

Guest Article

Millet: Nutri-Cereals

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Introduction

Millets are small-seeded crops with different species such as pearl millet (*Pennisetum glaucum*), finger millet (*Eleusine coracana*), kodo millet (*Paspalum setaceum*), proso millet (*Penicummiliaceum*), foxtail millet (*Setaria italica*), little millet (*Panicum sumatrense*), and barnyard millet (*Echinochloa utilis*). They are known as coarse cereals beside maize (*Zea mays*), sorghum (*Sorghum bicolor*), oats (*Avena sativa*), and barley (*Hordeum vulgare*) (Bouis 2000; Kauret. al., 2012). Millets are grown in semiarid tropics of Asia and Africa. Millets are utilized as foods and fuel. Among various millets species pearl millet is the most commonly grown in India and Africa. According to FAO in 2018, India is the leading producing country in the world followed by Niger and China. In India, Rajasthan is the leading millets producing state followed by Maharashtra and Gujarat (Adekunle et al., 2018). Millets are often the only cereal crop that can grow in dried and warm climate condition and require very less amount of water (350-400 mm annual rainfall). Some pearl millets varieties can survive up to 64°C temperature.

Nutritional status and Health benefits of millets-

In general millets contain 7-12 % protein, 2-5% fat, 65-75% carbohydrates and 15-20% dietary fiber. Proso millets and Foxtail millets have the higher percentage of protein 12.5% and 12.3% respectively than the wheat (11.8%) and rice (6.8%). Calcium contents are much higher in finger millets (344mg/100gm) than the wheat (41mg/100gm) and rice (10mg/100gm), even three times higher than the milk. Mothers from Mali, Indonesia to Mumbai, India used Finger millets as baby porridge because of its richness in calcium. Pearl millets also have the enormous amount of iron and zinc. Millets like Proso, Foxtail and Little millets show the significant amount of sulfur containing amino acid (Methionine and Cysteine). Micronutrients are also significantly higher than the wheat and rice. Monounsaturated fatty acids (MUFAs) and polyunsaturated fatty acids (PUFAs) are significantly higher in millets than the wheat and rice. Table 1 shows the nutrient composition of millets.

| Food grain | Protein (g) | Fat (g) | Crude fiber (g) | Minerals | | Sulfur containing amino acids | | Unsaturated fatty acids | | |
|-------------------|-------------|---------|-----------------|----------|--------|-------------------------------|----------|-------------------------|----------|-----------|
| | | | | Ca(mg) | Fe(mg) | Methionine | Cysteine | Oleic | Linoleic | Linolenic |
| Finger millet | 7.3 | 1.3 | 3.6 | 344 | 3.9 | 210 | 140 | - | - | - |
| Kodo millet | 8.3 | 1.4 | 9.0 | 27 | 0.5 | - | - | - | - | - |
| Proso millet | 12.6 | 1.1 | 2.2 | 14 | 0.8 | 160 | - | 53.80 | 34.90 | - |
| Foxtail millet | 12.3 | 4.3 | 8.0 | 31 | 2.8 | 180 | 100 | 13.0 | 66.50 | - |
| Little millet | 7.7 | 4.7 | 7.6 | 17 | 9.3 | 180 | 90 | - | - | - |
| Barnyard millet | 6.2 | 2.2 | 9.8 | 20 | 5.0 | 180 | 110 | - | - | - |
| Sorghum | 10.4 | 1.9 | 1.6 | 25 | 4.1 | 100 | 90 | 31.0 | 49.0 | 2.70 |
| Bajra | 11.6 | 5.0 | 1.2 | 42 | 8.0 | 150 | 110 | 25.40 | 46.0 | 4.10 |
| Wheat (whole) | 11.8 | 1.5 | 1.2 | 41 | 5.3 | 90 | 140 | 11.50 | 56.30 | 3.70 |
| Rice (raw milled) | 6.8 | 0.5 | 0.2 | 10 | 0.7 | 150 | 90 | 42.50 | 39.10 | 1.10 |

Table 1: Nutrient compositions of millets compared to wheat and rice (per 100g).
(Source: *Nutritive value of Indian foods*, NIN 2007)



Hypoglycemic property of millets-

GI (Glycemic index) of millets is less than the other cereal crops. The glycemic index is a scale that assigns a number to every food. It is used to indicate how fast and how high a particular food can raise our blood glucose (blood sugar) level. If the GI value comes between 0 to 55 then the food place in low GI category, 56 -69 is for moderate and more than 70 mean high GI.

Factors which contribute to make the millets low GI food are the effects of Starch, proteins, lipids, polyphenols and fibers on millets starch hydrolysis. The millet starch architecture (polygonal and spherical) has also been mentioned as one of the reasons for their hypoglycemic property. Foxtail, Proso and Pearl millets starch have pores in the structure which facilitate the starch hydrolyzing enzymes into the starch granules. Finger millets don't have pores in the starch granules.

Starch hydrolysis index of these millets are Finger<Pearl<Foxtail<Proso millets. Lowering the GI in the diets beneficial to reduce the blood glucose level, reduce cholesterol level, reduce the risk of type 2 diabetes mellitus and reduce the risk of cardiovascular disease. The absence of gluten protein in millets prevents coeliac disease and related complications.

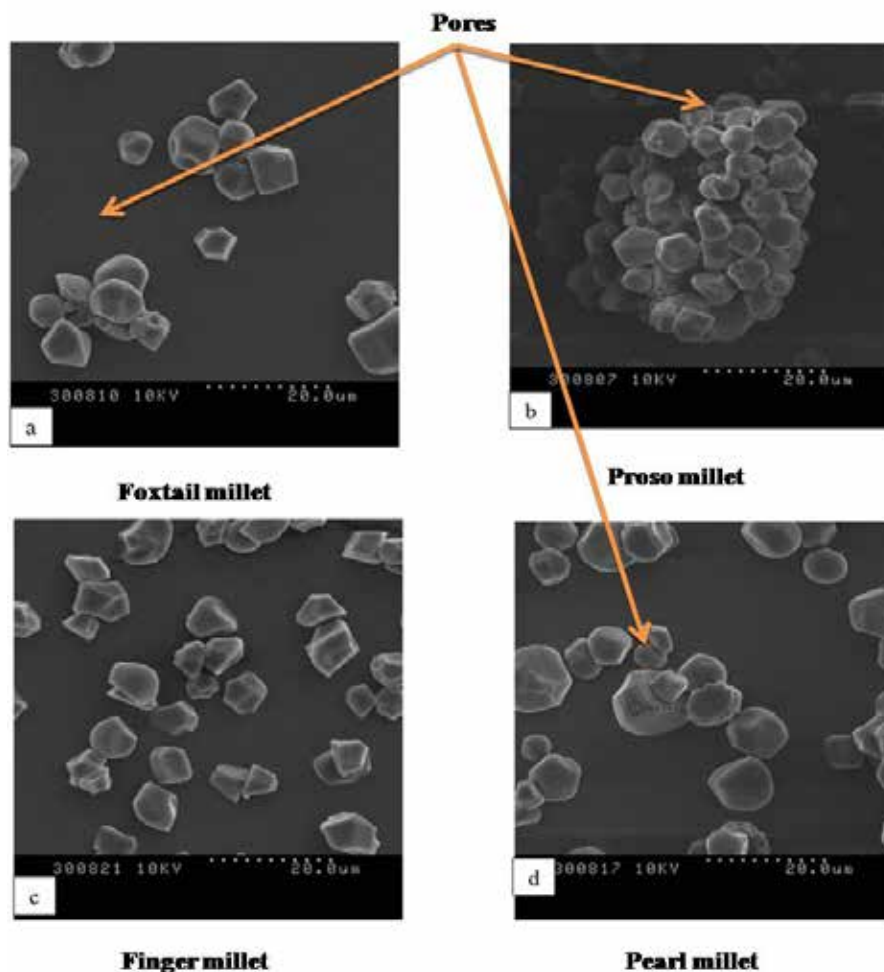


Fig.1: Scanning Electron Micrographs of Millet Starches. (*Annor et.al., 2017*)

Anti-nutrients in millets

Anti-nutrients are also found in millets like phytic acid, polyphenol, Cyanogenic glucoside, tannins, oxalates, amylase inhibitor. These anti-nutrients reduce the bioavailability of nutrients in the body. The proportions of these anti-nutrients can be reduced in the meals by adopting some household food processing techniques like fermentation, malting, germination, decortication etc, which improve the bioavailability of nutrients.

| S. No. | Processing techniques | Function |
|--------|-----------------------|---|
| | Soaking | <ul style="list-style-type: none"> • Reduce the amount of phytic acid and polyphenolic compound • Improve the protein digestability |
| | Germination | <ul style="list-style-type: none"> • Decrease the level of tannins (1.6% to 0.83%) • Increase bio-accessibility of minerals such as calcium, iron and zinc |
| | Fermentation | <ul style="list-style-type: none"> • provides many varieties of food products with different flavors and texture • decreases the levels of anti-nutrients and improves the protein availability, digestibility in vitro and appreciable change in chemical composition of food material |
| | Popping or puffing | <ul style="list-style-type: none"> • HTST (high-temperature short time) method used for starch gelatinization and the endosperm bursts open giving highly desirable flavor and aroma, helpful to promote ready to eat millets based products. |

Table 2. Processing techniques to overcome the effect of anti-nutrients in millets based meals. (Sarita and Singh, 2016)

Conclusion:

Millets are the major coarse cereals which have high human health benefits. They are rich in protein and carbohydrate, having high anti-nutritional activity and low in glycemic index. So consumption of millets with high nutritional value, have high impact on human health.

References

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