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Pearl Millet as an Emerging Smart Food

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Abstract :

Humans have been consuming cereals in diet as the main source of energy. With the aim to meet the increasing demand of food emphasis have been made over few staples that have lead to loss of many indigenous crops. That in turn is affecting us by reducing the dietary diversity, ecological imbalance and decline in soil fertility. Foxtail millet is a smart food that focuses over all these three problems in inclusion as it has great nutritional and physiological characteristics. The paper focuses over the nutritional composition health benefits of pearl millet.

Introduction :

Humans have been eating cereal for thousands of years, and it is a crucial part of our diet since it is our major source of energy. In particular low-income communities, they obtain major proportion of needed calories and nutrients from cereals itself (Srivastava et. al., 2013). Continuous efforts had been made to intensify the production of cereals through multiseason cropping, improved varieties, irrigation, and fertilizers to cope up with the increasing demand since post independence. The onset of green revolution in terms to eradicate mass starvation and cereal distribution through Public Distribution System (PDS) to reach larger population have shifted the focus majorly on rice and wheat leading to conversion of millets from being household staples to fodder and loss of many verities of indigenous crops (DeFries et. al., 2018; Eliazer Nelson et al., 2019).

The initiatives to eliminate the starvation lead to nation's self-sufficiency in food. However, it also eliminated the accessible gene pool's diversity. This resulted in less dietary diversity, and a need to focus on nutritional security and not just food security emerged (Davis et al., 2019). Additionally just focusing over few staple crops and following a high-input and high output model is causing ecological imbalance and decline in soil fertility, resultant farming have become more vulnerable to environmental shocks (Li and Siddique, 2020).

There is a need to link agriculture to health and sustainability. Hence it becomes important to shift our attention towards the crops that are capable of covering the recent environmental, health related and livelihood related concerns collectively (Kane-Potaka and Kumar, 2019). Smart food is an initiative by ICRISAT, which cover food in inclusions that are healthy, environmentally sustainable and can generate livelihood for farmers (Kane-Potaka, 2018). Pearl millet a smart food can be one of the alternative crops that can be used to solve the addressed problems. They have great advantageous physiological characteristics and nutritional properties that can bring a sustainable solution.

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The aim of present review is to have an insight about the properties, nutritional composition, health benefits of pearl millet and its potential to be used as food and feed.

Pearl Millet

Pearl millet, or Pennisetumglaucum, a tall grass, is a multipurpose grain used for food, feed, and forages. Depending on the surrounding climate, its summer annual cycle lasts between 75 and 120 days (Arora et al., 2003).Pearl like oval seeds are produced in compact cylindrical panicle, from which the millet got its name (Dias-Martins et al., 2018).

The kernel structure of pearl millet is similar to that of sorghum, consisting of the pericarp, germ, and endosperm. The grain of pearl millet is ovoid and can be nearly white, pale yellow, brown, grey, slate blue, or purple. The 1000-seed weight can range from 2.5 to 14 g, with a mean of 8 g (Hassan et al., 2021).

Production of pearl millet

In India, pearl millet is cultivated as a one-season crop. Marginal and unirrigated fields are the main locations for cultivation. Additionally, it is mostly planted as a fodder crop in a limited area as a summer crop under irrigation, notably in the northwest states of India (Basavaraj et al., 2010).

India continues to be the world's top producer of pearl millet, with Gujarat, Maharashtra, and Rajasthan accounting for 70% of the country's total production; however a decline in cultivation area is seen in the traditional growing states (Basavaraj et al., 2010). The widespread adoption of better cultivars has resulted in the rapid extinction of pearl millet landraces in the majority of Indian states. Pearl millet is being replaced by more lucrative crops like rice, wheat, maize, and other commercial crops as irrigation becomes more accessible (Pattanashetti et al., 2016).

Nutritional profile of Pearl Millet

The nutritional composition of pearl millet is, on an average, Carbohydrates (67.5g/100g), protein (11.6g/100g), fat (5.75g/100g), and energy (361Kcal/100g).In addition it is rich infibre (1.2g/100g) and many vital vitamins and minerals. Pearl millet has a number of health advantages. It is a good source of fibre, iron, and magnesium and particularly rich in essential elements including thiamin, niacin, and phosphorus.

Carbohydrates **-** Starch, dietary fibre, and soluble sugars are the main types of carbohydrates present in the grain of pearl millet. The expanding power and solubility of pearl millet starches are greater than those of other starches due to their amylose concentration, which ranges from 20 to 21.5%. The starch content of different varieties of pearl millet ranges from 62.8 to 70.5%, while the soluble sugar content ranges from 1.2 to 2.6% and free sugars such glucose, fructose, sucrose, and raffinose are 1.2 to 2.5% (Patni and Agarwal 2017).

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Table1. Essential Vitamins and Minerals present in Pearl Millet Compared to Recommended Dietary Allowance of Women and Men (Singh et al., 2023)

Nutrients	Amount in 100gm	RDA of Women	RDA of Men
Thiamin	1mg	0.9 mg	1.2 mg
Niacin	3.6 mg	14 mg	16 mg
Phosphorous	360 mg	700 mg	700 mg
Iron	3.6 mg	8 mg	18 mg
Magnesium	120 mg	320 mg	420 mg
Fibre	6 gram	25 gm	38 gm

Protein : In addition to being gluten-free and having a better amino acid balance than sorghum, pearl millet grain is also low in the sulfur-containing amino acids lysine, tryptophan, and threonine. Milletsinclude the following protein fractions: albumins and globulins from 22 to 28%, prolamin and prolamin-like from 22 to 35%, and glutelin and glutelin-like from 28 to 32% of the total nitrogen (Nambiar et al., 2011). Compared to other cereals, pearl millet has a greater apparent small intestine amino acid digestibility (Kalinova and Moudry 2006).

Fat : Unsaturated fatty acids make about 75% of the total fat content of the pearl millet. The oil has a greater concentration of n-3 fatty acids than other cereal grains because it contains 4% of the total fatty acids, which are omega 3, linolenic acid (C18:3n-3), or LNA (Nambiar et al., 2011).

Pearl millet for health

Due to the great nutritional profile of pearl millet, which is equivalent to or even better to most of the regularly consumed cereals, they are even referred to as "nutri-cereals" (Florence et al., 2014).

Bajra's chemical makeup has been linked to a number of health-promoting properties; for example, it has high quantities of iron (8 mg/100 g) and zinc (3.1 mg/100 g), which may assist to raise Hb levels (Malik 2015). Pearl millet has a high fibre content (1.2g/100g), making it an excellent source of fibre for persons who need a high fibre diet. This is especially true for those who struggle with constipation or obesity (Malik 2015).

The impact of eating pearl millet (Pennisetumglaucum(L.). R. Br.) on the glucose metabolism of diabetic rats was examined by Nani et al. in 2012. The authors came to the conclusion that eating pearl millet meal would be a good way to treat type 2 diabetes-related hyperglycemia and lessen the severity of the condition as a substitute for prevention (Nani et al. 2012).When compared to other cereal grains, pearl millet has more omega-3 fatty acids, which underlines its potential for use in the treatment and prevention of heart disease, diabetes, arthritis, and some forms of cancer (Goswami et al., 2020).

CONCLUSION :

This article has emphasized the pearl millet's potential characteristics and potential health advantages. Despite being a significant staple meal for many communities throughout the world, pearl millet is still

seen as a food for the underprivileged and is not included on the food shopping lists of the wealthy. Promotion of both traditional dishes derived from pearl millet and special health foods is necessary.

Due to its potential role as a high-energy diet during celiac disorders, diabetes, constipation, and noncommunicable diseases, its usage as therapeutic nutrition should even be studied. ?

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