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Udaybeer

Department of Food Science and Technology, JNKVV, Jabalpur, Madhya Pradesh, India

MA Khan

Department of Food Science and Technology, JNKVV, Jabalpur, Madhya Pradesh, India

LPS Rajput

Kasa Fine Foods (The Oven Classics), Tilheri, Jabalpur, Madhya Pradesh, India

Shriram Godase

Kasa Fine Foods (The Oven Classics), Tilheri, Jabalpur, Madhya Pradesh, India

Correspondence**Udaybeer**

Department of Food Science and Technology, JNKVV, Jabalpur, Madhya Pradesh, India

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Physical parameters of low gluten cookies and different flour combination (wheat, soybean and pearl millet flours)

Udaybeer, MA Khan, LPS Rajput and Shriram Godase

Abstract

In this era of industrialization and technological advancement, the life style of the people has changed. With the changing lifestyle, demand for ready to eat and convenient foods has increased considerably. Different types of such products are available in market. Among these, bakery products (cookies) are very common in children and adults. Cookies have been man's food since a long time. The cookies with pearl millet and soy flour combination had higher fat, protein, ash and calorific values as compared to control cookies. It is a processed convenience food ever produced and in most widely acceptable. It is one of the few universal staples, which is complete in it and requires no additional preparation. Thus, for many, cookies become an important source of high molecular carbohydrates, proteins and some vitamins and minerals. But it is important to know that, as compared to refined wheat flour which is deficient in certain essential amino acids thus has a lost nutritional value. The nutritional value of biscuit can be enhanced by fortification and supplementation with a wide variety of protein. Soya bean is the most efficient protein source of vegetable origin containing about 40% protein besides other nutrients like carbohydrate about (22%), fat about (19.01%) and reasonable quantity of minerals and vitamins and cookies are best physical parameters. The chief raw materials for production of these products are refined wheat flour, Table sugar, shortening, milk solids and leavening agents. The optimization of levels of ingredients shows optimum value of ingredients for cookies to be sugar 18g, fat 16g, baking powder, 0.3g, and water 12-13ml respectively.

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Keywords: Different food crops, best physical parameters, rich in carbohydrate, protein and other nutrients, and low gluten cookies

1. Introduction

Cookies are most popular and widely consumed processed food in India. In this era of industrialization and technological advancement, the life style of the people has changed. With the changing lifestyle, demand for ready to eat and convenient foods has increased considerably. Different types of such products are available in market. Among these, bakery products (cookies) are very common in children and adults. They are among the low cost processed food in the country when compared to Indian sweet meats, salted snacks items. They are high in carbohydrates, fat and calorie but low in fiber, vitamin, and mineral which make it unhealthy for daily use. Because of its acceptability in all age group, longer shelf life, better taste. Soybean is an excellent source of protein contains 35-45% with all essential amino acids required for proper growth and maintenance of body. Among all the snack foods, biscuits have certain advantages. Apart from offering good nutrition and taste, they can be packed in a variety of size. They have relatively longer shelf life then other snack food and can be used with advantage for fortification purpose. With changing food needs and socio economic pattern, they are no longer a tea time snack but have become an essential item in an average Indian house hold. Indian industrial scenario indicates that Bakery may be considered as the largest industry among other food industries in India with an annual turnover of Rs.7500 crores (Kamaliya and Subhash, 2003) [8]. The present growth rate of bakery industry is around 12% per annum. Bakery products are increasingly becoming popular in India as indicated by over 2.5 fold increase in their production during the last two decades (Puranik, 2003) [12]. The biscuit/cookie provides an excellent additional means of improving the dietary protein intake of people through the incorporation of proteins. The protein and micro-nutrients are gaining much importance in recent years and their deficiencies are recognized as major health problem in many developing countries.

Conventional biscuits contain low level of the proteins of poor quality (Rajor *et al.*, 1989) [13]. Wheat (*Triticum aestivum*) is has origin from mediterrrain region (south west Asia), Wheat is the world's number one cereal which supply major portion of energy and protein in the Indian diets (Hira *et al.*, 1993) [7]. Wheat contains about 12% protein, carbohydrate 71.2%, Mineral 1.5% and Fibre 1.2% but is deficient in the essential amino acid lysine. India is the second largest producer of wheat in the world after China. Cookies have been man's food since a long time. It is a processed convenience food ever produced and in most widely acceptable. It is one of the few universal staples, which is complete in it and requires no additional preparation. The cookies become an important source of high molecular carbohydrates, proteins and some vitamins and minerals. But it is important to know that, as compared to refined wheat flour which is deficient in certain essential amino acids has a low nutritional value. The nutritional value of cookies prepared with wheat flour (Maida) can be enhanced by fortification and supplementation with a wide variety of protein. Soya bean is the most efficient protein source of vegetable origin containing about 40% protein besides other nutrients like (carbohydrate about 22%), fat about (19.01%) and reasonable quantity of minerals and vitamins (Gandhi *et al.*, 1985). Pearl millet is a food that supplies a major proportion of calories and protein to large segments of populations in the semi-arid tropical regions of Africa and Asia (O'Kennedy *et al.*, 2006) [10]. Millet is a gluten-free and low-cost cereal (approximately 40% lower than the price of corn), which is resistant to drought and nutrient-poor soils (Gomes *et al.*, 2008) [6]. Millet is a superior cereal with regard to nutritional quality and presents several health benefits (Krishnan *et al.*, 2011) [9]. Moreover, millet is a potent source of antioxidants, due to its phenolic content (Dykes & Rooney, 2006; Shahidi & Chandrasekara, 2013) [3, 14] and is a staple food substitute for celiac patients who require gluten-free cereal (Shahidi & Chandrasekara, 2013) [14].

2. Method and Material

2.1 Preparation of Blends

RWF= Refined Wheat flour, PMF= Pearl Millet flour, SF= Soybean flour

Table 1: Different combination of wheat, pearl millet and soybean flours

S. No	Treatment	Symbol
1	100% RWF + 0% PMF + 0% SF	C ₀
2	65% RWF + 25% PMF + 10% SF	C ₁
3	45% RWF + 50% PMF + 5% SF	C ₂
4	20% RWF + 75% PMF + 5% SF	C ₃
5	10% RWF + 85% PMF + 5% SF	C ₄

Refined wheat flour, pearl millet flour, soya flour and various ingredients such as sodium bicarbonate, ammonium bicarbonate, vegetable oil, sugar, baking powder, vanilla essence, liquid glucose and salt were purchased from the local market.

2.2 Following ingredients were taken to make cookies per 100gm blend

Ingredients	Quantity
Wheat flour or blend	64 gm
Sugar	18 gm
Vegetable oil	16 gm

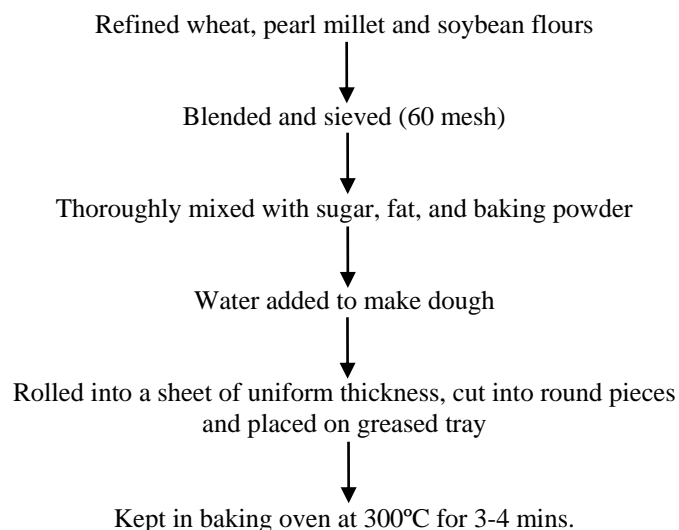
Glucose	1 gm
Ammonium bicarbonate	0.5 gm
Common salt	0.4 gm
Baking powder	0.3 gm
Sodium bicarbonate	0.2 gm
Vanilla	0.025 gm
Water	10-12 ml

2.3 Preparation of low gluten cookies

Sweet cookies from white flour (control) and blends (composite of, sugar, fat, baking powder and water) were prepared using the traditional creamery method as described by Whitley (1970) [16]. 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 300°C for 3-4 min.

The flow sheet illustrating the preparation of cookies has been described in the flowchart (Table 2).

Table 2: Flow sheet for preparation of low gluten cookies



3. Results and Discussion

3.1 Physical properties of low gluten cookies

3.2.1 Diameter (D)

The Diameter of cookies was measured by laying of cookies edge to edge and measuring to the nearest mm (A.A.C.C. 1967) [1]. The cookies were rotated at 90° and their diameter was remeasured as a check determination the average diameter was reported in mm.

3.2.2 Thickness (T)

Thickness of cookies was measured by placing the cookies edge to edge and by staking one above the other respectively measurement by rearranging and re staking were made and average values were taken and expressed as mm (A.A.C.C. 1967) [1].

3.2.3 Spread factor (D/T)

The spread factor was calculated by dividing the average value of diameter (D) by average value of thickness (T) of cookies (AACC, 1967) [1].

3.2.4 Specific Volume

This was calculated by dividing average weight of cookies by average volume of cookies. The results were expressed as ml/g.

Table 3: Physical properties of low gluten cookies

Treatment	Diameter (mm)	Thickness (mm)	Spread factor D/T	Specific volume
C ₀	46.00	10.00	4.60	8.9
C ₁	45.00	11.00	4.09	6.2
C ₂	48.00	10.00	4.80	7.5
C ₃	52.00	8.00	6.24	8.2
C ₄	50.00	7.00	7.14	9.1

3.3 Storage Stability

The storage study was conducted for 90 days at ambient temperature ($32^{\circ}\text{C} \pm 2$ and $65\% \pm 5\text{RH}$) in different packaging material viz., polypropylene, low density polyethylene and aluminium foil after 0, 30, 60 and 90 days and results are presented in Table 4.

Table 4: Effect of storability on overall acceptability of developed low gluten cookies

Formulation	0 days	30 days	60 days	90 days
P ₁ C ₀	8.80	8.60	8.10	7.40
P ₂ C ₀	8.80	8.40	7.50	6.70
P ₃ C ₀	8.80	8.20	7.30	6.40
P ₁ C ₁	8.21	8.20	7.88	7.50
P ₂ C ₁	8.21	7.80	7.08	6.90
P ₃ C ₁	8.21	7.90	7.00	6.88
P ₁ C ₂	8.61	8.50	7.92	7.50
P ₂ C ₂	8.61	8.20	7.64	7.20
P ₃ C ₂	8.61	7.86	7.40	6.90
P ₁ C ₃	8.45	8.40	8.16	7.95
P ₂ C ₃	8.45	8.20	7.80	7.40
P ₃ C ₃	8.45	7.88	7.50	6.80
P ₁ C ₄	8.57	8.54	7.70	7.42
P ₂ C ₄	8.57	8.20	7.40	6.80
P ₃ C ₄	8.57	8.10	7.30	6.60

P₁- Polypropylene, P₂- low density Polyethylene, P₃- Aluminium foil

4. Discussion

Utilization of low gluten cookies in 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. Cookies thus, made can be used effectively for feeding the diabetic and diseased peoples. The maximum and minimum diameter of cookie was at treatment C₄ (10% wheat flour, 85% pearl millet and 5% soy flour) in the diameter value in 52mm and treatment C₂ (45% wheat flour, 50% pearl millet and 5% soy flour) in the diameter value in 45mm respectively. Thickness was highest at treatment C₂ (45% wheat flour, 50% pearl millet and 5% soy flour) in the thickness value in 11mm and lowest at treatment C₄ (10% wheat flour, 85% pearl millet and 5% soy flour) in the thickness value in 7mm respectively. Shukla (1997) [15], Abboud *et al.* (1985) [2], Finney *et al.* (1950) [4] and Patel & Venkateswa Rao (1996) [11] also reported the similar findings. The maximum and minimum spread factor was observed in treatment C₄ (10% wheat flour, 85% pearl millet and 5% soy flour) in the spread factor value in 7.14 and treatment C₂ (45% wheat flour, 50% pearl millet and 5% soy flour) in the spread factor value in 4.09 respectively. The minimum and maximum specific volume was 6.2cc/g and 9cc/g was recorded in treatment C₂ (45% wheat flour, 50% pearl millet and 5% soy flour) in the specific volume value in 6.2cc/g and treatment C₄ (10% wheat flour, 85% pearl millet and 5% soy flour) in the specific volume value in 9cc/g respectively. The best instant mixes of wheat, pearl millet and soybean flours based cookies were stored in three different packaging materials i.e. polypropylene, low density polyethylene and

aluminium foil and stored at ambient temperature ($32^{\circ}\text{C} \pm 2$ and $65\% \pm 5\text{RH}$) for up to 90 days. The overall acceptability of mixes was decreased as increases in storage period. The highest mean scores for overall acceptability was found in polypropylene bag for mix up to 90 days. The overall acceptability of cookies prepared from mixes (wheat, pearl millet and soybean) flours stored in polypropylene had better result as compare to low density polyethylene and aluminium foil.

5. Conclusion

On the basis of obtained results, gluten free flours combinations could be used to produce good quality cookies with acceptable physical and sensory qualities. These cookies are advantageous for people suffering from gluten intolerance and low income groups. On the basis of overall acceptability of cookies from mixed flour were found to have higher overall quality compared to control. It could be concluded that 45% wheat, 50% pearl millet and 5% soy flours incorporation in preparation of composite flour for cookies could be considered optimum with respect to sensorial quality characteristics while the physical parameters of composite flour based cookie were also observed to be superior.

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