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AN OVERVIEW ON ECHINOCHLOA FRUMANTACEA MILLETS

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ABSTRACT

Echinochloa frumentacea is also known as Indian barnyard millet or sawa millet or billion dollar grass, which belongs to the species of *Echinochloa*. Both *Echinochloa frumentacea* and *E.esculenta* are called Japanese millet. A serving of barnyard millets gives 75 calories of energy and 1.5g of proteins. Barnyard millet is most effective in reducing blood glucose and lipid level. It also shows a high degree of retro gradation of amylase, which facilitates the formation of higher amounts of resistant starches. Hence it can be potentially recommended for the patients with cardiovascular disease and diabetes mellitus. They are gluten free grains and hence it can be consumed by everyone. The main constituents present in this plant are phenolic acids, tannins and flavonoids, and they are responsible for the antioxidant activity which plays key role in the development of body immune system. It is a gluten free food and hence it is used as to treat constipation, ascites, obesity and diabetes.

INTRODUCTION

Echinochloa frumentacea is also known as Indian barnyard millet, or sawa millet or billion dollar grass is a species of Echinochloa. Both *Echinochloa frumentacea* and *Echinochloa esculent are* called Japanese millet. This millet is widely grown in India, Pakistan and Nepal. Its wild ancestor is the tropical grass *Echinochloa Colona*. It is cultivated on marginal lands where rice and other crops will not grow well. While also being part of staple diet for some communities in India. These seeds are in particular, cooked and eaten during religious fasting [1]. For this reason, these seeds are commonly also referred to as "Vratkechawal" in Hindi (i.e. rice for fasting). Other common names to identify these seeds include "Oodalu" in Kannada, "Jhangora" in the Garhwali Hills, "Bhagar" in Marathi speaking areas and "KuthiraiVaali" in Tamil [2]. The barnyard millet is a wild seed not a grain mainly grown In the hilly areas of Uttaranchal, India. This is the fastest growing crop which can produce ripe grains within45 days from the sowing time under optimal weather conditions. These seeds have a hard-cellulosic layer that humans cannot digest. After the removal of the husk layer the respective millet rice is attained. Small seeds are of processed on grouts. The barnyard millet is tiny, white, round, bigger in size than semolina and small than sago. The barnyard is a wholesome grain over common cereal grains like rice and wheat. It is highly economical and makes a taste full food for all age groups. A serving of barnyard millets gives 75 calories and 1.5g of proteins. It occurs widely in tropical Asia as a cereal and millet. Traditionally the grains of the plant are used to treat biliousness and constipation in as cites, obesity and diabetes. In view of its traditional claim in the treatment of liver disorders. The highest flavonoid concentration

was found in the barnyard millet seed extracts (47.55 mg QE/g extract).The carbohydrate content is low and slowly digestible [3] which makes the Barnyard millet a natural designer food. In the present days of increased diabetes mellitus, barnyard millet could become an ideal food. In barnyard millet the major fatty acid is linoleic acid followed by palmitic and oleic acid. It also shows a high degree of retro gradation of amylase, which facilitates the formation of higher amounts of resistant starches. Hence it can be potentially recommended for the patients with cardiovascular disease and diabetes mellitus. Barnyard millet is most effective in reducing blood glucose and lipid level. In the Indian Himalayan region, barnyard millet is traditionally used a substitute for rice. The grains are dehulled, cooked and consumed like rice. In southern India, barnyard millet is used in traditional preparations such as idly, dosa and chakli. The millet has also been used to develop products such as biscuits, sweets, noodles, rusk, ready mix, popped products and some other specialty foods [4]. They are gluten free grains and hence it can be consumed by everyone. [5]

Scientific Classification

Kingdom : Plantae
Clade: Angiosperms
Clade: Monocots
Clade: Commenlinids
Order: Poales
Family: Poaceae
Sub-family: Panicoideae
Genus: *Echinochloa.*
Species: *E.frumantacea*.
Binomial Name: *Echinochloa frumentacea*.

Fig 1: Seeds of *Echinochloa frumentacea*

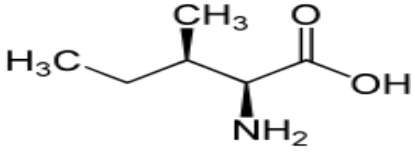
Fig 2: Powder of *Echinochloa frumentacea*

Nutrient composition of barnyard millet (Per 100g)

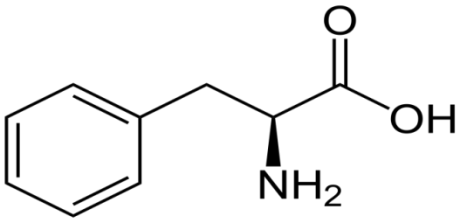
1. Moisture - 8.66 g
2. Protein - 10.52 g
3. Fat - 3.56 g
4. Fiber - 10.1 g
5. Energy - 398 kcal
6. Carbohydrate-65.5 g
7. Minerals - 4.4 mg
8. Calcium - 11 mg
9. Phosphorous - 280 mg
10. Iron - 15.2

Composition of Barnyard Millets

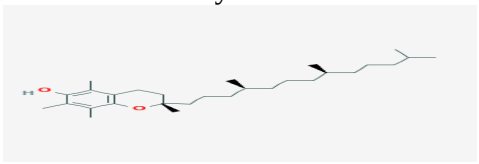
Millets are exclusive among the cereals because of their richness in calcium, dietary fiber, Polyphenols and protein. Millets generally contain fecund amounts of essential amino acids such as Isoleucine, Leucine, Lysine, Methionine, Phenylalanine, Threonine, Valine, Histidine, Tryptophan and Nonessential Amino Acid, Alanine, Arginine, Aspartic acid, Cystine, Glutamic Acid, Glycine, Serine, Tyrosine, Proline. Millets are also rich sources of phytochemicals and micronutrients. Phytochemicals such as phenolic (bound phenolic acid-ferulic acid, free phenolic acid-protocatechuic acid), lignans, β-glucan, inulin, resistant starch, phytates, sterols, tocopherol, dietary fiber and carotenoids are present in millets. The main polyphenols are phenolic acids and tannins, while flavonoids are present in petite quantities; they act as antioxidant and play many roles in the body immune system [6].



Isoleucine



Phenylalanine



Tocopherol

PLANT PROFILE

Barnyard millet has a wide adaptation capacity and can grow up to an altitude of 2000 m above mean sea level during summer season [7]. It is variable in flowering time, inflorescence shape, morphological features, and pigmentation of spikelet's, plant type and other plant traits [8]. The crop plant is a tall, robust annual and grows up to 220 cm high. It has a short generation time, fastest growth among all small millets and completes the life cycle from seed to seed in45–60 days (depending upon accession and growth environment) [9] however, may take longer time under northern hill ecosystem [10] reported that *Echinochloa* millets grow well in different seasons but at high elevations may require 3–4 months to mature. Leaf blades are flat and wide with no ligules. The inflorescence is a terminal panicle 10–25 cm long with dense racemes of 3- to 4-mm-long spike lets. [11] The inflorescence is usually erect, rarely drooping with shapes varying from cylindrical, pyramidal and globose. The spikelet's are green, brown to purple in color and crowded on one side of the rachis. Spikelet's are two flowered, awn less or awned, with red or green lawns and placed on short rough pedicels subtended by two glumes. [12] Lower floret is neuter (sterile) with lemma and small palea, and upper floret is bisexual. [13] The palea is flat, and surface texture is similar to fertile lemma [14] Stamens are three in number, and ovary superior contains two distinct styles with plumose stigma [15]. Grain is 2–3 mm long and1–2 mm wide and enclosed in white shinning hardened lemma and palea. The flowering starts from top of the inflorescence and moves downward completing in 10–15 days. Flowers open from 5 to10 am with maximum number of flower opens between 6 and 7 am [16]. In the individual raceme, the flowering first starts at marginal ends and then proceeds to the middle of the raceme. The flowers are hermaphrodite (have both male and female organs). Before the anthers dehiscence, the stigmatic branches spread, and flower opens [17].Late season florets are cleistogamous (not opening) [18]. It is primarily self-pollinating [19] and self-compatible. Some degree of out crossing recorded which was facilitated by wind pollination. *Echinochloa frumentacea* has smaller awn less spikelet's, with membranous glumes in comparison with large usually awned spike lets and cretaceous upper glumes and lower lemma [20] in *E.esculenta*. Based on inflorescence morphology, the species *E.frumentacea* was classified into four races namely Stolonifera, Intermedia, Robusta and Laxa. Similarly, *E.utilis* (Syn. *E.esculenta*) was classified into two races namely utilis and intermedia. The mean diploid 2C DNA content of barnyard millet is reported to be 2.65–2.7 [21].

Fig 3: Twig of *Echinochloa frumentacea*

Growth and Development

Barnyard millet grown under natural precipitation is a fast-growing annual summer crop for both food and fodder. Rapid growth, drought tolerance and ability to grow in marginal environments make barnyard millet an important crop for famine areas [22]. The crop seeds germinate within approximately 24 h of water imbibitions. After 5 days of emergence, plants produce adventitious roots [23] and the first tillers appear 10 days after emergence Temperature plays a major role in the growth of both the species [24], and low temperature conditions (15/10°C day/night) cease the growth and affect the plant

development particularly leaf area and dry weight. For proper growth of *E. frumentacea*, the optimum temperature range is 27–33°C and 15–22°C day and night, respectively [25]. In high hills of Uttarakhand, *E. frumentacea* and E. esculenta showed significant variation in seedling emergence and other characters in April sowing, whereas the differences were non-significant in May–June sowing

NUTRITIONAL VALUES

- LOW INCALORIES

It is a good source of highly digestible protein and at the same time is least caloric dense compared to all other cereals. It is a grain which makes one feel right and energetic after consumption.

- RICH IN FIBER

It is an excellent source of dietary fiber with a good amount of both soluble and insoluble fractions. The grain encompasses the highest amount of fiber in comparison to other grains. Millets with a serve providing 2.4gms of fiber.

According to study published in the journal of food science and technology, the dietary fiber content of barnyard millet was high (12.6%) including soluble (4.2%) and insoluble (8.4%) fractions. The high fiber content helps in preventing constipation, excess gas, bloating and cramping. [26]

- LOW GLYCEMIC INDEX

The carbohydrate content of barnyard is low and slowly digestible making the barnyard millet a low glycemic index food. The carbohydrates delicious rates in these seeds shows a high degree of retro gradation of amylase which facilitate the formation of higher amounts of resistant starch. Hence it can be potentially recommended for patients with CVS disease and diabetes mellitus. In today's scenario, the millet becomes one of the ideal foods for diabetes.

A study published in the journal of food science and technology showed that supplementation of barnyard millets among diabetes for a period of one week can reduce blood sugar levels.

- GLUTEN FREE FOOD

Like all the millets the barnyard is gluten free. It is an appropriate food for patients who are intolerant to gluten (those with celiac disease) or looking to follow a gluten free lifestyle which eliminates wheat, barley, rye-based foods. The millet is alternative to rice and wheat.

- GOOD SOURCE OF IRON

According to research some variety of barnyard millets have shown a contain high amounts of iron (18.6mg in 100g of raw millet) which was the richest amongst all millets and cereal grains. Barnyard seeds have relatively low carbohydrate content having slow digestibility. This health benefit was exploited in a research by Surekha by preparing value added low glycemic index noodles from barnyard millets.

PHARMACOLOGICAL USES

1. ***Anti Diabetic Activity:***

Lower prevalence of diabetes has been reported in millet-consuming population. Millet phenolics inhibits like alpha-glycosidase, pancreatic amylase reduces postprandial hyperglycemia by partially inhibiting the enzymatic hydrolysis of complex carbohydrates. Inhibitors like aldose reductase prevents the accumulation of sorbitol and reduce the risk of diabetes induced cataract diseases.[27]

2. ***Cardio Protective Activity:***

Millets are good sources of magnesium that is known to be adept of lessening the effects of migraine and heart attack. Millets are rich in Phyto-chemicals embracing phytic acid which is known for overcastting cholesterol. Millet may forefend cardiovascular disease by reducing plasma triglycerides in hyperlipidemic rats. [28]

3. ***Role of Millet in Celiac Diseases:*** Celiac disease is an immune-mediated enteropathy prompt by the gulp of gluten in genetically susceptible individuals. Millets are gluten-free, therefore an incomparable option for people anguish from celiac diseases and gluten-sensitive patients often irritated by the gluten content of wheat and other more prosaic cereal grains. [29]

4. ***Anti Cancer Activity:***

Millets are known to be rich in phenolic acids, tannins, and phytate

that act as "antinutrients" However; these antinutrients curtail the fortuity for colon and breast cancer in animals. It is trot out those millet phenolics may be cogent in the interception of cancer tenderness and progression in vitro. [30]

5. ***Anti Inflammatory Activity:***

Ferulic acid is very strong antioxidant, free radical scavenging and anti-inflammatory activity. Antioxidants axiomatically prevent tissue damage and impel the wound healing process. It is reported good antioxidant effects of finger millet on the dermal wound healing process in diabetes lured rats with oxidative stress mediated modulation of inflammation. [31]

6. ***Anti Aging Property:***

The chemical counteraction between the amino group of proteins and the aldehyde group of reducing sugars, termed as non-enzymatic glycosylation, is a main aspect responsible for the aggravations of diabetes and aging. Millets are rich in antioxidants and phenolic; like phytate, phenols and tannins which can furnish to antioxidant activity important in health, aging, and metabolic syndrome. [32]

7. ***Anti Microbial Activity***

Millets chunk and essence have been found to have antimicrobial activity. Seed protein extracts of pearl millet, sorghum, Japanese barnyard millet, foxtail millet, samai millet and pearl millet were evaluated in vitro for its ability to inhibit the growth of Rhizoctonia solani, Macrophomina phaseolina, and Fusarium oxysporum. Protein extracts of pearl millet are highly trenchant in arresting the surge of all 3 examined phytopathogenic fungi. [33]

DISCUSSION & CONCLUSION

Echinochloa frumantacea is also called as Indian barnyard millet, sawa millet or billion dollar grass is a species of echinochloa. It is mainly grown in the hilly areas of Uttaranchal, India. It is widely grown as a cereal in India, Pakistan and Nepal. It is especially eaten during fasting days. The chemical constituents present in these seeds are leucine, lysine, methionine, phenyl alanine, valine, histidine, tryptophan, alanine, arginine, aspartic acid, cysteine, glutamic acid, glycine, serine, tyrosine, phenolic, lignin, inulin, tocopherol, carotenoids, diethyl fibers, phenolic acids & tannins. It is a gluten free food and hence it is used as to treat biliousness, constipation, in as cites, obesity & diabetes.

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