

Effect of *Ragi* (*Eleusine coracana*) for the development of value added products and their nutritional implication

■ MANVI RASTOGI AND MAMTA JOSHI

Received: 21.11.2014; Revised: 01.03.2015; Accepted: 11.03.2015

■ **ABSTRACT** : The paper is an extension of minor research project titled effect of *Ragi* (*Eleusine coracana*) for the development of value added products and their nutritional implication. The present study was carried out to utilize, develop and evaluate value added products of underutilized grains like *Ragi* for their sensory characteristics. The products which Uttipam, with in the ratio of 75 per cent semolina and 25 per cent *Ragi* flour. Cutlets, with in the ratio of 60 per cent potato, 15 per cent bread and 25 per cent *Ragi*, 60 per cent bread. Disco wheel with in the ratio of 60 per cent bread, 15 per cent vegetables and 25 per cent of *Ragi*, respectively. All the products were found acceptable by the panel of judges. It is concluded that all the four products viz., uttipam, cutlets, disco wheel, were acceptable in terms of colour, flavour wise uttipam, Disco wheel (90 %) liked very much as cutlets (75 %) liked moderately. Over all acceptability of uttipam, disco wheel were high whereas cutlets was least acceptable. So, incorporation of *Ragi* flour into existing dietary pattern is very beneficial because of its therapeutic benefits.

■ **KEY WORDS**: *Ragi*, Cereals, Value added, Nutritional implication

■ **HOW TO CITE THIS PAPER** : Rastogi, Manvi and Joshi, Mamta (2015). Effect of *Ragi* (*Eleusine coracana*) for the development of value added products and their nutritional implication. *Asian J. Home Sci.*, **10** (1) : 1-5.

See end of the paper for authors' affiliations

MANVI RASTOGI
Department of Home Science,
Teerthanker Mahaveer
University, MORADABAD (U.P.)
INDIA

Cereals and millets have been an essential part of the human diet since the beginning of agriculture. They have played an essential role in world history and the evolutions of certain civilization coincide with the cultivation of cereal grain.

Cereals and millets used for human consumption belong to the grass family and are seeds of matured plants, in which nature has stored the elements for the germination and growth of the germ such as starch, fat, protein, organic minerals salts and vitamins. The important

cereals cultivated all over the world are rice, wheat, corn, barley, oats and millets (<http://www.naturalhealthcare.org/food/health-benefits-of-cereals.html>).

Ragi (*Eleusine coracana*) is a minor millet consumed by the economically weaker section of the population especially by south India rural folk. It is a hardy crop that provides high quality nutrition at a low price. *Ragi* also known as Madua or finger millet or nachni or rollu or sattemaw, grows well without irrigation pesticides or fertilizer so small millet are very important crops for

the Himalaya regions. It is an underutilized grain which is inexpensive, easy to cook and rich in vitamins and minerals and in addition, provides roughage. Majority of people in India are economically poor and their choice for a balanced diet is further restricted by poverty and insufficient supply of nutrition foods. In order to arrest the situation, much attention has been centered on the exploitation and utilization of unusual plant materials like *Ragi* for foods (Marfo *et al.*, 1988) consumed regularly, *Ragi* could help in keeping malnutrition, degenerative diseases and premature aging at bay. Green *Ragi* is recommended for conditions of blood pressure, liver disorders, asthma and heart weakness. Green *Ragi* is also recommended to lactating mothers in condition of lack of milk production. *Ragi* is an extremely nutritious cereal and is very beneficial for maintaining a good health. *Ragi* roti, *Ragi* dosa, *Ragi* porridge, *Ragi* upma, *Ragi* cakes, *Ragi* biscuits are few popular dishes of *Ragi* (<http://www.nutritiousIndianrecipes,recipe.in>).

Ragi is usually converted to flour and variety of preparation like cheela, ladoo, salty porridge. Traditionally it is used as an infant weaning food in south India (Meera, 1997).

Cereals form a major portion of human diet and are an important source of starch and other dietary carbohydrates (dietary fibre), which play an important role in the energy requirement and nutrient intake of human. The millets are with higher fibre content and their protein quality and mineral composition contribute significantly to nutritional security of a large section of population residing in the millet growing areas, considered to be the most disadvantaged groups (Desai, 2010).

Millets are most recognized nutritionally for being a good source of minerals magnesium, manganese and phosphorus. Research has linked magnesium to a reduced risk for heart attack and phosphorus is important for the development of body tissue and energy metabolism. Millets are also rich in phytochemicals, including phytic acid (Shashi *et al.*, 2007).

Finger millet also known as *Ragi* in India is one of the important cereals occupies highest area under cultivation among the small millets. Finger millet is comparable to rice with regard to protein (6-8 %) and fat (1-2 %) and is superior to rice and wheat with respect to mineral and micronutrient contents. It is a major source of dietary carbohydrates for a large section of society. Additionally *Ragi* has enormous health benefits and also a good source of valuable micro-nutrients along with the

major food components. In order to develop the value added food products based on *Ragi*, that can able to enrich the nutritional value and also beneficial for good health is the current need for the wellbeing of the society. Food is consumed in combinations (Lakshmi and Sumathi, 2002).

Nutritional composition of *Ragi* :

Ragi is considered to be a coarse grain as compared to rice because of its fibrous seed coat. It being unique among cereals, *Ragi* is very rich source of calcium containing 0.3 to 0.4 g as compared to other minerals like phosphorus, iron, magnesium and fibre. Its protein is relatively better balanced because *Ragi* contains more enzymes like lysine, threonine and valin then other millets (Ravindran, 1991).

Therapeutic value :

Ragi is rich in calcium which helps in strengthening bones. It is an excellent source of natural calcium for growing children and people. *Ragi* consumption helps in development of bones in growing children and maintenance of bone health in adults. *Ragi* keeps disease such as osteoporosis at bay and could reduce risk of fracture (<http://www.naturalhealthcure.org/food/healthy-benefits-of-cereals.html>).

■ RESEARCH METHODS

When the quality of product is assessed by mean of human sensory organs, the evaluation is said to be sensory or subject or organoleptic. Every time food is eaten a judgement is made.

Sensory quality is a combination of different senses of perception coming into play in choosing and eating a food. Appearance, flavour and mouthfeel decide the acceptance of the food (Srilakshmi, 2007).

■ RESEARCH FINDINGS AND DISCUSSION

The findings of the present study as well as relevant discussion have been presented under following heads :

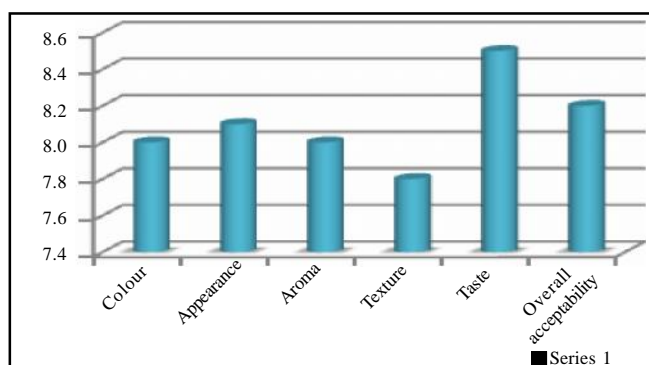
Sensory evaluation of uttpam :

The mean score of sensory evaluation of uttpam is presented in Table 1 and Fig. 1.

Uttpam prepared by the semolina received a score of 8.0, 8.1, 8.0, 7.8, 8.0 and 8.2 in the sensory characteristics like colour, appearance, aroma, texture, taste and overall acceptability. It was overall rated in the

Table 1 : Mean score of sensory evaluation of uttpam

Product	Variable	Mean	± SD
Semolina uttpam	Colour	8	±0.70
	Appearance	8.1	±0.45
	Aroma	8	±0.28
	Texture	7.8	±0.52
	Taste	8.5	±0.57
	Overall acceptability	8.2	±0.42

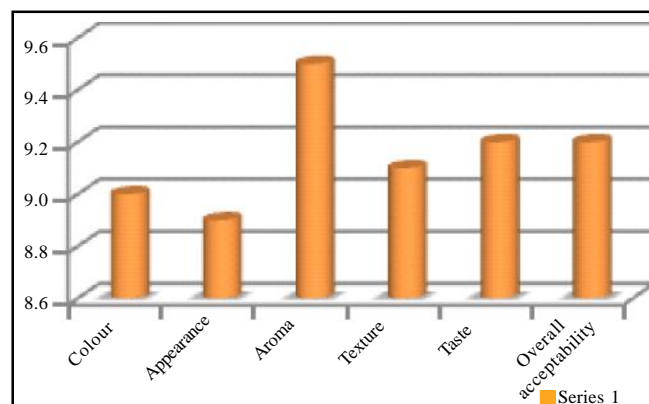
**Fig. 1 : Sensory evaluation of uttpam**

range of liked moderately by the panelist.

The mean score of sensory evaluation of *Ragi* uttpam is presented in Table 2 and Fig. 2.

Table 2 : Mean score of sensory evaluation of *Ragi* uttpam

Product	Variable	Mean	± SD
<i>Ragi</i> uttpam	Colour	9	±0.84
	Appearance	8.9	±0.77
	Aroma	9.5	±0.86
	Texture	9.1	±0.70
	Taste	9.2	±0.85
	Overall acceptability	9.2	±0.71

**Fig. 2 : Sensory evaluation of *Ragi* uttpam**

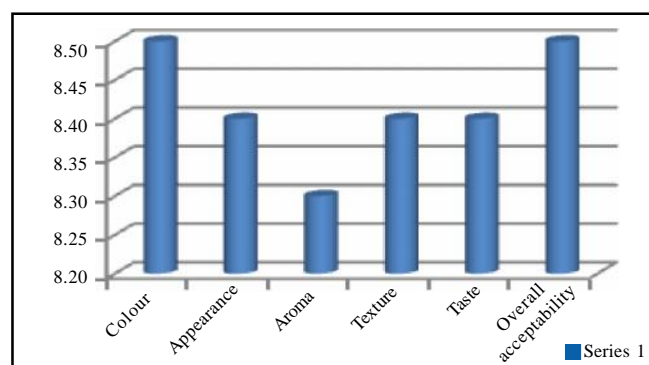
Ragi uttpam prepared by the combination of *Ragi* in semolina received a score of 9.0, 8.9, 9.0, 9.1, 9.2 and 9.2 in the sensory characteristics like colour, appearance, aroma, texture, taste and overall acceptability. It was overall rated in the range of liked very much by the panelist.

Sensory evaluation of cutlate:

The mean score of sensory evaluation of cutlate is presented in Table 3 and Fig. 3.

Table 3 : Mean score of sensory evaluation of cutlate

Product	Variable	Mean	± SD
Aloo cutlates	Colour	8.5	±0.52
	Appearance	8.4	±0.49
	Aroma	8.3	±0.48
	Texture	8.4	±0.49
	Taste	8.4	±0.49
	Overall acceptability	8.5	±0.52

**Fig. 3 : Sensory evaluation of *Ragi* cutlate**

Cutlates prepared by the bengal gram received a mean score of colour 8.5, appearance 8.4, aroma 8.3, texture 8.4, taste, 8.4 and overall acceptability 8.5 for all the organoleptic characteristics on the 9 points hedonic scale.

The mean score of sensory valuation of *Ragi* cutlate is presented in Table 4 and Fig. 4.

Table 4 : Mean score of sensory valuation of *Ragi* cutlate

Product	Variable	Mean	± SD
<i>Ragi</i> cutlates	Colour	9.1	±0.47
	Appearance	9.2	±0.54
	Aroma	9.2	±0.71
	Texture	9.4	±0.51
	Taste	9.2	±0.42
	Overall acceptability	9.2	±0.63

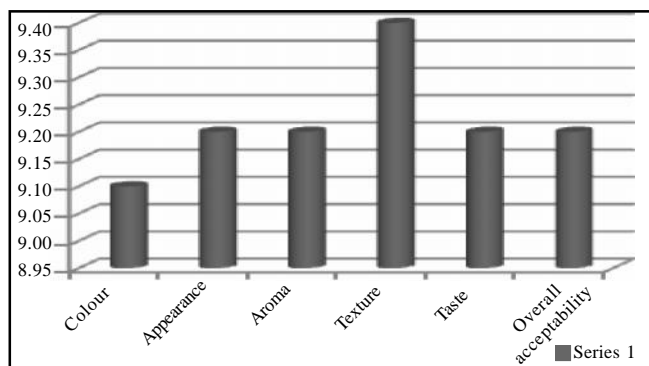


Fig. 4 : Sensory evaluation of Ragi cutlate

Ragi cutlates prepared by the combination of Bengal gram and Ragi received a mean score of colour 9.1, appearance 9.2, aroma 9.2, texture 9.4, taste, 9.2 and overall acceptability 9.2 for all the organoleptic characteristics on the 9 points hedonic scale. It was overall rated in the range of liked very much by the panel of judges.

Sensory evaluation of disco wheel :

The mean score of sensory evaluation of disco wheel is presented in Table 5 and Fig. 5.

Table 5 : Mean score of sensory evaluation of disco wheel			
Product	Variable	Mean	± SD
Standard disco wheel	Colour	8.5	±0.70
	Appearance	8.3	±0.94
	Aroma	8.4	±0.84
	Texture	8.1	±0.88
	Taste	7.9	±0.83
	Overall acceptability	8.4	±0.69

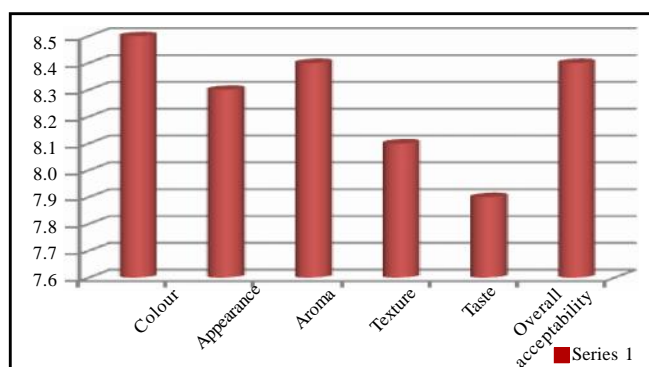


Fig. 5 : Sensory evaluation of disco wheel

Disco wheel prepared by the bread received a score of 8.5, 8.3, 8.4, 8.1, 7.9 and 8.4 in the sensory characteristics like colour, appearance, aroma, texture, taste and overall acceptability. It was overall rated in the

range of liked very much by the panelist.

The mean score of sensory evaluation of Ragi disco wheel is presented in Table 6 and Fig. 6.

Table 6 : Mean score of sensory evaluation of Ragi disco wheel			
Product	Variable	Mean	± SD
Ragi disco wheel	Colour	8.9	±0.76
	Appearance	9.2	±0.78
	Aroma	9.2	±0.63
	Texture	8.9	±0.73
	Taste	9	±0.68
	Overall acceptability	8.7	±0.42s

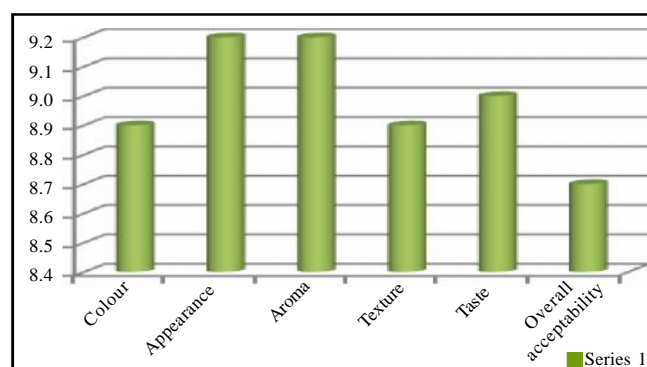


Fig. 6 : Sensory evaluation of Ragi disco wheel

Ragi disco wheels prepared by the combination of bread and Ragi received a mean score of colour 8.9, appearance 9.2, aroma 9.2, texture 8.9, taste 9.0 and overall acceptability 8.7 for all the organoleptic characteristics on the 9 points hedonic scale. It was overall rated in the range of liked very much by the panel of judges.

Conclusion :

The study was carried out in Moradabad town where Ragi was selected purposively for the present investigation. The Ragi cereal was obtained in the month of June to September. Nutritional and organoleptic evaluation of Ragi products was done. Standardization of different recipes of Ragi cereal was carried out by a panel of 10 judges. The present investigation was undertaken to study utilization of Ragi for the development of value added products.

Organoleptic evaluation of Ragi products :

Thus, from the observation made in this study, it is concluded that all the four products viz., uttpam, cutlets, disco wheel, were acceptable in terms of colour, flavour wise uttpam, disco wheel (90 %) liked very much as cutlets

(75 %) liked moderately. Over all acceptability of uttpam, disco wheel were high whereas cutlets was least acceptable.

Authors' affiliations:

MAMTA JOSHI, Department of Home Science, Teerthanker Mahaveer University, MORADABAD (U.P.) INDIA

■ REFERENCES

- Chaturvedi, R. and Srivastava, S. (2008).** Genotype variations in physical, nutritional and sensory quality of popped grains of amber and dark genotypes of finger millet. *J. Food Sci. Technol.*, **45**(5): 443-446.
- Desai, A.D., Kulkarni, S.S., Sahu, A.K., Ranveer, R.C. and Dandge, P.B. (2010).** Effect of supplementation of malted *Ragi* flour on the nutritional and sensorial quality characteristics of cake. *Adv. J. Food Sci. Tech.*, **2**(1): 67-71.
- Dulby, A. and Tsai, C.Y. (1976).** Lysine and tryptophan increases during germination of cereal grains. *Cereal Chem.*, **53**(2): 222-224.
- Edem, D.O., Ayatse, J.O. and Itam, E.H. (2001).** Effect of soy protein supplementation on the nutritive value of "starch" (farina) from *Manihot cocculenta*. *J. Agric. Food Chem.* **75**:57-62.
- FAO (1970). Rome, Italy, Nutritive value of Indian foods, 1998, NIN, Hyderabad (A.P.) INDIA.
- Gopalan, C., Ramasastri, B.V. and Balasubramanian, S.C. (2004).** Nutritive value of Indian Foods. National Institute of Nutrition (NIN). Indian Council of Medical Research, Hyderabad (A.P.) INDIA.
- Guigliano, R.P. (2011).** Niacin at 56 years of age –time for an early retirement. *New England J. Med.*, **365** (24): 2318-2320.
- Hedge, J.E. and Hofreiter, B.T. (1962).** In: R.L. Whistler and J.N. Be Miller, (Eds.). Carbohydrate Chemistry, 17 Academic Press, NEW YORK, U.S.A.
- ICAR (2010). ICAR News –A science and technology. *Newsletter*, **16**(3): 16.
- Joshi, A., Rawat, K. and Karki, B. (2008).** Millets as religious offering for nutritional, ecological and economical security. *Comp. Rev. Food Sci. Food Safety*, **7**:369-372.
- Kang, R.K., Jain, R. and Mridula, D. (2008).** Impact of indigenous fibre rich premix supplementation on blood glucose levels in diabetics. *Am. J. Food Tech.*, **3**(1): 50-55.
- Lakshmi, K.P. and Sumathi, S. (2002).** Effect of consumption of finger millet on hyperglycemia in non-insulin dependent diabetes mellitus (NIDDM) subjects. *Food Nutr. Bull.*, **23**(3): 241-245.
- Majumder, T.K., Premavalli, K.S. and Bawa, A.S. (2006).** Effect of puffing on calcium and iron contents of *Ragi* varieties and their utilization. *J. Food Sci. Technol.*, **42**(5): 542-545.
- Malleshi, N.G. and Desikachar, H.S.R. (1986).** Influence of malting conditions on quality finger millet. *J. Instant Beverage*, **92** (1) : 81-83.
- Marfo, E.K., Oke, O.L. and Afolabi, A. (1998).** Nutritional evaluation of pawpaw (*Carica papaya*) and flamboyant (*Delonix regia*) seeds oils. *Nutr. Rep. Int.*, **37**(2): 302-310.
- Meera (1997).** Promotion of coarse cereals through value addition and potential market demand of millet foods. Central research institute for dryland agriculture (ICAR) Hyderabad (A.P.) INDIA.
- Nirmala, M., SubbaRao, M.V.S.S.T. and Murlikrishna, G. (2000).** Carbohydrates and their degrading enzymes from native and malted finger millet (*Ragi, Eleusine coracana*, Indaf-15). *Food Chem.*, **69** (2) : 175-180.
- Nirmala, M. and Murlikrishna, G. (2002).** Changes in starch during malting of finger millet and its *in vitro* digestibility studies using purified *Ragi* amylases. *J. Eur. Food Res. Technol.*, **215**(4): 327-333.
- Panse, V.G. and Sukhatme, P.V. (1989).** *Statistical methods for agricultural workers*. Publication and information division, Indian Council of Agricultural Research, NEW DELHI, INDIA.
- Pawar, P.A. and Dhanvijay, V.P. (2007).** Weaning foods: An overview. *Beverage Food World*, **34**(11): 27-33.
- Ram, P.C., Lodha, M.L., Srivastava, K.N., Tyagi, R.S., Singh, J. and Mehta, S.L. (1979).** Improving nutritive value of maize (*Zea mays* L.) by germination. *J. Food Sci. Technol.*, **16**:268-270.
- Ranganna, S. (1986).** *Handbook of analysis and quality control for fruit and vegetable products*. Tata McGraw Hill Pub. Co. Ltd., NEW DELHI, INDIA.
- Ravindran, G. (1991).** Studies on millets proximate composition, mineral composition, phytate and oxalate content. *Food Chem.*, **39**(2): 114-116.
- Shashi, B.K., Sharan, S., Hittalamani, S., Shankar, A.G. and Nagarathna, T.K. (2007).** Micronutrient composition, antimicronutrient factors and bioaccessibility of iron in different finger millet (*Eleusine coracana*) genotype. *Karnataka J. Agric. Sci.*, **20**(3) : 583-585.
- Srilakshmi, B. (2007).** *Food science*, New Age International Publishers, 27pp.

■ WEBLIOGRAPHY

<http://www.naturalhealthcure.org/food/healthy-benefites-of-cereals.html>.

<http://www.nutritiousIndianrecepies,recipe.in>.

10th
Year
★ ★ ★ ★ ★ of Excellence ★ ★ ★ ★ ★