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Development and Utilisation of millet based composite mix

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Abstract
To prepare a millet based composite mix to meet daily Nutritional requirements. Bajra (pearl millet), wheat, Bengal gram, moringa olifera leaves. Millets are rich source of antioxidants, micronutrients, fibre. Wheat serve as good source of carbohydrates. Bengal gram for protein and moringa olifera leaves stand for vitamin, carotene and minerals. Roasting, drying, milling, sieving, mixing for millets, cereal drying, milling, sieving and mixing for leaves. Rapid change in life style due to challenges in Occupational pattern and hence unable to have a balanced diet. Composite mixes play a vital role with complete nutrition and in reduction of cooking time. Composite mix enable to solve problem of nutrition deficiency and also helpful to reduce cooking time. It also depicts instant mix to cook and serve.

Keywords: millets, bajra, micronutrients, balanced diet

1. Introduction

Food has acquired a significant position in human society beyond that of providing nourishment to the body which is reflected in many patterns of human behaviour. One of the major challenges of nutritionists is to minimize human sufferings due to nutritional stress as Indian population suffers from food and nutritional insecurity.

Rapid urbanization involving challenges in occupational patterns, life styles, family structure are reflected as changes in practices and level of physical activity. A shift in the consumption basket from coarse grains to refined cereals is obvious among urbanites and population belonging to high income group. This in turn leads to decreased intake of fibre coupled with increased the incidence of affluence related non-communicable diseases. Under such a situation it is essential to revive the traditional practice of coarse grain usage. Coarse cereals especially minor millets can provide viable alternative to diversify sources of health components in food.

Millets, small seeded grasses are hardy crops grow on dry zones as rain fed crops, under marginal conditions of soil fertility and moisture. These are one of the oldest foods known to humans and possibly the first cereal grain to be used for domestic purposes

The millets can be classified broadly into two types for convenience namely, major and minor millets based on their seed size. Major millets includes sorghum (*Sorghum vulgare*), finger millet (*Eleusine coracana*) and pearl millet (*Pennisetum glaucum*), while minor millets include little (*Panicum miliare*), proso (*Panicum miliaceum*), kodo (*Paspalum scrobiculatum*), itallian (*Setaria italica*) and barnyard millet (*Echinochloa frumantacea*).

Composite mix is a mixture of different foods or ingredients hence provides package of nutrients in a single dish. Composite mixes contain many ingredients which bring about improvement in nutritional composition and protein quality by mutual supplementation, in addition to providing convenient ready to use product for the housewives, who cannot afford to spend time in kitchen.

Usually cereals or millets are mixed with pulses in different proportion, reason being cereals are deficient in lysine and rich in methionine, while pulses are deficient in methionine and rich in lysine. Hence mutual supplementation improves the protein quality by balancing the amino acid profile.

Cereals in the composite mixes can be replaced with millets in the formulation to get the benefit of enhanced micronutrients, lower viscosity of the gruel. Besides the ingredients, process employed plays an important in adaptation of the technology at the household level. Simpler the processing technique greater the adaptation.

Roasting being user friendly technique imparts desirable sensory qualities, enhances the palatability by reducing anti-nutrients Aworh (2008). Drying helps in extending the shelf life by reducing moisture. Soaking, germination and fermentation improves desirable sensory qualities, nutritional value or digestibility. Popping improves taste, flavour, *in vitro* protein digestibility and has low moisture content, thus helps in minimising deterioration during storage.

1.1 Physical parameters of the composite mixes

Physical characteristics viz., particle size, water absorption capacity, and viscosity of composite mixes play an important role in determining the acceptability of the product.

Banakar (2005) [1] formulated malted and roasted supplementary mixes using cereals (sorghum, rice, and finger millet), pulses (soybean, green gram), oilseed (peanut) and amaranth leaves in equal proportion and

assessed the physical parameters. Results revealed that significantly higher proportion of roasted formulation had particle size between 250 and 420µ (47.11%), Malted supplementary food had significantly higher percent solubility (26.38%) and dispersibility (70.06%) compared to roasted (21.00 and 66.48% respectively). Latter with or without Amylase Rich Food recorded significantly higher viscosity (2791.67 and 705.44 cpu) compared to former (736.22 and 356.71 cpu).

1.2 Nutrient composition of developed composite mixes
Chemical composition of the mixes changes with the processing. Roasting increases the protein digestibility by denaturing the native protein and by destroying the trypsin inhibitor Aworh (2008). Malting enhances the nutritional quality of mix through the action of amylases and proteases as well as brings about an increase in vitamins, by reducing the trypsin inhibitors. Hence studies related to changes in nutrient composition of the formulations.

1.3 Protein quality of composite mixes:
The quality of a protein, required for building or maintenance of tissues, depends upon the essential amino acid composition. If the amino acid composition of a food meets that of a tissue, the food protein is said to be of high quality. A relative deficiency of a particular amino acid in a food is known as the limiting amino acid like lysine in cereal protein, tryptophan in maize, methionine in legumes etc. Hence mutual supplementation improves quality in terms of amino acid profile. Many scientists evaluated the protein quality of developed composite mixes employing *in vivo* and *in vitro* methods.

1.4 Shelf life studies of composite mixes
Storage of composite mixes results in changes in sensory and chemical parameters i.e moisture content, free fatty acid, peroxide value and alcoholic acidity when packed in various packaging materials and stored at different environmental conditions.

1.5 Utilization of composite mixes
Mixes prepared out of various ingredients can be used in the preparation of products of day today use or special dishes. Hence the studies related to extending the utilization of composite mixes are very crucial. Here study done by application of Extrusion technology to develop vermicelli using composite mix

1.6 Extrusion
It is a process used to create objects of a fixed cross sectional profile. A material is pushed or drawn through a die of the desired cross-section. The two main advantages of this process over other manufacturing processes are its ability to create very complex cross-sections, and to work materials that are brittle, because the material only encounters compressive and shear stresses. It also forms finished parts with an excellent surface finish

2. Materials and methods

2.1 Procurement of Raw materials
All raw materials bajra, wheat, Bengal gram purchased from local market.
Moringa olifera leaves freshly collected from nearby farm and dried and ground to make fine powder.
I Phase – Formulation of composite mix
II Phase –Nutritional evaluation of formulated composite mix
III Phase – Utilization of formulated composite mix

2.2 Proportion of ingredients for formulation of composite mix
Bajra-50%
Wheat-30%
Green gram dhal-15%
Moringa olifera leaf powder-2%

2.3 Steps for preparation of composite mix

All ingredients
↓
Roasting (70ºC)
↓
Milling
↓
Seiving
↓
Packing
↓
Storage

Fig 1: Steps for preparation of composite mix

3. Results and discussion

3.2 Proximate and Nutritional analysis of Composite Mix

Table 1: Below table shows the proximate and nutritional analysis of ingredients used in composite mix (per 100gms)

Product (gms)	Moisture (g)	Protein (g)	Fat (g)	Mineral (g)	Crude Fibre (g)	Carbo. (g)	Energy (kcal)	Ca (mg)	P (mg)	Fe (mg)
Bajra(50)	6.2	5.8	2.5	1.15	0.6	33.75	180.5	21	148	4
Wheat(30)	3.84	3.54	0.45	0.45	0.36	21.36	103.8	12.3	91.8	1.59
Greengramdal (15)	1.515	3.67	0.18	0.525	0.12	8.98	52.2	11.25	60.7	0.58
Drumstick leaf powder(2)	1.518	0.134	0.034	0.046	0.018	0.25	1.84	8.8	1.4	0.01
Total	13.073	13.144	3.164	2.171	1.098	64.34	338.34	53.35	302	6.2

3.3 Vitamin content

Table 2: Evaluation of vitamin content of the ingredients used in composite mix (All values are per 100gms of edible portion)

Product(g)	Thiamine (Mg)	Riboflavin (mg)	Niacin (mg)	Total B6 (mg)	Folic acid (free)	Folic acid (total)	Vitamin "C"
Bajra(50)	0.165	0.125	1.15	-	7.35	22.75	-
Wheat(30)	0.135	0.051	1.65	0.171	42.6	10.98	-
Greengramdal (15)	0.075	0.031	0.36	-	3.67	42	-
Drumstick leaf powder(2)	0.0012	0.001	0.016	-	-	-	4.4
Total	0.376	0.208	3.176	0.171	53.62	75.73	4.4

3.4 Formulation of Composite mix

Fig 2: Composite mix

3.5 Utilization of formulated composite mixes

Fig 3: Traditional laddu made using composite mix

Fig 4: Extruded product developed using composite mix

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