

Organoleptic and Nutritional Evaluation of Cookies Supplemented with Oat and Finger Millet

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ABSTRACT

The present investigation was undertaken with an objective to prepare cookies with partial replacement of wheat flour at different proportions of oats and finger millet and to study its effect on the physical, chemical and sensory characteristics of cookies were studied. The study was focused on standardizing the acceptable level of oat and finger millet flour in cookies. Replacement of wheat flour with oat and finger millet flour increased the protein, fibers and ash contents proportionately to the level of substitution.

Key words: Oats, Finger millet, Nutrition, Health benefits, Cookies

INTRODUCTION

Cookies are important food snacks for children and adults. At present cookies are prepared from white flour which is inferior in quality and low in fiber content. For this reason interest in research has been developed in increasing fiber content in the diet. In many countries, cookies are prepared with fortified or composite flour to increase its nutritive value⁶. Importance of bakery products has expanded especially the use of whole and natural grains and other natural ingredients⁹. Oat is an important cereal crop in the developing world and the most popularly cultivated. Oats have received considerable attention for their high content of dietary

fibres, phytochemicals and nutritional value. Oat products are consumed as ingredients in baked foods or in porridge and considered as source of low cost protein with a protein content of 15 to 20% (dry matter basis) in de-hulled oat grain⁸. Oats are an excellent food for lowering cholesterol and reducing risk of heart disease because of the high soluble fiber content. It is believed that consumption of oats possesses various health benefits such as hypo-cholesterolaemic and anti-cancerous properties. Owing to their high nutritional value, oat-based food products like breads, biscuits, cookies, breakfast cereals, flakes and infant food are gaining increasing consideration⁴.

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Finger millet is well comparable and even superior to many cereals in terms of mineral and micronutrient contents. It has good potential of providing nutritional security to the consumers. Its consumption in urban area can be increased through its proper processing and value addition¹². Finger millet is rich in protein, iron, calcium, phosphorous, fiber and vitamin content. The calcium content is higher than all the cereals and iodine content is said to be the highest among all the food grains. It has best quality protein along with the presence of essential amino acid, vitamin A, vitamin B and phosphorous⁵.

The reported research was aimed to evaluate the effect of replacement wheat flour by different levels of oats and finger millet on physico-chemical and sensory characteristics of cookies.

MATERIAL AND METHODS

Raw materials and chemicals

Oats, finger millet and other required materials were procured from the local market of Parbhani, Maharashtra. All the chemicals used in present investigation were of analytical grade and were obtained from the College of Food Technology, VNMKV, Parbhani (MS), India.

Preparation of cookies

The cookies were prepared by partial replacement of refined wheat flour with oats and finger millet at different proportions keeping the sugar and fat amount constant to 40 and 35 g respectively on 100 g flour basis. White wheat flour cookies were considered as control. Fat and ground sugar was creamed in a mixer with a flat beater for 2 min at slow speed. The flour, required amount of milk and 1.5 g ammonium bicarbonate were added to the creamed mixture and mixed for 8 min at medium speed in dough mixer to obtain a homogenous mixture. The batter was sheeted to a thickness of 4.5 mm with the help of rolling pin and an aluminum frame of standard height. The cookies were cut with cookie die to desired diameter of 50 mm and transferred to a lightly greased aluminum baking tray. Baking was done at 180⁰ C for 15 min in a

baking oven. The baked cookies were cooled and stored in an air tight container for further analysis.

Sample coding

Sample cookies were formulated with different levels of oats against refined wheat flour were taken containing T₁ (Control-100% wheat flour), T₂ (40% oats and 5% Finger millet), T₃ (50% oats and 5% Finger millet), T₄ (40% oats and 10% Finger millet) and T₅ (50% oats and 10% Finger millet). The prepared samples were assessed for different sensorial and compositional properties against control made from 100% wheat flour.

Physical characteristics

Weight of cookies was measured as average of values of four individual cookies with the help of digital weighing balance. Diameter of cookies was measured by laying six cookies edge to edge with the help of a scale rotating those 900 and again measuring the diameter of six cookies (cm) and then taking average value. Thickness was measured by stacking six cookies on top of each other and taking average thickness (cm). Spread ratio was calculated by dividing the average value of diameter by average value of thickness of cookies. Per cent spread was calculated by dividing the spread ratio of supplemented cookies with spread ratio of control cookies and multiplying by 100.

Chemical composition

Chemical composition in terms of moisture, fat, protein, ash and carbohydrate was estimated by employing standard methods of analysis¹.

Sensory analysis

The sensory evaluation of cookies was carried out by a 10 member semi-trained panel. Panelists were selected on the basis of availability, ability and interest and had some previous experience in sensory evaluation of bakery products. Panelists recorded their perceptions of each attribute in terms of the score. Judgements were made through rating products on a 9 point Hedonic scale with corresponding descriptive terms ranging from 9 'like extremely' to 1 'dislike extremely'.

Texture profile analysis (TPA)

TA-XT2 PLUS Texture Analyzer (Stable Micro System, Surrey, UK) was used for measuring texture profile of cookies. Warner Blatzer probe was used to determine the hardness and fracturability of food product with compression mode and having 5 mm/sec of pre- test speed, 2.0 mm/sec test speed, 10 mm/sec post- test speeds and distance was used as target with 10mm distance. Hardness (H) was the maximum load, expressed in kg, applied to the sample during the compression.

Statistical analysis

The data were statistically analysed in a completely randomized factorial design according to Panse and Sukhatme⁷.

RESULTS AND DISCUSSION

Proximate composition of flours

Proximate composition of wheat, oat and finger millet flour was determined in terms of moisture, crude fat, protein, fiber, ash, carbohydrate and results are represented in Table 1.

It was revealed from Table 1 that the moisture content of wheat flour was slightly higher (10.90 %) than that of the oat flour (8.70 %) and this may be due to higher temperature employed during drying of grains. Crude fat content of oat was found to higher (6.10 %) than wheat and finger millet flour. Oat was found to be rich in the content of protein and fiber than wheat and finger millet. Oat flour was having higher percentage of crude protein and crude fiber as 13.34 % and 3.92 % as compared to wheat flour which is 10.80 % and 0.86 % respectively. Similar trend of results were found by Bhatt *et al.*². Ash content of oat flour was found to be significantly higher (1.13 %) followed by finger millet (1.09 %) and then wheat flour (1.02 %). These results were in good accordance with the findings of Desai *et al.*³

Physical characteristics of Oat and Finger millet cookies

Physical characteristic of cookies are important from consumer point of view and also helps in evaluating the effect of replacement of oat and finger millet flour on

baking. The data pertaining to physical characteristics of oat fortified cookies is presented in Table 2.

Physical characteristics of cookies, such as weight, diameter, thickness and spread ratio, were affected significantly with the replacement of oat and finger millet cookies. From the table, it can be observed that the weight of cookies increased linearly and this was might be due to addition of oat flour and finger millet flour which increases fiber level in composite cookies. The increase in percentage of oat and finger millet flour progressively increased diameter and spread ratio according to treatments where as thickness was showing significantly decreased trend.

The changes in diameter and thickness were reflected in spread ratio of cookies. The spread ratio of 50% oat and 5% finger millet flour was highest 5.66 and it was lowest in control cookies i.e. 4.31. With the addition of oat and finger millet cookies the spread ratio was increased from 4.31 to 5.66 and followed by decreased from 5.27 to 5.13. Cookies with 50% oat flour and 5% finger millet flour showed good top grain development whereas control cookies showed negligible top grain development.

Chemical composition of Oat and Finger Millet cookies

Chemical composition of cookies with different level of oat and finger millet is presented in Table 3.

It is observed from table that moisture, fat, fiber, protein and ash content was found to be increased with increase in the replacement of oat and finger millet flour in cookies. Fat content of oat and finger millet cookies increased from 13.85 (T₁) to 15.33 (T₅). This increase in fat may be due to replacement of oat flour as it was rich in fat. Progressive increase in fiber content of cookies was observed among the treatments due to high fiber content in oat and finger millet flour as compared to wheat flour. Similar results about increase in fiber content of cookies were reported by Sharif *et al.*¹⁰.

Protein content in cookies increased linearly with increasing level of oat and finger millet flour. The highest protein content 9.20 was observed in cookies with 50% oat and 10% finger millet flour (T₅) whereas lowest protein content 8.63 was observed in control cookies (T₁). Ash content in food substances indicate inorganic remains when the organic matter has been burnt away and it was found to be increased among treatments. Carbohydrate content was found to be decreased. Singh *et al.*¹¹ reported that addition of milled millet flour to wheat flour increased the concentration of protein, fat and ash but decreased carbohydrates.

Sensory evaluation of Cookies

To find out the best formulation of composite flours for preparation of oat and finger millet cookies, the standardization of formulation of composite flours was made by taking different proportions of wheat flour, oat flour and finger millet flour. The prepared cookies were evaluated for its sensory acceptability using 9

point hedonic scale and results are shown in Fig.1.

Graph 1 reveals that the color and appearance of cookies gradually decreased from (8.40) T₁ to (8.12) T₅. Maximum score (8.40) for color was recorded in control cookies whereas minimum score (8.12) was recorded in cookies with 50% oat flour and 10% finger millet flour (T₅). The decrease in color of cookies might be due to replacement of wheat flour by finger millet flour which was slightly grayish in color. The cookies with 50% oat flour and 5% finger millet flour (T₃) scored maximum for taste and flavour whereas cookies with 50% oat and 10% finger millet scored minimum.

The textural qualities were greatly improved by increasing proportion of oats and flour in the cookies. The texture was improved from (8.70) T₁ to (8.94) T₅. The overall acceptability of T₃ sample of cookies was highest (8.80) in which composite flour of wheat flour (45%), oat flour (50%) and finger millet flour (5%).

Table 1: Proximate composition of flours

Parameters (%)	Wheat Flour	Oat Flour	Finger Millet Flour
Moisture	10.90	8.70	10.80
Crude Fat	1.62	6.10	1.08
Crude Protein	10.80	13.34	7.58
Crude Fiber	0.86	3.92	3.63
Ash	1.02	1.13	1.09
Carbohydrate	74.80	66.81	75.82

*Each value is an average of three determinations

Table 2: Physical characteristics of oat and finger millet cookies

Treatments	Physical characteristics				
	Weight (g)	Diameter (cm)	Thickness (cm)	Spread ratio	Top grain Development
T ₁ (Control)	12.10	50.00	11.60	4.31	Rare
T ₂	12.11	51.46	10.58	4.86	Moderate
T ₃	12.18	52.95	9.36	5.66	Most
T ₄	12.21	51.86	9.84	5.27	Moderate
T ₅	12.28	51.00	9.95	5.13	-
SE ±	0.0826	0.12247	0.1161	0.0224	-
CD @ 5%	0.2664	0.38530	0.3496	0.0673	

*Each value is an average of three determinations

Table 3: Chemical composition of Oat and Finger Millet cookies

Treatments	Chemical Parameters (%)					
	Moisture	Fat	Fiber	Protein	Ash	Carbohydrate
T ₁	3.38	13.85	0.37	8.63	1.10	72.67
T ₂	3.71	15.14	2.05	8.89	1.31	68.09
T ₃	3.95	15.31	2.34	9.16	1.39	67.85
T ₄	4.07	15.28	2.42	8.87	1.45	67.91
T ₅	4.23	15.33	2.53	9.20	1.53	67.18
SE _±	0.0224	0.0183	0.38730	0.082664	0.0387	0.91742
CD at 5%	0.0673	0.055	0.12184	0.26006	0.1218	2.8862

*Each value is an average of three determinations

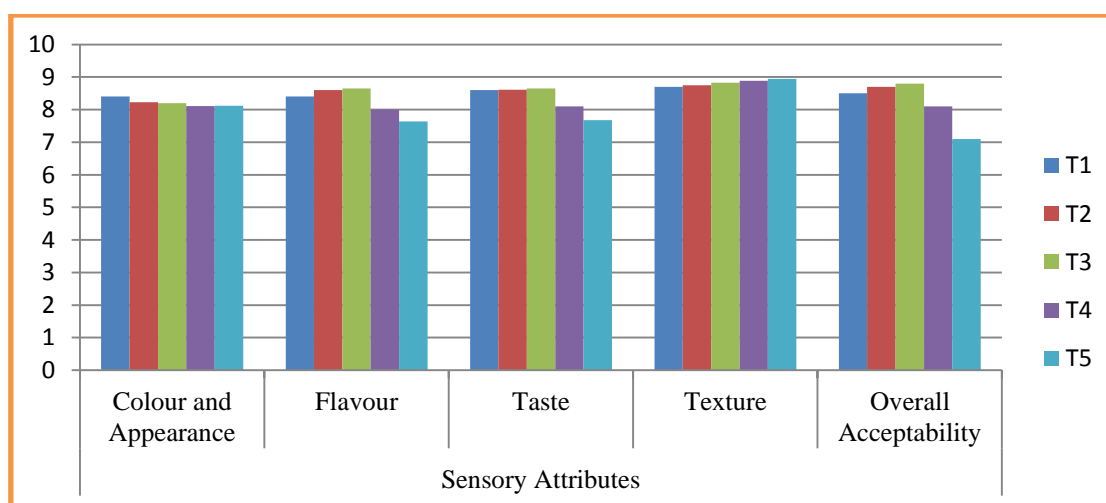


Fig. 1:

CONCLUSION

In the light of scientific data of present investigation, it was concluded that oat and finger millet flour can be successfully utilized up to 50% and 5% respectively in the preparation of oat and finger millet cookies without adversely affecting physical, chemical and organoleptic qualities of cookies. Cookies prepared by using composite flour of oat and finger millet with wheat flour were found to be rich source of fiber and protein.

Future Prospects

Demand for such oat and finger millet products will increase in future considering its positive health benefits.

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