POSSIBILITIES OF EXPLOITING MINOR MILLET TO NUTRITIONALLY ENRICH BAKERY PRODUCTS

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INTRODUCTION

Millets are one of the oldest forms of crops in the world. They were the first cereal grain to be domesticated for human consumption and are a major source of food in arid and semi-arid parts of the world. Millets provide nearly all essential nutrients. They are the set of complete nutrients and hence provide nutritional security in many developing countries. Millets are found to be safe for people suffering from gluten allergy and celiac disease. Improved techniques of milling, decortication, germination/malting, fermentation, popping, baking, extruding, etc. has increased the scope of value addition in millets which in return is giving out more products of wider acceptance in rural as well as urban areas. Commercialized use will increase the ease of adopting their products at wide scale.

Millets include (Figure 1) Finger millet (*Eleusine coracana*), Foxtail millet (*Setaria italica*), Kodo millet (*Paspalum scrobiculatum*), Little millet (*Panicum sumatrense*), Proso millet (*Panicum miliaceum*), Barnyard millet (*Echinochola crusgalli*), Guinea grass (*Panicum maximum*), Elephant grass (*Pennisetum purpurium*). These millets possess unique nutritional characteristics; for example, they are gluten-free, have complex carbohydrates, rich in dietary fibre as well as unique in phenolic compounds and photochemical having medicinal properties. Table 1 provides the data on proximate composition of various millets. Majority of millets are non-acid forming and non-allergenic, therefore, easy to digest.

Table1. Proximate composition of different Millets (Source: Nutritive value of Indian foods, NIN, 2007)

Millets	Carbohydrate (g)	Protein (g)	Fat (g)	Energy (kcal)	Ca (mg)	Fe (mg)	Mineral matter (g)
Finger millet	72	7.3	1.3	328	344	3.9	2.7
Kodo millet	65.9	8.3	1.4	309	27	0.5	2.6
Proso millet	70.4	12.5	1.1	341	14	0.8	1.9
Foxtail millet	60.9	12.3	4.3	331	31	2.8	3.3
Little millet	67	7.7	4.7	341	17	9.3	1.5
Barnyard millet	65.5	6.2	2.2	307	20	5	4.4
Wheat (whole)	71.2	11.8	1.5	346	41	5.3	1.5
Rice (milled)	78.2	6.8	0.5	345	10	0.7	0.6

ADVANTAGE OF MILLETS IN HUMAN DIET

1. **Millet And Diabetes -** The intake of whole grain foods is suggested to be beneficial for the prevention and management of diabetes mellitus, and epidemiologically lower incidence of diabetes has been reported in millet consuming populations.
2. **Millet And Cardiovascular Disease -** Obesity, smoking, unhealthy diet, and physical inactivity increase the risk of heart attacks and strokes. The feeding of proso millet protein improved plasma levels of adiponectin, high-density lipoprotein (HDL) cholesterol in

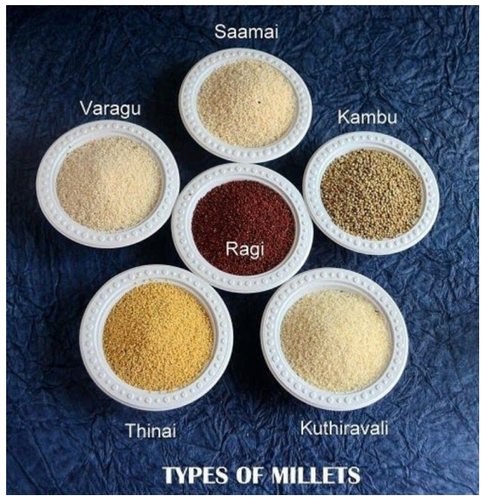

Figure 1. Pictorial representation of different types of millets

genetically obese type-2 diabetic mice under high-fat feeding conditions. Finger millet and proso millet may prevent cardiovascular disease.

3. **Cancer And Celiac Disease -** Celiac disease is an immune-mediated enteropathy triggered by the ingestion of gluten in genetically susceptible individuals. Millet grains are known to be rich in phenolic acids, tannins, and phytate that act as "antinutrients". A recent study has demonstrated that millet phenolics may be effective in the prevention of cancer initiation and progression in vitro.
4. **Aging -** Millet grains are rich in antioxidants and phenolics; however, it has been established that phytates, phenols, and tannins can contribute to antioxidant activity important in health, aging, and metabolic syndrome .It has also been found that methanolic extracts from finger millet and kodo millet inhibited glycation and cross-linking of collagen. Therefore, there is potential usefulness of millets in the protection against aging.
5. **Antimicrobial Activity -** Millet grain fractions and extracts were found to have antimicrobial activity. Seed protein extracts of pearl millet, sorghum, Japanese barnyard millet, foxtail millet, samai millet, and proso millet were evaluated in vitro for their ability to inhibit the growth of *Rhizoctonia solani, Macrophomina phaseolina, and Fusarium oxysporum*. The seed coat extract showed higher antimicrobial activity against *Bacillus cereus* and *Aspergillus flavus* than whole flour extract. Therefore, extracts of phenolic acids and other bioactive components have the potential to be used as natural alternatives in food preservation and for therapeutic purposes. However, more studies are needed to verify their potential antimicrobial effects

CONSTRAINTS LIMITING THE PRODUCTION AND CONSUMPTION OF MILLETS

- ✓ Lower or near absence of production support,
- ✓ Lack of reach of improved methods of production and technologies,
- ✓ Lack of appropriate post-harvest processing technologies,
- ✓ Competition from other market friendly remunerative crops,
- ✓ Changes in preference patterns in consumption,
- ✓ Lack of public procurement and marketing support,
- ✓ Absence of public or private funded promotion
- ✓ Its coarse fibrous seed coat, coloured pigments, astringent flavour and poor keeping quality of the processed products.

FORMULATIONS OF DIFFERENT BAKERY PRODUCTS WITH INCORPORATION OF MILLETS

For improvement of the nutritive value of food and to avoid malnutrition and certain diseases, different approaches are needed. Such approaches must not only offer improved food to adult and children, but should also be low-cost and locally available for preparation of food formulations. The incorporation of millet flour blend was one such advancement to improve the quality of composite flour in terms of increasing nutrient density.

- Use of a combination of additives in muffins with 60% Finger Millet Flour significantly improved the volume and quality characteristics of muffins. Furthermore, whole pearl millet, finger millet, and decorticated soybean blended (millet plus soy) extrudate formulations are used to minimize the total cost of the finished product.
- In many African countries, millet is often the main component of many meals and is essentially consumed as steam-cooked products ("couscous"), thick porridges ("To"), and thin porridges ("ogi") that can be used as a complementary food for infants and young children, it is also used in brewing beer. Finger millet can be used in a variety of ways and is a great substitute for other grains such as rice and other starchy grains.

DIFFERENT BAKERY PRODUCTS

Incorporation of finger millet flour in the preparation of bakery products like biscuit, nankhatai, muffins and bread has been attempted and efforts are being made to standardize the recipe and product quality. The use of millets in bakery products will not only cause enhancement in terms of fibre content and micronutrients but also create a good potential for millets to enter in the bakery world for series of value added products. Research have also been done to develop cakes the enriched with minerals and fibre by supplementing the refined wheat flour with malted finger millet flour. In recent years, finger millet has received attention and efforts are under way to provide it to the consumers in convenient forms.

Various bakery products incorporated with diverse millets are Millet bread, Millet bread rolls, Millets bun, Millets cookies, Millet cake, Millet doughnut etc. The detail recipe and ingredients for preparation of these products are briefly explained below.

A. Multi -Millet Bread

Ingredients- Refined wheat flour (800g), Finger millet flour (40g), Kodo millet flour (40g), Little millet flour (40g), Barnyard millet flour (40g), Fox tail millet flour (40g), Sugar (170g), Fat (20 g), Salt (20g), Yeast liquid (Sugar - 10g, Warm water - 500ml, Yeast - 30g)

Method- Prepare yeast liquid by dissolving sugar in water. Sprinkle the yeast. Leave for 10-15 minutes until fluffy. Rub fat into flour, add salt and yeast liquid. Prepare dough.Turn onto lightly floured board and knead till soft and elastic (20 minutes for kneading). Cover and leave to rise. Remove and knead lightly. Grease 2 bread tins. Divide dough into two. Stretch

each piece as oblong, the same width as tin and fold over in three. With the seam underneath, smooth over top, tuck in ends and place in tin. Place in a covered vessel leave to rise (20 to 30 minutes). Bake in a very hot oven for 30 to 40 minutes at 200°C.

B. Millet Bread Roll

Ingredients- Refined wheat flour (800g), Finger millet flour (40g), Kodo millet flour (40g), little millet flour (40g), Barnyard millet flour (40g), Fox tail millet flour (40g), Dalda (20 g), Salt - 15g, Yeast liquid (Sugar - 190 g, Warm water - 500ml, Yeast - 25 g).

Method- Prepare bread dough used for preparing rolls. Divide dough into 60g pieces. Roll into various shapes. Place on greased trays and leave to rise (30 minutes). Glaze and bake in hot oven for 15 to 20 minutes.

C. Bun

Ingredients- Refined wheat flour (800g), Finger millet flour (40g), Kodo millet flour (40g), Little millet flour (40g), Barnyard millet flour (40g), Fox tail millet flour (40g), Water (500ml), Milk powder (25g), Yeast (20g), Sugar (200g), Salt (15g), Fat (30g).

Method- Yeast liquid: yeast with little warm water and pinch of sugar. Mix sugar and salt in the remaining milk. Mix flour, milk powder and make a well in the centre. Add soften yeast froth and sugar and salt mixed water. Knead to soft dough. Incorporate fat while kneading. Leave the dough for proofing. Knock back and knead lightly. Divide into 60g balls and leave it for rising. Glaze it with egg and bake at 200°C for 10 to 15 minutes.

D. Cookies

Ingredients- Finger millet flour (200g), Kodo millet flour (200g), Little millet flour (200g), Barnyard millet flour (200g), Fox tail millet flour (200g), Fat (400g) Sugar (250g), Baking powder (¼ teaspoon)

Method- Sieve flour along with baking powder. Cream fat and sugar till light and fluffy. Sieved flour is mixed to the above cream. Make smooth dough necessary. Sheet the dough and cut with the cookies cutter. Bake at 160°C for about 15 minutes.

E. Cake

Ingredients- Finger millet flour (40g), Kodo millet flour (40g), Little millet flour (40g), Barnyard millet flour (40g). Fox tail millet flour (40g), refined wheat flour (400g), Sugar (800g), Fat (800g), Egg (2 no.), Vanilla essence (50 ml), Baking powder (¼ teaspoon).

Method- Sieve flour and baking powder twice. Cream fat and flour till light and fluffy. Beat the egg and sugar with vanilla essence. Prepare cake batter. Pour it in the tins and bake at 190°C for 20 minutes.

F. Dough Nut

Ingredients- Refined wheat flour (300g), Finger millet (60g), Kodo millet flour (60g), Little millet flour (60g), Barnyard millet flour 60g), Fox tail millet flour (60g), Sugar (250g), Dalda (75g), Milk (70ml), Egg (1 No.), Baking powder (1 teaspoon), Salt (¼ teaspoon), Nutmeg (¼ teaspoon), Cinnamon (¼ teaspoon)

Method- Warm the water, add sugar and sprinkle yeast on the top. Allow it to rise for 10 minutes. Mix warm milk, sugar and salt. Sieve flour and make a hollow centre. Add egg, yeast liquid, sugar and salt. Add milk and prepare soft dough. Mix fat while kneading. Allow it to rise to a double volume for one hour. Roll out 1.3rd of an inch. Cut with a doughnut cutter. Fry in medium heated oil till golden brown in colour. Roll in powdered sugar.