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Convenience foods from foxtail millet and garden cress seed

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■ **Abstract :** India is a major millet producing with 38.6% of total millet producing of world and one of the countries of major utilization. Millets are comparative with major cereals like wheat and rice with respect to nutritional value and parts of diet of poor due to less cost. Convenience foods impact convenience to the consumers with, no requirement of major processing or cooking before consumption. Instant upma mixes are the most convenient stable foods which required reconstitution in boiling water for 2 to 10 min. Rapid urbanization, industrialisation and changes in eating habits of people lead to development of such foods. Millets contains vitamins, minerals, sulphur containing amino acids and some phytochemicals and therefore described as nutritious millets, which release sugars slowly and thus have a low glycaemic index and can do ideal foods for diabetes and also free from gluten makes than ideal for celiac peoples. Market available ready to cook mixes are deficient in essential macro and micro nutrients. Foxtail millet (*Setaria italica*) has good nutritional profile as compared to rice and wheat in item of nutrients. Garden cress (*Lepidium sativum*) due to their high potential in health promotion and disease prevention can be incorporated in instant upma mix at low level. Popping of foxtail millet and garden cress seeds imparts acceptable taste and desirable aroma. It also reduces the level of antinutrients such as tannin, phytic acid and oxalic acids and improved the digestibility of starch and protein *in vitro*.

■ **Key words :** Convenience foods, Foxtail millet, Garden cress, Popping, Digestibility

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The last decade and half has seen a remarkable growth in the working women segment in India andso has the manufacture of convenience food industry grown in the last decade (Srinivasan and Shende, 2015). He studied that working women in Indiawho today are not only just seeking jobs but also are career oriented. Apart from their jobs, career, meetings and targets they are also a part of a family where a working woman needs to care of their meals too. The term "convenience foods" is used for a very heterogeneous group of foodswhich vary in composition, shape, size, method of preparation and processing, andeven with regard to their functions in the diet. These literally range from simple friedto roasted nuts to ready-mixes to canned and frozen foods to sophisticated warm-andservetype TV dinners (Arya, 1992).

Foxtail millet (*Setaria italica)* contains significant levels of protein, fibre, mineral, andphytochemicals. Anti-nutrients such as phytic acid and tannin present inthismillet can be reduced to negligible levels by using suitable processingmethods. The millet is also reported to possess hypolipidemic, low-glycemicindex, and antioxidant characteristics. This review concludes that, likemost millet varieties, foxtail millet remains under-utilized as a food

source.It is however receiving increased research and commercial attention,especially because its cultivation is not too demanding from point ofview of agricultural inputs and it can grow in difficult terrains. It wouldbe reasonable to surmise that foxtail millet has a promising role to play inenhancing nutritional and food security (Sharma and Niranjan, 2018).

Hyperglycemia is the scientific term used for high blood glucose (blood sugar), which is caused when the body has too little insulin or when the body cannot use insulin properly.Hyperlipidemia is the term usedto denote raised serum levels of one or more of total cholesterol,low-density lipoprotein cholesterol, triglycerides, or both total cholesterol and triglycerides (combined hyperlipidemia). Both these conditions are the possible outcomes of chronic diabetes.According to WHO, a high rise in the incidence of diabetes mellitus type 2 has been seen more rapidly in middle- and low-income countries with an estimated 422 million adults suffering fromthis health-threatening condition in the year 2014 (WHO, 2016).

Garden cress seed (*Lepidium sativum)* The seeds are aperients, diuretics, demulcent, aphrodisiac, carminative, galactogogue and emmenogogue. Paste of seeds is used against lumber pain and tea of seeds is useful in hiccups (Kirtikar and Basu, 1975). It also has anti carcinogenic properties (Sood *et al.,* 2005). Seeds are useful in bronchitis (Sood *et al.,* 2011). Cress seeds are largely used for the treatment of many diseases such as hypertension, renal disease, gastrointestinal disorders and asthma. The seeds are thermogenic, depurative, rubefacient. They are useful as poultices for sprains and in leprosy, skin diseases, spleenomegaly, ophthalmopathy, scurvy, seminal weakness, and hemorrhoids (Prajapati *et al.,* 2003). In Punjab, the plant is administered in case of asthma, cough with expectoration and bleeding piles (Kirtikar and Basu, 1975).

The seeds comprise 33-54 per cent of carbohydrate, 22-25 per cent of protein, 14-27 per cent of lipids and 8 per cent of crude fibre (Gokavi *et al.,* 2004). It also contains good amount of calories (454Kcal/100g). It is a good source of thiamine (0.59mg/100g), riboflavin (0.61mg/100g) and niacin (14.3mg/100g).It acts as memory boosters as it contains essential fatty acids like arachidic (2-3.5 %) and linoleic acid (8.5-11.5%) (Diwakar *et al.*, 2010, Zia –Ul-Haq *et al.*, 2012, Mohammad, 2013) and alpha linolenic acid (34 %) (Diwakar *et al.*, 2010, Dutta *et al.,* 2011). It is a good source of calcium (377 mg/100g) and magnesium (430mg/100g) which helps in normal contraction of muscle for healthy movements of limbs and heart. Iron content (30-90 mg/100g) in the seed powder often helps to cure mild anaemic conditions, especially in children. Phosphorus (723mg/100g) is needed for general healthy metabolic activities of the body. It also contains antioxidants such as tocopherols and carotenoid (Diwakar *et al.*, 2010 and Dutta *et al.*, 2011). It can be said that garden cress seeds are packed with power of nutrients.

An instant an instant upma mix was developed that can be reconstituted in 6 minutes in boiling water and investigated role of packaging and fatin the storage stability of the product. It was reported that the mix remained stable at R.T. for 10 months and 3 months, respectively in PFP laminate and PP pouches. Use ofVanaspati provided better stability than RBD palm oil. It was also found that change inperoxide value (PV), free acids (FFA) and Malonaldehyde content (MA) duringstorage did not correlate with acceptability scores (Dhumaketi *et al*., 2017).

Popping :

Popping is a simultaneous starch gelatinization and expansionprocess, during which grains are exposed to high temperatures for shorttime. During this process, super-heated vapour produced inside the grainsby instantaneous heating, cooks the grain and expands the endospermsuddenly, breaking out the outer skin. Mishra *et al*. (2014) stated that popping imparts acceptable taste and desirable aroma to the snacks. Thereare different methods of popping used *viz.*, conventional method ofdry heat, sand and salt treated, hot air popping, gun popping, popping in hotoil and by microwave heating. Though a wide range of cereals and milletssuch as rice, wheat, corn, sorghum, ragi, foxtail millet are used for popping; only few of them pop well. The reason behind this may bethe factors which influence popping qualities of cereals, such as season, varietal difference, grain characteristics such as moisture content,composition of grain, physical characteristics, types of endosperm, and also the method of popping.

Jaybhaye *et al.* (2014) stated that popping can be accomplished byusing dry heat such as sand roasting, roasting usingsalt, gun puffing, hot oil frying, using heating

mediumsuch as hot air or microwave radiation. Hoke *et al.,* (2005) reported that in India, themost frequent way is, popping in hot sand (temperatureof sand is about 250°C) or in oil (200-220°C).

Table 1 : Proximate composition (%dwb) of raw and popped foxtail millet

Nutrients	Raw	Popped
Crude protein	11.1 ± 0.17	12.0 ± 0.32
Fat	8.6 ± 0.17	5.5 ± 0.24
Total minerals	3.3 ± 0.02	2.7 ± 0.03
Crude fibre	8.2 ± 0.09	3.7 ± 0.20
Carbohydrate	68.8 ± 0.23	76.1 ± 0.38
Energy(kcal/100g)	396.9 ± 1.24	401.9 ± 1.16

Source: Nutritional evaluation of popped and malted indigenous millet of Assam (Choudhury *et al.,* 2011).

Starch and Protein digestibility :

Tovar *et al*. (1991) showed that starch digestibility of popped foxtailmillets significantly increased by 42.4%. This has been attributed to the release of starch granules from the protein matrix, making the starch content more susceptible to enzymatic digestion. An increase in digestibility after thermal treatments may be attributed to some factors like cell wall encapsulated starch, and physical disintegration of seeds.

Hulse *et al*. (1980) concluded that protein digestibility of foxtail millet increased significantly after popping. The increase in digestibility was recorded as 10.7%. This might be due to the localized rupture of the cell wall which occurred in the expanded endosperm during popping. Rao and Deosthale (1983) concluded that anti-nutritional factors are also get reduced during puffing and this could be the probable reason for increased in vitro protein digestibility.Kaur and Kapoor (1990) studies indicated that the decrease in the levels of anti-nutrients during heat treatment might be mostly responsible for the improved in vitro starch digestibility.

Kataria and Chauhan (1988) showedthat the enhanced in vitro starch digestibility during these processes might be partly due to the swelling and rupturing of starch granules as well as the activation of amylase and phosphorylase.Khalil and Mansour (1995) reported that *in vitro* protein digestibility improved on heat treatment most probably due to decrease in phytic acid and other antinutrients which unbound the protein from protein complexes. Antinutrients, including phytic acid, condensed tannins and polyphenols which are known to interact with protein to form complexes and decrease the solubility of proteins and making protein complexes less susceptible to proteolytic attack than the same protein alone. Improvement of protein digestibility after processing could be attributable to the reduction or elimination of these antinutrients. Jain *et al.* (2016) analyzed *in vitro* starch digestibility of raw garden cress seeds as25.44±0.44 per cent. A non-significant increase of 5.01 per cent was observed in case of roasting (26.71±0.96%).

Benefits of convenience food :

Convenience food reduces the time requiredfor pre-preparation and to some extend even cookingtime required. Hence, significant time can be saved where preparation from scratch for any meal can be avoided. Due to the various techniques used in theconvenience food manufacturing process one is able to geta lot of variety in the market. In fact, the amount of varietyavailable in the stores today does put a working woman ina fix on the choice that she needs to make. Another pointto be noticed is that this variety remains constant in themarket and does go off shelf citing seasonal reasons likethe fresh fruits and vegetables do. One can read the contents and detailing on thepackaging of the convenience product and decide towhether heath aspects are preferred or not. These products are convenient to carry, stackand store them since their packaging are well plannedconsidering various factors like consistency, texture, sizeand fragility. Most convenience foods have a longer shelflife due to additives and the same is also mentioned onthe package hence the user is well informed of its usageperiod. Storage of convenience foods is easy as theycan be stacked up anywhere and can also help betterutilization of the space available. Regeneration is alsofaster and better. Convenience food helps saving labour inthe terms of going to market for purchase, pre-cleaning,pre-preparation and post preparation cleaning. The new techniques used in the manufacturingand packaging of convenience like aseptic canning, rapidfreezing, various methods of eradicating bacteria reducesits presence and also reduces spoilage of food to a greatextent if stored properly. Many a time the working womandoes have requests from her own home or she herselfwants to try preparing something of which recipe mightnot be known to her. Hence she looks out for such productsfor which she need not bother to know how to

prepare itrather she would use the convenience of such availableproducts.Certain fresh products might not be availablethroughout the year due to their seasonal availabilitywhereas convenience products are manufactured usingstringent quality standards hence their availability besidesbeing consistent also has consistent taste, texture and taste.

Conclusion :

Instant upma mix could be a new product from popped foxtail millet and garden crees seed, which can offer inherent health benefits for the people suffering from metabolic disorder. It can be concluded that utilization of popped foxtail millet and garden cress seeds improved the quality of instant upma mix in term of nutrient density and sensory attributes. There has been a tremendous growth of the conveniencefood industry in India in the last decade. Many minor and major companies have opened door to consumers totry out their convenience product. A lot of investment isdone by these manufacturing companies in advertisingtheir products through different media to attract moreconsumers. Convenience food is surely gaining popularityamongst all ages today. The working women are not leftfar behind in this.

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REFERENCES

Arya, S. (1992). Convenience foods – Emerging scenario. *Indian Food Industry*, **11**(4) : 31-41.

Dhumketi, K., Singh, A. and Rajput, L. (2017). Suitability of foxtail millet semolina and soy grits for the formulation of instant upma mix. *Internat. J. Chemical Studies*, **5**(5) : 75-79.

Diwakar, B.T., Dutta, P.K., Lokesh, B.R., Kamatham and Naidu, K.A. (2010). Physicochemical properties of garden cress (*Lepidium sativum* L.) seed oil. *J. Am. Oil Chem. Soc.*, **87** : 539-48.

Dutta, P.K., Diwakar, B.T., Viswanatha, S., Murthy, K.N. and Naidu, K.A. (2011). Safety evaluation studies on Garden cress (*Lepidium sativum* L.) seeds in Wistar rats. *Internat. J. Appl. Resources Nat. Products*, **4** : 37-43.

Gokavi, S., Malleshi, N. and Guo, M. (2004). Chemical composition of garden cress (*Lepidium sativum*) seeds and its fractions and use of bran as a functional ingredient. *Plant Foods Human Nutrition,* **59** : 105-11.

Hoke, K., Housova, J. and Houska, M. (2005). Optimum conditions of rice puffing. *Czech J. Food Sci.*, **23** :1-11.

Hulse, J., Laing, E. and Pearson, O.E. (1980). Sorghum and millets: Theircomposition and nutritive value. *Chapter V. Academic, New York*, 396–478

Jain, T., Grover, K. and Kaur, G. (2016). Effect of processing on nutrients and fatty acid composition of garden cress seed (*Lipidium sativium*). *J. Food Chem.*, **213** : 806-812

Jaybhaye, R., Pardeshi, I., Vengaiah, P. and Srivastav, P. (2014). Processing and technology for millet basedfood products: a review. *J. Ready Eat Food.*, **1**(2) : 32-48.

Kataria, A. and Chauhan, B. (1988). Content and digestibility ofcarbohydrates of mung beans (*Vigna radiata* L.) as affected bydomestic processing and cooking. *Plant Foods Human Nutrition*, **38** : 51–59

Kaur, D. and Kapoor, A. (1990). Starch and protein digestibility of ricebean (*Vigna umbellata*): effect of domestic processing andcooking methods. *Food Chem.*, **38** : 263–272.

Khalil, A. and Mansour, E. (1995). The effect of cooking, autoclaving and germination on the nutritional quality of faba beans. *Food Chem.*, **54** : 177-82.

Kirtikar, K. and Basu, B. (1975). *Indian Medicinal Plants*,174.

Mishra, G., Joshi, D. and Panda, B. (2014). Popping and puffing of cereal grains: A Review. *J. Grain Processing & Storage*, **1**(2) : 34-46.

Mohammed, A.R.F. (2013). Preparation and characterization of protein isolate and biodiesel from garden cress seed. *European J. Chem.*, **4** : 85-91.

Prajapati, N., Purohit, S., Sharma, A. and Kumar, T. (2003). *A Handbook of Medicinal Plant, A Complete Source Book*, 312-13.

Rao, D. and Deosthale, Y. (1983). Mineral composition, ionizable iron and soluble zinc in malted grains of pearl milletand ragi. *Food Chem.*, **11** : 217–223.

Sharma, N. and Niranjan, K. (2018). Foxtail millet : Properties, processing and health benefits. *Food Reviews: Internat.*, **34**(4) : 329-363.

Sood, S., Parmar, S. and Lakhanpal, T.N. (ed) (2005). *Ethnic Plants of India, Used in Cancer Cure, A Compendium*,172.

Sood, S.K., Kaushal, S., Lakhanpal, T.N. and Kumar, S. (2011). Ethnic healing herbs for cold, flu and lung oilments. Days Publishing House, Delhi, p. 113.

Srinivasan, S. and Shende, K. (2015). Study on benefits of convenience foods to working women. *Atithya: A Journal on Hospitality,* **1**(1) : 56-63.

Tovar, J., de Francisco, A., Bjorck, I. and Asp, N.G. (1991). Relationship between microstructure and *in vitro* digestibility of starch inprecooked leguminous seed flours. *Food Structure,* **10** : 19–26

World Health Organization (WHO). *Global Report on diabetes*, 2016.

Zia-Ul-Haq, M., Ahmad, S., Calani, L, Mazzeo, T., Rio, D., Pellegrini, N. and De Feo, V. (2012). Compositional study and antioxidant potential of Ipomoea *hederacea* Jacq. and *Lepidium sativum* L. seeds. *Molecules,* **17**,10306-21.