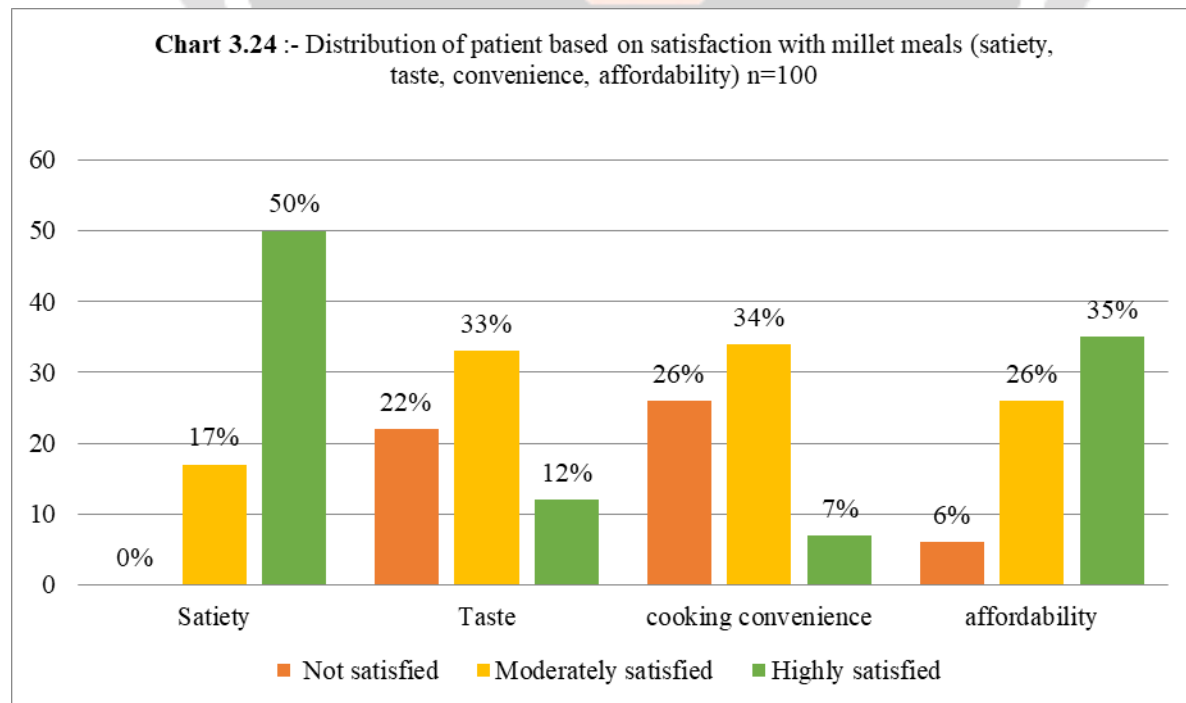
Table 3.24 :- Distribution Of Patient Based On Satisfaction With Millet Meals (Satiety, Taste, Convenience, Affordability)

Satiety		
	Frequency (N)	Percentage (%)
Not Satisfied	0	0
Moderately Satisfied	17	17
Highly Satisfied	50	50
Total	67	67%

Taste		
	Frequency (N)	Percentage (%)
Not Satisfied	22	22
Moderately Satisfied	33	33
Highly Satisfied	12	12
Total	67	67%

Cooking Convenience		
	Frequency (N)	Percentage (%)
Not Satisfied	26	26
Moderately Satisfied	34	34
Highly Satisfied	7	7
Total	67	67%

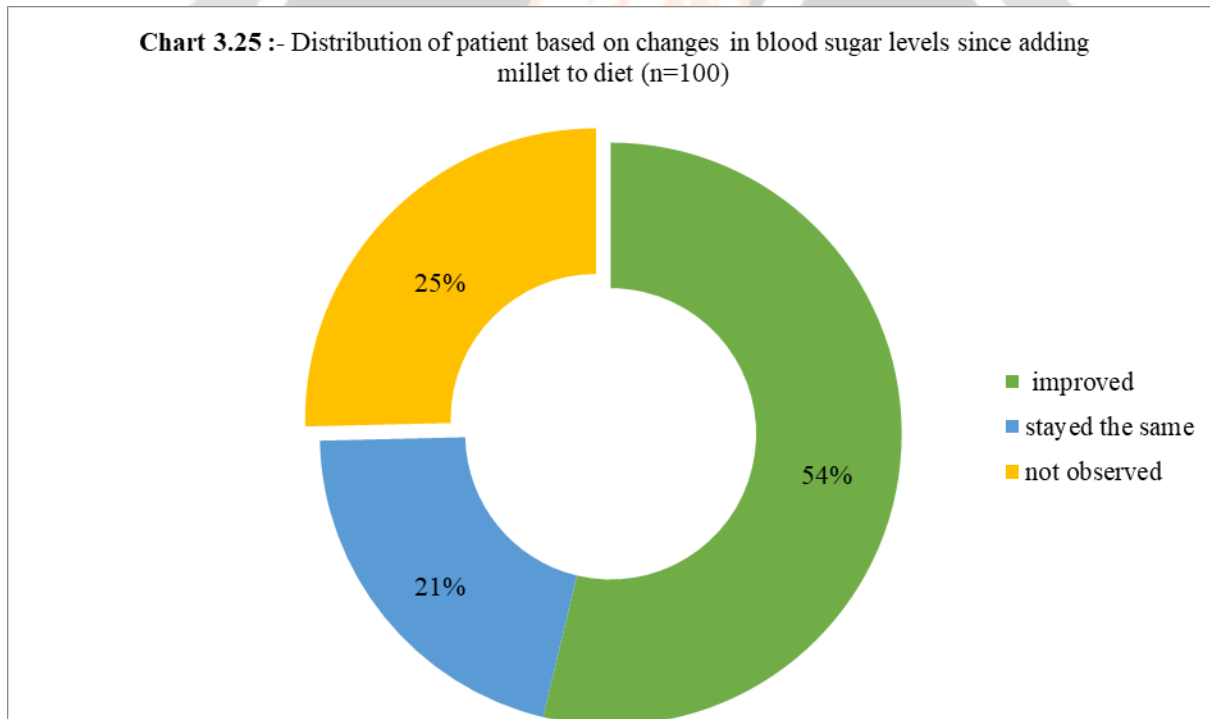
Affordability		
	Frequency (N)	Percentage (%)
Not Satisfied	6	6
Moderately Satisfied	26	26
Highly Satisfied	35	35
Total	67	67%



The Table Presents Patient Satisfaction Levels With Millet Meals Post-Educational Intervention Among Type 2 Diabetes Patients. Overall, Patients Reported High Satisfaction With Satiety And Affordability, With 50% Highly Satisfied With Satiety And 35% Highly Satisfied With Affordability. However, Taste Satisfaction Was More Varied, With 33% Moderately Satisfied, 12% Highly Satisfied, And 22% Dissatisfied. Similarly, Cooking Convenience Had Mixed Satisfaction Levels, With 34% Moderately Satisfied, 7% Highly Satisfied, And 26% Dissatisfied.

Figure 3.25 :- Distribution Of Patient Based On Changes In Blood Sugar Levels Since Adding Millet To Diet.

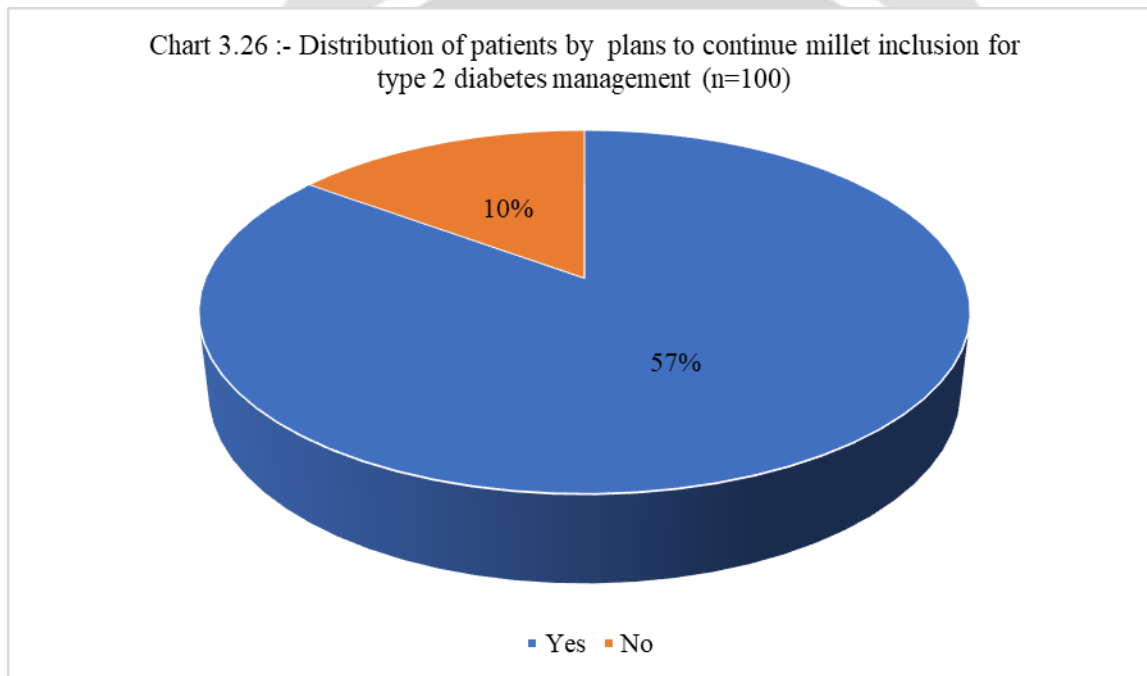
	Frequency (N)	Percentage (%)
Improved	36	36
Stayed The Same	14	14
Not Observed	17	17
Total	67	67%



The Table Presents The Distribution Of Patients Based On Changes In Blood Sugar Levels Since Adding Millet To Their Diet. Among The 67 Patients Who Reported A Change In Millet Consumption, Varied Outcomes In Blood Sugar Levels Were Observed. A Significant Proportion Of Patients, 36% To Be Exact, Reported Improvements In Their Blood Sugar Levels After Incorporating Millet Into Their Diet. Conversely, 14% Stated That Their Blood Sugar Levels Remained The Same, While For 17%, No Significant Changes Were Observed. These Findings Suggest A Potential Positive Impact Of Millet Consumption On Blood Sugar Management Among Type 2 Diabetes Patients.

Table 3.26 :- Distribution Of Patients By Plans To Continue Millet Inclusion For Type 2 Diabetes Management

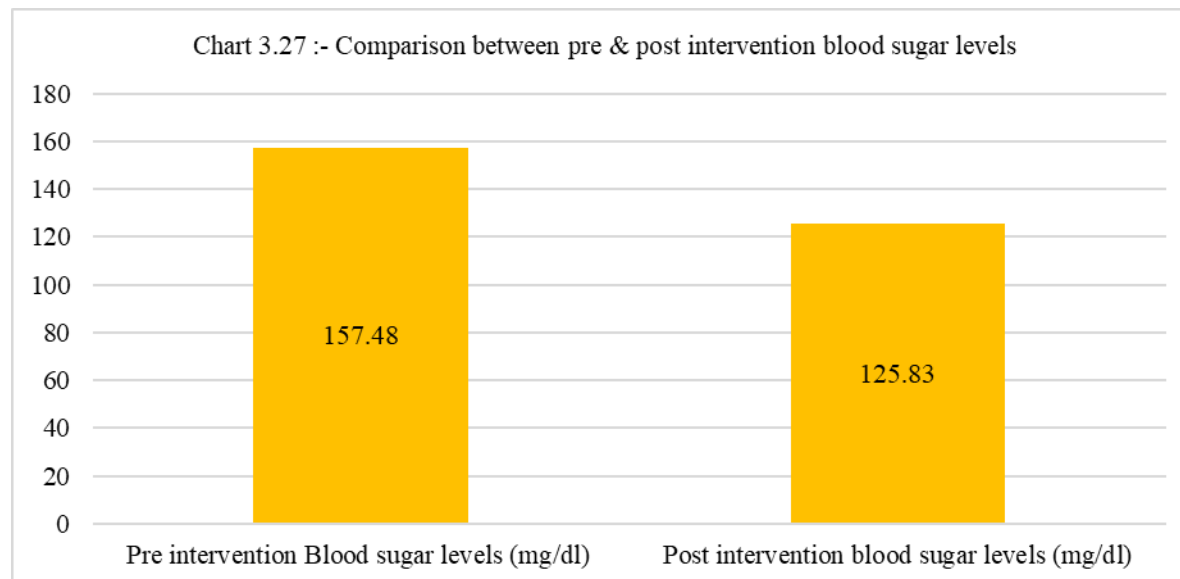
	Frequency (N)	Percentage (%)
Yes	57	57
No	10	10
Total	67	67%



The Table Illustrates The Distribution Of Patients Based On Their Plans To Continue Including Millet In Their Diet For Type 2 Diabetes Management. Among The 67 Patients Who Reported A Change In Millet Consumption, A Significant Majority, Accounting For 57% Of Participants, Expressed Intentions To Continue Incorporating Millet Into Their Dietary Regimen. This Finding Suggests A Positive Response To The Educational Intervention And Underscores The Perceived Value Of Millet In Diabetes Management Among The Study Cohort. However, 10% Of Participants Indicated No Plans To Continue Including Millet In Their Diet, Highlighting Potential Reservations Or Barriers That Need To Be Addressed

Table 3.27 :- Comparison Between Pre & Post Intervention Blood Sugars Levels

	Mean	N	Std Deviation	T-Value	Df	Sig (P-Value)
Pre Hgt What Is Your Current Blood Glucose Level – Hgt (Mg/Dl)	157.48 Mg/Dl	58	43.622	8.768	57	.000**
Post Hgt What Is Your Current Blood Glucose Level – Hgt (Mg/Dl)	125.83 Mg/Dl	58	23.490			



The Comparison Between Pre And Post-Intervention Blood Sugar Levels Revealed Significant Findings. Prior To The Intervention, The Mean Blood Glucose Level (Hgt) Was 157.48 Mg/Dl With A Standard Deviation Of 43.622, Indicating Considerable Variability Among The Participants. Following The Educational Intervention, There Was A Notable Decrease In The Mean Blood Glucose Level To 125.83 Mg/Dl. This Decrease Was Statistically Significant, As Evidenced By The T-Value Of 8.768 And A P-Value Of .000, Indicating A Substantial Improvement In Blood Sugar Control Post-Intervention. The Findings Suggest That The Educational Interventions Had A Positive Impact On Blood Glucose Management Among Type 2 Diabetes Patients

4. CONCLUSIONS

In conclusion, this study illuminates the promising potential of educational interventions targeting millet consumption among individuals with type 2 diabetes. The significant reduction in mean blood glucose levels post-intervention underscores the tangible impact of incorporating millet into dietary practices for managing diabetes. The findings, including notable improvements in blood sugar levels among participants and their expressed intentions to continue millet consumption, highlight the relevance of dietary modifications in diabetes management strategies.

However, amongst these encouraging results, identified barriers to millet adoption, such as time constraints and taste concerns, underscore the complexity of implementing dietary changes. Addressing these barriers will be critical for ensuring the sustainability and effectiveness of such interventions. Future research initiatives should aim to address the limitations identified in this study, including sample size constraints and reliance on self-reported data. Additionally, longitudinal studies could offer deeper insights into the long-term impacts of educational interventions on millet consumption and diabetes outcomes.

This study contributes valuable insights into the potential role of millet as a dietary component in diabetes management. By bridging the gap between nutritional education and practical application, such interventions hold promise for improving the overall health and well-being of individuals living with type 2 diabetes.

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