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Himanshi
Researcher, Department of Food Technology, Desh Bhagat University, Punjab, India

Dr. Ritu Aggarwal
Major Advisor, Department of Food Technology, Desh Bhagat University, Punjab, India

Deepak
Assistant Professor and Advisor, Department of Agriculture & Technology Maharana Pratap University Udaipur, Rajasthan, India

Corresponding Author:
Himanshi
Researcher, Department of Food Technology, Desh Bhagat University, Punjab, India

Development of cookies enriched with protein (Soya Flour) and fibre (Banana Peel Powder)

Himanshi, Dr. Ritu Aggarwal and Deepak

Abstract
An experimental study was designed to formulate ready-to-eat cookies by incorporating banana and banana peel flour which is normally unused in Bangladesh but contains an excelleamountsunt of nutrients especially dietfibreiber, essential vitamins and minerals. Cookies were prepared by replacing 5% (sample-1), 10% (sample-2) and 15% (sample-3) of wheat flour with banana and banana peel flour. The proximate analysis and sensory parameters of those cookies were compared with control cookies where no banana and banana peel flour were added and designated as normal cookies (0% substitution). Functional properties were also evaluated and a significant difference once found (p<0.05) in WHC, OHC, swelling capacity, emulsion activity, emulsion stability and flour dispensability in banana peel flour when compared to wheat flour. On proximate analysis of cookies, significant variation (p<0.05) was also observed in proteifibreh, fibre and carbohydrate content of banana and banana peel flour cookies in a comparison to normal cookies. The increasing the substitution of banana and banana peel flour in cookies increased the ash anfibrede fibre content remarkably. About 15% substitution of banana and banana peel flour in cookies increased 93.25% crude ash (mineral) and 19fibre crude fibre than normal cookies. Energy values of the cookies were also evaluated and ranged between 480 Kcal and 513 Kcal per 100 g, with sample-3 cookies having the lowest value. In conclusion, the addition of both banana and banana peel flour in cookies by replacing 10% wheat flour were more acceptable with all quality characteristics.

Keywords: Banana, cookies, dietary fibre, functional properties, sensory evaluation

1. Introduction
The bakery industry in India plays an important role within the industrial map of this country. Bakery products are things of mass consumption because of its low pricing and palatability city. Due to inhabiting eating habits of the summer growth of the bakery industry has been significantly noticed. These I consists, typically, consist of cookies, biscuits, breads cakes etc. Among the bakery products cookies and biscuits constitute to the A cookieopular group.

Cookie is defined as a small thin crisp cake made of Cookies of unleavened dough. Cookie are an imp the important baked product in human diet and are usually eaten with tea and are also used as a Cookie sing food for infants. Cookie are ideal for their nutritive value, palatability, compactness and convenience. Having low moisture content than cakes and bread, Cookies are generally safer from microbe biological spoilage and have long shelf-life, Akubor. Ready-to-eat be classified as ready-to-eat and convenient foods. Cookieonally, the process of cookies making is fairly consistent 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 metmoulded press edition such as drop, molded, presses, refrigerated, bar or rolled. Apart from that at, 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, Norhidayah 2014 [4].

A cookie is a product consumed from infants to old and now a day's because of health awareness they demanded fortified and enriched. The development has high cookiesional value. Development of fortified cookie or other composite flour bakery products is the latest trend in the bakery industry. Most of bakery products are used as a source of ingredients of different nutritionally rich ingredient for their diversification. With the increasing public health awareness worldwide, demand for functional food with multiple health benefits has also increased. The use of medicinal food from folk medicine to prevent diseases such as diabetes, obesity, and cardiovascular problems is now gaining momentum among thshowlic. Consumers are demanding the first one that shows two main properties: The first-one deals with traditional the l nutritional aspects of the food, whereas, second feature, additional benefits are expected from its regular ingestion.

These kinds of food products are often called functional foods. Varunkumar Here we are making efforts to raise the nutritive value of Cookies by replacing Refined Wheat flour (RWF) with Soya flour and Banana peel powder (BPP).

1.1 Main ingredients

1.1.1 Soya bean: Soybean (*Glycine max* L.) is a species of legume native to East Asia, widely grown for its edible bean which has several uses. The soybean is a valuable legume because it does provide all of t, the essential amino sulfur-containing however it is relatively low in the sulfur-containing amino acids, cysteine and methionine. It is one of the few legumes that can be consumed as a complete protein.

The soybean is comprised of approximately 37-42% protein, Shukla 2019 [17].

1.1.2 Banana peel: The banana peel is a household and industrial food waste discarded in large quantities in nature. It represents about 35% of the involvement mass of ripe fruit and there is not further involvement in remarkable industrial applications Bananas are one of the fruits most produced and consumed worldwide and the potential use of the peel would be of great relevance. Some researchers have revealed that the banana pee the l has compounds and nutrients important for food fibre food industry. The banana peel is rich in dietary fibre, protein, essential amino acids, polyunsaturated fatty acids and potassium. It also contains antioxidant compounds including polyphenols, catecholamines and carotenoids, Rebello 2014, Spiller Mohammad A. [11] suggested that soy protein can be used as a source of high-quality protein to help satisfy the higher need for protein during muscle-building by providing the necessary essential amino acids for Wachirasir [17] shows that important constituent present in banana peels it alsfibregests. The main purpose of using banana peel is its fibre. It contfibrearound 50.25±0.2% of Total dietary fibres, Dietary fibre has shown beneficial effects in the prevention of several diseases, such as cardiovascular diseases, divertfibresis, constipation, colon cancer and diabetes The fruit fibre has a Better quality fibre other fibre sources due to its high total and soluble fibre content, water and oil holding capacities, fermentation ability, as well as a lower phytic acid and caloric value content.

2. Materials at the and Methods

This chapter includes the materials required and the method adopted in the study. The present study on the Development of cookies enriched with protein and fibre was carried out at the Food Technology Laboratory, University Department of Science and Technology Maharana Pratap University, Udaipur. The banana peel was collected from the local manufacturer of banana chips. The major ingredients for the preparation of products were RWF, Soyaflour, Powdered Sugar, Butter, Milk Powder and other chemicals were used from the laboratory store.

2.1. Raw materials

1. Refined Wheat flour.
2. Soya flour.
3. Banana Peel Powder.
4. Butter.
5. Milk Powder.
6. Sugar.
7. Egg.

2.2. Chemicals

1. Baking Powder.
2. Sodium bicarbonate.
3. Essence.

3. Proximate analysis

3.1 Moisture Content: The moisture content was determined as per standard methods and results were expressed in terms of percentage. The moisture content of as it is practised in the lab. Calibrating the weight of the Petri dish, than the weight of the sample 5gm was taken. The sample along with the petri dish was placed in the oven for 3 hours and maintained at the temperature of 105 °C, by repeating the process of drying, cooling and weighing at 30 min intervals until it become to a constant weight. Then it was transferred to desiccators and the weight of each sample as soon as the dishes are cool. Weight losses were calculated in each sample and get the average moisture content of sample. The percent moisture content was calculated as.

Moisture (%) = Weight loss/Weight of the sample *100
Total solid % = 100-moisture.

3.2 Ash content: The ash content was determined with the help of a muffle furnace as per standard methods (AOAC, 2000 [2]) and results were expressed in terms of percentage. The ash content is a measure of the total amount of minerals present within a food, whereas the mineral content is a measure of the amount of specific inorganic components present within a food, such as Ca, Na, K and CL. Water and other volatile materials are vaporized and organic substances are burned in the presence of the oxygen in air to CO_2, H_2O and N2. Ash contents of fresh foods rarely exceed 5%, although some processed foods can have ash contents as high as 12%. Some necessary apparatus includes.

- Crucible (or similar porcelain or metal dishes).
- Muffled furnace.
- Hot plate.

To perform Ash content analysis product sample is powdered and the weight is measured up to 110gm after the weight of the crucible is measured. The required amount of sample is introduced in crucible and the crucible is placed in a Muffle furnace at 550-600 °C for 4 to 5 hrs. The food sample is weighed before and after ashing to determine the concentration of ash present. The ash content can be expressed on either a *dry* or *wet* basis.

% ash (Dry basis) = (Weight after ashing ÷ Weight before ashing)*100

3.3 Protein content: The protein content was determined with the help of the Kjeldahl apparatus method as per the standard method (AACC, 2006 [1]) and results were expressed in terms of percentage. 0.5 gm. of ground sample by digesting with concentrated sulfuric acid at 100 ºC. Then it was distilled with 40 per cent NaOH liberated ammonia was trapped in 4% boric acid, using a mixed indicator (methyl red: Bromocresol green 1:5). Then titrate it with 0.1NHCL, the percent of nitrogen was estimated and the protein percentage was calculated by multiplying percent nitrogen with factor 6.25 Calculation.

% nitrogen = (S-B) normality of HCL × 14× 100 ×100
Weight of the sample ×10×1000.....1% protein = % N2 ×EM(6.25)

3.4 Fat content: The fat content was determined with the help of the Soxhlet apparatus as per the standard method (AOAC, 1995) [20] and results were expressed in terms of percentage. Fat contributes to the flavour of food as well as it gives texture and also mouth feel to the food. It gives us maximum energy 9Kcal energy per gram. To measure the amount of fat present in the food because extra intake of fat mostly leads to obesity and below the level lead to malnutrition. Soxtronis a solvent extraction method is more pronouncedly known as the Soxhlet method.

3.5 Calculation
Fat (%) = (W2-W1) / W ×100

Where,
W2 = Weight of flask with oil.
W1 = Weight of empty flask.
W= Weight of initial sample.

3.6 Fiber content: About 5 g of moisture and fat-free sample was boiled in a 500 ml beaker containing 200 ml boiling 0.255 N (1.25 w/v) H2SO4. The mixture was boiled for 30 min keeping the volume constant by the addition of water at frequent intervals. At the end of this period, the mixture was filtered through a filter paper and the residue was washed with hot water till free from acid. The material was then transferred to the same beaker and 200 ml of boiling 0.313 N NaOH solution added. After boiling for 30 min, the mixture was filtered through filter paper. The residue was washed with hot water till free from alkali. It was then transferred to a crucible and dried in oven for overnight at 80-100 °C and weighed. The crucibles were heated in a muffle furnace at 550-600 °C for 4-5 hrs. then cooled and weighed again. The difference in the weights represented the weight of the crude fibre (AOAC).

4. Results and Discussion

The results obtained in the present investigation entitled "Development of cookies enriched with protein and fibre" are summarized here with and discussed for their significance. The whole data obtained on various aspects of the study is categorized under the following headings and subheadings.
Effect of level of addition of Soya Flour and Banana Peel Powder on physicochemical properties of cookies.

Table 1: Shows results regarding moisture, ash, protein and fat which are discussed below in their respective sub-headings

Parameters	level of soya flour and BPP				
	Control	T_1	T_2	T_3	T_4
Moisture (%)	3.6	3.8	4.0	4.1	4.3
Carbohydrate (%)	68.9	68.1	68.0	67.8	67.6
Protein (%)	7.26	8.06	9.01	10.35	10.59
Fat (%)	21.61	21.59	21.64	21.42	21.40
Fibre (%)	0.12	0.78	1.52	2.49	3.21
Ash (%)	0.64	0.71	0.76	0.98	1.02

4.1 Proximate composition of cookies

Moisture Content: Moisture content is the amount of moisture present in given food sample. When the food is baked the moisture present in the food is evaporated increasing keeping quality and reducing moisture levels. Cookies should have less than 5% moisture so that it appears crispy. In baking, there is a loss of moisture. From the above table, it represents the moisture content at different levels of Soya flour and BPP. The control sample has a 3.6% moisture content. Moisture content increase with increase in the replacement of flour. Moisture content is lowest in the control sample as compared to other samples.

Estimation of carbohydrate: As shown in the fig and table below the carbohydrate of the prepared sample is found to be higher in control (68.9%) followed by other, in sample T_1 (68.1%), sample T_2 (68.0%), sample T_3 (67.8%) and sample T_4 (67.6%). Carbohydrate is higher in control as compared to other samples.

Protein content: Protein content is nothing but amino acids present in sample. The control sample has 7.26% protein content. From Table 1 it is shown that protein content increases with the addition of soya flour. The protein content is highest in biscuits prepared by adding soya flour at levels of 20% followed by 15%, 10%, and 5%. Protein content is found out by finding out nitrogen content and then multiplying by its factor 6.25. The protein content of T_3 was 10.35%.

Fat content: Cookies are made with "shortening". The fat was rubbed into the flour. The molecules of fat surround the flour particles and exclude water. This prevents the development of gluten in the dough. The fat is said to shorten the dough. Any increase in water in the mixture will tend to encourage the development of gluten, which will make biscuits hard. Fat content was calculated by the Soxhlet extraction method. 5 g samples were mixed with about 90 ml of n-hexane. The mixture was vigorously shaken with the separation flask knob opened at intervals to release the accumulated air pressure, which may burst the flask if left there. The fat in spirit was evaporated to dryness over a Soxhlet extraction, which extracts n-hexane from its solution of fat. The control sample has 21.61% fat. From the table 4.1, it is shown that fat content increases with an increase in levels of the addition of Soya flour. Fat content is highest in cookies with 20% replacement followed by 20, 15, 10, and 5% fat content respectively.

Fiber Content: Fiber content is highest in cookies prepared by adding 12% of BPP (T_4) followed by 9%, 6% and 3%. Fibre content increased with the addition of BPP.
This study shows that BPP addition in cookies is accepted to certain levels beyond it damages the overall acceptability of product. T_3 was found to be 2.49% fibre.

Ash content: Ash content refers to the amount of minerals present in the food. As the level of incorporation of BPP flour increases the ash content increases. The main reason of the increment of ash content with increase of BPP is the fibres are rich in minerals. Ash content was determined by using muffle furnace. The sample in the crucible were kept in furnace at 500-550 °C for 5-6 hrs. and cooled in desiccators and calculated. It found that Ash content was maximum in T_4 sample followed by T_3, T_2, T_1 and the control sample.

Microbial Analysis: Cookies are classified under low moisture food categories which has a shelf of more than 3 months and could be extended to a year. Due to the low Availability of moisture cookies are not prone to bacterial growth easily but sometimes fungal infection can occur. Fungal colonies (CFU/gm) was calculated for control and selected sample T_3.

Table 1: Show group, control, sample T_3 and permissible

Group	Control	Sample T_3	Permissible
Fungal count(CFU/gm)	11	22	50

Dilution factor = $1x10^3$

5. Results and Conclusion

Summary: The experiment was carried out with the different levels of Soya Flour and BPP to check the increase in the nutritional level of cookies. The cookies were prepared by adding Soya flour at the levels of 5%, 10%, 15%, 20% and Banana Peel Powder at 3%, 6%, 9%, and 12% respectively. Cookies were evaluated for their various physicochemical, nutritional and organoleptic quality parameters, and then study revealed that biscuits prepared by adding Soya flour at levels of 15% and 9% BPP gave a better acceptable taste, texture and flavor.

There was a gradual increase in medicinal properties and organoleptic tests gave the best results for the level of T_3 addition of samples. Cookies enriched with soya flour and BPP are rich in protein and fibre, antioxidants along with certain medicinal properties.

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