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## An overview of Barnyard millet (*Echinochloa frumentacea*)

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**Abstract**

Barnyard millet (*Echinochloa frumentacea*) belongs to the family Poaceae and it is self-pollinated crop. Barnyard millet is the oldest domesticated small millet. In India it is mainly cultivated in Orissa, Maharashtra, Madhya Pradesh, Tamil Nadu, Bihar, Punjab, Gujarat and hills of Uttarakhand. It is a good source of protein about 10.5%, highly digestible and an excellent source of dietary fibre. Barnyard millet is the minor kharif crops in Uttarakhand and grows under rainfed conditions. Barnyard millet contains about 8.7 – 9.63% moisture. The carbohydrate content in barnyard millet is low and also slowly digestible. It is ideal food for the patient suffering from diabetes mellitus. Even though barnyard millet is nutritionally superior to cereals and has the potential to provide food and nutrition but their utilization is still limited.

**Keywords:** Barnyard millet (*Echinochloa frumentacea*), Value added, Health Benefits

**Introduction**

Barnyard millet is the oldest domesticated small millet. There are two main species of Barnyard millet, the one is *Echinochloa esculenta* which is Japanese Barnyard millet or Japanese millet and other is *Echinochloa frumentacea* which is Indian Barnyard millet. The Indian barnyard millet is also known as Billion Dollar Grass. (USDA NCRS., 2002) [24]. *Echinochloa frumentacea* belongs to the family Poaceae and it is self-pollinated crop. *Echinochloa frumentacea* is the hardest millet and commonly known by several names viz; *Sanwa* and *Jhangora* (hindi), *Shyama* (sanskrit), *Oodalu* (kannada), *Kuthiravaali* (tamil), *Udalu* and *Kodisama* (telugu), *Shamul* (marathi), *Sama* (gujarati), *Shamula* (bengali) and *Swank* (punjabi). It is cultivated in many countries such as; India, China, Japan, Malaysia, East Indies, Africa and United States of America. (Anuradaha *et al.*, 2014). In India it is mainly cultivated in Orissa, Maharashtra, Madhya Pradesh, Tamil Nadu, Bihar, Punjab, Gujarat and hills of Uttarakhand. (Kumar *et al.*, 2000) [8].



**Barnyard Millet Grain**

In India, barnyard millet is developed in the Himalayan area from the north to the Deccan region in the south. Barnyard millet is one of the minor cereal kharif crops of Uttarakhand and grown under rainfed condition in hills up to a higher of 2000m from sea level. It is commonly developed in slope of hilly areas and undulating fields of hilly, marginal, or tribal areas, where

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barely any alternatives exist for crop enhancement. Introducing the two tamed species, the class incorporates around 20–30 yearly and lasting wild species dispersed overall a considerable lot of which can develop in wet or very much watered circumstances and contend effectively with rice. (Hilu., 1994)<sup>[4]</sup>.

Diversity in barnyard millet has fast eroded, due to a full-size reduction in changing socio-cultural and monetary dimension of the farming network in India. (Sood *et al.*, 2015)<sup>[17]</sup>. Barnyard millet (*Echinochloa frumentacea*) is the minor millet which is emerged as very essential dual-motive crop for feed and fodder. They have specific adaptation properties for negative degraded land and capacity to tolerate the abiotic strain and grown in extreme climatic condition.

Nutritional composition of barnyard millet in per 100gm is; 10.1% protein, 8.7% moisture, 3.9% fat, 6.7% crude fiber, 2.0% total fat, 68.8% carbohydrate and 398 kcal/100 g energy. In the barnyard millet total dietary fiber content was high (12.5%) including soluble (4.2%) and insoluble (8.4%) fractions was recorded. (Ugare *et al.*, 2014)<sup>[23]</sup>

**Table:** Nutritional Composition of Barnyard Millet in Per 100g

Compositions	Values
Moisure	8.74%
Protein	10.1%
Fat	3.9%
Crude fibre	6.7%
Total minerals	2.1%
Carbohydrate	68.8%
Total dietary fibre	12.5%
Insoluble dietary fibre	8.4%
Soluble dietary fibre	4.2%
Phosphorus	281 mg
Iron	5 mg
Magnesium	83mg
Calcium	19mg

**Source:** - IFCT 2017, Nutritive value of Indian Food, 2009.

Barnyard millet is a multi-reason crop. Nutritionally, it is a decent source of protein, which is profoundly absorbable and is an amazing source of dietary fibre. Carbohydrate present in barnyard millet is low and slowly digestible, which makes the barnyard millet a natural gift for the mankind. In barnyard millet the significant unsaturated fats are linoleic acid and oleic acid. It shows the high level of retrogradation of amylase, which encourages the development of higher measures of resistant starch. Consiquently can be suggested for the patients with cardiovascular sickness and diabetes mellitus. (Rao *et al.*, 2017)<sup>[12]</sup>

Now a day the interest of customers is increase for the healthy nutrition rich food products. These products are categorised by rich and high quality of protein content, high fibre substances etc. Many industries are trying to figure out serviceable or useful products which are more affordable, easily reachable and must have to satisfactory practices and physical properties (Thongram *et al.*, 2016)<sup>[21]</sup>. The use of barnyard millet should be investigated to produce new products such as puff, cookies, noodles and pasta, fermented products, etc.

Many researchers have work to attempt to produce composite millet flours by supplanting regular oat flours somewhat in making of the traditional food items, prepared to-utilize or RTE food items. Singh *et al.* (2005)<sup>[15]</sup> arranged composite flours offoxtail, barnyard millet and finger millet with wheat flour by including 10-30% millet flour and saw that expansion of processed millet flour to wheat flour expanded the merging

of protein, fat and ash content however reduced the carbohydrate content. Expansion of processed barnyard millet flour expanded essentially ( $p < 0.01$ ) the degree of protein, total ash content and crude fibre however entire barnyard millet flour reduced basically ( $p < 0.01$ ) the degree of protein. With the expansion in the degree of finger millet flour in the mix, protein content diminished from 11.59 to 10.99% while fat and ash content expanded from 1.06 to 1.37 and 0.55 to 1.37% separately with nonsignificant variety in starch content.

### Value added products from Barnyard Millet

Puffing of grains is an old conventional process of cooking grains to be consumed as snacks or breakfast cereals either plain or with a few flavours/salt/sugars. Starch is the major component in human nourishment and offers a scope of required innovative properties. The good quality of starch clearly relies upon starch structure and on its preparing (Lehmann and Robin, 2007)<sup>[9]</sup>.

Jaybhyae and Srivastav (2010) formulate (RTE) barnyard millet (*Echinochloa frumentacea*) based snacks by making slim rectangular formed, steam cooked cold extrudate trials and puffing them with HTST puffing process. It was seen that appropriate level of ingredients and moisture content were the basic variables for making and cutting the mixture in shape done by dolly pasta machine. The samples ready from barnyard millet, potato poundand custard powder mixture in the extent of 60:37:3 were steam cooked and puffed in hot air at ideal temperature (238 °C) and time (39.35 secs) to deliver puffed item with a development proportion of 2.05 having moisture content of 0.09 kg/kg dry bases. After puffing the item was oven toasted at ideal toasting temperature and time mix of 116.26°C and 20.23 mins individually to get toasted snack food with moisture content (0.0464 kg/kg), freshness (18.45 +ve tops), color (L-value - 69.79), and hardness (362.64 g). During the procedure popped/puffed grains/items are dried out to the very low level of moisture content (3-5%), which serves to improve the time span of usability.

Noodles are produced using the flours of grains or leguminous plant as major ingredient and the dried food items are utilized as ready-to-eat. Noodles are the pasta items otherwise called convenient food product ready through cold expulsion process which become hard and stiff after drying. The cooking of these noodles is convenient and requires few mins (Devaraju *et al.*, 2006)<sup>[3]</sup>. Noodles are one of the most favourite food products between all age groups and they are having longer shelf life and profitable value. Barnyard millet has moderately low sugar content (58.56%) having slow edibility of 25.88% (Veena, 2003)<sup>[25]</sup>. This good advantage of millet was utilised by formulated low glycaemic index noodles from barnyard millet flour with the combination of sago flour, pulse flour and bengal gram leaf powder at various levels to create plain, pulse and vegetable noodles separately (Surekha *et al.*, 2013)<sup>[19]</sup>.

Srivastava *et al.* (2003)<sup>[18]</sup> developed popped grains from barnyard millet, foxtail and little millet utilizing normal salt as warming medium in an open iron saucepan containing samples and salt in the proportion 1:20 at 240-260 °C for 15-25 s. The sensory analysis scores on nine-point hedonic scales for first and second sort ladoo were 5.0-6.9 and 7.2-8.1. The product developed from foxtail millet had higher estimations of protein and calcium than those dependent on barnyard millet.

Bakery food items are well known everywhere throughout the world furthermore, and has highly demandable due to low

cost, variation in taste and texture, attractive packaging and longer shelf life (Patel and Rao, 1996) [11]. The utilization of millets in bakery food items won't just be main as far as fibre content, micronutrients yet they have a potential for millets to enter in the bakery industrial world for arrangement of significant worth included items (Verma and Patel, 2013) [26]. Biscuits formed with substituting 50% of refined wheat grain flour with barnyard millet flour had lower glycemic index, GI (50.17) in comparison to the glycemic index of wheat biscuits (73.58) without tons difference in the nutrient composition. (Shrivastva *et al.*, 2005)

Naik *et al.*, (2013) [19] developed value added cookies barnyard millet cookies with the combination of sago flour, pulse flour and vegetable flour. The plain cookies were 100% barnyard flour, pulse cookies contain 10% of soy bean and green gram dhal flour and vegetable cookies contain 10% of dehydrated carrot. Among all the three, pulse cookies are more acceptable by the consumers which are 85% and the formulated cookies have shelf life of 45-60 days.

Nazni and Karuna (2016) [10] developed the muffin and rusk from the Barnyard millet bran. The wheat flour is combined with barnyard millet bran at different ratio: V1 (100:0), V2 (95:5), V3 (90:10), V4 (85:15), V5 (80:20), V6 (75:25) and V7 (70:30) for both muffin and rusk. The sensory score of rusks V4 (85:15) is more acceptable by the panel of judges and for muffin is V7 (70:30) is highest score among all the samples.

**Health Benefits:** Barnyard millet is recommended to patient who suffers from Cardiovascular diseases and diabetes. They are also most effective to reduce the blood glucose level and lipid level. The barnyard millet ideal millet for those patients who have gluten intolerance which cause celiac disease.

- **Diabetes:** In spite of the fact that barnyard millet comprises of good measure of starch, it is end up being low in sugar content. It makes barnyard millet as excellent for individuals with diabetes. It is conceivable since diabetic consume the food with low glycemic index. The diabetic can keep away from shoot up glucose by substituting white rice with barnyard millet. Lower occurrences of diabetes have been revealed in barnyard millet overwhelming populace. Millet phenolics constrains like alpha – glucosidase, pancreatic amylase decreases postprandial hyper glycemia by limited constraining the enzymatic hydrolysis of complex sugars (Shobana *et al.*, 2009) [14]. Inhibitors like aldose reductase avoids the aggregation of sorbital and decrease the risk of diabetes persuaded cataract illnesses (Chethan *et al.*, 2008) [2]. Dehulled and heat-treated barnyard millet are beneficial for the Type II diabetes in which low glycemic index for dehulled millet (50.0±4.19) and heat rewarded was recorded (41.7±2.55) (Ugare *et al.*, 2011) [22].

- **Cardiovascular diseases:** Obesity, smoking, undesirable eating routine and physical dormancy increment the danger of heart disease and strokes. A large portion of the world nations face high and expanding paces of disease related to cardiovascular. It has been exhibited that rodents feed with diet of native and treated starch from barnyard millet had the most minimal blood glucose, serum cholesterol and triglycerides as compared with and rice and other minor millets (Kumari and Thayumanavan 1997) [7].

- **Celiac disease:** In other words, celiac disease is also known as celiac sprue, nontropical sprue, and gluten-delicate enteropathy. The specific reason of celiac ailment isn't clear, yet it known to have a hereditary (inhibited) segment. Celiac illness is an autoimmune system illness, where the immune system attacking the ordinary tissue, especially the inward lining tissue of the small intestine, because of eating gluten, the wheat protein. The particular response that prompts irritation is called prolamins. They are found in specific grains; such as gliadin in wheat, secalin in rye, horedin in grain, and venin in oats (Rao *et al.*, 2018) [13]. According to Thompson (2009) [20] the products made from wheat, rye, barley is replaced with gluten free grains such as sorghum, barnyard millet; buckwheat is helpful for people to obeying gluten free diet.

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