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Nutritional quality of the developed multigrain flour and cookies

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Abstract
Utilization of therapeutic multigrain cookiesin food products is an area of current interest because of nutritional awareness of consumer and changing demographics. The nutritive value of foods particularly baked products like cookies can be improved by fortification. The moisture content in cookies sample varies from 3.30 to 3.39%. The protein, fat, carbohydrates, ash and crude fibre (by difference) in products varied from 10.38 to 12.60, 16.32 to 17.10, 63.60 to 66.90, 1.33 to 1.76 and 1.30 to 1.55%. The maximum value of moisture, protein, fat, ash and crude fibre were found in C_1 and the minimum value of moisture, protein, ash and crude fibre were found in C_3.

Keywords: Multigrain cookies, Nutritional quality, Wheat, Chickpea, Barley, Maize, Pearl Millet, Finger Millet Flour, Safedmusali Powder

1. Introduction
Cookies are the most popular bakery items consumed nearly by all levels of society. This is mainly due to its ready-to-eat nature, good nutritional quality and availability in different varieties and affordable cost. Most of bakery products are used as a source for incorporation of different nutritionally rich ingredients for their diversification. Several health products have now become available. Cookies are made in a variety of style using an array of ingredients including sugars, spices, chocolates, butter, peanut butter, nuts or dried fruits. Cookies are ideal for nutrient availability, palatability, compactness and convenience. They differ from other bakery products like bread and cakes because of having low moisture content, comparatively free from microbial spoilage and long shelf life of the product.
Cookies constitute major component of human snacks in most part of the world. It is an unleavened crisp, made from wheat flour, shortening (Hydrogenated fat) and sugar & is usually made light by the addition of baking powder. Wheat flour constitutes the basic ingredient for cookies production because of its gluten proteins, which are not present in flour of other cereals. The consumption of cereals and legumes all over the world gives them an important position in international nutrition. Besides the high starch & protein content as energy source, these grains provide dietary fibre, nutritious protein & lipids rich in essential fatty acids**,** vitamins, minerals, antioxidants and phyto-chemicals. A multigrain snack helps in high intake of fibre& health enhancing components (Ragaee and AbddelAal, 2006).
Wheat is staple food crop which occupies important place next to rice in India. India stands second in wheat production in the world next to China. In India, Punjab produces maximum wheat. Wheat (*Triticumaestivum*) is has origin mediterain region (south west Asia), Wheat is the world's number one cereal supply major portion of energy and protein in the Indian diets (Hira *et al*., 1993). Wheat contains about protein 12%, carbohydrate 71.2%, Mineral 1.5% and Fibre 1.2% but is deficient in the essential amino acid lysine. In India wheat is grown in an area of 25.68 million hectare with an annual production of 74.04 million tones and wheat is grown in an area of 2.69 million hectare with an annual production of 19.46 million tones in M.P. The wheat flour is major ingredient in chapatti, bread and the bakery products such as cakes, cookies, crackers, doughnuts, sweet rolls, biscuits etc.
In India, finger millet (Ragi) are mostly grown and consumed in Karnataka, Andhra Pradesh, Tamil Nadu, Maharashtra and Goa. Finger millet is highly nutritious, non-glutinous foods. Hence, they are soothing and easy to digest. Finger millet is particularly rich in minerals like calcium (440 mg/100 g) and magnesium (435.1 mg/100g). Finger millet is traditionally used for the preparation of food products such as porridge, unleavened bread, cookies, cakes and malted beverages. In India, Finger millet flour is made into flatbreads, including thick, leavened dosa and thinner, unleavened roti. Development of value added food products based on Finger millet, enrichment of its nutritional value and provide beneficial effect for good health are the current need of today for the well-being of the society.

Materials and Methods

The present investigation was carried out in the Department of Food Science and Technology, College of Agriculture, JNKVV, Jabalpur (M.P.) during the year 2017.

Preparation of cookies

Sweet cookies from wheat flour (control) and Blends (composite of sugar, fat, baking powder and water) were prepared using the traditional creamery method as described by Whitley (1970). Following general formula has been used for product preparation. The required quantity of sugar, fat and flavour (vanilla) was creamed well. To this, well mixed blends of remaining ingredients were added along with a required amount of water. The contents were mixed further for 2 min. to make dough of desired consistency. Using a wooden rolling pin, dough was rolled into a sheet of uniform thickness of approximately 5mm. Then cookies were cut into round shape pieces and placed on greased tray. The tray was kept in baking oven at 180 to 200^{0}C for 10-13 min.Following ingredients were taken to make cookies:

Ingredients	Quantity
Wheat flour or blend	64g
Safedmuslipowder	5g
Sugar	32 g
Vegetable oil	20 g
Glucose	1 g
Ammonium bicarbonate	0.5 g
Common salt	0.4 g
Baking powder	0.3 g
Sodium bicarbonate	0.2 g
Vanilla	0.025 g
Water	10-12 ml

Preparation of blends

Table 1: Different combinations of multigrain cookies

S. No	Treatment	Symbol
1	100% WF + 0%CF + 0% BF +0% MF + 0% PMF + 0% FMF	**C0**
2	70% WF + 6% CF + 6% BF + 6% MF + 6% PMF + 6% FMF	**C1**
3	60% WF + 8%CF + 8%BF + 8% MF + 8% PMF + 8% FMF	**C2**
4	50% WF + 10% CF + 10% BF + 10% MF + 10%PMF + 10% FMF	**C3**

*WF= Wheat flour, CF= Chickpea flour, BF= Barley flour, MF=Maize flour, PMF= Pearlmillet flour, FMF=Fingermillet flour

Results and Discussion

Proximate composition of raw material

The results of experiments are tabulated in the Table2. The moisture of the maize was maximum(14.90%) while that of chickpea was minimum(10.00%). Maximum content of protein and fat were in chickpea (21.27% and 5.10%) and minimum content was recorded in finger millet and barley (8.3% and 1.30%; respectively). Carbohydrate and ash content was noted maximum in finger millet (71.50% and 2.55%; respectively) and minimum content was in chickpea (60.80% and 1.12%; respectively). In case of crude fibre content maximum in barley (3.50%) and minimum content was noted in pearlmillet (1.20%).

Table 2: Proximate composition of raw material

Treatments	Moisture (%)	Protein (%)	Fat (%)	Carbohydrate (%)	Ash (%)	Crude Fibre (%)
Wheat	12.20	12.10	3.50	69.40	1.60	1.20
Chickpea	10.00	21.27	5.60	60.80	1.12	1.21
Barley	12.50	11.50	1.30	69.59	1.61	3.50
Maize	14.90	11.18	3.60	66.50	1.20	2.62
Pearl millet	12.40	11.60	5.00	67.60	2.20	1.20
Finger millet	12.29	8.30	1.88	71.50	2.55	3.48
SEM±	0.015	0.013	0.013	1.662	0.012	0.014
CD@ 5%	0.048	0.043	0.044	5.503	0.038	0.046

Chemical composition of multigrain cookies

Moisture content: It is evident from the Table 3 that, moisture content varied from 3.30 to 3.39%. The treatment C_0 was found to have higher moisture content (3.87%) followed by C_1 and C_2. The treatment C_3 got lower value of 3.30%. All treatment combinations were having significant differences among each other.

Protein content: It is obvious from the Table 3 that, the protein content of the cookies was in the range of 10.04 to 12.60%. The highest protein content (12.60%) was recorded in C_1 followed by C_2 and C_3, whereas the lowest protein content (10.04%) was recorded in C_0. All treatment combinations were having significant differences among each other.

Fat content: It is obvious from the Table 3 that, the fat content of the cookies was in the range of 16.32 to 18.50%. The highest fat content(18.50%) was recorded in C_0 followed by the formulation C_3 and C_1, whereas the lowest fat content (16.32%) was recorded in C_2. All treatment combinations were having significant differences among each other.

Carbohydrate content: It is clear from the Table 3 that, numerically the maximum carbohydrate content (66.90%) was observed in C_3 statistically at par with C_2 and C_0, whereas the minimum carbohydrate (63.60%) content was recorded in C_1. All treatment combinations were having significant differences among each other.

Ash content: It is obvious from the Table 3 that, the ash content varied from 1.29 to 1.76%. The highest ash content was observed in treatment C_1 scored (1.76%) statistically at par with C_2 and C_3. The treatment scored lowest 1.29% C_0. All treatment combinations were having significant differences among each other.

Crude fiber content: It is clear from the Table 3 that, crude fiber ranged from 1.12 to 1.55% in different treatment combinations. The maximum fiber content recorded in C_1 or

C_3 1.55% compared to C_2. The treatment C_0 scored minimum 1.12%. All the treatments differed significantly from each other.

The chemical composition of cookies was conformity with the findings obtained by Sathe *et al*. (1981), France (1988), Semwal *et al*. (1996) and Swamy*etal*. (2003).

Table 3: Chemical composition of multigrain cookies

Treatments	Moisture (%)	Protein (%)	Fat (%)	Carbohydrate (%)	Ash (%)	Crude Fibre (%)
C0	3.87	10.04	18.50	65.18	1.29	1.12
C1	3.39	12.60	17.10	63.60	1.76	1.55
C2	3.32	11.98	16.32	65.71	1.37	1.30
C3	3.30	10.38	16.54	66.90	1.33	1.55
SEM±	0.014	0.016	0.012	0.017	0.015	0.015
CD@ 5%	0.046	0.054	0.040	0.055	0.049	0.049

Conclusion

On the basis of sensory evaluation and chemical properties of different formulation of multigrain cookies showed that wheat, chickpea, barley, maize, pearl millet, finger millet flour addition significantly improved the nutritional value in terms of protein, carbohydrate and crude fiber content. Hence C_3 (wheat 70% + chickpea 6% + barley 6% + maize 6% + pearl millet 6% + finger millet 6%) was found to be best.

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