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Nutritional Review of Millet Foods for Children

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ABSTRACT

Background: Millets, members of the Pinaceae family, are hailed for their capacity to deliver high energy and vital nutrients, making them a potent ally in the battle against childhood malnutrition. Their innate characteristics, such as hypolipidemic properties, low glycaemic index, and antioxidative prowess, offer formidable defenses against various health afflictions. Embedded within the traditional dietary fabric of numerous cultures worldwide, millets stand as dietary staples for more than a third of the global populace. With nutritional values eclipsing those of rice and wheat by three to five times, millets emerge as a transformative force in fortifying global nutrition and health resilience.

The aim of this review is to curate innovative and nutritious recipes featuring millets tailored specifically for children's dietary needs.

Methods: The data about nutritional and nutraceutical properties of millets and their recipes are collected from reputed journals such as PubMed and Google scholar.

Results: The study reveals the nutritional and nutraceutical properties of millets and various smart and delicious recipes for children.

Conclusion: Despite their abundance in dietary fibres, antioxidants, minerals, phytochemicals, polyphenols, and proteins attributes known to combat various health ailments—India grapples with persistent malnutrition issues, especially among school-age children. This endeavour seeks to offer innovative millet-based recipes tailored to address malnutrition, promoting healthier growth and development among children.

Keywords: Millets; Nutrition; Smart Recipes

Introduction:

Millets are important parts of diets in many of the world. They are hardy crops that can grow well in dry areas and are more nutritious than common grains like rice and wheat. Millets are a main food source for more than a third of the people living around the globe. Different types of millets such as finger millet (ragi), pearl millet (kambu), foxtail millet (thinai), barnyard millet (kuthiraivaali), kodo millet (varagu), and little millet (samai) are grown in many countries. These grains are rich in fiber, antioxidants, minerals, phytochemicals, polyphenols, and proteins, which help fight off different health problems. As people become less active and face issues like obesity, diabetes, heart diseases, stomach problems, and cancer, adding millets to our daily meals can greatly improve our health. Teaching children to eat millet-based foods can offer them many health benefits. Millets are full of necessary nutrients like fiber, antioxidants, minerals, phytochemicals, polyphenols, and proteins that help support healthy growth [2]. Using millet in meals gives kids a wide range of micronutrients needed for their development and energy. Making the switch to millet-based foods not only helps prevent malnutrition but also creates long-lasting healthy eating habits, leading to a better future for children [19].

Nutritive value of millets

Millets play a crucial role in ensuring nutritional security for individuals around the world by providing calories and protein. Millet's rich in nutrients, contain 60-70% carbohydrates, 6-19% protein, 1.5-5% fat, 12-20% dietary fiber, 2-4% minerals, and phytochemicals. Packed with Vitamin B, magnesium, and antioxidants, millets offer an abundance of both micronutrients and macronutrients. compared to wheat and rice, millets excel in terms of mineral content and essential amino acids. According to USDA statistics, a serving of cooked millet (about 174 grams or one cup) delivers the following nutritional information:

Nutritive value of one cup serving of cooked millet

| | |
|--------------|---------|
| Calories | 207 |
| Fat | 1.7gm |
| Sodium | 3.2gm |
| Carbohydrate | 41.2gm |
| Fibre | 2.3gm |
| Sugar | 0.2gm |
| Protein | 6.1gm |
| Magnesium | 76.6mg |
| Folate | 33.1mcg |

Significance of millets

With antioxidant, metal-chelating, and reducing characteristics, different kinds of millet whole grains—such as kodo, finger, foxtail, proso, pearl, and little millets—are excellent providers of phenolic compounds. Whole grain millets function as prebiotics, encouraging the development of healthy gut flora that are necessary for digestion, whereas fermented millet products serve as organic probiotic treatments for childhood diarrhea. Millet-eating populations exhibit a decreased incidence of diabetes mellitus, which is linked to whole-grain meal consumption [18]. Millets are gluten-free, they are a great option for those with celiac disease and gluten sensitivities. Even with the presence of phytates, phenols, and tannins, which promote antioxidant action, millets still have a high concentration of phenolics and antioxidants, which are crucial for maintaining general health, metabolism, and aging, as well as metabolic syndrome [8]. Millet has a long history of being a key component in the manufacture of a diverse range of healthy food products [1].

Cholam (sorghum Bicolor)

The primary prolamin in sorghum protein, called kaffirin, has the unusual ability to reduce digestibility when cooked, perhaps providing health benefits for certain dietary requirements. Rich in protein, fiber, thiamine, riboflavin, folic acid, and beta-carotene, sorghum is a nutritional powerhouse. In addition, it contains sufficient amounts of iron, zinc, and sodium, as well as vital minerals like calcium, phosphorus, and potassium [15].

Recipes from Cholam

1. **Cholam dosa:** Black gram dal and soaked sorghum grain should be combined and ground into a homogeneous batter. Let the batter ferment and season with salt. Pour a ladleful of batter onto a dosa-making tawa that has been heated and oiled. It thinly spread the batter, then cook until crisp and golden brown. For a tasty dinner, serve the dosas hot with chutney.
2. **Cholam Idli:** Soak sorghum grain and black gram dal, then grind them into a smooth batter. Add salt to taste and let the batter ferment. Grease stainless steel idli molds and pour the batter into them. Steam for 15-20 minutes until the idlis are cooked through. Serve hot with chutney for a wholesome and nutritious meal.
3. **Cholam Roti:** After sifting the sorghum flour, gently pour in hot water and knead until a soft, smooth dough forms. Form the dough into round balls by dividing it into smaller sections. Using a rolling pin or your hands, flatten each ball into a spherical form on a sheet of polythene. On a tawa that has been prepared, cook the roti till golden brown on both sides. For a filling supper, serve hot with your favourite curry or dal.
4. **Cholam Halwa:** In a skillet, roast ghee and sorghum flour until aromatic and golden brown. Add milk to the mixture gradually and boil until it thickens. Make sure there are no lumps when you stir in the melted jaggery and ghee, then simmer the mixture until it thickens. Then after transferring the mixture to a mold, let it to solidify.

Kambu (Pennisetum Glaucum): Pearl millet may increase hemoglobin levels due to its high zinc levels (3.1 mg/100g) and enhanced iron content (8 mg/100g). It is good for you since it has more niacin than any other cereal. It is appropriate for controlling diabetes mellitus due to its low glycemic index. It is also safe to include in the diets of elderly people, nursing mothers, convalescents, and infants due to its hypoallergenic qualities. The high content of magnesium helps to relieve respiratory problems, especially in asthmatic patients. [9].

Recipes from Kambu

1. **Kambu Roti:** Sift kambu flour and slowly incorporate hot water, kneading until a smooth, soft dough forms. Split the dough into smaller pieces and form them into round balls. Press each ball into a circular form on a polythene sheet using a rolling pin or your hands. Prepare the roti on a heated tawa until it turns golden brown on both sides. Enjoy it hot alongside your favorite curry or dal for a fulfilling meal.
2. **Kambu Halwa:** Kambu flour with ghee in a pan until fragrant and golden brown. Gradually add milk to the mixture and cook until thickened. Stir in melted jaggery and ghee, ensuring there are no lumps, and continue cooking until the mixture reaches a thick consistency. Transfer the mixture to a mold and let it set until firm.
3. **Kambu Khichdi:** Soak pearl millet (kambu) and moong dal overnight. Pressure cook the soaked millet and dal with vegetables, green chilies, salt, and turmeric powder. In a separate pan, temper mustard seeds, cumin seeds, asafoetida, and sauté onion, ginger garlic paste, and tomato. Add red chili powder, coriander powder, and mix in the cooked millet and dal mixture. Let it simmer for a few minutes before garnishing with coriander leaves and lemon juice. Serve hot.

Recipes from Ragi

1. **Ragi onion chapati:** Mix finger millet (ragi) flour with chopped onion, salt, green chili, curd, water, and coriander leaves to form a soft dough. Heat a pan greased with oil. Shape the dough into small rotis by pressing with oiled palms and cook them on low flame until golden brown on both sides. Serve the rotis with curd, pickle, or your favourite curry for a delicious meal.
2. **Ragi Laddu:** Toast finger millet (ragi) flour until it becomes fragrant. In another pan, sauté various dried fruits in ghee until they turn golden. Warm milk and mix in sugar to create a syrup. Mix the roasted flour, dried fruits, syrup, and cardamom powder well. Incorporate coconut shavings for added taste. Form the blend into round balls the size of lemons by hand. Present and relish these enjoyable delights.
3. **Ragi Halwa:** In a pan, roast finger millet (ragi) flour with ghee until it becomes fragrant and turns golden brown. Slowly incorporate milk into the blend and heat until it thickens. Combine melted jaggery and ghee, making sure to eliminate any lumps, and keep cooking until the mixture attains a thick texture. Pour the mixture into a mold and allow it to solidify until it is firm.
4. **Ragi Dosa:** Combine soaked finger millet (ragi) and black gram dal, then grind them into a smooth batter. Addition of salt for flavour and let the batter ferment. Grease a dosa making tawa with oil and pour a ladleful of batter onto it. Spread the batter thinly and cook until golden brown and crisp. Serve the dosas hot with chutney for a delicious meal.

Thinai (Setaria Italica)

Foxtail millet is a healthy option for both children and pregnant women. Rich in dietary fiber and vital minerals such as copper and iron, it enhances the body's immunity and strength. Significantly, foxtail millet exceeds rice in calcium, magnesium, copper, iron, and phosphorus levels. It also contains a variety of vitamins, such as vitamins A, B1, B2, and E, which support general health and well-being [4].

Recipes from Thinai

1. **Thinai Kheer:** Cook dehulled foxtail millet (thinai) in boiling water for 5 minutes. Meanwhile, roast dry fruits in ghee until golden brown. In a separate pot, boil water and milk together, then add the cooked foxtail millet (thinai). Sweeten with sugar and stir slowly until thickened. Flavor with cardamom powder and garnish with roasted dry fruits. Serve hot as a delightful traditional dessert.
2. **Thinai Thengai Sadham:** Soak foxtail millet (thinai) for 2 hours and cook until fully done. In a pan, heat ghee and add mustard seeds, chopped onions, green chilies, and curry leaves, sautéing until onions are translucent. Add the cooked foxtail millet (thinai) and grated coconut, and cook for two minutes. Season with salt as per taste and serve hot, garnished with chopped coriander leaves.
3. **Thinai Vegetable Biryani:** Cook foxtail millet (thinai) until it's three-quarters cooked and put aside. differently boil the chopped vegetables and set them aside. In a skillet, toast whole spices like cardamom, clove, cinnamon, and bay leaves along with caraway seeds. Incorporate tomatoes, ginger-garlic paste, onions, and cooked vegetables. Add spices and let it simmer. Layer cooked millet with veggies, top with fried onions, drizzle lemon juice, and add fresh herbs. Cover it and allow it to cook for several minutes. Serve while hot.

Varagu (Paspalum Scrobiculatum)

Kodo millet contains 8% protein, rendering it a significant source of protein. It's also loaded with fiber, offering vital digestive assistance. Containing 66.6 grams of carbohydrates, it provides enduring energy [4]. This millet is a rich source of B vitamins, especially niacin, pyridoxine, and folic acid, as well as essential minerals such as calcium, iron, potassium, magnesium, and zinc. Additionally, its elevated lecithin levels support the nervous system, fostering general wellness [5].

Recipes from Varagu

Varagu upma: Rinse kodo millet (varagu) well and put aside. Combine a blend of diced onions, green chilies, carrots, beans, and potatoes with shredded ginger. In a pressure cooker, warm oil and incorporate mustard seeds, black gram dal, bengal gram dal, and curry leaves. When the dal becomes golden brown, incorporate the onion mixture and sauté until it is golden brown. Incorporate turmeric powder and include the vegetables, sautéing them for several minutes. Add the kodo millet (varagu) along with water, and pressure cook for three whistles. When finished, serve warm with your choice of side dish.

Varagu Pulao: In a compact pressure cooker, warm ghee and incorporate cinnamon, fennel seeds, and a bay leaf. Cook until it releases a pleasant aroma. Incorporate diced onion and ginger-garlic paste, sautéing until onions turn golden brown. Mix in diced vegetables, green chilies, mint leaves, and salt. Incorporate rinsed and drained kodo millet (varagu) and blend thoroughly. Add water, modify salt, and heat until boiling. Cook for one whistle over medium or low heat. Serve warm, decorated with coriander leaves.

Varagu Malli Rice: it is in a pressure cooker with water, salt, and a bay leaf until fully cooked. In the meantime, make coriander chutney using little water. In a skillet, warm oil and sauté whole spices. Incorporate diced onion and sauté until clear. Mix in diced carrots and mint chutney, cooking until the raw flavor of coriander is gone. Add salt to taste. After the cooked millet cools, combine it thoroughly with the vegetable mixture. Serve warm alongside raita.

Varagu Payasam: Mix kodo millet (varagu), saffron, and milk in a pot and simmer on low until the millet is tender and mashed. Mix in sugar to enhance the sweetness of the payasam. In a separate pan, melt ghee and toast the assorted dry fruits until they turn golden. Incorporate the toasted nuts and dried fruits into the prepared payasam. Serve the payasam warm or cold.

Samai (*Panicum Sumatrense*)

Little millets are famous for their high fiber levels, closely trailing barnyard millets. The flavonoids present in little millets play a vital role in enhancing the body's protective mechanisms and immune system. Moreover, small millets are rich in tannins and flavonoids, providing defense against various ailments such as diabetes, heart diseases, cataracts, cancer, inflammation, digestive issues, and they also help in slowing down the aging process [7].

Recipes from Samai

Samai Payasam: Cook dehulled little millet (samai) in water for 5 minutes until done. In another pan, gently sauté dry fruits in ghee. Warm the milk in a different pot and incorporate the cooked millet. Add sugar to sweeten and cook until the blend thickens. Season with cardamom powder and top with roasted nuts. Serve warm as a classic dessert.

Samai Thakkali Sadham: Rinse the Samai under running water until it is clear. Immerse the Samai in water for roughly 30 minutes, then drain and place aside. Warm oil in a pressure cooker on medium heat. Incorporate mustard seeds and cumin seeds. Allow them to sputter. Incorporate diced onions and fry until they become golden brown. Incorporate grated ginger and chopped garlic. Cook for an additional minute until the uncooked odor vanishes. Incorporate diced tomatoes and green chili. Prepare until the tomatoes become tender and squishy. Mix in turmeric powder, red chili powder, coriander powder, and garam masala. Stir thoroughly and heat for 2-3 minutes. Incorporate the soaked and drained Samai into the cooker. Thoroughly combine with the tomato blend. Add 2 cups of water and season according to your taste with salt. Mix thoroughly to blend. Secure the lid of the pressure cooker and cook for 2 whistles over medium heat. When the pressure naturally decreases, lift the lid and gently fluff the Samai Thakkali Sadham with a fork. Top with freshly chopped coriander leaves. Serve warm alongside raita or chutney. Savor the tasty and healthy Samai Thakkali Sadham.

Result and Discussion

Research by ICRISAT has revealed strong evidence that including millets in everyday diets can significantly enhance the growth of children and adolescents by nearly 39% in comparison to diets based exclusively on rice. A thorough review involving infants, preschoolers, and school-aged children demonstrated notable improvements in height, weight, mid-upper arm circumference, and chest circumference for those eating millet-based meals.

Conclusion

Millets stand out as a nutritional gem, providing an abundance of vital nutrients that address various health requirements globally. Comprehensive scientific studies highlight their effectiveness not only in addressing child undernutrition but also in controlling issues such as type 2 diabetes, lowering overall cholesterol levels, fighting obesity, and easing iron deficiency anemia. Numerous studies confirm that incorporating millets into diets significantly boosts nutrient consumption and reduces deficiencies. By integrating millet-focused recipes, including the 25 suggestions given in the article, into everyday cooking, people can support enhanced growth and development for children while tackling malnutrition and other prevalent health issues.

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Consent

It is not applicable

Competing interests

Author has declared that no competing interests exist.