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Millets for Sustainable Agriculture and Nutritional Security

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Abstract

Increasing population creates a pressure to meet the quality food, and presents a challenge to explore the feasible options to get the potential food sources to meet the increasing food demand. Underutilized crops like millet are the prominent options to meet the food demand as well as to reduce malnutrition. Improved processing and utilization techniques will give out more value added products of wide acceptance in rural as well as urban areas. Thus, it may be important food crop worldwide with a markable impact on economy as well as health. Millets have variety of desired characteristic such as drought and pest resistance, rich in nutrients and minerals helps in abolishing malnutrition, potential prebiotic and probiotics which have several health advantages etc. It must be considered as potential food to meet the future demand in terms of quality as well as quantity.

Introduction

Millets (minor millets) comprises of different small seeded millets viz., foxtail millet, finger millet, kodo millet, proso millet, barnyard millet and little millet, etc. (Figure 1). All of these millets share small proportions of cultivable land worldwide and grown for food and forage purposes. Small millets have numerous advantages in production as they require less water, short-period crop, resistant to environmental stress and drought. Due to these benefits millets may play crucial role in agriculture. In semi-arid regions, it is difficult to grow most of the crops, but millets can easily survive in such harsh conditions. They are resilient towards different climatic conditions as well as they are less affected by various pests and diseases. Millets are boon for small scale agriculture due to their short growing period of 60-70 days. Hence, millet farming can be done with little effort, time and resource, hence becoming beneficial crops which can be grown in a harsh climatic and environmental conditions (Bora *et al.*, 2019).

Millets “(miracle crop)” is an important constituent for sustainable agriculture and this will help to achieve sustainable development. To solve global hunger problem, day by day newer technologies are being developed but we should concentrate our research and development for complete abolishment of hunger and achieve nutritional security. The research avenue of nutritional biology has been working efficiently for providing food based nutraceuticals. Millets have tremendous nutraceuticals properties but these crops are under-utilized and less explored, and are always neglected in respect of cultivation, production, marketing, research and development.

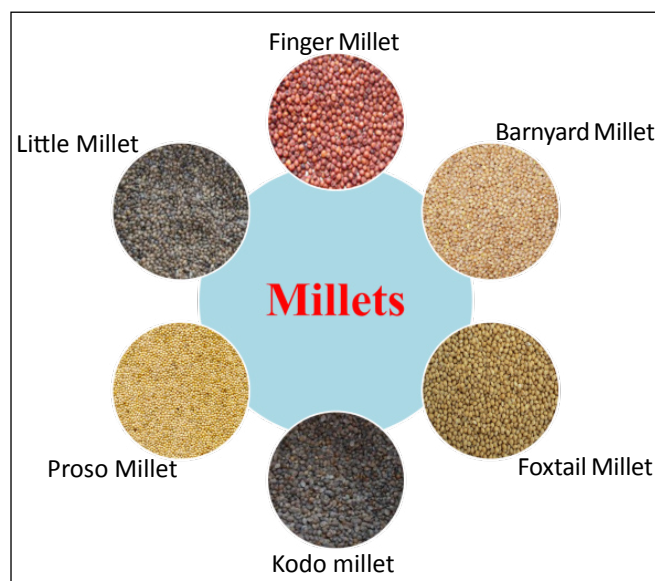


Figure 1: Common millets of India

Exploration and utilization of these millets' species may favour long term sustainability, preservation, conservation and ecosystem diversification, rural upliftment, nutritional health security and overall sustainable agriculture development (Figure 2).

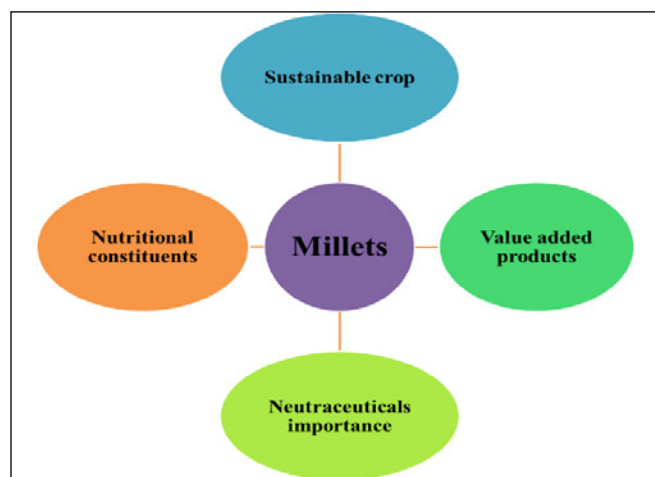


Figure 2: Importance and uses of millets

Nutritional Composition of Millets

Millets have good nutritional composition/ quality as compared to common food grains such as rice and wheat. Millets, especially ragi (finger millet) is considerably good source of micronutrients and minerals. Among cereals richest source of calcium is finger millet (350 mg/ 100 gm) and it contains iron also. It also contains significant amount of Phosphorus, Potassium, Magnesium, Sodium, Manganese, Molybdenum and Zinc. Apart from minerals, ragi (finger millet) is also good source of essential amino acid like lysine and methionine, these

amino acids are necessary for human nutrition. In addition, it also contains essential fatty acid such as linoleic acid (18:2) and α -linolenic acid (18:3) which facilitates development of central nervous system. It constitutes both water soluble (thiamine, riboflavin, niacin) as well as liposoluble vitamins (tocopherol). Carbohydrates and dietary fibres are also high in millets.

Flavonoids Compound of Millets for Neutraceuticals Development

Phenolics and flavonoids are the diverse group of secondary metabolites of plant which play significant role as it imparts colour and defence from other herbivores animals. It exhibits antioxidant properties and can scavenge free radicals which are generated during metabolic reaction. Millets, especially ragi (finger millet) is a good source of phenolic and flavonoid compound. Polyphenols has the capacity of binding free radicals, chelating metal catalyst, helps in activating antioxidant enzymes, removing α -tocopherol radicals and prevents damage of biomolecules and membrane. Millets are good source of phenolics compounds such as caffeic acid, gallic acid, protocatechuic acid, polymeric tannins, vanillic acid, gentisic acid, syringic acid, para-coumaric acid, ferulic acid, 5-n-alkylresorcinols and trans-cinnamic acid. The flavonoids commonly present in millets are quercetin, catechin, luteolin, apigenin, orientin, isoorientin, daidzein, vitexin, myricetin, sponarin, isovitexin, violanthin, tricinandlucenin-1. These varieties of compounds possess potential neutraceuticals value. In recent years, the compound isolated from millets and its crude extracts have gained a huge interest in neutraceuticals applications as functional food. Millet grains have various secondary metabolites and, these secondary metabolites have various biological properties and they also exhibit antibacterial and antifungal activities. Seed coat of millet grains contains higher amount of phenolic and flavonoids compounds which have tremendous health advantages such as protection from cancer, neuro-degenerative diseases and cardiovascular problems. Phenolic extract from finger millets are effective inhibitor of α -glucosidase and pancreatic amylase which lowers blood glucose level therefore it is beneficial for diabetic patients. Since finger millet is high in dietary fibre content, therefore it shows lower glycemic index. Dietary fibres are categorized as soluble and insoluble; both types are present in finger millet. Insoluble dietary fibres are not digested in small intestine therefore they prevent colon cancer, gastro-intestinal disorders, diabetes and coronary heart disease. Finger millet based food is a rich source of calcium, therefore millet based diet is beneficial for children's bone mass development and in adults it prevents osteoporosis and other bone related disorders. Due to higher content of iron in millets, it protect from anaemia also (Nithiyanantham et al., 2019).

Processing and Utilization

Several processed forms/ products of millets can be developed by utilizing different processing techniques such as malting, milling, popping, puffing, debranning, flaking etc. (Kumar *et al.*, 2018). These processing technologies provide a way for development of millet based value added products (Figure 3).

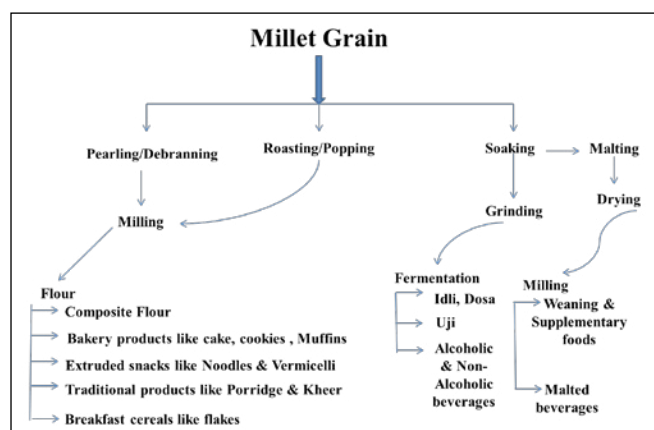


Figure 3: Millet grain based value added products (Kumar *et al.*, 2018)

Reason for Underutilization of Millets

Share of millets in the food basket is low and the main underlying barriers limiting the production and consumption of millets are lack of proper post-harvest

processing technologies, competition from other commonly used crops, changes in preference patterns in consumption, lack of marketing and absence of public or private funded promotion, awareness etc.

Conclusion

The growing demands for healthier food, and increased public awareness are the major factors that will promote millets cultivation in coming years. Millets are rich in different types of bioactive compounds as well as essential minerals, amino acids and vitamins having diverse health benefits. Innovative processing technologies will be helpful to promote its utilization which will opens new market for farmers to improve their income and help to sustain the agriculture and its growth.

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