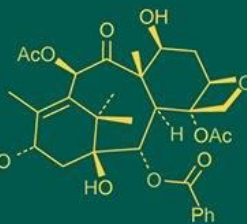
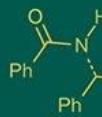
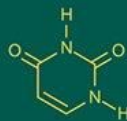
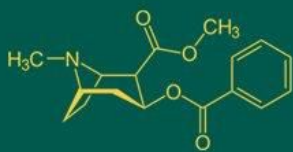


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Development and sensory evaluation of bakery products incorporated with pearl millet and cowpea flour

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Abstract

The present study was carried out for the development of a nutritional and functional bakery products (cupcake and crackers) by incorporating pearl millet flour and cowpea flour. The study includes development and sensory evaluation of bakery products. The study involved the standardization of cupcake and crackers recipes by replacing refined wheat flour with pearl millet flour and cowpea flour. Different variations of cupcake and crackers were prepared by varying the levels of Pearl millet and cowpea flour. Organoleptic evaluations indicated that the cupcake variation (T₂) with 10 % pearl millet flour and 20 % cowpea flour achieved the highest scores for the color, flavor, texture, taste, and overall acceptability, where as crackers variation (T₁) with 5 % pearl millet flour and 15 % cowpea flour achieved the highest scores for color, flavor, texture, taste, and overall acceptability. The research suggests that pearl millet and cowpea can serve as a functional ingredients for cupcake and crackers preparation, while enhancing its nutritional and functional value.

Keywords: Pearl millet, cowpea, cupcake, crackers, sensory evaluation

Introduction

Wheat flour has been utilized in the baking industry since time immemorial to produce airy and light crumb structures. However, its use exacerbates health problems in persons who suffer from gluten-related illnesses. Moreover, exploitation and overconsumption of wheat have prompted food researchers to seek new solutions to tackle malnutrition and food insecurity in many nations. Wheat flour is fortified to increase its micronutrient content, whereas recent research has shown that millets (pearl, foxtail, kodo) can provide a nutritionally rich alternative to wheat-based bakery products (Rustagi *et al.*, 2022) [6].

Cakes are a popular food item that people identify with a delectable sponge product that has the appropriate organoleptic properties. Three main aspects affect cake quality: using the right amount of ingredients in the right proportions for the type of cake being produced, using a formula that is well balanced, and mixing and baking cakes at the ideal temperatures. Because legume flours are high in fiber and amino acids, they are the perfect ingredient to increase the nutritional value of baked goods. Another name for legumes is "poor man's meat." Legumes have a low glycemic index and are a good source of fiber, vitamins, and carbohydrates. The inclusion of legumes to cereal-based baked items may be an effective way to increase legumes intake. Legume proteins are high in lysine but low in sulfur-containing amino acids, whereas cereal proteins are low in lysine but high in sulfur-containing amino acids. Therefore, the combination of grain and legume protein will provide improved overall amino acid balance, which is useful in preventing malnutrition problems.

Crackers are flat, crispy baked bakery product crackers made primarily from wheat flour. Recently, there has been an increase in efforts to incorporate novel ingredients with health, economic, and nutritional benefits in the creation of crackers (Akeem *et al.*, 2023) [1]. Sensory evaluation is an important stage in product development and optimization studies because items designed for consumers must first appeal to their senses.

Considering various aspects of health and nutrition, bakery products incorporated with pearl millet and cowpea can enhance the nutritional qualities of cupcake and crackers. The present study focused on the preparation and sensory evaluation of cupcake and crackers.

Materials

Pearl millet, cowpea, refined wheat flour, sugar, hydrogenated fat, egg, milk, cardamom, baking powder, ammonium bicarbonate, and vanilla essence were purchased from parbhani local market.

Methods

Preparation of cupcake

Pearl millet flour and cowpea flour were ground to make fine flour. Then all the ingredients were weighed in a required quantities. The Egg and hydrogenated fat were beaten together until a light and fluffy cream was obtained. Then, refined wheat flour, Pearl millet flour, Cowpea flour, sugar, and Baking powder were added to the cream and mixed thoroughly. Then vanilla essence was added, and milk is gradually added to achieve the desired consistency of a batter. The batter was then poured into cupcake molds and baked in a preheated oven at 160° to 180 °C for 20 – 25 minutes.

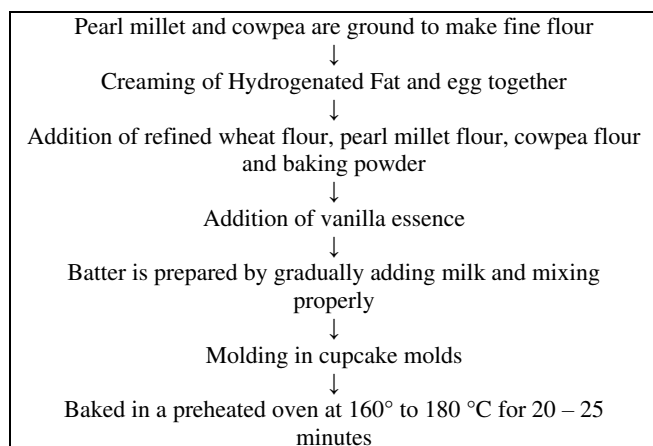


Fig 1: Flow sheet for preparation of standardized cupcake

Table 1: Preparation of cupcake with incorporation of different variations of pearl millet flour and cowpea flour

Ingredients (%)	T ₀ (Control)	T ₁	T ₂	T ₃	T ₄
Refined wheat flour	100	80	70	60	50
Pearl millet flour	0	10	10	10	10
Cowpea flour	0	10	20	30	40
Sugar	21	21	21	21	21
Hydrogenated fat	17	17	17	17	17
Egg	20	20	20	20	20
Milk	40	40	40	40	40
Baking powder	1.5	1.5	1.5	1.5	1.5
Vanilla Essence	0.5	0.5	0.5	0.5	0.5

Preparation of crackers

Pearl millet flour and cowpea flour were ground to make fine flour and cardamom was ground to make fine powder. Then all the ingredients were weighed in a required quantities. Then, refined wheat flour, Pearl millet flour, Cowpea flour, sugar, and ammonium bicarbonate were mixed together and stiff dough was kneaded by adding 45 ml milk gradually. The Prepared dough was rolled into sheets of uniform thickness, and the crackers were cut into even shapes. Then crackers were baked in a preheated oven at 160° to 180 °C for 15 – 20 minutes.

Sensory evaluation

Sensory evaluation of the products was carried out by a group of 10 panel members, who were academic staff from the College of Community Science in Parbhani. They utilized a

9-point Hedonic scale, which featured descriptive terms ranging from 'like extremely' (rated as 9) to 'dislike extremely' (rated as 1).

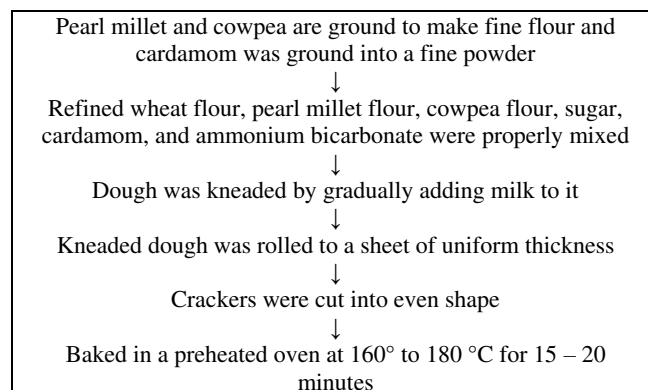


Fig 2: Flow sheet for preparation of standardized crackers

Table 2: Preparation of crackers with incorporation of different variations of pearl millet flour and cowpea flour

Ingredients (%)	T ₀ (Control)	T ₁	T ₂	T ₃	T ₄
Refined wheat flour	100	80	70	60	50
Pearl millet flour	0	5	5	5	5
Cowpea flour	0	15	25	35	45
Sugar	50	50	50	50	50
Cardamom	2.5	2.5	2.5	2.5	2.5
Milk	45	45	45	45	45
Ammonium bicarbonate	2.5	2.5	2.5	2.5	2.5

Results and Discussions

Organoleptic evaluation of Bakery products (cupcake and crackers)

Cupcake

Table 3: Organoleptic evaluation of cupcake.

Sample	Color and appearance	Flavour	Texture	Taste	Overall acceptability
T ₀	7.4	8.2	8.0	8.1	7.9
T ₁	7.6	8.3	8.1	8.2	8.0
T ₂	8.1	8.5	8.2	8.5	8.3
T ₃	7.1	6.8	7.0	6.5	6.8
T ₄	6.6	6.5	6.8	6.1	6.4
CD at 5 %	0.358	0.205	0.234	0.266	0.088

T₀: RWF 100 percent, PMF: 0 percent, CPF: 0 percent,

T₁: RWF: 80 percent, PMF: 10 percent, CPF: 10 percent

T₂: RWF: 70 percent, PMF: 10 percent, CPF: 20 percent, T₃: RWF: 60 percent, PMF: 10 percent, CPF: 30 percent

T₄: RWF: 50 percent, PMF: 10 percent, CPF: 40 percent

(RWF: Refined wheat flour, PMF: Pearl millet flour, CPF: Cowpea flour)

Overall acceptability is the overall score of the sensory evaluation, it was observed that cupcake T₂ secured the maximum score (8.3) and it was cleared from the sensory evaluation that T₂ have maximum acceptability. Overall acceptability of T₄ was lower than other four samples (6.4). Statistical analysis reveals the significant difference among the obtained results (Anonymous. 1971)^[3].

It was thus observed that variant T₂ scored highest in attributes of colour flavor, texture, taste and overall acceptability. The variant T₂ was accepted well with a total score of 8.3. Overall, the T₂ was acceptable and tasted good.

Upto 20 percent pearl millet flour is accepted in quality cakes (Singh *et al.*, 2023) ^[7], and upto 20 percent cowpea flour

could be incorporated with satisfactory performance and highly acceptability (Vandana *et al.*, 2014) ^[8].

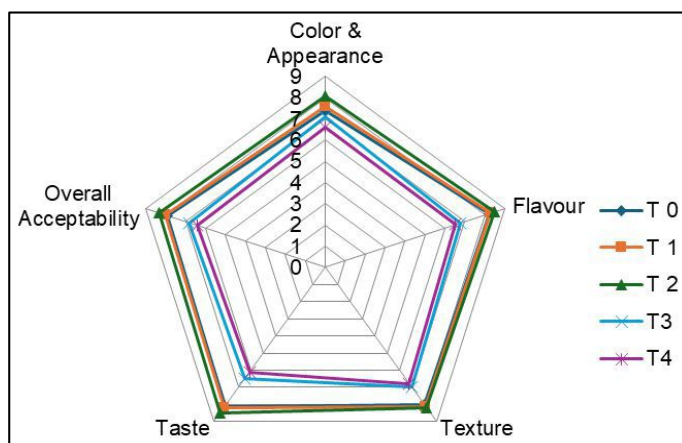


Fig 3: Sensory evaluation of cupcake incorporated with pearl millet and Cowpea

Crackers

Table 4: Organoleptic evaluation of crackers.

Sample	Color and appearance	Flavour	Texture	Taste	Overall acceptability
T ₀	7.8	8.0	8.1	8.1	8.0
T ₁	8.2	8.4	8.2	8.2	8.2
T ₂	7.9	7.7	7.5	7.1	7.5
T ₃	7.2	7.1	7.1	6.6	7.0
T ₄	6.7	6.3	7.0	5.9	6.4
CD at 5 %	0.207	0.305	0.228	0.234	0.658

T₀: RWF 100 percent, PMF: 0 percent, CPF: 0 percent,

T₁: RWF: 80 percent, PMF: 5 percent, CPF: 15 percent

T₂: RWF: 70 percent, PMF: 5 percent, CPF: 25 percent,

T₃: RWF: 60 percent, PMF: 5 percent, CPF: 35 percent

T₄: RWF: 50 percent, PMF: 5 percent, CPF: 45 percent

(RWF: Refined wheat flour, PMF: Pearl millet flour, CPF: Cowpea flour)

Overall acceptability is the overall score of the sensory evaluation, it was observed that crackers T₁ secured the maximum score (8.2) and it was cleared from the sensory evaluation that T₁ have maximum acceptability. Overall acceptability of T₄ was lower than other four samples (6.4). Statistical analysis reveals the significant difference among the obtained results (Anonymous. 1971) ^[3].

It was thus observed that variant T₁ scored highest in attributes of colour flavor, texture, taste and overall acceptability. The variant T₁ was accepted well with a total score of 8.2. Overall, the T₂ was acceptable and tasted good. Similar results found by Pandit *et al.*, (2021) ^[5] and Vandana *et al.*, (2014) ^[8].

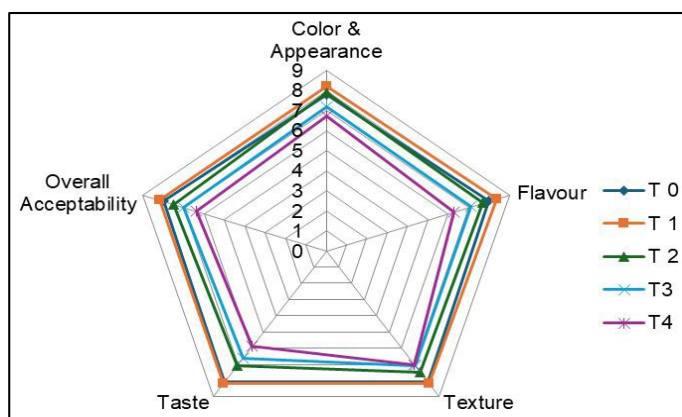


Fig 4: Organoleptic evaluation of crackers incorporated with pearl millet and Cowpea

Conclusion

The recipe standardization of cupcake and crackers with incorporation of pearl millet and cowpea were done by varying the levels of cowpea flour and constant level of pearl

millet flour. The standardization of prepared products were done by incorporating the pearl millet flour and cowpea. Products made with 100 percent refined wheat flour are considered as control. The organoleptic evaluation of

cupcake incorporated with 10 percent pearl millet flour and 10, 20, 30 and 40 percent cowpea flour and crackers incorporated with 5 percent pearl millet flour and 15, 25, 35, and 45 percent cowpea flour were carried out. Hedonic rating scale revealed that the variation prepared by incorporation of 10 percent and 5 percent pearl millet flour and 20 percent and 15 percent cowpea flour were having highest scores of 8.1, 8.5, 8.2, 8.5 and 8.3 and 8.2, 8.4, 8.2, 8.2 and 8.2 for colour, appearance, flavour, texture, taste and overall acceptability of cupcake and crackers respectively. Hence, it can be concluded that pearl millet flour and cowpea flour can be utilised to make good quality bakery products (cupcake and crackers) with acceptable sensory qualities.

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