

Theme of the Month

Diabetes and Millets

To keep Members of Diabetes Care team abreast about DSME/DSMS - (Diabetes Self management Education/Support) Concepts



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RSSDI Indian Diabetes



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RSSDI Indian Diabetes Educator Journal



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FOREWORD

Research Society for the Study of Diabetes in India (RSSDI) founded by Prof MMS Ahuja in the year 1972 is the biggest scientific association of healthcare professionals involved in promoting diabetes education and research in India. RSSDI is happy to collaborate with USV to support their endeavour to make India the 'Diabetes care capital of the world'. Through this collaboration, RSSDI would like to strengthen the cadre of diabetes educators by empowering them with recent updates in diabetes management helping bridge the gap between the physician and the patient. Today, the rule of 50% is prevailing in terms of awareness, detection, treatment and control in T2DM. Our aspiration is to achieve 90-90-90-90 i.e.90% of people with diabetes should be made aware, 90% should be detected, 90% of those detected should be treated, and 90% of those treated should reach their goals.

Indian Diabetes Educator Journal (IDEJ) is the first of its kind in India, and the longest running monthly diabetes educator journal since April 2015 & continues its endeavour to spread awareness, knowledge and enable healthcare teams to manage individuals with diabetes and empower them for self-care. RSSDI IDEJ will continue to keep the members of diabetes care team abreast with concepts of Diabetes Self-Management Education/Support (DSME/S) with a reach of 44000 doctors and diabetes educators digitally.

The year 2023 has been declared as the international year of millets. India is at the forefront of the production and consumption of millets. These nutrigrains have been shown to be beneficial in the prevention and management of diabetes as well. This month's IDEJ issue is a platform to spread awareness about the beneficial role of millet consumption for diabetes along with ways to incorporate them into the diet for healthy living.

We sincerely thank our contributors for making this issue delightful reading for our readers. We dedicate this journal to all the healthcare professionals who are working relentlessly towards making "India–The Diabetes Care Capital of the World."

Sincere Regards,

-Bumal

Dr. Sanjay Agarwal RSSDI Secretary

Disclaimer: This Journal provides news, opinions, information and tips for effective counselling of people with diabetes. This Journal intends to empower your clinic support staffs for basic counselling of people with diabetes. This journal has been made in good faith with the literature available on this subject. The views and opinions expressed in this journal of selected sections are solely those of the original contributors. Every effort is made to ensure the accuracy of information but Hansa Medcell or USV Private Limited will not be held responsible for any inadvertent error(s). Professional are requested to use and apply their own professional judgement, experience and training and should not rely solely on the information contained in this publication before prescribing any diet, exercise and medication. Hansa Medcell or USV Private Limited assumes no responsibility or liability for personal or the injury, loss or damage that may result from suggestions or information in this book.

Expert Contributors of the month

Dr. Vijay Shankar Mishra

MD (Medicine)

Consultant Physician (Specialist Heart, Diabetes, and Neuro Disease), Dr. V S Mishra Clinic, Mandsaur

Article: 2023 - The International Year of Millets

Dr. Alok G. Lalwani

MD (Medicine) Consultant Physician (Specialist Heart and Diabetes), Sacred Heart Hospital, Jalandhar

Article: Nutritional Benefits of Millets





Dr. Gajanand Mohata

MBBS, MD (Internal Medicine) Consultant Physician, Mohata Heart and Medicare, Ahmedabad

Article: Millets - Their Potential in Managing Diabetes from an Indian Perspective

Dr. Shabbir S. Gadi

MD (Medicine) Consultant Physician, Raj Clinic, Ahmedabad



Article: Tips to Incorporate Millets in the Indian Diet



Dr. Rojer David Binny V.

MBBS, MD (Gen Medicine) Consultant Physician, H G M Hospital, Muttuchira

Article: Glycemic Index (GI) of Millets

Dr. Deepak Bhagchandani

MD (Medicine)

Assistant Professor, Dept. of Internal Medicine, King George's Medical University, Lucknow

Article: The Flip Side of Millet Nutrition: Understanding the Disadvantages



Expert Contributors



Dr. Sharwari D. Dua

MD (Internal Medicine), PG Dip Endocrinology (Cardiff, UK) Consultant Physician and Endocrinologist, Dr. Dua's Speciality Clinic, New Delhi

Article: Effect of Processing on Millets

Dr. Nilesh Upadhyay

MBBS, DNB (Medicine), CCEBDM, CCGDM Consultant Physician and Diabetologist, Shree Clinic, Thane

Article: Food for Thought: Can Dairy Be Replaced by Millet for Probiotic Effect?





Dr. Aasim Maldar

MD (Medicine), DNB Endocrinology, SCE Endocrinology and Diabetes, UK Consultant Diabetologist and Endocrinologist,

P. D. Hinduja Hospital and Medical Research Centre, Mumbai

Article: Millets for Gut Health

Dr. Kanhaiya Agrawal

MBBS, MD, DM Endocrinology Consultant Diabetologist and Endocrinologist, Hormones and Diabetes Care, Gorakhpur

Article: Frequently Asked Questions



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2023 - The International Year of Millets



Dr. Vijay Shankar Mishra

MD (Medicine) Consultant Physician (Specialist Heart, Diabetes, and Neuro Disease), Dr. V S Mishra Clinic, Mandsaur Millets cover a diverse group of dryland cereals, which are small-grained. Millets were one of the first plants to be domesticated and they remained a traditional staple crop for many in Asia and Sub-Saharan Africa. While there are many diverse species, millets in India include Pearl, Proso, Foxtail, Barnyard, Little, Kodo, Brown-Top, Finger millets,

and *Sorghum*. Local names of various millets are displayed in Table 1. Millets, as whole grains, are said to have a comparatively higher nutritional profile than cereals, such as wheat, rice, or corn. They can be good sources of minerals, dietary fibers, vitamins, and proteins, depending on the variety and growth conditions. Each variety of millet provides different quantities and types of fiber. Dietary fiber has a role in regulating bowel function, blood glucose levels, lipid profile, and satiety. Millets are also gluten-free and a cost-effective source of iron.

Table 1: Vernacular Names of Millets								
English	Sorghum	Pearl millet	Finger millet	Little millet	Kodo millet	Foxtail millet	Barnyard millet	Proso millet
Hindi	Jowar	Bajra	Mandua	Kutki	Kodon	Kangni and Kakum	Sanwa and Jhangon	Barre
Sanskrit	-	-	Nandimukhi and Madhuli	-	Kodara	Kanguni	Shyama	China
Kannada	Jola	Sajjai	Ragi	Saame	Harka	Navane	Oodalu	Baragu
Tamil	Cholam	Kamboo	Kelvaragu	Samai	Varagu	Tenai	Kuthiravaali	Panivaragu
Telugu	Jonna	Sajjalu	Ragulu	Samalu	Arikelu and Arika	Korra and Korralu	Udalu and Kodisama	Varigulu and Varagalu
Malayalam	Cholam	Kamboo	Moothari	Chama	Varagu	Thina	-	Panivaragu
Marathi	Jowari	Bajri	Nachni	Sava	Kodra	Kang, Rala	Shamul	Vari
Gujarati	Juar	Bajri	Nagli and Bavto	Gajro and Kuri	Kodra	Kang	Sama	Cheno
Bengali	Juar	Bajra	Mandua	Kangani	Kodo	Kaon	Shamula	Cheena
Punjabi	-	Bajra	Mandhuka and Mandhal	Swank	Kodra	Kangni	Swank	Cheena

[Ref: Dayakar Rao B, et al. 2017, Nutritional and Health Benefits of Millets. ICAR-Indian Institute of Millets Research (IIMR)].

Millets are able to thrive on poor soils and resist or endure many crop diseases/pests. They are also resilient to adverse climatic conditions. They support biodiversity and sustainable land restoration by providing land cover in arid areas and reducing further soil degradation. This way millets can help overcome food scarcity in difficult times, contributing to the food security and nutrition of vulnerable populations.

The global food system faces many challenges, including hunger, malnutrition, limited natural resources, an ever-growing global population, and a changing climate. The solution to this is to improve sustainable crop production, resilient value chains, and consumer access to affordable and varied diets. Millets also require less water for irrigation compared to wheat and rice, which require 26 times more water. They grow faster than wheat by 50% and need 70% less water than rice. Millets also are naturally pest-resistant, and thus, reduce the need for pesticides.

Millets, thus in their diversity can contribute as affordable sources of nutrients for healthy diets that can be cultivated in various adverse climates and arid regions with minimal external inputs, which is advantageous to the farmers as well as the environment. (As described in the Figure 1)



Millets were the staples in India for centuries, but gradually were downgraded to the background and got side-lined post the green revolution, as the emphasis shifted to increased food grain production and productivity using high-yielding varieties of wheat and rice in the identified green revolution regions.

With growing evidence of lifestyle diseases associated with a 'refined' diet culture, modern consumers are gradually but increasingly favoring nutrient-rich millets as an alternative to wheat and rice. With the coronavirus disease (COVID-19) pandemic,

the "healthy eating" momentum picked up, and both urban and rural consumers started choosing millets for better nutrition and to strengthen immunity.

The government of India in order to encourage production and consumption of millets, notified millets as nutri-cereals in April 2018. This included *Sorghum*, Pearl millet, Finger millet, and minor millets, such as Foxtail millet, Proso millet, Kodo millet, Barnyard millet, Little millet, and two pseudo-millets i.e. Buckwheat and Amaranth. To establish domestic and global demand and to provide nutritional food to the people, the government of India had proposed



to the United Nations to declare 2023 as the International year of millets (IYoM-2023). This proposal of India was supported by 72 countries, and the United Nations General Assembly (UNGA) declared 2023 as the International year of millets on 5th March 2021.

It is an opportunity to raise awareness of the innumerable benefits of millets, ranging from nutrition and health to environmental sustainability, as well as economic development.

Each individual has a role to play - From the government sector to the private and the general public. Together, everyone must unleash the potential of millets for human and planetary health and well-being.

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Nutritional Benefits of Millets



Dr. Alok G. Lalwani

MD (Medicine) Consultant Physician (Specialist Heart and Diabetes), Sacred Heart Hospital, Jalandhar Diabetes has become a major healthcare problem in India with an estimated 66.8 million people suffering from the condition, representing the largest number in any country in the world.

Food has gained more attention in recent years, not only for its nutritional value but also for its potential to prevent illness rather than only treat it. Cereal



foods play a significant role in the food chain, since, they include a wide range of vital macronutrients and micronutrients, as well as non-nutrient bioactives, secondary metabolites, and phytochemicals. Since, millet crops are an excellent source of vitamins, minerals, and fibrous materials (non-starch polysaccharides), they have long been recognized as a valuable component of a healthy diet. Consuming millets has several health benefits, mostly because of the bioactive phytochemicals (lignans, flavonoids, phenolics, beta-glucans, sterols, inulin, pigments, dietary fibers, and phytates) included in these grains. These substances demonstrate the characteristics of immunological modulators, detoxifiers, and antioxidants. They prevent cancer, celiac disease, diabetes, hypertension, hyperlipidemia, duodenal ulcers, Parkinson's disease, and other conditions, while also enhancing gastrointestinal and cardiovascular health. The common health benefits of some of the millet varieties are shown in the table below.

Variety of millets	Nutritional and health benefits
Foxtail millet (Kangani)	It is one of the healthiest grains for digestion. This millet is a good source of calcium and protein, thus aids in fighting against diseases like osteoporosis and fractures. Having anti-hyperglycemic and anti-lipidemic properties, they suppress pro-inflammatory and hypertrophic responses in individuals with diabetes.
Sorghum (Jowar)	It is rich in riboflavin, folic acid, and beta-carotene and is readily digested when cooked, due to the presence of prolamin. The soluble fibers lower the chance of developing type 2 diabetes.
Barnyard millet	Increases the synthesis of hemoglobin and keeps the red blood cells healthy because it is rich in iron. Beta-glucan and gamma amino butyric acid (GABA) helps to lower blood lipid levels.
Pearl millet (Bajra)	Highest niacin content amongst all cereals; rich in protein and dietary fiber. Rich in antioxidant vitamin E. Reduces the risk of inflammatory bowel disease, lowers triglyceride levels, and prevents heart-related illnesses.
Finger millet (Ragi)	Contains 10 times more calcium than brown rice and wheat and therefore, helps to strengthen and develop bones. It has high antioxidant properties and has balanced amounts of essential amino acids.
Little millet	Prevents spikes in blood glucose levels and helps control diabetes. It also prevents heart disease by reducing cholesterol levels. It helps improve respiratory ailments.
Kodo millet	It is very easily digested and is used for the formulation of infant and geriatric products. Helps in maintaining the health of the nervous system. Rich in niacin, pyridoxine, folic acid, and other minerals.
Proso millet	A good source of protein and calcium and lowers the risk of heart disease by reducing cholesterol levels.

Millets are high-energy-yielding nourishing foods that are also resistant to drought and can grow well with limited water availability. Millets provide high-fiber, minerals, vitamins, macro and micronutrients, and phytochemicals that help to prevent and manage many health conditions. They are therefore truly emerging as 'super-foods' to benefit overall health and well-being.

- 1. Agrawal P, Singh B, Gajbe U, et al. Managing Diabetes Mellitus with Millets: A New Solution. Cureus. 2023;15(9):e44908. doi:10.7759/cureus.44908
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Millets - Their Potential in Managing Diabetes from an Indian Perspective

Dr. Gajanand Mohata

MBBS, MD (Internal Medicine) Consultant Physician, Mohata Heart and Medicare, Ahmedabad Dietary management is the central and most economical way to manage diabetes and its associated complications. Numerous diabetes associations across the globe suggest guidelines for the consumption of appropriate amounts of nutrients, such as carbohydrates, fiber, proteins, fats, and sodium in the diet to encourage healthy

eating habits among people with diabetes (PWD). In addition to staple food crops, such as wheat and rice that people have been eating for years in India, millets have also been native to India. Millets have been an under-utilized crop for the past few decades and are now also called "Shrianna" or "nutri-cereals" as they gain popularity due to their multitude of health benefits.

Millets stand by as the ideal food crop for PWD according to the guidelines set by various associations. The fiber content and phenolic content in millets are beneficial for PWD. PWD often complain of increased hunger (polyphagia) and frequent food cravings. Owing to their fiber content, they are beneficial in managing polyphagia and reducing excess snacking in between meals. This will also help in weight management, which is an important component of diabetes management.



Glycemic index (GI) is another factor that directly impacts post-prandial glucose levels. Millets are seen to have a low to moderate GI. Studies have shown that the mean GI of millet is about 36% lower than the GI of milled rice and refined wheat. This translates to better glycemic control post meals.

Millets reduce the duration of gastric emptying. They contain slowly digested starch that delays the digestion and absorption of carbohydrates in the intestine. Thus, compared to widely consumed rice, they release less glucose into the blood for a longer period of time. This helps maintain post-meal blood glucose homeostasis, reduce insulin excursions, and manage diabetes.

Another way through which millets help in glycemic control is due to the presence of phenols. Polyphenolic ligands have an inhibitory effect on alpha-glucosidase and pancreatic amylases which inhibit the enzyme hydrolysis of complex carbohydrates reducing post-prandial hyperglycemia.

Studies evaluating long-term millet consumption have shown a significant reduction in glycated hemoglobin (HbA1c) levels when compared to a control rice-based diet or pre-intervention (baseline) HbA1c levels (p < 0.01). Similarly, replacing a rice-based breakfast (rice dosa) with a millet-based breakfast (Foxtail millet dosa) has been shown to lower post-prandial blood glucose levels in PWD (Narayanan J, *et al* 2016). Another study (Shweta Joshi, *et al* 2013) found a better glucose profile on replacing rice with millets (millet khichadi vs rice khichadi).

National Institute of Nutrition (NIN) also has demonstrated in their study on PWD that, regular consumption of millet translates into better post-prandial blood glucose and better HbA1c levels. Consumption of millets has also been shown to reduce total cholesterol, triacylglycerol, low-density lipoprotein (LDL) cholesterol, and very-low-density lipoprotein (VLDL) cholesterol (p < 0.01) by 8.0%, 9.5%, 10%, and 9.0%, respectively, and 5% reduction in systolic and diastolic blood pressure.

They also have a higher content of essential amino acids compared to conventional cereals, and the presence of prolaminin in millets increases the digestibility of proteins.



Millets have certain phytochemicals which impart antioxidant and immune-modulatory properties, these are phytosterols, lignans, polyphenols, phytocyanins, and phytoestrogens. This is especially helpful for PWDs as they are known to have immune dysfunction and low immunity levels because of hyperglycemia.

Millets are the 'future crops' that have the potential to merge as a powerful and effective way to manage diabetes. Having said that, they do contain certain anti-nutritional factors and are a source of carbohydrates too. So, cannot be consumed ad libitum. No single grain provides all the nutrients in an adequate quantity. So, it is important to incorporate millets wisely for diet diversity in combination with other food sources in a balanced portion-controlled way.

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Tips to Incorporate Millets in the Indian Diet

Dr. Shabbir S. Gadi

MD (Medicine) Consultant Physician, Raj Clinic, Ahmedabad For generations, millets have been consumed as a part of the Indian diet. However, in the last few years, the culture of eating wheat and rice as the main carbohydrates in the meal has taken over. Gradually, things are changing and with growing awareness millets are coming back for their various health benefits. Some of the most well-known and

commonly eaten millets in India are Ragi (Finger millet), Bajra (Pearl millet), Jowar (*Sorghum*), Foxtail, Barnyard, Koddo, Proso, etc. Millets should be added to the diet gradually over time, starting with a small amount at first.

Here are a few ways to include millets in the diet



- 1. Millet flour can also be used to make bread or chapattis that can be eaten with vegetables, lentils, or pulses.
- Germination and fermentation increase the grain's nutritional availability. Hence, millet dosas or idlis can be consumed with vegetable sambhar and chutney.
- 3. Millets can be added to salads or soups.
- 4. Millets puffed, flaked, and popped can be consumed as a snack.
- 5. It can be used to replace rice in the diet like plain rice, pulao, or biryani.
- 6. In winter, kheer and porridge prepared from millets, particularly pearl millets can be consumed.
- 7. In recent years noodles, spaghetti, vermicelli, savory dishes, and millet-based sweets have become more popular and can be incorporated in the diet wisely keeping portion control in mind.

Millets are packed with nutrients and fiber that help to prevent illness. However, one needs to incorporate them in the diet as a part of a balanced meal with all other food groups, such as pulses, vegetables, dairy, etc., to reap the benefits of good health and well-being.

Resource:

• Agrawal P, Singh BR, Gajbe U, Kalambe MA, Bankar M. Managing Diabetes Mellitus With Millets: A New Solution. *Cureus*. 2023;15(9):e44908. Published 2023 Sep 8. doi:10.7759/cureus.44908.

Glycemic Index (GI) of Millets

Dr. Rojer David Binny V.

MBBS, MD (Gen Medicine) Consultant Physician, H G M Hospital, Muttuchira The prevalence of diabetes is rising among Indians living in both urban and rural areas. Reportedly, the rise in obesity and type 2 diabetes prevalence is correlated with increased intake of refined carbohydrates. This suggests that the type of carbohydrates consumed has an impact on the blood glucose profile. All national and international

bodies recommend intake of low GI foods for people living with diabetes to maintain good glucose control. They support the maintenance of normal lipoprotein levels and euglycemia.

Millets in recent times are being widely recognized as having low-moderate GI (avg. 52.7 \pm 10.3), thus, helping to manage diabetes. They are a good substitute for commonly consumed foods with high GI, like white milled rice (71.7 \pm 14.4) and refined wheat (74.2 \pm 14.9). Minimally processed millets are lower in GI and should be the choice for consumption.

Millets have high fiber and resistant starch, thereby having low GI, aiding to reduce blood glucose levels. High fiber content results in slow hydrolysis of carbohydrates, proteins, and fats present in millet-based diets. This delays the absorption of glucose, thereby exhibiting a low glycemic response. High resistant starch formation in millets is due to the presence of amylose type of



starch, which on retrogradation forms resistant starch which is difficult to hydrolyze by digestive enzymes, causing a slow rise in blood glucose levels. Millets are also known to have higher protein and fat content compared to milled rice. Both fats and proteins



are known to blunt the glycemic response and contribute to the low Gl advantage of millets.

Processing impacts the GI of millets, and it is seen that processing techniques like steaming, baking (including flat bread cooked in a pan), and boiling increase the GI of millets.

Below is a table of average GI values of millets. These findings show that the consumption of food items made from various millets helps to keep the blood glucose level stabilized compared to the food based on maize, milled rice, and refined wheat.

Table 1: Glycemic Index of Millets		
Millet variety	Glycemic index	
Foxtail millet	50-60	
Little millet	50-65	
Kodo millet	50-65	
Proso millet	50-65	
Barnyard millet	50-65	
Finger millet	70-80	
Pearl millet	70-88	
Sorghum	70-85	
Amaranth	65-70	

[Ref: Agrawal P, et al. Cureus. 2023]

- 1. Agrawal P, Singh BR, Gajbe U, Kalambe MA, Bankar M. Managing Diabetes Mellitus With Millets: A New Solution. *Cureus*. 2023;15(9):e44908. Published 2023 Sep 8. doi:10.7759/cureus.44908.
- 2. Dayakar Rao B., Bhaskarachary K., Arlene Christina G.D., Sudha Devi G., Vilas, A. Tonapi. Nutritional and Health benefits of Millets. *ICAR_Indian Institute of Millets Research* (IIMR). 2017: Rajendranagar, Hyderabad, PP 112.
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The Flip Side of Millet Nutrition: Understanding the Disadvantages



Dr. Deepak Bhagchandani

MD (Medicine) Assistant Professor, Dept. of Internal Medicine, King George's Medical University, Lucknow Millets are frequently referred to as "super-foods," since, they are typically more nutrient-dense than other cereals with regard to vitamins, fiber, proteins, and minerals. They are also gluten-free. However, one of the drawbacks of millets is a higher concentration of anti-nutritional factors like phytic acid, polyphenols, and tannins compared to wheat

and rice which hinder nutrient absorption and reduce nutrient bioavailability and utilization. Unlike other cereals, the biofortification of millets is still limited, due to the presence of these anti-nutrients. Given below are some disadvantages of certain millets.

Millets	Anti-nutritional properties	Impact on health
Pearl millet	Goitrogenous compounds, phytic acid and polyphenols	Impaired thyroid hormone synthesis
Finger millet	Polyphenols, tannins, phytates, trypsin inhibitors, and oxalates	Hinder the absorption of micronutrients and the digestion of proteins.
Foxtail millet	Polyphenol and saponins	Hinder the bioavailability of minerals
Certain millets	Contains higher concentrations of unsaturated fatty acids, hence, rancidity and off-flavors occur in millet flour during storage, due to lipolysis. There are also tannins, phytates, oxalates, trypsin, and chymotrypsin inhibitors present.	De-esterified fatty acids undergo lipolysis, and then oxidize. They also hinder the micronutrient absorption and the digestion of proteins.

Solution

Since millets have anti-nutritional properties in their natural form, processing techniques like dehulling, soaking, germination, malting, fermentation, and roasting are used to make millets fit for consumption. These methods help to enhance digestibility and nutrient bioavailability.

- 1. Gowda NAN, Siliveru K, Prasad PVV, Bhatt Y, Netravati BP, Gurikar C. Modern Processing of Indian Millets: A Perspective on Changes in Nutritional Properties. *Foods*. 2022;11(4):499. Published 2022 Feb 9. doi:10.3390/foods11040499.
- Laraib Yousaf, Dianzhi Hou, Humna Liaqat, Qun Shen, Millet: A review of its nutritional and functional changes during processing, Food Research International, Volume 142, 2021, 110197, ISSN 0963-9969. Available at: https://doi.org/10.1016/j.foodres.2021.110197.

Effect of Processing on Millets

Dr. Sharwari D. Dua

MD (Internal Medicine), PG Dip Endocrinology (Cardiff, UK) Consultant Physician and Endocrinologist, Dr. Dua's Speciality Clinic, New Delhi Millets are frequently processed using a variety of techniques. They must be processed to remove inedible portions and convert them into edible form. Processing is crucial because it increases the bioavailability of nutrients, improves organoleptic qualities, and lowers anti-nutritional factors. Processing techniques have a major impact on the digestibility and nutrient content of millets, which has been summarized in the below table.

Processing techniques	The effect observed on millets
Dehulling/decortication	 Significant reduction in protein, insoluble dietary fiber, fat, ash, lysine, tryptophan, and other amino acid content Significantly lowered tannins, phytic acid, calcium, iron, and phosphorous content
Soaking	 Improved mineral bioavailability by reducing anti-nutrients Reduced iron and zinc contents Significant reduction in total polyphenolic content after overnight (12 hours) soaking of Pearl and Finger millet grains Improved starch and protein digestibility
Germination/sprouting/ malting	 Fifty percent increase in protein and fiber content in Pearl millet, Kodo millet, and Finger millet Increased calcium, iron, and vitamin C Decreased fat and carbohydrate content Reduction of anti-nutrients like phytic acid, oxalic acid, and tannins
Milling and sieving	 Lower phytic acid and polyphenol content Sieving of milled Finger millet significantly reduced protein, fat, soluble dietary fiber, and insoluble dietary fiber content Decline in some minerals (iron, zinc, and calcium), vitamin E, and vitamin B (thiamine and riboflavin)
Fermentation	 Rise in protein and crude fat content Decrease in crude fiber and carbohydrate content Significant decrease in phytate, tannin, and increased polyphenol content Increased availability of minerals (calcium iron, zinc, and phosphorous), vitamins (thiamine, niacin, and riboflavin), and amino acid content (methionine and cysteine) Reduction in total phenolic compounds in Finger millet
Roasting	 Significant improvement in iron and calcium content Reduced the protein, fat, and crude fiber content

Processing techniques	The effect observed on millets
Puffing/popping	 High phenolic compounds and mineral content Significantly increased carbohydrate, protein, and iron content Decreased crude fiber, fat, and calcium content Reduced anti-nutrient content like trypsin inhibitor activity, tannins, and phytic acid
Other processing treatments	 Hydrothermally treated Finger millet grains had lower starch digestibility than native grains Proso millet flour subjected to high-pressure processing (HPP) showed a significantly improved protein digestibility compared to unprocessed flour

In general fermentation and germination show an enhancement in the overall nutritional traits of millets and improve protein digestibility, whereas, excessive polishing, dehulling, milling, and extrusion cause a reduction of the dietary fiber, protein, and micronutrient content. Thus, care should be taken to choose the right processing technique for millets to make them more acceptable without compromising the health benefits.

- 1. Gowda NAN, Siliveru K, Prasad PVV, Bhatt Y, Netravati BP, Gurikar C. Modern Processing of Indian Millets: A Perspective on Changes in Nutritional Properties. *Foods*. 2022;11(4):499. Published 2022 Feb 9. doi:10.3390/foods11040499.
- 2. Yousaf L, Hou D, Liaqat H, Shen Q. Millet: A review of its nutritional and functional changes during processing. *Food Res Int.* 2021;142:110197. doi:10.1016/j.foodres.2021.110197.

Food For Thought: Can Dairy Be Replaced by Millet for Probiotic Effect?

Dr. Nilesh Upadhyay

MBBS, DNB (Medicine), CCEBDM, CCGDM Consultant Physician and Diabetologist, Shree Clinic, Thane In recent years, there has been a global increase in the demand for healthy foods, leading to the emergence of functional foods that offer more than basic nutrition. Probiotics are a prime example of functional foods, consisting of live microorganisms that enhance intestinal health, boost immunity, and provide essential nutrients.

Traditionally, dairy-based probiotics have been widely consumed due to their rich nutrient profile. However, there is a notable shift in consumer preferences towards plant-based alternatives driven by health-conscious choices, veganism, lifestyle changes, cost-effectiveness, and easier accessibility. Dairy-based probiotics are associated with concerns such as lactose intolerance, excess calories, high-fat content, milk protein allergies, and hypercholesterolemia.

Cereal-based probiotics have gained attention as an affordable source of calories and nutrients worldwide. Cereals contain phytochemicals like phytoestrogens, phenolic compounds, antioxidants, phytic acid, and sterols making them suitable for the development of functional foods. These components can reduce the risk of cardiovascular diseases, cancer, atherosclerosis, and diabetes making them an attractive choice for consumers.

Cereals are rich in water-soluble fibers, oligosaccharides, and resistant starch, which can support the growth of beneficial microorganisms, aligning with the concept of prebiotics. Millets, such as Foxtail millet, Finger millet, and

Proso millet stand out among cereals. They have a low glycemic index and exhibit good probiotic activity, promoting gut health and digestion.

In conclusion, non-dairy probiotic products, particularly cereals and millet-based products are becoming popular as a healthier alternative to dairy-based probiotics. This shift towards plant-based and cereal-based probiotics demonstrates a growing awareness of the significance of healthy food choices. Consumers are increasingly drawn towards these choices because of their nutritional advantages and the promise of enhanced overall health.

- 1. Kouamé, K.J. *et al.* New insights into functional cereal foods as an alternative for dairy products: A Review', *Food Bioscience*, 2023 (55). 102840. doi:10.1016/j.fbio.2023.102840.
- 2. Kumari Kirti. Cereals and millet based probiotic products: A healthy approach for non-dairy consumers: A review. *The Pharma Innovation Journal*. 2023;12(5):3784-3789.
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Millets for Gut Health

Dr. Aasim Maldar

MD (Medicine), DNB Endocrinology, SCE Endocrinology and Diabetes, UK Consultant Diabetologist and Endocrinologist, P. D. Hinduja Hospital and Medical Research Centre, Mumbai Millets are small grain crops that are nutritionally superior and highly versatile due to their diverse adaptive mechanisms and have a long history of cultivation in India. India is the largest producer of millets in the world, accounting for 80% of millets in Asia and comprising 20% of the total production in 131 countries across the globe. With the goal of

raising awareness of the grain and increasing its cultivation and consumption, the United Nations, at the behest of the government of India, declared 2023 as the International year of millets. Millet-based cuisine was also the theme at this year's G20 summit under the presidency of India.

Millets have been gaining popularity in recent years for several good reasons. One of these includes millet as a "super-food", that may be able to help with the rising number of gut-related ailments and metabolic problems. Following are a few reasons of millets being beneficial for gut health:

- **Millets inherently lack gluten:** These are easier to digest and less likely to trigger allergic reactions. This makes it a popular choice for people with non-celiac gluten sensitivity as well as those with celiac disease.
- Millets are rich in fiber: The fiber content of millets is roughly 2-9 g/ 100 g. The amount of fiber in millet is higher when consumed as whole grain. Therefore, can be useful in patients with chronic constipation, diabetes, and heart disease.
- Millets are low-fermentable oligosaccharides, disaccharides, monosaccharides, and polyols (low-FODMAP): A low-FODMAP diet allows millets to be one of the permitted items. A low-FODMAP diet reduces bloating, gas, and abdominal pain, thus, making way for gut health.
- Millet has a potent prebiotic effect: One study which investigated the therapeutic effect of millet on mice models concluded that, millet showed prebiotic effect promoting healthy bacteria, such as *Bifidobacterium* and *Lactobacillus* in the colon, while reducing the growth of pathogenic bacteria, such as *Enterococcus*, *Escherichia coli*, and *Bacteroides*. This suggests that, millets may also have a prebiotic effect on the gut.
- Millets that have been fermented and germinated have been demonstrated to be protective against ulcerative colitis. However, additional investigation into conditions, such as inflammatory bowel disease (IBD) and irritable bowel syndrome (IBS) is required.

Therefore, for people with gastrointestinal (GI) disorders, millets are gluten-free, low-FODMAP, high-fiber, anti-inflammatory, and prebiotic food options. They are gut barrier friendly and promote a healthy gut microflora.

- 1. Dayal G, Kushwaha R G. An Introduction of Millets. *Just Agriculture*. April 23;3(8):2582-8223. Accessed October 13, 2023. Available at: https://justagriculture.in/files/newsletter/2023/April/04.%20An%20Introduction%20of%20Millets.pdf
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Personalized Counseling and Education of Insulin Injecting Techniques in Individuals with Diabetes: A Doctor's Experience on the MyCare Patient Support Program

Dr. Vitrag U. Shah

MBBS, C.Daib Achintya Diabetes Care, Surat A 54-year-old man with type 2 diabetes mellitus is being managed by Dr. Vitrag U. Shah.

Here's what Dr. Vitrag has to say:

The patient was referred to me due to his continuous elevated and deranged blood glucose levels. He was on insulin therapy. Due to the patient's hectic routine and erratic lifestyle, his glucose levels were constantly high.

This was because the patient had no proper education about insulin and diabetes. Here is where I took the help of MyCare diabetes educator (MDE) Ms. Khushboo in order to educate the patient. After a counseling session, the reason for frequent high glucose levels was understood. The patient had poor knowledge about insulin injecting technique and was not aware of 'needle change'. The MDE realized that he changed the needle when he replaced a new cartridge in the pen i.e. after almost 50 pricks. He was also found to have lipo-hypertrophy, which is a major reason for his high glucose levels.

During the following sessions, the MDE then educated him about the correct insulin injection technique, site rotation, and the importance of changing needles. She also taught him about lipo-hypertrophy, and how to prevent and detect one in the future. The patient also had dyslipidemia, which the MDE took into consideration while customizing a suitable meal plan for him. She also educated him on the impact a good healthy lifestyle, diet, and exercise can have on his glucose readings. By the end of the program, the patient's glucose readings which were 336 mg/dL [fasting blood sugar (FBS)] and 403 mg/dL [post-prandial blood sugar (PPS)] are now 87 mg/dL (FBS) and 131 mg/dL (PPS).

Ms. Khushboo Tilwani

NDEP and T1DE Certified Diabetes Educator

Here's what MDE Khushboo has to say:

Along with the doctor's intervention and my assistance, the patient achieved extremely good control of his blood glucose levels post 16 weeks of enrolling in the program. He also adopted a healthy lifestyle, learned how to eat in moderation, and is now doing well and is content with himself.

MyCARE Service available at Ahmedebad, Bangalore, Bhopal, Bhuvaneshwar, Burdwan, Chandigarh, Chennai, Cochin, Coimbatore, Delhi, Guwahati, Hubli, Hyderabad, Jaipur, Jodhpur, Kolkata, Lucknow, Ludhiana, Madurai, Meerut, Mumbai, Mysore, Nagpur, Patna, Pune, Siliguri, Surat, Thiruvananthapuram, Varanasi, Vijayawada, Visakhapatnam *PWD: People with Diabetes

Abridged Prescribing Information

indication: It is indicated as an adjunct to doet and econise to improve glycaeting sourced in adults with type 2 diabetes notlikes.

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Adverse Reactions: Maiz common adverse eactions reported are: Dapagiffuster-Temale genital reports infections, nariopharyngitis, and unitary tract infections. Stuggetiv: Upper regolutory tract infection, nariopharyngitis and heatache. Netformia-Dambea, nanees/scienting, flatulence, athenia, indigenion, addominal docordint, and heatache.

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Additional information is available on request. Last updated: Linuxy 01, 2023

In Uncontrolled Obese T2DM,

Glycomet-GP2 FORTE

Gimepinide use is associated with induced cardiovascular mortality in patients with type 2 diabetes and chronic heart failure, a prospective cohort study | European Journal of Preventive Cardiology | Oxfort Academic (oup.com)
 Z. Ther Adv Endocrinol Metab 2020. Vol 11:1-12 DOI: 10, 1177/2042018820928000.
 # Data on file
 * As compared to non-glimepinide group
 EET: Epoxyelcosatrienoic acid; sEH: soluble Epoxide Hydrolase: AHAs: antihyperglycemic agents: T2DM: Type 2 Diabetes Mellitus

Prescribing Information

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Last updated: March 13, 2021

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Corvette Team

Frequently Asked Questions

MBBS, MD, DM Endocrinology Consultant Diabetologist and Endocrinologist, Hormones and Diabetes Care, Gorakhpur 1. My 8 year-old-child was diagnosed with type 1 diabetes mellitus almost 1 ½ years ago. Since then, we have cut-off all processed foods and beverages. His glucose readings are also under control. A friend advised us to try Ragi millet biscuits as its good for diabetes, but my child's sugar readings spiked after eating that. I wanted to know the reason why this

happened, as Ragi is a millet and millets are good for diabetes.

Ans. Yes, millets do help in controlling blood glucose levels but only if eaten in the right way with moderate portions. You observed a spike in the readings because of two reasons. The first being biscuits of any kind, millets or any grain are processed foods. They are high-fat and high-carbohydrate foods that spike glucose readings. It is important to check the ingredient label and not be blinded by the advertising on the front of the pack.

Ingredients are mentioned in descending order by weight, which means that the first ingredient is in the largest amount in the product followed by the next

and last ingredient is in the smallest amount. The majority of times, the quantity of 'refined flour' will be higher than Ragi. It may also contain hidden sugars, such as 'dextrose' or 'corn syrup', etc. Apart from this, Ragi has a high glycemic index (GI) which causes spikes in glucose levels. So, Ragi should be consumed with some protein and fiber to blunt the glycemic response.

2. My 14-year-old son who is having type 1 diabetes, has recently been diagnosed with celiac disease. I am devastated. I have been giving him wheat rotis, as they give better glucose control than rice. Now if I have to stop wheat also, how will I manage his diet?

Ans. Celiac disease is common in people who have type 1 diabetes. While your worry and anxiety is understandable, the good news is that in India we are blessed with millets, and all millets are gluten-free. You definitely need to avoid wheat, barley, and its products for your son as they contain gluten, however, you can include various millets in the diet that are gluten-free and also have high fiber content, which helps in blood sugar management. Rotis can be made from millets. Bajra and Jowar flour can be kneaded with hot water to make rotis. Rice too can be consumed in moderation by adding vegetables and protein to it. Nowadays, gluten-free varieties of flour, pasta, daliya, etc., are also available. Remember to include foods from all food groups along with millets for healthy living.

3. My 65-year-old uncle was diagnosed with diabetes mellitus a few years ago, his blood glucose levels are mostly in the normal range. Lately, he has been facing a lot of bloating and gastric disturbance. We were advised to avoid gluten for a few days and try millets. However, millets too are grains, and we are worried it may further aggravate his gastric disturbance.

Ans. Yes, Millets are now a very popular food. They are regarded as super-foods, as they have a rich nutrient profile and also improve gut health. However, they also have certain anti-nutritional factors and have high fiber content, which may cause gastric issues in some people. Easy processing methods like soaking, fermentation, germination, cooking, and boiling reduce the anti-nutrient levels and improve digestibility. Studies have revealed that in majority of millets, dietary fiber, mineral, and vitamin content increases after germination and fermentation. Therefore, millet recipes, such as millet dosa/idli and millet khichdi/pulao /sprouted millet salad can be a part of his diet.

Recipe: Foxtail Millet Pulao

Serves: 2

Ingredients	Amount	
Foxtail millet (soaked for 30-45 minutes)	1 cup	
Cumin seeds	1⁄4 tsp	
Finely chopped green chili	1 no.	
Finely chopped onion	1 no.	
Finely chopped ginger	1 inch	
Curry leaves	4 no.	
Turmeric powder	1⁄4 tsp	
Diced carrots	1⁄4 cup	
Green peas	½ cup	
Finely chopped coriander leaves	For garnishing	
Salt	To taste	
Oil	1 tsp	
1 cup: 250 mL; 1 tablespoon: 15 mL; 1 teaspoon: 5 mL		

Method

- 1. In a large pan, heat oil and add cumin seeds. Once it splutters, add green chili, onions, ginger, and curry leaves.
- 2. Once the onion turns translucent, add turmeric powder, carrots, and peas. Mix well and cook for a minute.
- 3. Add Foxtail millet and sauté it for a few seconds. Pour 4 cups of water, add salt, and bring it to a boil. Simmer it for about 15 minutes or till water is absorbed and the Foxtail is cooked.
- 4. Serve hot and garnish it with coriander leaves.

Dia-Games

Match the column

A Column	B Column
1. Finger millet (Ragi)	A. Helps in hemoglobin synthesis
2. Kodo millet	B. Good source of calcium
3. Pearl millet (Bajra)	C. Good source of niacin
4. Barnyard millet	D. Has anti-hyperglycemic and anti-lipidemic properties
5. Foxtail millet	E. Easy to digest so used in infant and geriatric products

Answer: 1. B, 2. E, 3. C, 4. A, 5. D

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In Newly Diagnosed & Young T2DM,

Start Early with

Glycomet-GP0.5 Glycomet-GP0.5 FORTE Mettormin Hydrochloride 500 mg SR + Glimepiride 0.5 mg Methamin Hydrochloride 1000 mg SR + Gimepiride 0.5 mg

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1. Asian Journal of Diabetology, Vol. 23, No. 2, April-June 2022; YALAMANCHI SADASIVA RAO etal, 2. Asian Journal of Diabetology, Vol. 23, No. 2, April-June 2022; SAUMITRA RAY etal, 3. Cureus 2020; 12(9): e10.7759/cureus.1070 4. CMARC Data 5. Healthplix Data 6. Lim L-L, Lau ESH, Cheung JTK, et al. Real-world usage of sulphonylureas in Asian patients with type 2 diabetes using the Joint Asia Diabetes Evaluation (JADE) register. Diabetes Obes Metab. 2022;1-14. Doi:10.1111/dom.14865;

Prescribing Information

Information: Metformin hydrochloride (as prolonged release) and glimepiride tablets. Glycomet-GP 0.5/Glycomet-GP 1/ Glycomet-GP 1/ Glycomet-GP 2/ Glycomet-GP 2/ Glycomet-GP 2/ Glycomet-GP 2/ Glycomet-GP 3/ Glycomet-G 3/850/ Glycomet-GP 4/ Slycomet-GP 4/850/ Glycomet-GP 1 Forte/ Glycomet-GP 2 Forte/ Glycomet-GP 3 Forte/ Glycomet-GP 4 Forte Abridged Prescribing Information Composition: Glycomet-GP 0.5mg: Each uncoated tablet contains metformin hydrochloride IP (as prolonged release form) 500mg and glimepinide IP 0.5mg.• Glycomet GP 0.5 Forte: Each uncoated tablet contains metformin hydrochloride IP (as prolonged release form) 1000mg and glimepinide IP 0.5mg.• release form) 850 mg and glimepiride IP 1 mg. • Glycomet GP 2: Each uncoated tablet contains mettormin hydrochloride IP (as prolonged release form) 500 mg and glimepiride IP 2 mg. • Glycomet GP 2/850: Each uncoated tablet contains metformin hydrochloride IP (as prolonged release form) 850 mg and glimepiride IP 2 mg • Glycorret GP 3: Each uncoated tablet contains metformin hydrochloride IP (as prolonged release form) 500 mg and glimepiride IP 3 mg. • Glycorret GP 3/850: Each uncoated tablet contains metformin hydrochloride IP (as prolonged release form) 850 mg and glimepinide IP 3 mg. • Glycomet GP 4: Each uncoated tablet contains metformin hydrochloride IP (as prolonged release form) 500 mg and glimepiride IP 4 mg. • Glycomet GP 4/850: Each uncoated tablet contains metformin hydrochloride IP (as prolonged release form) 850 mg and glimepiride IP 4 mg. • Glycomet GP 1 Forte: Each uncoated tablet contains metformin hydrochloride IP (as prolonged release form) 1000mg and glimepiride IP 1mg. • Glycomet GP 2 Forte: Each uncoated tablet contains metformin hydrochloride IP (as prolonged release form) 1000mg and glimepiride IP 2mg. • Glycomet GP 3 Forte: Each uncoated tablet contains metformin hydrochloride IP (as prolonged release form) 1000mg and glimepiride IP 3mg. • Glycomet GP 4 Forte: Each uncoated tablet contains metformin hydrochloride IP (as prolonged release form) 1000mg and glimepiride IP mg. Indication: For the management of patients with type 2 diabetes mellitus when diet, exercise and single agent (glimepiride or metformin alone) do not result in adequate glycaemic control. Desage and Administration: The recommended dose is one tablet daily during breakfast or the first main meal. Each tablet contains a fixed dose of glimepiride and Metformin Hydrochioride. The highest recommended dose per day should be 8 mg of glimepiride and 2000mg of metformin. Due to prolonged release formulation, the tablet must be swallowed whole and not crushed or chewed. Adverse Reactions: For Glimepiride: hypoglycaemia may occur, which may sometimes be prolonged. Occasionally, gastrointestinal (GI) symptoms such as nausea, vomiting, sensations of pressure or fullness in the epigastrium, abdominal pain and diarrhea may occur. Hepatitis, elevation of liver enzymes, cholestasis and jaundice may occur; allergic reactions or pseudo allergic reactions may occur occasionally. For Metformin: GI symptoms such as nausea, vomiting, diarrhea, abdominal pain, and loss of appetite are common during initiation of therapy and may resolve spontaneously in most cases. Metallic taste, mild erythema, decrease in Vit 812 absorption, very narely lactic acidosis, Hemolytic anemia, Reduction of thyrotropin level in patients with hypothyroidism, Hypomagnesemia in the context of diarrhea, Encephalopathy, Photosensitivity, hepatobiliary disorders. Warnings and Precautions:: For Glimepinide: Patient should be advised to report promptly exceptional stress situations (e.g., trauma, surgery, febrile infections), blood glucose regulation may deteriorate, and a temporary change to insulin may be necessary to maintain good metabolic control. Metformin Hydrochloride may lead to Lactic acidosis; in such cases metformin should be temporarily discontinued and contact with a healthcare professional is recommended. Sulfonylureas have an increased risk of hypoglycarmia. Long-term treatment with metformin may lead to peripheral neuropathy because of decrease in vitamin B12 serum levels. Monitoring of the vitamin B12 level is recommended. Overweight patients should continue their energy-restricted diet, usual laboratory tests for diabetes monitoring should be performed regularly. Contrainedications: Hypersensitivity to the active substance of glimepiride & Metformin or to any of the excipients listed. Any type of acute metabolic acidosis (such as lactic acidosis, diabetic ketoacidosis, diabetic pre-coma). Severe renal failure (GFRS30ml/min). In pregnant women. In lactating women. Acute conditions with the potential to alter renal function (dehydration, severe infection, shock, intravascular administration of jodinated contrast agents); acute or chronic disease which may cause tissue hypoxia (cardiac or respiratory failure, recent myocardial infarction, shock); hepatic insufficiency; acute alcohol intoxication; alcoholism. Use in a special population: Pregnant Women: Due to a lack of human data, drugs should not be used during pregnancy. Lactating Women: It should not be used during breastfeeding. Pediatric Patients: The safety and efficacy of drugs has not yet been established. Renal impairment: A GFR should be assessed before initiation of treatment with metformin containing products and at least annually thereafter. In patients at increased risk of further progression of renal impairment and in the elderly, renal function should be assessed more frequently. e.g. every 3-6 months.

Additional information is available on request.

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"In case of any adverse events, kindly contact; pv@usv.in

USV Private Limited Con

ited Corvette Team

Arvind Vithal Gandhi Chowk, B. S. D. Marg, Govandi, Mumbai - 400 088. | Tel.: 91-22-2556 4048 | Fax: 91-22-2558 4025 | www.usvindia.com

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