Development And Analysis of Antioxidant Profile of Ginger Powder Enriched Tulsi Cookies

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Abstract-The objective of the study was to create antioxidant-rich cookies with a high nutritional content using tulsi powder and ginger powder. This study investigated the antioxidant profile of the tulsi cookie by altering the ginger powder (10% and 12%). The chemical and rheological properties of created dough blends, as well as the sensory, physical, and chemical properties of the formulated cookies, were examined. The variations were standardized and organoleptic acceptability was assessed using a five-point hedonic scale. The combination of tulsi cookie and 12% ginger powder was optimized for the development of composite cookies with improved nutritional and organoleptic properties that met widely recognized requirements. The addition of ginger powder to cookie dough increased the antioxidant capacity, and ash content in the finished product.

The organoleptic test revealed that adding 12% ginger powder to tulsi cookies improved their acceptability when compared to all other quality attributes.

Keywords: Herbal cookie, Antioxidant, Tulsi Powder, Ginger Powder, Functional Foods

INTRODUCTION

Functional foods contribute significantly to human health and reduce the risk of illness. Fresh, natural food serves as functional food in our bodies. Food is referred to as "functional food" when it is cooked or prepared utilizing "scientific intelligence," with or without understanding of how or why it is employed. Thus, functional food provides the body with the necessary vitamins, lipids, proteins, carbs, and so on for healthy existence [1]. The addition of functional ingredients to bakery products has risen in popularity due to the ability to reduce risk of chronic diseases beyond basic nutritional functions.

Tulsi (*Ocimum sanctum)* is an aromatic plant in the basil family Lamiaceae that is said to have originated in north central India. It is known as "The Queen of Herbs," and is regarded as an "elixir of life" with unparalleled therapeutic and spiritual properties [2]. The chemicals in tulsi, when combined, have powerful antioxidant, antiviral, antibacterial, adaptogenic, and immune-enhancing effects that improve overall health and boost the body's natural defense against stress and illness.

Ginger *(Zingiber officinale Roscoe)*, is a root or subterranean stem (rhizome) that is known to contain gingerols, an oleoresin that has a number of health advantages [3]. It is a popular food and beverage additive because of the aromatic components that give it a spicy, pungent, and pleasant flavour (Bartley and Jacobs, 2000) [4]. Due to its softness, ginger rhizome is picked six months after planting for value addition and consumption, depending on market need. It reduces the risk of colon cancer, obesity, diabetes, cardiovascular diseases, cold related diseases and arthritis.

Bakery products come in a range of levels of complexity, all of which primarily use wheat flour to give them structure and volume. In addition to being consumed often, bakery products have a significant impact on human nutrition. Cookies are ideal because of their nutritional benefits, palatability, compactness, and convenience. Because cookies contain less moisture than cakes and bread, they are more resistant to microbial deterioration and have a longer shelf life [5].

The current study aimed to create antioxidant-rich cookies with high nutritional content.

METHODOLOGY

Materials

The main material for this product; All Purpose Flour (Maida), Tulsi Powder (Ocimum tenuiflorum), Ginger (Zingiber officinale Roscoe), Butter and Sugar was procured from the grocery store at Chennai, Tamil Nadu, India.

Preparation of cookies:

To a mixing bowl, maida and sugar were added and mixed well. Butter was added to it and the dough was mixed well without any lumps. The oven was preheated to 325 degrees Fahrenheit (165°C). The dough was molded into desired shapes and was placed on a baking tray one by one. The cookies were baked at 180°C till 12-15 min. Once the cookies were baked properly, the oven was switched off and the cookies were allowed to cool for some time and were served.

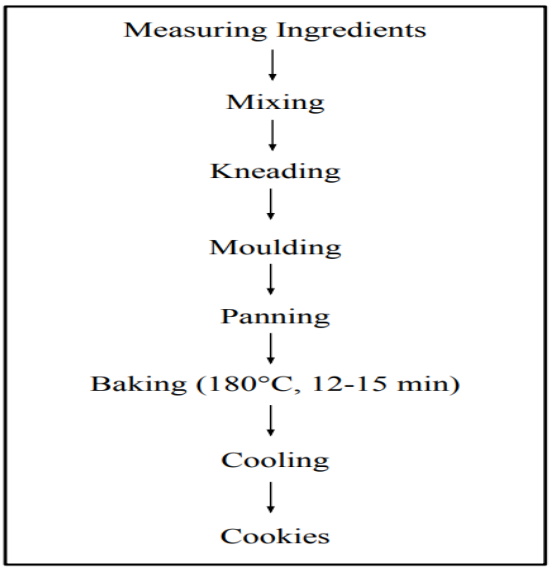

Figure 1: Process flow for the preparation of cookies

Preparation of variations: [Cookies 100g]

INGREDIENTS	STANDARD	VARIATION 1	VARIATION 2
All Purpose Flour (Maida)	90g	80g	78g
Tulsi Powder	10g	10g	10g
Ginger Powder	-	10g	12g
Butter	42g	42g	42g
Sugar	42g	42g	42g

Table 1: Quantity of the ingredients used for the preparation of cookies

ANALYSIS:

Physico-chemical analysis of the formulated cookies were conducted by using standard analytical procedures.

Cookies diameter (D) and thickness (T) were determined using a vernier caliper.

SPREAD RATIO: The spread ratio was determined by using this formula.

$$\text{Spread Ratio} = \frac{\text{diameter (mm)}}{\text{thickness (mm)}}$$

BAKING WEIGHT LOSS (BWL)

The baking weight loss was determined by measuring the cookie weight before and after baking where the cookies weight was determined as an average value of 3 independent measurements.

Baking weight loss was calculated according to the equation given by Saric et al. (2014) [6].

$$\text{BWL (\%)} = \frac{\text{Initial cookie weight (g) - Weight after baking (g)}}{\text{Initial cookie weight (g)}} \times 100$$

MOISTURE ANALYSIS

Into a flat bottom metallic dish a thin layer of finely divided asbestos is spread, which is pre dried in an oven 110° C for one hour. The dish is removed and cooled in a dessicator. 20 g of the sample chosen is spread over the asbestos layer, the sample is dried at the atmospheric pressure without the lid in the hot air oven at 100° C for 3-5 hours. After drying the lid is replaced and reweighed.

ASH CONTENT

Weight of empty silica dishes is noted. 5-10g of the sample is weighed into each. After determining the moisture content the same dishes may be used for ashing. Ignite the dish and the contents on a Bunsen

burner. Ash the material at not more than 525°C for 4 to 6 hr, if need be, ash overnight, in a muffle furnace. Cool the dishes and weigh. The difference in the weights gives the total ash content and is expressed as percentage.

TOTAL ANTIOXIDANT CAPACITY (TAC)

The TAC was estimated by molybdate assay (Prieto et al., 1999). This assay measures the absorbance at 695nm when Mo (VI) is reduced to Mo (V) by the sample. Stock of each sample (14 mg/ml) was used to prepare different concentrations (14-210 µg/ml). To this, 1ml of TAC reagent (3.24 ml sulphuric acid + 0.397g sodium sulphate + 0.494g ammonium molybdate, volume made upto 100 ml) was added. Thereafter, the mixture was vortexed thoroughly and after incubation for 90 min at 95°C, absorbance was measured at 695 nm against blank using distilled water. The results were expressed as µg Ascorbic Acid Equivalent (AAE)/10 mg extract [7].

SENSORY ANALYSIS

Sensory evaluation of the cookies was carried out on a panel of ten members using a 5-point hedonic scale. A five point hedonic scale with 1-dislike extremely; 2-dislike slightly; 3-neither like nor dislike; 4-like slightly; 5-like extremely was used. Ranking was noted on the sensory score card. The biscuit variations presented to the panelists were scored for different quality attributes like appearance, aroma, taste, texture, color, mouth feel and overall acceptability.

RESULTS AND DISCUSSION

The cookie was estimated by using different analytical methods. The results obtained from the physical measurements showed a mean diameter (D) of 58.5 mm with 12.02 mm thickness (T) and a spread ratio of 4.86 for control, diameter of 57 mm with 13 mm thickness and a spread ratio of 4.38 for Variation 1 and diameter of 59 mm with 17 mm thickness and a spread ratio of 3.47 for Variation 2. It was found that variation 2 had a better thickness, diameter and spread ratio as compared to control. The spread ratio shows a high cohesiveness of network between all the ingredients, and a decreased spread ratio improves the crispiness and acceptability of baked goods. The average bake loss in the cookies was observed as 4.81% for control and 4.83% for variation 2, which was comparatively similar to control. The results of the proximate composition in Table 1 shows per 100g of product (Control) contained 4.4% moisture, 2.5% ash content, 20.46% total antioxidant capacity. Variation 1 contained 4.2% moisture, 3.26% ash content, 29.82% total antioxidant. Variation 2 contained 4.5% moisture, 3.716% ash content, 33.32% total antioxidant.

It was found that variation 2 had an increased moisture loss% compared to control indicating better shelf life of the cookie. Ash is an indicator of the amount of mineral content in any food sample [3]. The ash % result presents that variation 2 has better mineral content compared to control.

According to Kaushal et al, the research they conducted on bioactive compounds and acceptance of cookies supplemented with ginger flour, it was also concluded in their research that 12% ginger incorporated cookies had a higher acceptance of the functional and organoleptic quality characteristics when compared to control. The results obtained in this research was similar to that of Kaushal et al.

Parameters	Control	Variation 1	Variation 2
Thickness (T,mm)	12.02	13.00	17.00
Diameter (D,mm)	58.5	57.00	59.00
Spread Ratio	4.86	4.38	3.47
Bake Loss (%)	4.81%	4.54%	4.83%
Moisture Content (%)	4.4%	4.2%	4.5%
Ash Content	2.5%	3.26%	3.71%
Total Antioxidant Capacity	20.46%	29.82%	33.32%

Table 2: Physico-chemical characteristics of cookies

SENSORY ANALYSIS:

A five-point hedonic scale with 1-dislike extremely; 2-dislike slightly; 3-neither like nor dislike; 4-like slightly; 5-like extremely was used. A total of two variations and a control was presented to the panelists. The control was made using all purpose flour and 10g of Tulsi powder. Variation 1 was made with 10% ginger powder and variation 2 was made with 12% ginger powder. From the results obtained, in comparison to the control, 12% ginger powder (variation 2) was found to have higher desirable functional and organoleptic quality parameters.

Food Characteristics: Appearance, Aroma, Taste, Texture, Colour, Mouthfeel, Overall Acceptability
Score Value:
5- Very Good; 4- Good; 3- Neither Good nor Bad; 2- Bad; 1- Extremely Bad

Parameters	Appearance	Aroma	Taste	Texture	Colour	Mouthfeel	Overall
Control	3.9	3.6	3.8	3.3	3.7	3.7	3.7
Variation 1	3.4	3.7	3.9	3.4	3.3	3.6	3.6
Variation 2	3.7	3.8	3.8	3.4	3.8	3.8	3.8

	Control	Variation 1	Variation 2
Total Score	25.7	24.9	26.1
Average Score (total score ÷ total no.of testers)	2.57	2.49	2.61

Figure: Summary of Results from Hedonic Rating Test Taken by the Young Adults and Adults for Herbal Cookies.

Table 3: Sensory analysis score for the cookies

CONCLUSION

The current study found that combining ginger powder and tulsi powder in cookie formulation had a significant influence on the physicochemical and sensory characteristics of the cookie. When compared to the control, ginger powder (12%) incorporated cookies had highly acceptable functional and organoleptic quality characteristics. As a result, the development and consumption of such functional foods will not only enhance the nutritional state of the population, but will also benefit people suffering from degenerative illnesses. More research should be done to look into the idea of employing ginger powder in conjunction with tulsi powder as an ingredient in other food items in order to expand the applicability of such value-added ingredients.

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