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Development and quality assessment of cookies prepared by using "Wheat flour & Sattu"

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Abstract
Baking industry is currently seeking to expand its products range, but also to constitute a way of maintain and improving people's general health. Bakery products are mainly prepared from wheat as its main ingredient. Cookies are widely consumed and are an ideal vehicle for functional delivery. The objective of this work was to develop sattu based good nutritional value cookies. The use of wheat flour and sattu blends as a source of high protein, fat and low gluten content in production of cookies was studied. The flour blends of wheat and sattu were composites at replacement levels of T_1 (90:10), T_2 (80:20), T_3 (70:30), % while the wheat flour cookies T_0 (100:00) served as control cookies. Various analysis parameters were analyzed by two way ANOVA to obtained a predicted optimum result prepared cookies was subjected to chemical, microbial, and sensory analysis to evaluate the suitability of cookies were T_3 protein (15.77%), fat (25.32%), ash (2.60%), moisture (3.21%) and carbohydrate (53.10%) as comparable to control without adversely affecting the sensory parameters. Based on the result it was indicated that beneficial component of sattu made them more favorable choice for food technologist to develop cookies especially for healthy breakfast.

Keywords: Cookies, Wheat flour, Sattu, high protein

Introduction
The Dutch introduced cookies, or "little cakes," to the new American colonies in 1614. They were actually small amounts of batter or dough placed in the oven to see if the oven was hot enough to bake bread. Since then, most of our most popular cookies have only been around since the late 19th and early 20th century. According to the Home Baking Association, 95 percent of American homes bake cookies. Cookies have been used to organize A Bake-and-Take Day, to remember friends and shut-ins with a favorite baked goodies, and The Great American Bake Sale (www.greatamericanbakesale.org), to help end childhood hunger in America. No matter why you bake cookies, the measuring of the ingredients is the most important part. Cookie is a small, flat, sweet, baked food, usually containing flour, eggs, sugar, and either butter or cooking oil. It may include other ingredients such as raisins, oats, chocolate chips or nuts. They come in an infinite variety of sizes, shapes, texture, composition, tenderness, tastes, and colors (Pyler, 1988).
Cookies can be classified as ready to eat and convenient foods. Traditionally, the process of cookies making are fairly simple with basic ingredients consist of flour, eggs and sugar. Generally, cookies are recognized as flat, hard and crunchy food. Normally, cookies are classified according to their method of preparation such as drop, moulded, presses, refrigerated, bar or rolled. Apart from that, the dominant ingredients that been used in the formulation also commonly being used to classify the cookies, for example, nut cookies, fruit cookies and chocolate cookies.

Chemical composition of cookies	
Moisture (%)	9.93
Fat (%)	6.05
Protein (%)	7.37
Ash (%)	2.65
Fibre (%)	2.28
Carbohydrates (%)	71.72
Energy (kcal/100 g)	370.81

Wheat Flour

Wheat is the most widely cultivated cereal crop in the world and mainly used for milling and baking. Some wheat varieties (e.g. *Triticum aestivum*) are suitable for bread making while others (e.g. *Triticum durum*) are suitable for biscuits and cooking making (Sapirstein *et al.*, 2007). The major factor for the suitability of wheat varieties for making different types of bakery products is the ability to form gluten network. Gluten, the protein component of flour which gives the dough.

Wheat flour is a powder made from the grinding of wheat used for human consumption. More wheat flour is produced than any other flour. Wheat varieties are called "soft" or "weak" if gluten content is low, and are called "hard" or "strong" if they have high gluten content. Hard flour, or *bread flour*, is high in gluten, with 12% to 14% gluten content, and its dough has elastic toughness that holds its shape well once baked. Soft flour is comparatively low in gluten and thus results in a loaf with a finer, crumbly texture. Soft flour is usually divided into cake flour, which is the lowest in gluten, and pastry flour, which has slightly more gluten than cake flour.

Chemical composition of Wheat flour	
True digestibility (%)	9.93
Fat (%)	2.9
Protein (%)	13.70
Ash (%)	1.7
Crude Fibre (%)	2.6
Carbohydrates (%)	70.2
Energy (kcal/100 g)	440

(**Source:** USDA Nutrient Database)

Sattu

Sattu is an age old remedy to beat the heat in India. Made after powdering roasted chick peas, gram flour (sattu) is immensely popular in the Indian states of Bihar, Punjab, Madhya Pradesh, UP and West Bengal. The health benefits are such that it is popularly called ``desi horlicks''. Once a rural delicacy, sattu has gradually caught the fancy of urban India. With rising popularity, sattu has now evolved to include nutritious flours like barley, wheat etc. It is consumed in various forms starting from a simple drink to paranthas, laddoos, litti chokhas, etc. Traditionally, sattu is served during summers as a nutritious drink that has cooling effects on the body.

Sattu shall be derived from clean, washed, dried and sound grains of maize (*Zea mays* Linn), gram (*Cicer arietinum*), barley (*Hordeum vulgare* or *Hordeum distichon*), wheat (*Triticum aestivum* Linn or *Triticum vulgare* or *Triticum durum* Desf.) after grinding of roasted and puffed form either single or in combination in certain ratio. *Sattu* shall be of white or white to light yellowish color. It shall be of uniform color and size; having characteristic taste, smell and flavor associated with the product; free from insect infestations, live insect, dead insects, insect fragments, mould or mites, and larvae; free from rodent hair and excreta; free from fermented and musty odor, rancidity or any objectionable odor; free from dirt, extraneous matter (including added colors) or any other adulterants; free from any fungal or bacterial contamination; and free from preservatives, flavoring agents and other food additives. '*Sattu'* is a roasted flour mixture of cereal and pulse combination and used as 'ready -to-eat' snack food in most parts of India. It is a convenient and inexpensive food product, containing digestive and dietary constituents or principles of vital importance. Owing to its high nutritional value, long shelf life and excellent taste, *sattu* is popular supplement food especially in rural India.

Nutritious Sattu

The best thing about sattu is that its prepping process of dry roasting keeps the nutritional values intact, and has a longer shelf life. It is high on fibre and low on sodium. It contains good proportions of calcium, iron, manganese and magnesium.

Nutritional Value Of Sattu (per 100 gm)	
Protein	20.6%
Fat	7.2%
Crude fibre	1.35%
Carbohydrates	65.2%
Total Ash	2.7%
Moisture	2.95%
Calories	406 kilo joules

Materials and methods

Ingredients

- All purpose wheat flour (madia) to be purchased from the local market.
- Sattu to be purchased from the local market.
- Butter to be purchased from the local market.
- Sugar powder to be purchased from the local market.
- Baking powder to be purchased from the local market.
- S M P to be purchased from the local market

Chemical used

- Hydrochloric acid will be procured from department laboratory.
- Sulphuric acid will be procured from department laboratory.
- Amyl alcohol will be procured from department laboratory.

Treatment combination

a. T0 - Control prepared from wheat flour (100:00).
b. T1 - Experimental sample prepared from wheat flour and Sattu (90:10).
c. T2 - Experimental sample prepared from wheat flour and Sattu (80:20).
d. T3 - Experimental sample prepared from wheat flour and Sattu (70:30).

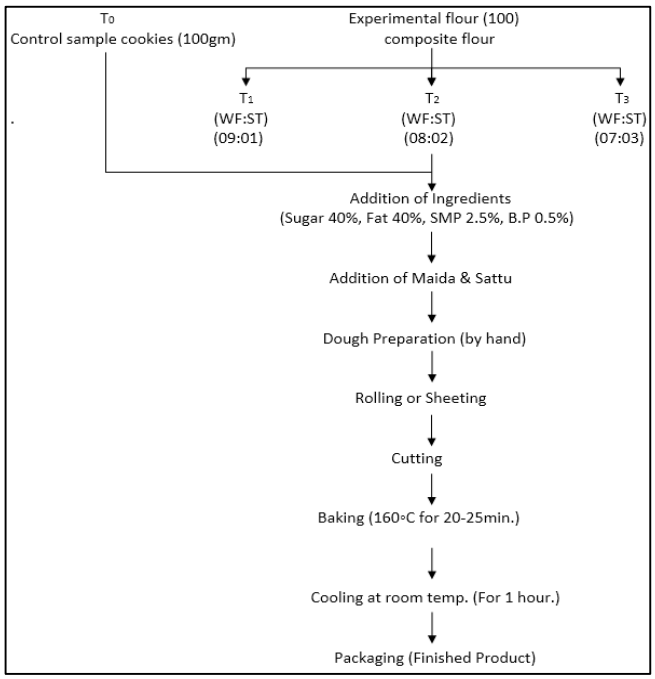
Ingredients	**Amount required (in gram)**			
	T0	**T1**	**T 2**	**T3**
Wheat flour	100	90	80	70
Sattu	0	10	20	30
Sugar power	40	40	40	40
Butter or oil	40	40	40	40
Baking power	0.5	0.5	0.5	0.5
S.M.P	2.5	2.5	2.5	2.5

The experiment will be carried out in student training dairy and the laboratories of the department of Warner College of dairy technology.

The data collected during the experiment will be analyzed statistically.

Plan of work

Flow diagram adopted for control & experimental



Technical programme

The following analysis will be conducted during the investigation.

❖ **Chemical analysis**

- Fat percent- was estimated by soxlet extraction method (AOAC, 1984).
- Protein percent - was estimated by kjhaldal method.
- Carbohydrate percent - was estimated by difference method.
- Ash percent - was estimated by muffle furnance (Ranganna, 1986).
- Moisture percent - was determined by oven method (AOAC, 1990).

❖ **Microbiological Analysis**

- **Coliform test-** was determined as for the procedure given by APHA standard methods for the examination of dairy products.
- **Yeast and Mould count-** was determined as per the procedure given in ISO standard.
- **Standard plate count test-** was determined as for the procedure given by APHA standard methods for the examination of dairy products.

❖ **Organoleptic evaluation**

- Color and Appearance
- Body and Texture
- Flavor and Taste
- Overall acceptability

Sensory evaluation of the bread samples were carried out by 5 experienced staff members of Warner College of Dairy Technology served as panelists on a 9 point hedonic scale allotted for different parameters such as color, flavor, taste, texture, appearance and overall acceptability of bread. The numerical score was used as an indication of quality of the product.

❖ **Statistical Analysis**

- Treatment: 4
- Replication: 5
- Total no. of trails: 20

The data was statistically analyzed using the analysis of variance (ANOVA) technique &critical difference.

❖ **Cost Analysis**

Cost is very important factor, which affects the marketability of the products and needs to be considering while manufacturing of food products. It is the basis for price fixation and determining the profit on the cost of production. The cost has been calculated on the basis of prevailing price of raw materials.

Result and Discussion

The present experiment entitled “development and quality assessment of cookies prepared by using “wheat flour & sattu” was conducted for the preparation of cookies using maida and sattu in the proportions, (90:10) (80:20) (70:30). Thus final product was analyzed for their Physico-chemical, Microbiological, sensory and cost. The results were analyzed statically at 5% level of significance.

Table: Different treatments of experimental.

Parameters	Treatments				C.D. Value
	T_0	T_1	T_2	T_3	
1. Physico-Chemical analysis (%)					
Moisture	3.18	3.05	3.28	3.21	0.18
Fat	24.24	24.57	24.95	25.32	0.31
Protein	13.62	14.39	15.08	15.77	0.34
Carbohydrate	56.22	55.92	54.67	53.10	0.45
Ash	2.64	2.07	2.02	2.60	0.18
2. Microbiological analysis					
Yeast and mould Count(cfu/gm)	2.8	3.8	3.8	5	1.10
Coliform Count	Nil	Nil	Nil	Nil	Nil
SPC x 10^3 (cfu/gm)	7.2	7.2	8.4	8.2	0 .94
3. Organoleptic Score (9- point hedonic scale)					
Color and Appearance	7.6	7.4	7.20	6.52	0.71
Body and Texture	7.0	7.1	7.2	7.9	0.56
Flavor and Taste	7.0	7.1	7.4	7.8	0.54
Overall acceptability	4.8	4.6	5	6.4	1.01
4. Cost analysis					
Cost Rs./100gm	25.65	26.07	26.50	26.93	

Physico-chemical analysis

Moisture percentage: There was significant difference in ash content of different treatment combinations. Maximum ash percent was recorded in the sample of the difference in ash was due to the composition difference of wheat flour and sattu which are used in different propositions in different treatments.

Ash percentage: There was significant difference in ash content of different treatment combinations. Maximum ash percent was recorded in the sample of the difference in ash was due to the composition difference of wheat flour and sattu which are used in different propositions in different treatments.

Protein percentage: There was non- significant difference in protein content of different treatment combinations. Maximum protein percent was recorded in the sample of T_3 (15.77) followed by T_2 (15.08), T_1 (14.39), T_0 (13.62).
The difference in Protein was due to the composition difference of wheat flour and sattu which are used in different propositions in different treatments.

Fat percentage: There was non- significant difference in fat content of different treatment combinations. Maximum fat percent was recorded in the sample of T_3 (25.32) followed by T_2 (24.95), T_1 (24.57), T_0 (24.24).
The difference in fat was due to the composition difference of wheat flour and sattu which are used in different propositions in different treatments.

Carbohydrate percentage: There was non- significant difference in Carbohydrate content of different treatment combinations. Maximum Carbohydrate percent was recorded in the sample of T_0 (56.22) followed by T_1 (55.92), T2 (54.67), T_3 (53.10).
The difference in Carbohydrate was due to the composition difference of wheat flour and sattu which are used in different propositions in different treatments.

Organoleptic analysis

Color and appearance score: There was non-significant difference in color and appearance score of different treatment combination. Maximum color and appearance score was recorded in the sample of T_0 (7.6) followed by T_1 (7.4), T_2 (7.2), T_3 (6.5).
The difference in color and appearance was due to the composition difference of wheat flour and sattu which are used in different proposition in different treatments.

Body and texture score: There was non-significant difference in Body and texture score of different treatment combination. Maximum Body and texture score was recorded in the sample of T_3 (7.90) followed by T_0 (7.0), T_1 (7.1), T_2 (7.2).
The difference in Body and texture was due to the composition difference of wheat flour and sattu which are used in different proposition in different treatments.

Flavor and taste score: There was non-significant difference in Flavor and taste score of different treatment combination. Maximum Flavor and taste score was recorded in the sample of T_3 (7.8) followed by T_2 (7.4), T_1 (7.1), T_0 (7.0).
The difference in Flavor and taste was due to the composition difference of wheat flour and sattu which are used in different proposition in different treatments.

Overall acceptability score: There was non-significant difference in Overall acceptability score of different treatment combination. Maximum Overall acceptability score was recorded in the sample of T_0 (4.8) followed by T_1 (4.6), T_2 (5.0) and T_3 (6.4).
The difference in Overall acceptability was due to the composition difference of wheat flour and sattu which are used in different proposition in different treatments.

Conclusion

The results obtained from the statistical analysis revealed that wheat flour and sattu can be satisfactorily added together for making fortified cookies. According to analysis of different treatments T_3 (70% wheat flour & 30% sattu) was found to best in terms of organoleptic, chemical, microbial & cost analysis.

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