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FORMULATION AND ASSESSMENT OF PHYSICOCHEMICAL AND SENSORY PROPERTIES OF PROTEIN ENRICHED COOKIES

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The present study aimed at formulating cookies using composite flour with the benefit of less utilized yet nutritious millets. The physicochemical, shelf life and sensory properties of the cookies (soy+bajra+kodo millet flour) were studied. Cookies made from a blend of flours were found to have 6.87 g, 5.98 g and 41.898 g protein, moisture and fat content respectively. The diameter, height and spread ratio of the protein enriched cookies were 5.5 cm, 0.441 cm and 12.47 respectively. Sensory evaluation was carried out by 10 semi trained panelists for aroma, crispiness, mouth feel, taste, color, flavor, texture and overall acceptability. The overall acceptability was found to be 8 on a 9 point hedonic scale.

INTRODUCTION

Millet is a word which originated from the French word *'mille',* which means thousand, this is because a handful of the grains makes a thousand. The millet belongs to a group of forage grasses which produces small-sized grains. This group of species are said to have originated from China, Asia and Africa. Millets are the sixth biggest cereal crops after wheat, maize, rice, barely and sorghum. These are superior in nature in terms of nutritional quality, have higher protein, aminoacids, macro and micro nutrient content. Millets also have other properties which are not present in cereals like rice or wheat like antioxidant, antimicrobial, anti-inflammatory, antiviral, anticancer, antiplatelet aggregation and catractogenesis inhibitor activities (Adebiyi *et al.*, 2016).

Millets are also known as nutria-cereals, because of their higher vitamin and amino acid content. According to Leder (2004) it contains 22-28% Albumins and Globulins, 28-32% Glutelein and Glutelein like protein and 22-35% Prolamin.

They are also rich sources of phytochemicals, polyphenols, soluble and insoluble dietary fibers and minerals. They contain highly polysaturated fatty acids and also have a low glycemic index (Adebiyi *et al.*, 2016).

Millets require only very less water and other resources to grow. They can be used as a sustenance food for communities which do not have enough nutrition. Although these are rich in nutrition they are not used in food in a wide range (Geetha *et al.*, 2014). As the population is growing in size, they require the nutrition provided by the millets to survive (Pu Huang *et al.*, 2016). The millet is small in size and hence, there are high chances of small pebbles mixing in that and making it a bit difficult to eat. They undergo blanching, malting, dry heating, acid treatment, popping, etc., to reduce level of antinutrients, increase shelflife and improve digestibility (Kavitha Patil *et al.*, 2014).

Cookie is a baked product which is available in various shapes and is made mainly using flour, sugar and fat. When

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whole wheat is milled, only the carbohydrate rich endosperm is retained. This results in a big loss of many nutritionally valuable biochemical compounds such as dietary fibre, vitamins, minerals and antioxidant which play an important role in reducing the cardiovascular diseases. The loss of vitamins and minerals in refined wheat flour has led to widespread prevalence of constipation and other digestive disturbances and nutritional disorders (Heshe *et al.*, 2015).

Cookies are generally formulated using refined wheat flour, which doesn't provide much nutrient value. To make it nutritious, a substituted formula of millets and pulses are used in the present research which increases the protein content of the cookies. Soy, bajra and kodo millet flour are incorporated in the making of cookies, which makes it nutritious.

MATERIALS AND METHODS

Materials

The ingredients for the cookies such as millets, whole wheat flour, baking powder, butter, were purchased from a local market in Chennai. The millet was ground in a grinder-mixture to obtain a fine powder, so that there will not be small kodo millet pieces in the cookies.

Preparation of the Cookies

The experimental cookies were made using standard cookie recipe, where a portion of refined wheat flour was replaced by mixture of soy, bajra, kodo millet flour. The butter and sugar were creamed in a hand beater for 3 minutes and the mixture of flours along with baking powder was sifted and

Table 1: Formulation of Experimental Cookies

Ingredients	Quantity
Refined wheat flour	50 g
Bajra flour	25 g
Kodo millet flour	25 g
Soy flour	45 g
Butter	120 g
Sugar	100 g
Baking powder	5 g
Water	1 tbsp
Vanilla essence	Few drops

added to the creamed mixture. The dry ingredients were then folded into the butter-sugar mixture. Essence was then added to the dough. The dough was then made into shapes and transferred to a slightly greased baking tray. The cookies were then baked in a preheated oven for 10 minutes at 180 °C. The cookies were then removed and allowed to cool for 1 hour before analysis was done.

Proximate Composition Analysis

Moisture: The moisture for the cookies was analysed by the AOAC method. 5 g of the sample was transferred to the dried and weighed dishes. The sample was placed in the drying oven and dried for 3 hrs at 105 °C, and then cooled in desiccators to room temperature and reweighed (Heshe *et al.*, 2015).

Fat: The fat was determined using a Soxhlet extractor using diethyl ether (boiling point, 55 °C) to extract the fat from a 5 g sample. The ether was evaporated from the extraction flask. The amount of fat was calculated from the difference in weight of the flask before and after extraction as percentage (Heshe *et al.*, 2015).

Protein: The protein is found by Khjeldahl method with the help of concentrated sulphuric acid, copper sulphate and potassium sulphate, these help in the conversion of nitrogen to ammonia. The ammonia which is released after alkalization (using Sodium Hydroxide) is steam distilled into boric acid and titrated with hydrochloric acid (Heshe *et al.*, 2015).

Physical Characteristics

Diameter and Thickness: The diameter and the thickness of the cookies were measured using a Vernier calliper before and after the baking. To measure these 4 samples of the cookies were taken and the total diameter was measured. The cookies were rotated by 90° and the diameter was measured. The average of the two was taken as the final diameter. The height was measured by stacking the 4 cookies and measuring their thickness. The average was taken as the final thickness. The weight of the cookies was measured using an electronic balance (Noor Azhia *et al.*, 2012).

Sensory Evaluation

Sensory evaluation was done for the cookies after the baking and cooling. The cookies were evaluated by 10 semi-trained panellists on the basis of colour, flavour, taste, texture and overall acceptability on a 9 point hedonic scale.

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RESULTS AND DISCUSSION

Proximate Composition

The result of the proximate analysis of the experimental cookies made using soy, bajra, kodo millet is shown in the Table 2. The fat content of the cookies was 41.898%, this was required to bind the cookies together. The protein content of the cookies has been enriched due to the addition of soy flour, which is naturally rich in protein.

Cookies diameter, thickness and spread factor is shown in Table 3. The diameter of the cookies has increased from 3.5 cm to 5.5 cm with a slight difference in the height of the cookies. The increase in the diameter is due to the viscosity of the dough. The viscosity of the dough is influenced by the protein content of the dough. The protein forms a web in the dough which will restrict the expansion of the cookie.

Table 2: Proximate Analysis of the Experimental Cookies	
Parameter	**Values**
Moisture	5.98%
Crude fat	41.90%
Crude protein	6.87%
pH	5.5

Table 3: Measure of Physical Characteristics of Cookies		
Parameter	**Before Baking**	**After Baking**
Diameter	3.5 Cm	5.5 Cm
Thickness	0.5 Cm	0.441 Cm

Table 4: Sensory Evaluation of the Experimental Cookies	
Sensory Characteristics	**Score**
Taste	8
Flavour	8.1
Color	8.2
Texture	7.5
Crispness	7.5
Overall acceptability	8

Graph 1: Sensory Evaluation of the Experimental Cookies
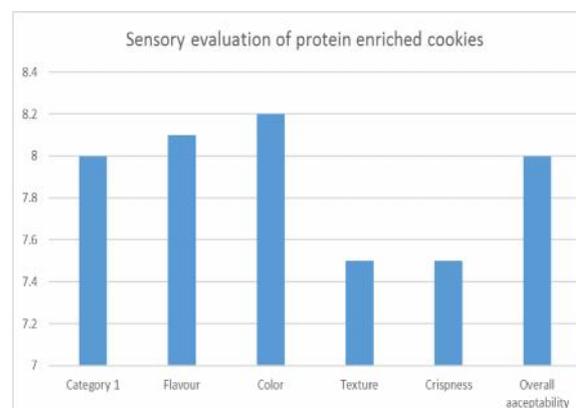
Here even though the content of protein is high the expansion of the cookie is high.

Sensory Evaluation

The results of the sensory evaluation is shown in the Table 4. The color of the experimental cookies was darker than any standard butter cookie made with refined wheat flour, due to the addition of soy flour. The experimental cookies made were found to be acceptable to the panellists. The sensory valuation revealed the overall acceptability of the product as 8 on a 9 point hedonic scale.

CONCLUSION

The cookies enriched with soy, bajra and kodo millet was found to have more protein content than the butter cookies. The aim of the study was to increase the level of protein in cookies, this was achieved by the incorporation of soy flour. This study has indicated that acceptable and nutritious cookies can be formulated using a mix of flours of soy, bajra and kodo. The overall acceptability of the cookies was also good.

REFERENCES

- Adebiyi J A, Obadina A O, Adebo O A and Kayitesi E (2016), "Fermented and Malted Millet Products in Africa: Expedition from Traditional/Ethnic Foods to Industrial Value Added Products", *Critical Reviews in Food Science and Nutrition*.

- Anu Bala, Khalid Gul and Charanjit Singh Riar (2015), "Functional and Sensory Properties of Cookies Prepared from Wheat Flour Supplemented with Cassava

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and Water Chestnut Flours", *Food Science and Technology*, Vol. 1.

- Bhat M A and Ahsan H (2015), "Physico-Chemical Characteristics of Cookies Prepared with Tomato Pomace Powder", *Journal of Food Processing and Technology*, Vol. 7, p. 543.

- Chinma C E and Gernah D I (2015), "Physicochemical and Sensory Properties of Cookies Produced from Cassava/ Soybean/Mango Composite Flours", *Journal of Food Technology*, Vol. 5, No. 3, pp. 256-260.

- Geetha R, Mishra H N and Srivastav P P (2012), "Twin Screw Extrusion of Kodo Millet-Chickpea Blend: Process Parameter Optimization, Physico-Chemical and Functional Properties", *Journal of Food Science and Technology*, Vol. 51, No. 11, pp. 3144-3153.

- Heshe G G, Haki G D, Woldegiorgis A Z and Gemede H F (2015), "Effect of Conventional Milling on the Nutritional Value and Antioxidant Capacity of Wheat Types Common in Ethiopia and a Recovery Attempt with Bran Supplementation in Bread", *Food Science and Nutrition*, Vol. 4, No. 4, pp. 534-543.

- Huang P, Shyu C, Coelho C P, Cao Y and Brutnell T P (2016), "Setaria Viridis as a Model System to Advance Millet Genetics and Genomics", *Frontiers in Plant Science*, Vol. 7, p. 1781.

- Patil K B, Chimmad B V and Itagi S (2015), "Glycemic Index and Quality Evaluation of Little Millet (*Panicum miliare*) Flakes with Enhanced Shelf Life", *Journal of Food Science and Technology*, Vol. 52, No. 9, pp. 6078-6082.