Mogili Swathi* et al.
(IJITR) INTERNATIONAL JOURNAL OF INNOVATIVE TECHNOLOGY AND RESEARCH
Volume No.4, Issue No.6, October – November 2016, 5323-5328.

Development Of Malted Millet Mixes For Pregnant Women And Lactating Mothers

MOGILI SWATHI
M.Tech(Food Technology)
University College of Technology
Osmania University
Hyderabad,500007,India

Dr.KAVITHA WAGHRAY
Professor, FoodTechnology
University College of Technology
Osmania University
Hyderabad,500007,India

NAYANALA BABU
DY Manager (Q.C Lab), Telangana Foods,
I.D.A., Nacharam,
Hyderabad,500076,India

RAMU GOLLA
Senior lab chemists, Telangana foods
I.D.A., Nacharam,
Hyderabad,500076,India

Abstract: **In the present study cost effective malted mixes were prepared by using millets which are very nutritious for pregnant women and lactating mothers. Millets are processed by traditional processing techniques to improve the bioavailability of micronutrients, decrease anti nutrient factors.Ragi, Bajra, Jowar, Barley based premixes were developed as alternative health mix for pregnant women and lactating mothers.The premixes were prepared into two formulations with variations.The premixes were prepared with roasted wheat flour,skim milk powder and sugar powder along with millets (ragi,bajra,jowar,barley). Formulation 1 contains roasted millets mixes with variations 50%, 45%, 40%, 35% . Formulation 2 contains germinated millets mixes with variations 50%,45%, 40%, 35% . Sensory evaluation of the samples was carried out using 9 point Hedonic scale.The superior products were packed in a packaging material. The physico chemical characteristics and nutritional quality characteristics along with microbial quality the shelf life of the superior products at ambient and accelerated conditions were studied.**

Keywords: **Germination; Ragi; Bajra; Jowar; Barley; Wheat; Skimmilk;**

I. INTRODUCTION

Millets are a group of highly variable small-seeded grasses, widely grown around the world as cereal crops or grains for fodder and human food. Millets are major food sources for millions of people, especially those who live in hot, dry and hilly areas of the world. They are grown mostly in marginal areas under agricultural conditions in which major cereals fail to give substantial yields. Millets are important foods of many developing and undeveloped countries because of their ability to grow under adverse weather conditions like limited rainfall so that millet is the major source of energy and protein for millions of people. It has been reported that millet has many nutritious and medical functions.

Millets are important or the unique among cereals because of their richness in calcium, dietary fibre, polyphenols and protein. The most important millets are pearl millet (Pennisetum glaucum), finger millet (Eleusine coracona), proso millet (Panicum miliaceum) and foxtail millet (Stalia italica). the most important cultivated millet species are: pearl Millet (Pennisetum typhoides), also known as bulrush millet; proso millet (Panicum miliaceum), also known as common millet; foxtail millet (Setaria italica); Japanese barnyard millet (Echinochloa crusgalli var. Frumentacea or E. colona (Sawa)); finger millet (Eleusine coracona) also known as birds food millet or African millet; and kodo millet of India (Paspalum scorbiculatum). Other millets include little millet (Panicum sumatrense), tef millet (Eargrostis tef) and Fonio millet (Digitaria exilis and D. iburua).

Jowar, Jola or Sorghum is a cereal perceived to be an important coarse grained food crop. Sorghum is rich in potassium and phosphorus and also has a good amount of calcium with small amounts of iron and sodium. Sorghum grain has higlevels of iron and zinc and is hence being targeted as means to reduce micronutrient malnutrition globally. Adding sorghum regularly in the meals of pregnant woman helps them attain requirements for minerals and vitamins in their diet. Jowar helps control heart problems, body weight and arthritis.

Bajra, Sajje or Pearl Millet is an extensively grown variety of millet. This millet is known to possess phytochemicals that lowers cholesterol. This millet contains folate, magnesium, copper, zinc, vitamins E and B- complex.Bajra has a high energy content compared to other flours. It is also rich in calcium and unsaturated fats which are good for the body.

Pearl millet is a principal source of energy, protein, vitamins and minerals for millions of poorest people in the regions where it is cultivated. It is rich in calcium, potassium, magnesium, iron, zinc, manganese, riboflavin, thiamine, niacin, lysine and tryptophan .Pearl millet grains are all very high in

calories—precisely the reason they do wonders for growing children and pregnant women.

Ragi or Finger millet is a short, profusely tillering plant with characteristic finger like terminal inflorescences, bearing small reddish seeds. Ragi contains high amount of calcium, protein with well balanced essential amino acids composition along with Vitamin A, Vitamin B and phosphorous. It also contains high amount of calcium.Pregnant and lactating women are advised to consume Ragi as it helps to increase the production of breast milk in the body.

This will enable the mother to feed the child for a longer period of time. Ragi proves to be a great cereal for pregnant and lactating women due to its high calcium and iron content. It is rich in folic acid which helps in brain development of baby.

Calcium in ragi will helps in bone development of child. Ragi is also rich in dietary fibre and hence bowel friendly Barley offers daily requirements of our body by providing the required amount of calcium, magnesium, iron and potassium. Barley is rich in dietary fibre, which helps it to prevent issues like constipation and hemorrhoids, which are a serious medical condition that occurs in pregnant women. The presence of niacin in this grain promotes digestion in pregnant women; niacin also aids in clotting of blood, which makes it highly helpful when delivering your baby. Barley has copper in it which promotes the flexibility of blood vessels, joints and bones for pregnant women. Barley can perform tissue repair and aids in growth of cells, which makes it very helpful while your belly is growing at a rapid pace to accommodate the growing baby.

II. MATERIALS AND METHODS

2.1 Selection of ingredients

Pearl millet, finger millet, sorghum, barley,whole wheat,skim milk powder,sugar were brought from nearby retail shops in Hyderabad market.

2.2 Preparation of malted millet flour

Grains of millets were steeped in static water at ambient temperature until they absorbed water. The water was changed every 2 h over a period of 8 h. The millet grains were allowed to germinate in the humidity chamber at 30 °C and 80% humidity for sprouting. To prevent matting and to even up the growth, the grains were repeatedly turned. The germinated millet grains were dried for 1 h in sun. The dried grains were reduced to flour in a hammer milled and then sieving is done about a mesh size 150mm.

2.3 Malting process

The malting process converts raw grain into malt. Various grains are malted, the most common grains used are barley, sorghum, Bajra and ragi. There are a number of different types of equipment that can be used to produce the malt. A traditional floor malting germinates the grains in a thin layer on a solid floor, and the grain is manually raked and turned to keep the grains loose and aerated. In a modern malt house the process is more automated, and the grain is germinated on a floor that is slotted to allow air to be forced through the grain bed. Large mechanical turners keep the much thicker bed loose with higher productivity and better energy efficiency.

2.4 Steeping

The purpose of steeping is to evenly hydrate the endosperm in the raw millets kernel. Steeping will raise the moisture content of the grain from approximately13% to 45% which will help in the promotion of germination. Before the grains are set to steep the grains are washed thoroughly for 5 times. The steeping process for grains is 24hrs (i.e.one day) depending on the moisture content going into steep.

2.5 Germination:

After steeping water is drained and then set for germination. The steeped grains are tied in a muslin cloth and are kept in box and closed it tightly and keep some heavy weight on it. The malt's protein modification and enzyme content is set over the next two to three days as the grain's rootlets develop. These seeds were germinated at 30± 3ºC (room temperature) for 48 hrs (2days) and dried in sun for 2 hours.

2.7 Flow sheet

millets
↓
Washing 4-5 times with water
↓
Soak for 24hours in fresh water
↓
Drain the excess water
↓
Tie in a muslin cloth
↓
Keep weight on the tied cloth
↓
Keep for 48 hrs at 30±3ºC for germination
↓
Dry in sun for 2-3 hrs
↓
Grind to make flour
↓
Sieving(180mm)

Fig 1-preparation of malted powders

2.8 Evaluation of nutrient content of powders

The nutritional values like moisture, protein, fat, fiber and ash content of biscuits were determined

by AOAC methods. The carbohydrates were calculated by difference. The sum of moisture, fat, protein, fiber and ash contents was subtracted from 100 to obtain the total carbohydrates by difference (Pearson, 1976).

Energy was calculated as described by Sukkar (1985) using the Atwater factors: 1g of carbohydrates provides 4 K calories, 1g of protein provides 4 K calories and 1g fat provides 9 K calories. Carbohydrates (g) X 4 = K Cal. of carbohydrates. Protein (g) X 4= K Cal. of protein. Fat (g) X 9 = K Cal. of fat.

2.9 Evaluation of microbial quality

The microbiological analysis of the developed products were carried out as per the standard method, for bacteria Nutrient Agar was used and for Fungi using Rose Bengal Agar (RBA). Ten gram of sample was diluted in 90 ml of buffer blanks and subsequent dilutions were prepared up to 10^{-6} dilution. Two dilution factors were used for plating of bacteria and fungi viz. 10^{-2}, 10^{-3}, 10^{-4}, $10^{-5}$and 10^{-6}. The total number of microbial count was calculated using the formula given below (Thambekar*et al*., 2009).

No. of microorganisms

(Per g/ml) = $\frac{\text{No. of colonies} \times \text{Dilutionfactor}}{\text{Weight / volume of aliquots taken (g/ml)}}$

III. RESULT AND DISCUSSION

The result of the proximate composition of malted mix on dryweight basis showed significant increase ($p<0.05$) in protein levels with germination . The increase in protein could be attributed to a net synthesis of enzymic protein by germinating seeds. The increase in protein might also be due to the fact that some amino acids are produced in excess of the requirement during protein synthesis and these tend to accumulate in free amino acid pool . Other researchers have attributed the increase to the degradation of storage protein and synthesis ofnew protein and other materials stated that the increase in protein on germination of seed was due to mobilization of storage nitrogen producing the nutritionally high quality proteins which the young plant needs for its development. The fat levels of millets were increased on germination and slight decrease in the malt.some obsevations proved that reduced fat content in malted millet are known to increase shelf life of the product. A significant increase in carbohydrate levels of the malted mix was observed with germination. Malted mixes from germination had the highest calcium and iron levels which are consider very important minerals for pregnant women and lactatingmothers.

Table 1: Composition of malted mixes(per 100gms)

SAMPLE 1	**SAMPLE 2**	**SAMPLE 3**	**SAMPLE 4**
Ragi malt- 35g	Bajra malt-35g	Jowar malt-35g	Barley malt-35g
Skim milk powder(SMP)-15g	SMP-15g	SMP-15g	SMP-15g
Roasted wheat flour(RWF)- 25g	RWF-25g	RWF-25g	RWF-25g
Sugar powder(SP)-25g	SP-25g	SP-25g	SP-25g

Table 2 :Results on sensory evaluation of roasted powder mixes

Sample	**Appearance**	**Taste**	**Colour**	**Texture**	**aroma**	**overal acceptance**
SAMPLE 1	7.6±0.699	6.9±0.737	8.1±0.737	7.5±0.527	8±0.667	7.8±0.421
SAMPLE 2	7.6±0.699	6.9±0.737	8.1±0.737	7.5±0.527	8±0.667	7.8±0.421
SAMPLE 3	7.6±0.699	6.9±0.737	8.1±0.737	7.5±0.527	8±0.667	7.8±0.421
SAMPLE 4	7.6±0.699	6.9±0.737	8.1±0.737	7.5±0.527	8±0.667	7.8±0.421

Table 3 : Results on sensory evaluation of germination powder mixes

Sample	**Appearance**	**Taste**	**Colour**	**Texture**	**Aroma**	**overal acceptance**
SAMPLE 1	8.2±0.836	7.6±0.547	8.2±0.447	7.8±0.447	8.6±0.54	8.2±0.836
SAMPLE 2	8.2±0.836	7.6±0.547	8.2±0.447	7.8±0.447	8.6±0.54	8.2±0.836
SAMPLE 3	8.8±0.447	8.6±0.547	8.4±0.547	8.6±0.547	8.4±0.54	8.6±0.547
SAMPLE 4	7.8±0.836	7.8±0.447	7.8±0.447	7.6±0.547	7.6±0.89	7.8±0.836

Table 4 : Effect of roasted based powder mixes on proximate composition(per 100g of mix)

Samples	Moisture (g)	Protein (g)	Fat (g)	Minerals (g)	Crude-Fibe (g)	Carbo-Hydrates (g)	Energy (Kcal)
Ragi	8.36±0.0141	11.31±0.0028	1.036±0.0014	2.66±0.0014	1.736±0.0014	75.832±1.105	357.12±5.68
Bajra	8.095±0.014	12.82±0.014	2.2±0.014	2.526±0.0014	0.896±0.0014	73.915±0.622	366.64±2.81
Jowar	7.885±0.063	12.395±0.007	1.106±0.0014	2.29±0.014	1.036±0.0014	75.80±0.772	362.71±3.199
Barley	8.095±0.014	12.845±0.049	2.2±0.0014	2.526±0.0014	0.896±0.0014	73.886±0.581	366.62±2.794

Table 5: Effect of roasted based powder mixes on minerals content(per 100g)

Samples	Calcium (mg)	Phosphorus (mg)	Iron (mg)
Ragi	340.50±0.558	338.06±0.0014	2.839±0.0014
Bajra	235.3±0.1414	342.7±0.1414	4.2738±0.00014
Jowar	229.26±0.014	316.8±0.1414	2.909±0.001414
Barley	235.1±0.1414	342.7±0.1414	4.27±0.00014

Table 6 : Effect of germination based powder mixes on proximate composition(per 100g mix)

Samples	Moisture (g)	Protein (g)	Fat (g)	Minerals (g)	Crude-Fibre (g)	Carbo-Hydrates (g)	Energy (Kcal)
Ragi	6.362±0.00141	14.35±0.0028	1.08±0.014	2.74±0.014	1.17±0.007	75.46±0.007	374.6±0.141
Bajra	6.046±0.0014	14.67±0.113	1.46±0.0014	2.61±0.0014	1.05±0.0028	75.19±0.1117	372.68±0.0070
Jowar	5.81±0.028	14.39±0.014	1.35±0.0021	2.39±0.0070	1.028±0.0014	75.532±0.674	371.92±2.773
Barley	6.43±0.0028	14.32±0.028	2.02±0.014	2.626±0.0021	0.884±0.0014	74.60±0.0473	373.86±0.050

Table 7: Effect of germination based powder mixes on minerals content(per 100g)

Samples	Calcium (mg)	Phosphorus (mg)	Iron (mg)
Ragi	374.6±0.141	370.1±0.028	4.27±0.0014
Bajra	256.8±0.1414	356.1±0.028	4.97±0.014
Jowar	253.27±0.028	343.8±0.141	4.37±0.0014
Barley	245.5±0.141	359.75±0.212	4.97±0.0141

Table 8 : Microbial load in powders during storage (malted mixes)

product	Storage Period	Total bacterial count			
		Ragi	**Bajra**	**Jowar**	**Barley**
powder	**0**	Nil	Nil	Nil	Nil
	30	1.24	1.26	1.257	1.36
	60	4.57	5.63	5.34	5.86
	90	7.89	7.90	8.654	8.56

Table 9 : Physical characteristics of roasted and malted mixes

Parameters	Roasted mix	Malted mix
Water absortion capacity(ml/g)	0.33±0.05	0.35±0.05
Dispersability	73.4±0.3	75.0±0.5

IV. CONCULSION

The study showed that germination of millet grain prior to raw, increased protein, ash, iron, calcium and phosphorus levels of malted mixes. From the study, it may be concluded that locally available low cost ingredients available in the developing countries have a great potential in developing highly nutritious and acceptable foods. Addition of malt in food improved functional and nutritional qualities. Such a protein and energy dense food would help in eradication of low birth weight .

V. ACKNOWLEDGEMENT

I take immense pleasure in thanking Dr. kavithawaghray **(**Professor), Food Technology, University College of Technology, for her guidance and cooperation extended to me to enable the completion of this project work. I also thank Ramu Golla (lab chemist), Telangana Foods, I.D.A., Nacharam, Hyderabad, for his continuous guidance and encouragement during the course of project. I also extend my sincere thanks to Faculty of Food Technology at University College of Technology and quality control laboratory staff of Telangana Foods, for their continuous support, which helped me in this endeavor.

VI. REFERENCES

[1] Mahgoub SEO (1999) Production and evaluation of weaning foods based on sorghum and legumes. Plants Foods Hum Nutr 54:29– 42.

[2] Malleshi NG, Desikachar HSR (1981) Studies on suitability of roller flour mill, hammer mill and plate grinder for obtaining a refined flour from malted ragi. J Food Sci Technol 18:37–39.

[3] AACC (2000) Approved methods of the AACC, 10th edn. American Association of Cereal Chemists, St. Paul.

[4] Ashworth A, Draper A (1992) The potential of traditional technologies for increasing the energy density of weaning foods. A critical review of existing knowledge with particular reference to malting and fermentation. WHO/CCD/EDP 92.4. Centre forHuman Nutrition, London, UK, pp 1–50.

[5] Malleshi NG, Daodu MA, Chandrasekhar A (1989) Development of weaning food formulations based on malting and roller drying of sorghum and cowpea. Int J Food Sci Technol 24:511–519.

[6] Parvathy K, Sadasivam S (1982) Comparison of amylase activity and carbohydrate profile in germinating seeds of Sertaria italica, Echinochloa frumentacea, and Panicum miliaceum. Cereal Chem 9:543–544.

[7] Afify AE-MMR, El-Beltagi HS, Abd El-Salam SM, Omran AA. Bioavailability of Iron, Zinc, Phytate and Phytase Activity during Soaking and Germination of Wh{ite Sorghum Varieties. PLoS ONE. 2011 Oct 7;6(10):e25512.

[8] Fasasi OS. Proximate, Antinutritional Factors and Functional Properties of Processed Pearl millet Pennisetum glaucum. Journal of Food Technol. 2009; 73: 92-97.

[9] AOAC. Official Methods of Analysis of the Association of Official Analytical Chemists. In.

[10] Horwitz W, editor. Association of Official Analytical Chemists, Washington, D.C.; 1980.

[11] AOAC. Official Methods of Analysis of the Association of Official Analytical Chemists. 17th Edn., In: Horwitz W, editor. Association of Official Analytical Chemists, Washington, D.C.; 2000.

[12] Inyang CU, Zakari UM. Effect of germination andfermentation of pearl millet on proximate, chemical and sensory properties of instant 'Fura' a Nigerian cereal food. Pakistan J Nutr. 2008; 7(1):9-12.

[13] IS. Method for yeast and mould count of foodstuffs and animal feeds, first revision. Indian Standard; IS 5403:1999. Bureau of Indian Standards, New Delhi; 1999.

[14] IS. Microbiological – General guidance for the enumeration of microorganisms – colony count technique at 35□C (first revision) IS 5402: 2002. Bureau of Indian Standards, New Delhi; 2002.

[15] ISI. Handbook of analysis. Part XI. Indian Standards Institution, New Delhi; 1981.

[16] Nzeribe, H.C. and C.C. Nwasike, 1995. The brewing potential of acha (Digiteria exlils)

malt compared with pearl millet (Pennisetum glaucum) malt and sorghum (Sorghum bicolar) malts. J. Inst. Brewing, 101: 345-350.

[17] Khetarpaul, N. and B.M. Chauhan, 1989. Effect of germination and pure culture fermentation on Hclextractability of,minerals of pearl millet (Pennisetum glaucum). Int. J. Food Sci. Tech., 24: 327-331.

[18] Lasekan, O.O., 1996. Effect of germination on alphaamylase activities and rheologcal properties of sorghum (*Sorghum biocolar*) and acha (Digitaria exilis) grains, J. Food Sci. Technol., 33: 329-331.

[19] AOAC. 1981. Official Methods of Analysis for fat and carbohydrate. Analytical Chemists.13th Edition. Washington, DC.Association of Official .

[20] AOAC. 1984. Official Methods of Analysis for ash. Association of Official AnalyticalChemists.14th Edition. Washington, DC.

[21] AOAC.1990. Official Methods of Analysis for moisture and fibre. Association of OfficialAnalytical Chemists.14th Edition. Washington, DC.

