

# The Flour of the Future

## Millet-Based Composite Flour

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### Introduction

Composite flour, a blend of different flours, is an innovative approach to address nutritional challenges and enhancing the overall quality of flour-based food products. As defined by Milligan in 1981, composite flour is a mixture of flours, starches and other ingredients intended to replace wheat flour totally or partially. This unique combination typically comprises of flours such as rice, millet, barley, maize, chickpea, corn, cassava, yam, sweet potato, soy, peanut, sorghum, and buckwheat etc. The concept of composite flour stems from a holistic comprehension of nutritional needs and an intend to optimize the utilization of available resources to develop cost-effective and sustainable solution to combat malnutrition, particularly in developing countries including India. Protein

energy malnutrition (PEM) and other nutrient deficiencies are major public health problems in developing countries and particularly vulnerable group for PEM are children aged below five years. Composite flours contain higher protein, dietary fibre, minerals (like zinc, copper, calcium, iron, magnesium) and vitamins content compared to normal wheat flours. Millets are nutritionally rich and are readily accessible in India, as it is the largest producer of millets. Using millet-based composite flour presents a practical approach to address the issue of PEM and other health concerns. Here in this article, we discuss the increasing significance and advantages of incorporating millet-based composite flour into diets.



Fig. Millet based composite flour and its benefits

### Millet based composite flour

Millets are considered as miraculous grain because of their rich nutritional profile compared to other cereal crops like wheat and rice. Millets contain 60-70% dietary carbohydrate, which is rich in dietary fibre, slowly digestible starch and resistant starch, and thus provide sustained release of glucose. Millets pertinently contains high quality protein, calcium, iron, zinc, lipids, vitamin and other phytochemicals such as phenolic compounds. The millets are categorized into i) major millets such as sorghum (*Sorghum bicolor*), pearl millet (*Pennisetum glaucum*), finger millet (*Eleusine coracana*); ii) minor millets such as foxtail millet (*Setaria italica*), kodo millets (*Paspalum scrobiculatum*), Barnyard millet (*Echinochloa esculenta*), little millet (*Panicum sumatrense*), proso millet (*Panicum miliaceum*); and iii) pseudo millets such as amaranth (*Amaranthus caudatus* L), buckwheat (*Fagopyrum esculentum*). The nutrient profile and availability of millet in India makes it a sustainable choice to develop millet based

composite flours. In various literature reported that when millet flours such as sorghum, pearl millet, and foxtail millet flour were employed in developing composite flour, resulted in an augmented nutrient profile of food products, including increased protein, fibre, and mineral contents. Millet based composite flour also have high oil absorption capacity (59.2% to 77.9%), water absorption capacity (117% to 225%), better functional properties comparable with 100% wheat flour (Table 1). Further, millet based composite flours are receiving global attention for their health promoting properties such as anti-diabetic, antioxidant activity and gluten free alternative for people with celiac disease etc. Many studies have utilised composite millet flour for the development of food products like rusk, bread, porridge, instant noodles which would enhance the marketability of millets and improve the therapeutic value of formulated food products.

**Table. 1** Few millets based composite flours and their benefits.

	Composition	Benefits	Reference
1	Millet grains, pumpkin seeds, carrots, cowpea leaves, and skimmed milk powder	Improved mineral (Ca, Fe, Cu, Zn, Mg), protein, dietary fibre content	Tumwine et al., 2019
2	Pearl millet, kidney beans and tigernut with xanthan gum	Improved functional and rheological properties	Awolu O. O. 2017
3	Millets, rice, soybean, tigernut	High Protein content, dietary fibre and improved functional properties and pasting characteristics.	Awolu et al., 2017
4	Pearl millet, wheat and sorghum	Higher crude protein, soluble dietary fibre and low glycemic index.	Bindra and Manju 2019
5	Finger millet, ground nut, orange fleshed sweet potato and soy bean flours.	Improved water absorption capacity, swelling power, water solubility and oil absorption capacity	Feyera et al., 2021
6	Barnyard millet black rice, black soya bean, and pumpkin seeds enriched with herbal mix	Improved nutritional composition and antioxidant activity.	Latha Rani and Jamuna, 2023
	Pearl millet enriched with moringa seeds	Improved protein, essential amino acid content and digestibility.	Nour et al., 2018

**Advantages of millet based composite flour over normal wheat flour**

**Prevents diseases:** Composite flour may help prevent from diabetes due to its low glycemic index and high dietary fibre content. Additionally, because of its low gluten or gluten free composition serves as a boon for individuals with gluten allergies or celiac disease.

**Promotes native plant species:** Though millets are widely produced in India, yet they remained underutilized as compared to cereal crops like wheat, rice and maize. Incorporation of millet in composite flour can enhance the utilization of indigenous and underutilized inexpensive food raw materials.

**Improves nutritional supply:** Millet contains a substantial amount of protein (7-12%) and dietary fibre (15-20%) which accounts for a better supply of protein and fibre for human nutrition to combat PEM and diabetes mellitus respectively. Also, millet based composite flour enriched with herbal

mix like amrutha balli, Indian borage, honagone leaves, dried ginger, turmeric, moringa and clove have antioxidant activity.

**Improves agricultural economy and farmers welfare:** Importing high quality wheat and combining it with local flours to create composite flours or completely replacing wheat flour, it is possible to save foreign exchange dedicated to importing wheat. This approach not only has the potential to generate employment opportunities for the youth in agriculture and food processing sectors but also conserves foreign exchange that could be directed towards the development of other sectors of the economy. Moreover, as India is the largest producer of millet (World's largest producer, accounting for 20% of global production), composite flour based on millet can help improve the overall use of domestic agriculture production.

**Conclusion**

Overall, millet-based composite flour offers a promising solution for enhancing the nutritional value and functional properties of food products, as well as the development of gluten-free and nutrient-rich food alternatives. These findings highlight the potential of millet-based composite flour in

addressing nutritional deficiencies and creating value-added food products. Millet based composite flours has a good potential to combat the energy malnutrition in India along with potential to improve the agricultural economy of India.

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