Optimizing Cookie Formulation Using a Composite Flour Blend of Soybean, Beetroot, and Wheat: Effects on Physicochemical and Phytonutrient Characteristics

ABSTRACT

This study aimed to optimize cookie formulation using a composite flour blend of soybean (SF), beetroot (BF), and wheat (WF). Four blends were formulated: 50% WF:45% SF:5% BF (T1), 50% WF:35% SF:15% BF (T2), 50% WF:25% SF:25% BF (T3), and 100% WF (Control) (T4) for cookie preparation. The inclusion of SF and BF had significant effects on the physical, chemical, and phytonutrient attributes of the cookies. Results showed an increase in diameter and height with the addition of beetroot and soy flour. T2 had the highest weight (9.57g), diameter (5.42cm), and spread ratio (6.46) among the blends, while T3 had the highest total color difference. T1 cookies had higher levels of protein, crude fiber, total phenolic content, and total antioxidant activity compared to the control. Statistical analysis indicated that the sensory characteristics of the cookies were not significantly affected by the addition of soy and beetroot flours. This study suggests that composite flour cookies enriched with nutritional and antioxidant properties can be developed by incorporating varying levels of beetroot and soy flour alongside wheat flour.

Keywords: Beetroot flour; Soy flour; Composite flour; Cookie; Antioxidant; Functional properties

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INTRODUCTION

In recent years, the functional food sector has experienced significant growth, surpassing conventional foods and supplements, attracting interest from consumers and food producers [1]. To meet the evolving dietary preferences, incorporating functional ingredients into commonly consumed foods is preferred over creating entirely new products [2]. The demand for bakery products, particularly cookies, is on the rise as convenience foods become more prevalent in daily life [3]. Cookies, a popular snack worldwide, are ideal for fortification and value addition [4]. Given the nutritional status of cookies and the increasing demand for nutritious options, focusing on their nutritional value is crucial. Beetroot, known by various names such as table beet or garden beet, is rich in fiber, folic acid, manganese, and potassium [6]. Soybean, a leguminous crop, is a valuable source of proteins, lipids, vitamins, and minerals, making it a popular choice for consumers [7]. Soy foods offer essential nutrients like proteins, dietary fiber, B-vitamins, calcium, and omega-3 fatty acids [8]. Soybean also contains isoflavones like genistein and daidzein, known for their health benefits [9 and 10]). Soy flour is rich in antioxidants such as isoflavones, saponin, tocopherol, phytate, and vitamin C, which play a role in reducing the risk of cancers and cardiovascular diseases [11]. Incorporating soy flour into cookies enhances digestibility and provides a range of antioxidants and bioactive components. Augmenting wheat flour with beetroot and soy flour offers an opportunity to produce cookies with enhanced physicochemical and phytonutrient characteristics. This study aims to optimize cookie formulations by blending composite flours. Four formulations were developed: T1 (50% wheat flour, 45% soy flour, 5% beetroot flour), T2 (50% wheat flour, 35% soy flour, 15% beetroot flour), T3 (50% wheat flour, 25% soy flour, 25% beetroot flour), and the control group (100% wheat flour). Wheat provides essential nutrients, soy flour adds protein, fats, and fiber, while beetroot flour contributes color, sweetness, fiber, and flavor. The study focuses on protein content, crude fiber content, total phenolic content, and total antioxidant activity

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to assess the health benefits of cookies fortified with soy and beetroot flour. This research aims to explore the impact of the composite flour blend on cookie attributes and pave the way for a new category of cookies. By combining soybean, beetroot, and wheat, this study contributes to the field of functional foods, offering consumers a nutritious and appealing option

MATERIALS AND METHODS

Procurement of raw materials: To formulate the cookies, the following ingredients were procured from the local market: wheat flour, soy flour, beetroot, butter, powdered sugar, milk, and sodium bicarbonate.

Development of beetroot flour: Washed beetroot with water, dried it, and then sliced it into thin pieces. These slices were then arranged on a tray and subjected to drying in a tray drier at approximately 60ºC and 40% relative humidity for a period of 24 hours. Subsequently, the dried slices were ground using a mechanical grinder to obtain beetroot flour.

Preparation of cookies: The plain cookies were prepared from wheat flour as per the standard method suggested by (Thongram*et al*., 2016) [3] and treated as a control sample. The beetroot and soy flour were incorporated in wheat flour at different levels (5% beetroot flour and 45% soy flour;15% beetroot flour and 35 % soy flour; 25% beetroot flour and 25 % soy flour and 100% wheat flour) and prepared cookies were treated as samples (T_1, T_2, T_3 and T_4) respectively. The cookies were prepared using the following ingredients such as wheat flour, beetroot flour, soy flour, butter, cane sugar, skim milk powder, common salt, sodium bicarbonate, and water. Butterand sugar were mixed well to form a cream, then addedto the mixture of flour, sodium bicarbonate, and skimmilk powder, and mixed thoroughly to form the dough.The dough was then kneaded and sheeted to a uniformthickness followed by cutting into circular shapes. Thecookies were then baked at 165°C for 15 mins in oven. Cookiessamples were cooled and stored in airtight containers.

Physical and functional properties: The oil and water absorption capacities of different flours were determined according to the method described by Adejuyitan*et al*., (2009) [14]and swelling

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power (SP) was determined according to the method followed by Thongram*et al*., (2016) [3]. The bulk density was estimated by taking a known amount of sample into 50ml graduated measuring cylinder. The sample was packed by gently tapping the cylinder on the bench top 10 times from a height of 5cm. The volume of the sample was recorded and the bulk density was calculated by the following formula:

Bulk density (g/ml or g/cm) = Weight of sample / Volume of sample after tapping

The cookies were selected randomly; weighed using analytical balance; and the height and diameter were measured with a caliper before and after baking. To measure the diameter of the cookies, four samples were placed next to one another and the total diameter was measuredfor all the prepared cookies. All of them were then rotated at 90° and the new diameter was measured. The average of the two measurements divided by four was taken as the final diameter of the cookie. Thickness was measured by stacking the cookies one above the other and restacking four times. Weight of the cookies was determined by a digital top loading balance which consists of different units of weights like gm and mg. Cookie diameter and height were measured with a vernier caliper method. Spread ratio of cookies was calculated as diameter/height (Jacob and Leelavathi, 2007) [15].

Color analysis: The color of cookies and flour was measured using a “Colorflex” colorimeter and the results were expressed in terms of the CIELAB system. Before the test, the instrument was calibrated with standard black and white tiles as specified by the manufacture. The light source was dual beam xenon flash lamp. Data was expressed in terms of ΔL (Lightness): ranging from 0 (black) to 100 (white), ΔA (redness): ranging from +60 (red) to -60 (green) ΔB (yellowness): ranging from +60(yellow) to -60(blue) values. After calibration, one cookie was kept into clean and dry glass beaker (provided with the instrument: 6cm height and 6 cm diameter) and evaluated for the color values.

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Chemical analysis: Moisture, crude protein, ash, fiber, and fat were analyzed as perstandard method of AOAC (2010) [16]. Carbohydrates were computed by subtracting the moisture, crude protein, ash, fiber, and fat from 100. The results were reported on wet weight basis.

Antioxidant activity: 2,2-diphenyl-1 picryl hydrazyl (DPPH) radical scavenging capacity DPPH was determined according to the method of Bondet*et al*., (1997) [17].

Total phenolic content (TPC): The total phenolics content (TPC) of the sample was determined according to Siddhuraju*et al*., (2002) [18].

Sensory evaluation: Sensory evaluation of cookies was done using a 9-point hedonic test based on the color, flavor, taste, texture, and overall acceptability from 15 untrained panelists (Hussain *et al*., 2006) [19].

Statistical analysis: All experiments were performed in triplicates. The results were analyzed using Minitab version 13 software for one-way analysis of variance (ANOVA) with Tukey's test to determine the significant difference between the mean at 5% level. Differences were measured statistically significant at $p \leq 0.05$.

RESULTS AND DISCUSSION

The present study underscores the exceptional benefits of incorporating soy flour and beetroot flour in cookie development.Table 1 provides an overview of the proximate and color analysis of wheat, soy, and beetroot flour. The moisture, ash, protein, fat, and crude fiber content in these flours ranged from 5.2 to 20.3%, 2.3 to 4.3%, 1.2 to 32.1%, 4.5 to 8.5%, and 1.47 to 6.8%, respectively. The present results were found to be in agreement with Saleh *et al*., (2012) [20] and Mishra and Chandra (2012) [21]. Flour color plays a pivotal role in determining the appearance of the final product and is a critical specification for end-users. Among the flours, beetroot flour exhibited the highest L* value (lightness) at 61.05 and a* value (redness) at 2.42, but the lowest b* value (yellowness) at 3.83 compared to wheat and soy flour. However, the total color difference (ΔE) was minimal between wheat flour (21.73) and soy flour (25.97),

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but maximal with beetroot flour (61.22).The results of the color analysis (L*, a*, b*, and ΔE) demonstrated significant differences ($P \leq 0.05$) between wheat, soy, and beetroot flours.

Estimating bulk density, water absorption capacity, and oil absorption capacity of flours for cookie production is crucial for quality control and process optimization. Bulk density indicates how the flour will behave during handling and mixing, ensuring consistent processing (Chandra *et al*., 2015) [22]. On the other hand, water absorption capacity helps determine the optimal hydration level for desired texture and moisture content in the dough, while oil absorption capacity guides the incorporation of fats for flavor and texture (Jose *et al*., 2022) [23]. These measurements collectively enable precise ingredient selection and formulation, leading to consistent, high-quality cookies that meet consumer expectations. The functional properties are parameters that determine the application and use of food material for various food products (Awuchi*et al*., 2019) [24]. The functional properties of wheat, soy and beetroot flour are represented in Figure 1. The bulk density, water absorption capacity (WAC), oil absorption capacity (OAC) of wheat, soy and beetroot flour ranges from 0.618 to 0.731 gm/cm^3, 196.6 to 585.40 % and 0.67-2.63%, respectively. Similar results were reported by Adebowale *et al*.,(2012) [25] and Ajanaku *et al*.,(2012) [26]. Figure 2 depicts the DPPH range from 5.003% to 65.09 %. Beetroot flour was reported with highest DPPH value i.e., 65.09% and wheat flour with lowest DPPH value i.e., 5.003%. The study by Yu*et al*.,(2013) [27] reported almost similar results of DPPH for wheat flour i.e., 4.53%.

Physiochemical properties of cookies

Data pertaining to the physical analysis of the cookies developed from wheat, soy and beetroot flour blends is given in Table 2. It is evident from the data that the supplementation of beetroot and soy flour in wheat flour at different levels had a significant effect ($p<0.05$) on weight, height, diameter and spread ratio.

Table 2 presents the physical analysis data of cookies produced using blends of wheat, soy, and beetroot flour. The cookie weight ranged from 8.7 to 9.57 g. Specifically, Sample T2 (15% B.F and 35% S.F) exhibited the highest weight (9.57 g), while T3 (25% B.F and 25% S.F) had the lowest (8.7 g). No significant distinctions ($P \geq 0.05$) in weight were observed among T1, T2, T3, and T4.The height of the cookies ranged from 0.84 to 1.05 cm, while the diameter ranged from 4.89 to 5.42 cm. Notably, T2 (15% beetroot flour and 35% soy flour) exhibited the lowest height (0.84 cm) but the highest diameter (5.42 cm); whereas T1 (5% beetroot flour and 45% soy flour) displayed the highest height (1.05 cm) and T3 had the lowest diameter (4.89 cm). Significant differences ($P \leq 0.05$) in diameter and height were observed among T1, T2, T3, and T4.The spread ratio, varied from 5.08 to 6.46, was highest in T2 (15% beetroot flour and 35% soy flour) and lowest in T1 (5% beetroot flour and 45% soy flour). Significant differences ($P \leq 0.05$) were noted between samples T1, T2, T3, and T4. Similar findings were reported by Mishra and Chandra, 2012 [21].The reduction in spread ratio with increasing soy flour content could be attributed to the higher binding power of proteins in soy flour, which binds with water and hinders cookie spread. Competition for available water also influences the spread ratio (Zaker*et al*., 2012 [2]; Godswill 2019 [28]).

Sample T3 exhibited the highest L* value (64.67), lowest a* (9.21) and b* value(29.41);while sample T4 showed the highest b* (29.41), lowest L* value (43.50); Sample T1 displayed the highest a* value (11.92). Total color difference (ΔE) was highest in sample T3 (25% beetroot flour and 25% soy flour) at 67.06 and lowest in sample T4 (100% wheat flour) at 53.34.The results of the color analysis for all four parameters demonstrated significant differences ($P \leq 0.05$) among samples T1, T2, T3, and T4. It is noteworthy that this observed color variation in cookies can be attributed to their brownish or golden hue.

The incorporation of beetroot and soy flour in cookie formulation resulted in notable changes in various nutritional components (Table 2). Moisture content ranged from 4.46% to 6.26%, with T1 (5% beetroot flour and 45% soy flour) displaying the highest moisture content and T4 (100%

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wheat flour) the lowest. This variation can be attributed to the inherently higher moisture content in beetroot flour.Similar findings were reported by Mishra and Chandra (2012) [21]. Elevated moisture levels may potentially impact the shelf life of the composite cookies, as it may facilitate microbial growth, leading to spoilage (Brennan and Grandison, 2012) [29].The ash content of the cookies ranged from 1.66% to 4.33%, demonstrating an increase with the addition of beetroot and soy flour. The ash content remained relatively stable in cookies compared to the respective flours after baking, indicating that the heat treatment did not significantly alter the mineral content (Mota*et al*., 2016) [30].Protein content was highest in T1 (21.28%) and lowest in T4 (10.32%). The inclusion of soy flour, being an excellent protein source and a complement to lysine-limited cereal protein, contributed to both the quantity and quality of the food product (Modgil *et al*., 2021) [7]. Previous studies by Shahzadi *et al*., (2005) [31] and Alabi and Anuonye (2007) [32] corroborated that legumes with high protein content enhance the nutritional profile of bakery products, suggesting that substituting cereal with legume-based composite flour can improve protein content and quality of cookies.Fat content remained relatively consistent in T1, T2, and T3 (27.74%, 27.52%, and 27.28% respectively), but notably decreased in T4 (18.07%). This variation could be attributed to the inherently low-fat content in wheat flour, in contrast to the substantial fat content in soy flour. The observed differences in fat content were statistically significant ($p \leq 0.05$).Crude fiber content was highest in T1 (4.56%) and lowest in T4 (1.53%), highlighting that the incorporation of beetroot and soy flour led to an increase in dietary fiber content. Carbohydrate content was highest in T4 (100% wheat flour) and lowest in T1 (5% beetroot flour and 45% soy flour), accounting for 63.96% and 39.16% respectively. This disparity indicates a significant difference ($P \leq 0.05$) between T1, T2, T3, and T4. The rise in carbohydrate content post-baking is attributed to the addition of sugar and butter in the cookie formulation. These alterations in nutritional composition reflect the dynamic impact of incorporating beetroot and soy flour into the cookie formulation.

Phytochemical Composition

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Total phenolic content exhibited a range of 6.14 to 23.24 mg/100g (Table 2). Notably, sample T3 demonstrated the highest total phenolic content at 23.24 mg/100g, while sample T4 exhibited the lowest at 6.14 mg/100g. Significant differences ($p \leq 0.05$) were observed among samples T1, T2, T3, and T4. It is worth noting that total phenolic content experienced a reduction post-baking compared to the values observed in the respective flours, probably due to degradation of heat-sensitive phenolic compounds during baking (Ribas Agusti*et al*., 2018) [33].Additionally, baking can alter the pH of the dough, potentially affecting the stability of phenolic compounds (Zilic*et al*., 2016) [34]and maillard reaction which occurs at high temperatures during baking, can lead to the degradation of phenolic compounds(Teng *et al*.,2018) [35].

The incorporation of beetroot and soy flour at varying levels in cookies led to an elevation in DPPH levels, as depicted in Figure 2. Specifically, T3 (25% beetroot flour and 25% soy flour) exhibited the highest DPPH value at 69.72%, while T4 (100% wheat flour) displayed the lowest at 9.87%. This elevated DPPH level indicates a substantial antioxidant activity in the investigated product/s. Notably, DPPH values experienced an increase, primarily attributed to the substitution of beetroot, post-baking when compared to the respective flours. The addition of beetroot and soy flour increases the total phenolic content in the cookies, as beetroot and soy flour are rich sources of phenolic compounds. Phenolic compounds are known for their antioxidant properties, as they can scavenge free radicals and prevent oxidative damage to cells and tissues (Shahidi*et al*., 2019 [36]; Rathod *et al*., 2023) [37].

Organoleptic Evaluation

The cookies from T4 (100% control) were highly favored for their color, followed by T1 (5% beetroot flour and 45% soy flour) which received a moderate level of liking. On the other hand, T2 (15% beetroot flour and 35% soy flour) and T3 (25% beetroot flour and 25% soy flour) were slightly favored, likely due to their creamy to dark brown color attributed to higher beetroot flour content. This darker hue may be a result of the Maillard reaction, which occurs between

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reducing sugars and proteins during baking (Lukinac*et al*., 2022) [38].Regarding flavor, sample T4 (100% control) received the highest level of acceptance, followed by T1 (5% beetroot flour and 45% soy flour) and T2 (15% beetroot flour and 35% soy flour), both of which were moderately liked. T3 (25% beetroot flour and 25% soy flour) received a slightly lower preference, likely due to the complex earthy flavor of beetroot and the natural beany taste of soy flour. As the proportion of beetroot flour in the cookies increased incrementally from T1 (5% beetroot flour and 45% soy flour) to T3 (25% beetroot flour and 25% soy flour), a noticeable gritty and earthy taste emerged. This characteristic flavor profile was attributed to the higher content of beetroot flour. As a result, T1, T2, and T3 received a moderate level of liking from the tasters.The texture of all cookie samples received high praise for their combination of crispiness and chewiness. However, T4 (100% control) garnered greater preference over T1 (5% beetroot flour and 35% soy flour), T2 (15% beetroot flour and 35% soy flour), and T3 (25% beetroot flour and 25% soy flour) due to its puffier consistency, while the others were relatively flatter.Both T4 (100% control) and T1 (5% beetroot flour and 45% soy flour) were favorably received in terms of overall acceptability. It was noteworthy that the increase in soy flour and the exclusive use of wheat flour positively influenced the overall preference. This led to the conclusion that cookies formulated with a respective 45 and 5% substitution of soy and beetroot flour and 100% wheat flour exhibited satisfactory performance and high acceptability.

CONCLUSION

This study demonstrated the significant advantages of incorporating soy flour and beetroot flour into cookie development. Soy flour, known for its high protein and essential fatty acids, emerged as a crucial component for creating nutritionally enriched food products. The inclusion of soy and beetroot flour also introduces a substantial dietary fiber content, promoting healthy bowel movements and reducing cholesterol levels. This composite flour blend, combining wheat, soy, and beetroot, not only enhances the cookies' nutritional profile but also

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enriches their flavor and appearance. The physicochemical properties of the flours were rigorously assessed, ensuring precise ingredient selection and formulation for consistent, high-quality cookies. Moreover, the study unveils the dynamic influence of beetroot and soy flour on cookie morphology, emphasizing their transformative potential in baked goods. The research culminates in the development of cookies that offer a balanced combination of essential nutrients, presenting a promising avenue for both nutritious and flavorful baked products.

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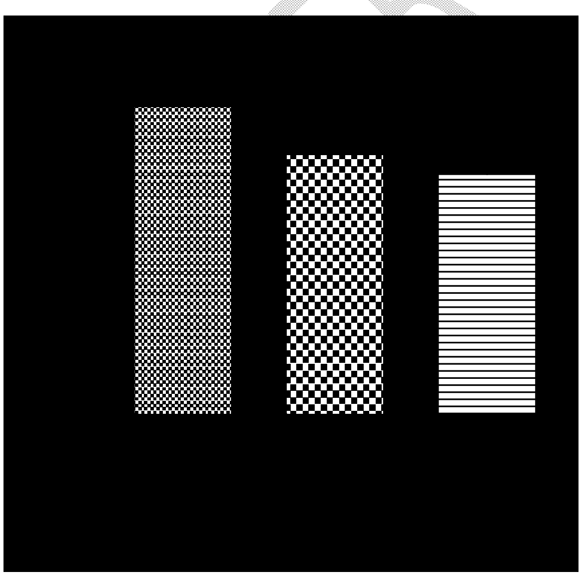
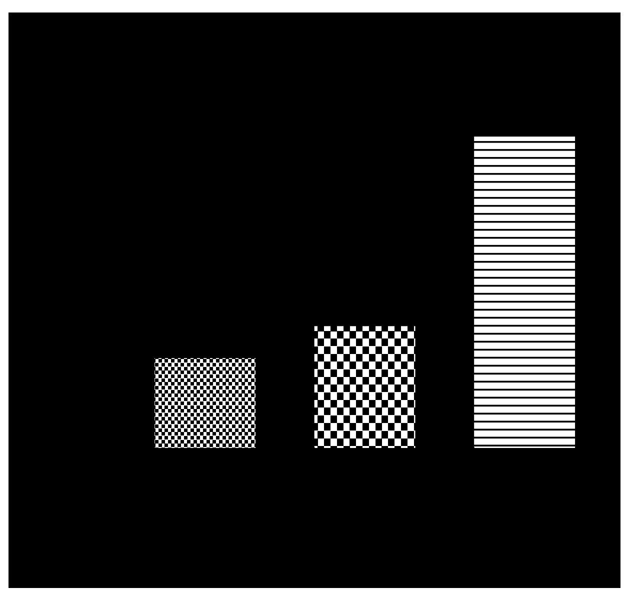
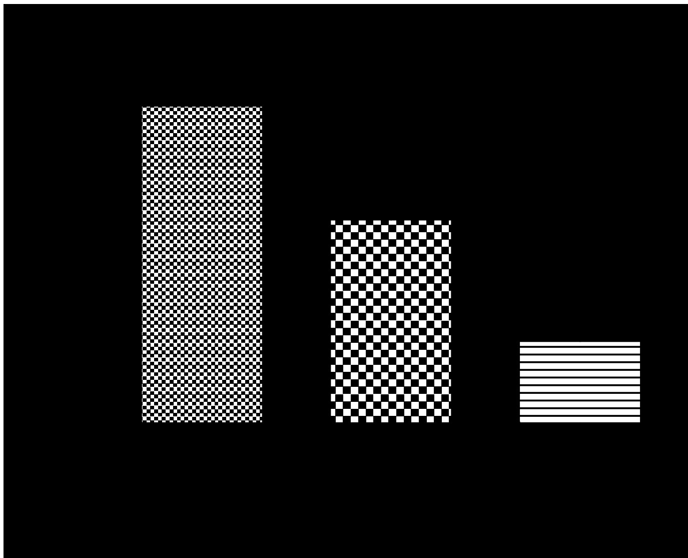




a) Bulk Density (g/cm^3) of flours

b) Water Absorption Capacity (WAC) (%) of flours



c) Oil Absorption Capacity (OAC) (%) of flours

Values are mean ± SD, n=3; different superscripts in the same row are significantly different (P≤0.05).Where, WF= Wheat flour, SF= Soy flour and BF= Beetroot flour.

Figure 1. Functional properties of wheat, soy and beetroot flour

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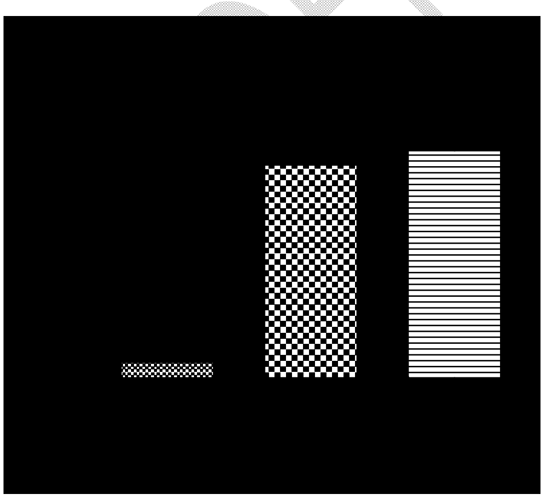

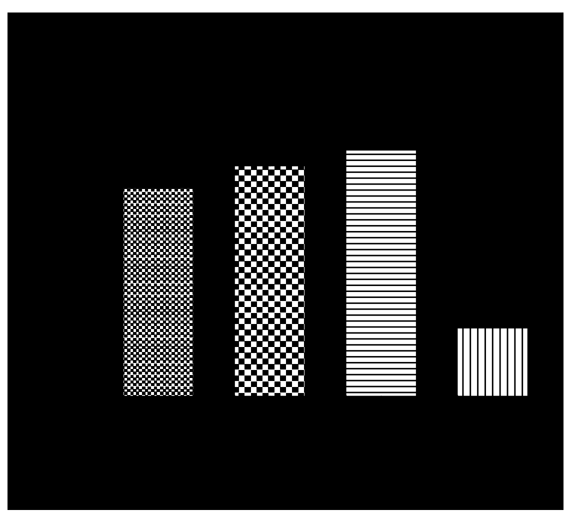

a) Total antioxidant activity (%) of flour **b) Total Antioxidant Activity (%) of cookies**

***Values are mean ± SD, n=3; different superscripts are significantly different ($P \leq 0.05$).Where, WF= Wheat flour, SF= Soy flour and BF= Beetroot flour;T_1= 5% beetroot flour and 45% soy flour, T_2= 15% beetroot flour and 35 % soy flour, T_3= 25% beetroot flour and 25 % soy flour, T_4= Control (100% wheat flour).

Figure 2. Antioxidant activity of flours and cookies

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Table1: Proximate composition, colour and total phenolic content of different flours

Parameters	WF	SF	BF
Moisture content (%)	5.26±0.92^{a}	6.53±0.30^{b}	20.33±1.44^{c}
Ash content (%)	2.33±0.57^{a}	4.33±1.15^{a}	3.33±1.52^{a}
Protein content (%)	9.56±0.37^{a}	32.14±0.73^{b}	1.21±0.42^{c}
Fat content (%)	5.46±0.12^{a}	8.54±0.11^{b}	4.53±0.06^{c}
Crude fibre (%)	1.90±0.01^{a}	6.80±0.11^{b}	1.47±0.23^{a}
Carbohydrate (%)	75.70±1.01^{a}	41.16±0.94^{b}	69.43±0.59^{c}
L*	18.75±0.04^{a}	15.96±.03^{b}	61.05±0.04^{c}
a*	0.56±0.05^{a}	0.17±0.05^{b}	2.42±0.05^{c}
b*	10.96±0.02^{a}	20.48±0.05^{b}	3.83±0.03^{c}
ΔE	21.73±0.04^{a}	25.97±0.03^{b}	61.22±0.06^{c}
Total Phenolic content (mg/100ml)	21.68±0.38^{a}	20.43±0.25^{b}	36.78±0.52^{c}

Values are mean ± SD, n=3; different superscripts in the same row are significantly different ($P \leq 0.05$).Where, WF= Wheat flour, SF= Soy flour and BF= Beetroot flour.L*=Lightness, a*=Redness, b*=Yellowness and ΔE=Total color difference.

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Table 2: Physico-chemical parameters of composite flour cookies

Parameters	T_1	T_2	T_3	T_4
Weight (g)	9.18 ± 0.97^{a}	9.57 ± 1.22^{a}	8.70 ± 1.04^{a}	9.42 ± 0.86^{a}
Height (cm)	1.05 ± 0.07^{a}	0.84 ± 0.06^{b}	0.87 ± 0.10^{bc}	0.94 ± 0.09^{a}
Diameter (cm)	5.34 ± 0.31^{a}	5.42 ± 0.41^{a}	4.89 ± 0.19^{a}	4.97 ± 0.19^{a}
Spread ratio	5.08 ± 0.355^{a}	6.46 ± 0.66^{b}	5.67 ± 0.609^{ab}	5.31 ± 0.38^{a}
L*	53.89 ± 0.01^{a}	58.85 ± 0.03^{b}	64.67 ± 0.02^{c}	43.50 ± 0.01^{d}
a*	11.92 ± 0.02^{a}	10.86 ± 0.04^{b}	9.21 ± 0.02^{c}	9.42 ± 0.01^{d}
b*	26.08 ± 0.01^{a}	21.22 ± 0.04^{b}	15.14 ± 0.02^{c}	29.41 ± 0.02^{d}
ΔE	$61.04\pm0.01_{a}$	63.49 ± 0.04^{b}	67.06 ± 0.02^{c}	53.34 ± 0.01^{d}
Moisture content (%)	4.60 ± 0.52^{b}	5.80 ± 0.4^{a}	6.26 ± 0.50^{a}	4.46 ± 0.94^{b}
Ash content (%)	3.66 ± 1.52^{a}	4.33 ± 0.57^{a}	3.66 ± 1.15^{a}	1.66 ± 1.15^{a}
Protein content (%)	21.28 ± 0.05^{a}	17.84 ± 0.12^{b}	14.40 ± 0.05^{c}	10.32 ± 0.50^{d}
Fat content (%)	26.74 ± 0.05^{a}	27.52 ± 0.06^{b}	27.28 ± 0.04^{c}	18.07 ± 0.06^{d}
Crude fibre (%)	4.56 ± 1.15^{a}	3.07 ± 0.01^{b}	2.13 ± 0.43^{c}	1.53 ± 0.14^{d}
Carbohydrate (%)	39.16 ± 1.23^{a}	41.44 ± 0.5^{b}	46.27 ± 0.02^{c}	63.96 ± 1.13^{d}
Energy (Kcal)	482.42 ± 0.02^{a}	485.20 ± 0.01^{b}	488.20 ± 0.01^{c}	459.75 ± 0.05^{d}
Total phenolic content (mg/100gm)	17.70 ± 0.36^{a}	21.03 ± 0.52^{b}	23.24 ± 0.4^{c}	6.14 ± 0.06^{d}

Values are mean ± SD, n=3; different superscripts in the same row are significantly different ($P\leq0.05$).Where, T_1= 5% beetroot flour and 45% soy flour, T_2= 15% beetroot flour and 35 % soy flour, T_3= 25% beetroot flour and 25 % soy flour, T_4= Control (100% wheat flour).

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Table 3 Sensory scores of composite flour cookies

Parameters	T_1	T_2	T_3	T_4
Color	7.14 ± 0.89^{a}	6.57 ± 0.97^{a}	6.14 ± 0.69^{ab}	7.78 ± 0.99^{ac}
Flavor	6.57 ± 1.27^{a}	6.14 ± 0.89^{a}	6.00 ± 0.81^{ab}	7.64 ± 1.02^{ac}
Taste	6.71 ± 1.70^{a}	6.42 ± 1.27^{a}	6.42 ± 0.76^{a}	7.78 ± 0.56^{a}
Texture	7.00 ± 1.15^{a}	7.00 ± 1.15^{a}	7.00 ± 0.81^{a}	7.78 ± 0.56^{a}
Over Acceptability	6.85 ± 1.07^{ab}	6.80 ± 0.8^{a}	6.39 ± 0.62^{a}	7.75 ± 0.78^{ac}
Index of Acceptance (%)	76.11%	75.55%	71%	86.11%

Values are mean ± SD, n=10; different superscripts in the same row are significantly different ($P \leq 0.05$).Where, T_1= 5% beetroot flour and 45% soy flour, T_2= 15% beetroot flour and 35 % soy flour, T_3= 25% beetroot flour and 25 % soy flour, T_4= Control (100% wheat flour).

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