Studies on development of sweet potato biscuits

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***Abstract*—The present study aimed to develop and evaluate sweet potato-supplemented biscuits by partial replacement of refined wheat flour with sweet potato flour (SPF) to varying levels (0%, 25%, 50%, and 75%) to achieve nutritionally superior, sensory-acceptable, and stable bakery food. Functional analysis identified SPF possessed greater water and oil absorption, bulk density, and swelling index compared to wheat flour and thus is suitable for biscuit making. Proximate analysis revealed 50% SPF-containing biscuits (T2) contained significantly higher ash content (2.36%), fiber content (1.69%), and moisture content (4.91%) compared to control (T0). Texture Profile Analysis assessed softer and acceptable texture in SPF-supplemented biscuits. Sensory evaluation on 9-point Hedonic scale rated T2 as most acceptable formulation for color, taste, aroma, texture, and overall acceptability with scores above 8. Storage studies for 90 days indicated negligible differences in moisture, fat content, and hardness, with T2 losing sensory quality significantly less than other samples. Microbial analysis indicated all samples within safe limits throughout storage duration. Techno-economic analysis of feasibility assessed production of sweet potato biscuits cost-effective and commercially viable. The study concludes incorporation of SPF to 50% enhances nutritional value without compromising sensory and microbial quality, and thus its inclusion can be advocated in value-added functional bakery foods.**

***Index Terms*—Sweet potato flour, biscuit formulation, Nutritional enrichment, functional foods, physio - chemical analysis**

I. INTRODUCTION

Biscuits are one of the most widely consumed ready-to-eat bakery foodstuffs due to convenience, price, sensory appeal, and durability. White wheat flour, sugar, and fat are used to traditionally make biscuits, which contain high calories but are low in nutritional value (Tortoe *et al.,* 2017). As consumer demand for diet-related sickness prevention grows, consumer demand for functional food—food that provides health benefits beyond conventional nutrition—is growing (Ponka *et al.*, 2022). Ingredient addition of nutrient-rich, under-utilized foods into common foods such as biscuits carries the potential solution to improved diet quality.

Ipomoea batatas L., or sweet potato, is a small tuber with β-carotene richness, dietary fiber, complex carbohydrates, vitamin C and E, and essential minerals like calcium, magnesium, and potassium (Onabanjo *et al.*, 2014; Bakar *et al.*, 2022). Its adaptability to grow on poor-quality soils with minimal inputs is an advantage to its use as a sustainable crop. Orange-flesh crops are particularly significant in the prevention of vitamin A deficiency, a serious public health issue in the majority of developing countries (Kidane *et al.*, 2024; WHO, 2022).

Sweet potato flour (SPF) has certain desirable baking functional properties like high foam volume and water absorption, even though there is no gluten and it is superior when blended with wheat flour (Srivastava *et al.*, 2012).. SPF-biofortified biscuits have demonstrated positive sensory characteristics, such as enhanced color, taste, and texture. Yet, excessive replacement can influence structural integrity, with calls for rationalized formulations (Jemziya & Mahendran, 2015). Additionally, the natural sweetness and gluten-free property of the flour allow it to be appealing to celiac and health-focused consumers.

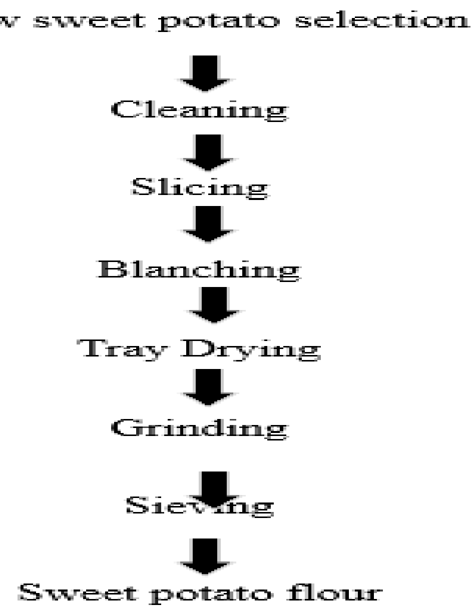
Processing of SPF entails operations such as drying and milling, where drying temperature plays a crucial role in retaining nutrients (Collado *et al.*, 2018). Its use is not limited to health advantages, as it benefits rural economies by minimizing post-harvest losses, decreasing reliance on wheat imports, and value addition to a perishable product. Economically, sweet potato biscuits have economic benefits and are in line with clean-label trends. Their shelf life and consumer acceptability, improved through proper packaging, render them potential functional food products. Assessing their techno-economic viability and sensor performance is important for guaranteeing bulk acceptance and commercial success.

Manufacturing nutritionally fortified biscuits using sweet potato flour is a viable option, as sweet potato and wheat flour are inexpensive and widely available raw materials. Sweet potato is a good source of dietary fiber, complex carbohydrates, β-carotene, and essential micronutrients, and hence a good crop for the production of new functional foods. Sweet potato flour can be used to fortify biscuits with nutrition and nutritional functionality and is an inexpensive and scalable process, and hence a viable option for small-scale and industrial production. With the customers more and more concerned about healthy, sustainable snacking, a sweet potato-based biscuit is a compelling direction for both trend and nutrition.

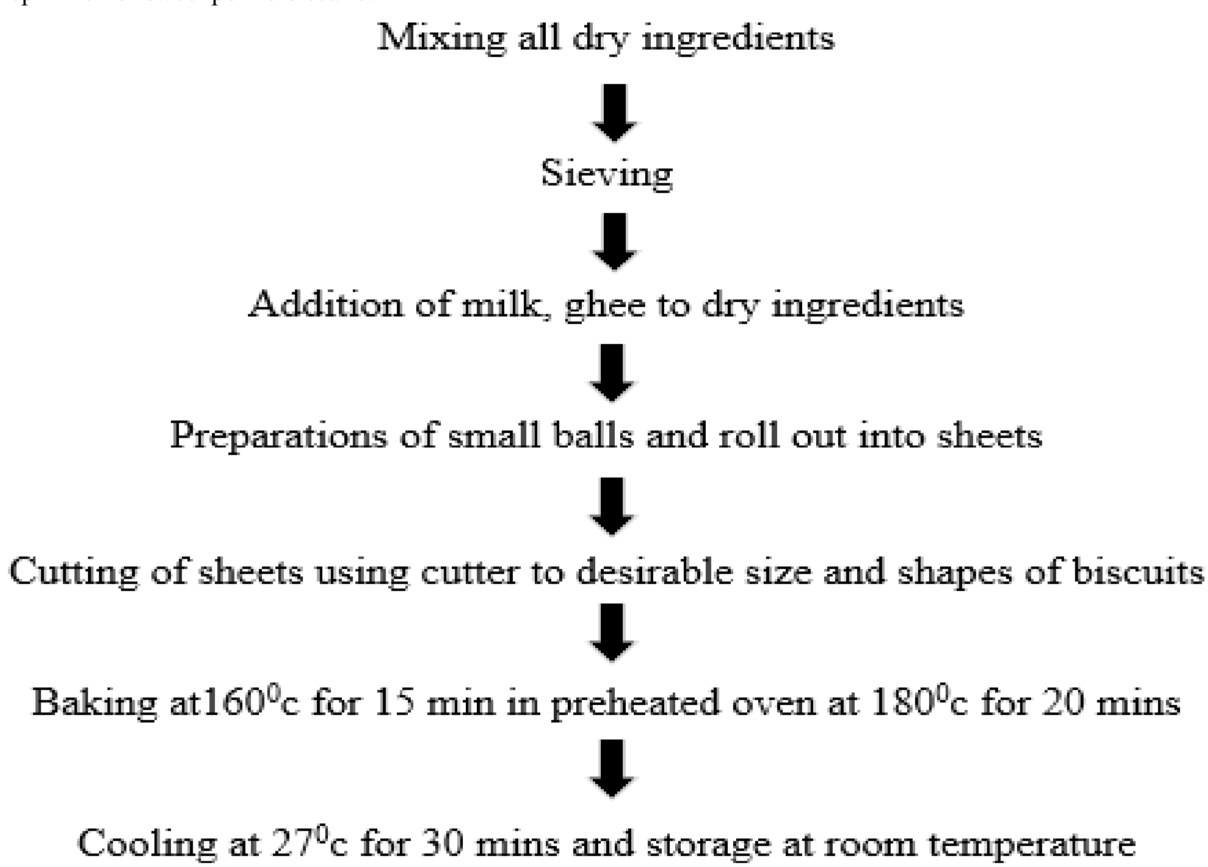
II. MATERIAL AND METHODS

Raw material such as Sweet potato, wheat flour, vanaspati ghee, sugar, salt, baking powder, baking soda, milk was procured from the local market of Pune.

Preparation of sweet potato flour (SPF)



Preparation of sweet potato biscuits:



Formulation Table For Sweet Potato Flour

Raw materials	T0	T1	T2	T3
Wheat flour	100gm	75 gm	50 gm	25 gm
Sweet potato flour	0 gm	25 gm	50 gm	75 gm
Butter	13 gm	13 gm	13 gm	13 gm
Milk	19 gm	19 gm	19 gm	19 gm
Sugar	7 gm	7 gm	7 gm	7 gm
Baking powder	1.5 gm	1.5gm	1.5 gm	1.5 gm
Salt	0.5 gm	0.5gm	0.5 gm	0.6 gm

III. FUNCTIONAL ANALYSIS OF RAW MATERIALS

Determination of water absorption capacity

The water absorption capacity of flour was determined according to the method described by Sosulski *et al.* (1976) Investigated the procedures provided. Take 1 gram of sample, mix with 10 ml of distilled water, leave at ambient temperature (30 ± 2 ° C) for 30 minutes, then centrifuge at 3,000 rpm or 2000 x g for 30 minutes. Water intake was measured as a percentage of bound water per gram of flour.

Determination of oil absorption capacity

Sosulski *et al.*, (1976) has given the method for determination of oil absorption capacity of flours. Take 10 ml of soybean oil (Sp. Gravity:0.9092) and mix 1gramofsamplein it and allow to stand for the period of 30 min at ambient temperature (30±2 0C), then it was centrifuged at 300 rpm or 2000 × g for the 30 min time period. Percent oil bound per gram flour is expressed as oil absorption capacity.

Determination of Bulk density

The 10 g of sample was weighed and poured into 50 ml measuring cylinder. The volume was noted and the bulk density was calculated.

$$Density = \frac{weight\ of\ sample}{volume}$$

Determination of foaming capacity

The foaming capacity (FC) was determined as described with slight modification which are given by Narayana and Narsinga Rao (1982). The 1.0 g flour sample was added to 50 mL distilled water at 30±2 0C in a graduated cylinder. Mix the suspension gently and shake for 5 min to form foam. The volume of foam which is formed at 30 s after the whipping process has been done was expressed as foam capacity using the formula.

$$Foaming\ capacity\ (\%) \frac{volume\ of\ foam\ AW - volume\ of\ foam\ BW}{volume\ of\ foam\ BW} x100$$

Determination of swelling capacity

The swelling capacity of the materials was examined by the method provided by Okaka and Potter (1977). Take sample and fill it into 100 ml graduated cylinder up to 10 mL mark. Add distilled water in it to give a total volume of 50 ml. Cover the top of the graduated cylinder tightly and mix it by inverting the cylinder. Again invert the suspension after 2 min of time period and left to stand for 8 min further. After 8 min, the volume occupied by the sample was taken. The swelling capacity was determined by using following formula.

$$swelling\ capacity\ (\%) = \frac{weight\ of\ sample\ after\ centrifugation - weight\ of\ sample\ with\ centrifuge\ tube}{weight\ of\ sample} x\ 100$$

IV. PROXIMATE ANALYSIS OF RAW MATERIALS AND SWEET POTATO BISCUITS

Determination of Moisture content

To obtain a constant weight, the oven-dry method was used to measure the moisture content at 105°C (AOAC, 2005). 5 grams of the material were precisely weighed in a moisture box that had been previously weighed. After 5 hours of oven drying at 105ºC, the sample was moved to desiccators to cool, and 30 minutes later it was weighed once more until a consistent weight was achieved, this process was repeated.

$$Moisture\ content\ (\%w.b.) \frac{2 - w}{w1 - w} X100$$

Determination of Ash content

The weighed samples (5.0 g) were placed in crucibles, burned on a hot plate and subsequently in a muffle furnace at 600°C for 4 hours to yield a light grey ash and the per cent ash content was calculated as:

$$Ash\ content\ (\%)\frac{w3-w1}{w2}x100$$

Determination of protein content

Protein content of flour and formulated biscuits was determined by Kjeldhal method (A.O.A.C., 2005) using KJELDHAL apparatus.

1. Digestion- 2-gram sample is accurately weighed in kjeldahl digestion flask. 15g Na2SO4/K2SO4 + 1g CuSO4 were added to the sample as a digestion mixture. Then 25ml conc. H2SO4 was added to it. The contents were vigorously boiled until the solution was clear. Heating was continued for 2-3 hours.
2. Distillation The flask was cooled, and 250ml distilled water was added to it. A few zinc granules and 100 ml NaOH were added to it. The distillation assembly was connected. The condenser was immersed well below 1cm in the collecting flask to avoid loss of ammonia (collect 200ml). The excess of acid was titrated with 0.1N NaOH. Blank was carried out. Amount of Nitrogen and Proteins was calculated by the conversion factor.

$$nitrogen\ content(\%)\frac{(\ sample\ titre-blank\ titre\ X\ 14\ X\ N\ X\ 100}{100}$$

Determination of fat content

Reagent - Petroleum ether (B.P. 60-80oC)

Place the bottle and lid in the incubator at 105 °C overnight to ensure that the weight of the bottle is stable. Weigh about 3-5 g of sample to paper filter and wrap. Take the sample into an extraction thimble and transfer it into a Soxhlet. Fill petroleum ether about 250 ml into the bottle and take it on the heating mantle. Connect the Soxhlet apparatus and turn on the water to cool them and then switch on the heating mantle. Heat the sample for about 8 h (heat rate of 150 drops/min). Evaporate the solvent by using the vacuum condenser. Incubate the bottle at 80-90 °C until the solvent is completely evaporated and the bottle is completely dry. After drying, transfer the bottle with a partially covered lid to the desiccator to cool. Reweigh the bottle and its dried content (AOAC, 2016).

$$fat\ content\ (\%)\frac{w3-w1}{w}X100$$

Determination of fibre content

Fibre content was estimated as measured using the FIBROTRON procedure as explained by A.O.A.C. (2005). Sample of 2.0 g weight (W) was first digested, whereby addition of glass beads helped to facilitate the digestion by the use of 200 ml of 0.255 N H 2 S O 4 and this procedure took 30 minutes. This was thoroughly washed using hot distilled water and digested again using 200 ml of 0.313 N NaOH into it, which was followed by washing with hot distilled water. That residue was further treated with 15 ml ethanol and made to dry in a hot air oven at the temperature of 100oC to a constant weight (W1). Lastly, the dried sample was burnt in muffle furnace at 550 o C and 5 hours of time duration to ignite all the carbonaceous content and became ash whereby the weight of ash (W2) was obtained after cooling.

$$Fibre\ content(\%)\frac{w1-w2}{w}X\ 100$$

Determination of total carbohydrates

The carbohydrate was estimated by subtracting from 100 with the addition of moisture, ash, Fat content, Protein content, Crude Fibre. The determined value is known as total carbohydrate (%),

Carbohydrate (%) = 100- (Moisture + Ash + Fat + Protein + Fibre)

V. PHYSICAL ANALYSIS

Texture Profile Analysis (TPA)

The texture of sweet potato biscuits was assessed using a texture analyzer under standard conditions. Samples were compressed twice to mimic chewing, and key parameters—hardness, cohesiveness, springiness, chewiness, and gumminess—were recorded. All measurements were conducted at room temperature in triplicate for accuracy. The results helped determine biscuit structure and sensory quality.

Sensory Evaluation

Sensory analysis was performed using a 9-point Hedonic scale (1 = extremely dislike, 9 = extremely like) by a panel from MIT School of Food Technology. Biscuits were evaluated for colour, flavour, taste, texture, mouthfeel, and overall acceptability at room temperature. Scores for each attribute were averaged across panellists.

Microbiological Assay

Microbial quality was evaluated through Total Plate Count (TPC) and yeast and mould count following the method of Kukade et al. (2017).

Total Plate Count

Sterile nutrient agar (28 g/L) was prepared and autoclaved (121°C, 15 psi, 20 min). Serial dilutions were made using sterilized distilled water. Plates were prepared aseptically under laminar airflow, inoculated with 1 ml of diluted sample, and overlaid with 15–20 ml molten media. After incubation at 37°C for 48 hours, colonies were counted and expressed as CFU/g.

$$TPC\ (CFU/ml)\frac{Number\ of\ colonies\ x\ dilutions}{volume\ of\ sample\ taken}$$

Determination of Yeast and Mould Count

Yeast and mould counts were estimated using Potato Dextrose Agar (PDA) following standard microbiological protocols. PDA (39 g/L) was prepared and autoclaved (121°C, 15 psi, 20 min). Serial dilutions of the sample were prepared using sterile distilled water. Under aseptic conditions in a laminar flow cabinet, 1 ml of each dilution was plated with 15–20 ml molten PDA. Plates were incubated at 37°C for 48 hours, and colony-forming units (CFU/ml) were calculated as per Kukade et al. (2017):

$$yeast\ and\ mould\ \ (CFU/ml)\frac{Number\ of\ colonies\ x\ dilutions}{volume\ of\ sample\ taken}$$

Storage Study of Sweet Potato Biscuits

Biscuits packed in HDPE pouches were stored at ambient temperature (25 ± 2 °C) and analyzed at 15-day intervals for 90 days. Evaluations included sensory attributes (colour, aroma, texture, taste, and overall acceptability) using a 9-point Hedonic scale and physico-chemical parameters (moisture, fat content, and hardness) using AOAC (2012) methods. The study aimed to assess quality changes and shelf-life for commercial viability.

VI. RESULT AND DISCUSSION

Functional Properties of Wheat Flour and Sweet Potato Flour

Parameters	Wheat flour	Sweet potato flour
Water Absorption Capacity (%)	77.2 ± 2.15^b	251.80 ± 3.40^a
Oil Absorption Capacity (%)	128 ± 2.80^a	69.6 ± 1.90^b
Bulk Density (g/cm^3)	0.63 ± 0.02^b	0.73 ± 0.01^a
Foaming Capacity (%)	12.54 ± 0.60^b	51.29 ± 1.50^a
Swelling Capacity	16.49 ± 0.30^a	8.20 ± 0.25^b

There were considerable differences in the functional properties of wheat and sweet potato flours, with important relevance for biscuit development. In terms of water absorption, sweet potato flour (251.8%) had greater water absorption than wheat flour (77.2%), resulting from the respective starch and overall fiber contents. In comparison, wheat flour had greater oil absorption than sweet potato flour (128 v 69.6%), suggesting potentially better retention of flavour. Sweet potato flour (0.73 g/cm³) had a slightly greater bulk density than wheat flour (0.63 g/cm³), which may matter in potential means of packaging. Sweet potato flour had better foaming capacitance (51.29%) and emulsion capacity (40.38%) than wheat flour, which indicated better aeration and better emulsion capacity. On the other hand, wheat flour had a greater swelling capacity (16.49) than sweet potato flour (8.20) indicating better gelatinization potential. These results correlate with past feedback from Sosulski *et al.*, (1976), Suresh Chandra and Samsher (2013) and the previous reports from the couple of studies with functional properties of the relative functional properties of the different flours suggesting some definite functional attributes of sweet potato flour.

Proximate Analysis of Sweet Potato Flour and Wheat Flour

Sr. no	Parameter	Wheat flour	Sweet Potato Flour
1.	Moisture	7.00 ± 0.15^{b}	7.25 ± 0.20^{a}
2.	Fat	1.40 ± 0.05^{a}	0.69 ± 0.03^{b}
3.	Protein	9 .00± 0.20^{a}	3.12 ± 0.10^{b}
4.	Carbohydrate	81.78 ± 0.30^{b}	85.97 ± 0.25^{a}
5	Crude fibre	0.10 ± 0.01^{b}	1.57 ± 0.05^{a}
6.	Ash	0.72 ± 0.02^{b}	1.40 ± 0.04^{a}

This table presents the proximate composition of sweet potato and wheat flours used in biscuit formulation. Sweet potato flour showed higher moisture (7.25%), ash (1.40%), fiber (1.57%), and carbohydrate content (85.97%) than wheat flour, indicating greater mineral content, dietary fiber, and energy density. In contrast, wheat flour had higher protein (9%) and fat (1.4%) levels. These findings are consistent with earlier studies (Khure et al., 1998; Onabanjo & Ighere, 2014). Both flours remained within safe moisture limits for shelf stability.

Sensory Evaluation of Prepared Sweet Potato Biscuits

Sample	Colour	Taste	Flavour	Texture	Mouthfeel	Overall Acceptability
T0	8.5	8.6	8.5	8.6	8.5	8.5
T1	8.0	7.8	7.9	7.7	7.6	7.8
T2	8.2	8.0	8.1	8.0	8.1	8.0
T3	7.5	7.3	7.2	7.4	7.3	7.4

The sensory evaluation of the biscuit samples using a 9-point hedonic scale showed the highest overall acceptability in the control (T0) (8.5). Of the enriched samples, T2 (50:50 sweet potato and wheat flour) received attractive scores for flavor (8.1), texture (8.0), and mouthfeel (8.1), with an overall acceptability of 8.0, demonstrating the best overall sensory properties. T1 and T3 demonstrated lower sensorial acceptability (7.8 and 7.4), which is supported by both low and high levels of sweet potato negatively impacting the score of T1 and T3, respectively. T2 was ultimately identified as the best idea for future product development.

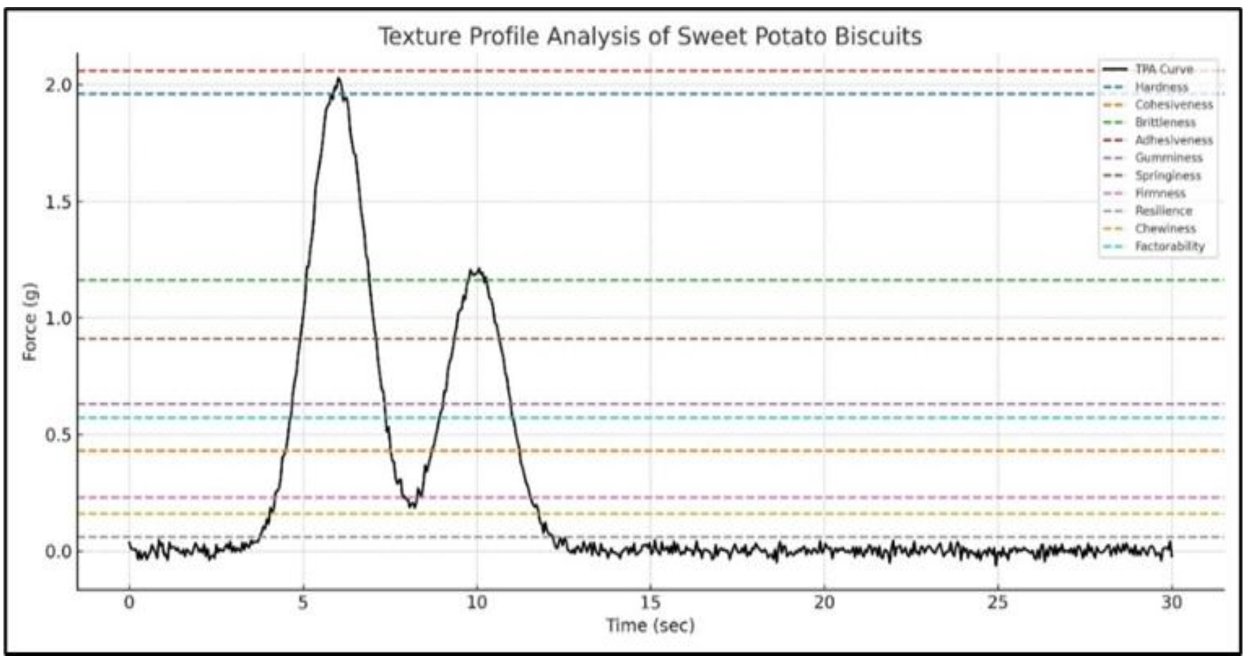
Physical properties of sweet potato biscuits

Treatment	Diameter (cm)	Thickness (cm)	Spread Ratio	Weight (g)
T0(100% wheat flour)	4.50 ± 0.05^{a}	0.86 ± 0.01^{a}	5.23 ± 0.08^{b}	13.60 ± 0.12^{a}
T1 (75WF:25SPF)	4.48 ± 0.06^{a}	0.84 ± 0.02^{b}	5.33 ± 0.07^{a}	13.20 ± 0.14
T2 (50WF:50SPF)	4.46 ± 0.04^{a}	0.84 ± 0.01^{b}	5.31 ± 0.06^{a}	13.10 ± 0.15^{bc}
T3 (25WF:75SPF)	4.42 ± 0.03^{b}	0.83 ± 0.02^{b}	5.32 ± 0.05^{a}	13.00 ± 0.10^{c}

Table shows that increasing sweet potato flour (SPF) led to a slight decrease in biscuit diameter and weight, likely due to reduced gluten and higher water-holding capacity. Thickness also declined slightly, while the spread ratio remained fairly consistent, with a slight increase in T1. Among all, T2 (50% WF: 50% SPF) showed the most balanced physical attributes—spread (5.31±0.06), thickness (0.84±0.01 cm), and weight (13.10±0.15 g)—making it the most suitable formulation for nutritionally enhanced biscuits (Yadav *et al.*, 2012; Kurek *et al.*, 2020).

Texture Profile analysis

Parameter	T0 (control sample)	T2
Hardness	2.65 ± 0.12[a]	1.96 ± 0.10[b]
Cohesiveness	0.36 ± 0.02[b]	0.43 ± 0.03[a]
Brittleness	1.42 ± 0.10[a]	1.16 ± 0.08[b]
Adhesiveness	1.42 ± 0.15[b]	2.06 ± 0.18[a]
Gumminess	0.80 ± 0.04[a]	0.63 ± 0.03[b]
Springiness	0.84 ± 0.05[b]	0.91 ± 0.04[a]
Firmness	0.31 ± 0.02[a]	0.23 ± 0.02[b]
Resilience	0.09 ± 0.01[a]	0.06 ± 0.01[b]
Chewiness	0.22 ± 0.03[a]	0.16 ± 0.02[b]
Factorability	0.49 ± 0.02[b]	0.57 ± 0.03[a]



At the completion of the Texture Profile analysis (reported in Table 4.5), the T2 biscuit (50:50 WF:SPF) was noted to have a lower hardness score (1.96 ± 0.10), as compared to the control T0 (2.65 ± 0.12) and therefore a lower hardness score suggests cheaper texture. This was a result from a reduction in gluten composition and a higher fibre composition compared to 50:50 wheat flour alone biscuit. The T2 biscuit also improved in cohesiveness (0.43 ± 0.03) and adhesiveness (2.06 ± 0.18) which is likely due to the starch-rich sweet potato flour promoting moisture retention. The T2 biscuit exhibited a lower brittleness and lower gumminess, with a slight increase in springiness (0.91 ± 0.04), indicating a favourable improved structural design. T2 had a higher factorability (0.57 ± 0.03) indicating improved crispness. Overall, the T2 biscuit exhibited a softer and more cohesive and crisper texture profile supporting improved consumer acceptability.

Proximate analysis of control and selected sweet potato biscuits sample

Parameter	Control Sample (T0)	T2
Moisture	5.80 ± 0.12[a]	4.68 ± 0.10[b]
Fat	26.50 ± 0.30[a]	10.08 ± 0.25[b]
Protein	9.50 ± 0.20[a]	7.87 ± 0.15[b]
Carbohydrate	62.20 ± 0.50[b]	73.81 ± 0.40[a]
Crude fibre	1.00 ± 0.05[b]	1.20 ± 0.04[a]
Ash	0.80 ± 0.02[b]	2.36 ± 0.06[a]

The proximate composition compared the nutritional contents of the control biscuits (T0) and T2 (50% sweet potato flour). T2 had lower moisture content (4.68±0.10%) than T0 (5.80±0.12%), indicating a higher stability when shelfed. For fat content, T2 showed lower fat amount (10.08±0.25%) than T0 (26.50±0.30%) given the lipid limited present in sweet potato flour. The protein level was lower in T2 (7.87±0.15%) than T0 (9.50±0.20%), though the derived relative differences were due to dilution. When comparing Williams et. al. (2009) nutrition energy values. carbs in T2 (73.81±0.40%) and coarse fiber content (1.20±0.04%) improved formulations when comparing T0 (62.20±0.50% and 1.00±0.05%, respectively). Ash content was significantly higher in T2, which had significantly more ash (2.36±0.06%) than T0 (0.80±0.02%), which showed superior mineral quality.

Storage study of prepared sweet potato biscuits based on sensory evaluation

Storage period (Days)	Appearance	Colour	Aroma	Taste	Texture	Overall Acceptability
0^{th}	8.2	8.0	8.1	8.0	8.1	8.0
15^{th}	8.0	7.9	7.8	7.9	7.9	7.9
30^{th}	7.8	7.7	7.6	7.7	7.7	7.7
45^{th}	7.6	7.6	7.3	7.5	7.5	7.5
60^{th}	7.3	7.3	6.9	7.1	7.2	7.1
75^{th}	6.9	6.9	6.5	6.7	6.8	6.7
90^{th}	6.5	6.5	6.0	6.2	6.2	6.1

The evaluation of the sensory quality of sweet potato biscuits showed a decline in quality over 90 days with acceptability ratings that remained acceptable after this storage duration. At day 0 acceptability ratings of Appearance, Taste, Texture, and Overall Acceptability were rated above 8.0. By day 30 only slight reductions in appearance and overall acceptability were observed, while a more robust decline in acceptability occurred from day 45 especially aroma (7.6±0.3) and taste (7.9±0.3) scores. By day 90 acceptability of overall sensory quality declined to 6.5±0.4. This decline in sensory quality is most likely explained by changes in flavor volatiles, texture and moisture distribution. Even with this decline in quality, the sensory quality of biscuits remained acceptable for up to 60 days in PET packaging, supporting a shelf stable product for medium term storage duration.

Microbial assessment of sweet potato biscuits

Days	Total plate count (CFU/g)	Yeast and mould (CFU/g)
0^{th}	ND	ND
15^{th}	ND	ND
30^{th}	ND	ND
45^{th}	1.2×10^{2a}	ND
60^{th}	2.4×10^{2b}	1.5×10^{1a}
75^{th}	3.6×10^{2c}	2.8×10^{1b}
90^{th}	4.8×10^{2d}	4.5×10^{1c}

Microbiological analysis for sweet potato biscuits prepared during the 90-day study period revealed that the total plate count (TPC) and yeasts and mould counts were nonexistent up to day 30. This suggests a high level of microbial stability as a result of good hygienic processing. The TPC started to show from day 45 with 1.2×10^3 CFU/g recorded on day 45 and a total of 4.8×10^3 CFU/g by day 90. Moreover yeasts and mould counts rose from 1.5×10^2 CFU/g on day 60 to 4.5×10^2 CFU/g on day 90. However, although the TPC and yeasts and mould counts were acceptable and did not pose a health risk, it seemed that sweet potato biscuits were not best consumed after 60 days after manufacture. Overall an enhancement in packaging or use of natural preservatives may provide better overall consumer use potential as shelf-life could be improved and product quality maintained.

Techno-Economical feasibility of Sweet Potato Biscuits

Sr. No.	Raw Material	Cost (₹/kg)	Quantity required (g)	Cost of material (₹)
1.	Sweet potato flour	50	75	3.75
2.	Wheat flour	35	25	0.88
3.	Butter	400	13	5.20
4.	Milk	50	19	0.95
5.	Sugar	40	7	0.28
6.	Baking powder	250	1.5	0.38
7.	Salt	15	0.5	0.01
8.	Total			11.45
9.	Processing cost (20% of raw material cost)			2.29
10.	Packaging cost			3.00
11.	Miscellaneous charge			1.50
12.	Total production cost per 100g			18.24
13.	Selling price per 100g			20.00
14.	Total profit			1.76
15.	% profit			9.65 %

The techno-economic viability assessment of sweet potato biscuits was based on the cost of purchasing raw materials, processing, packing and other miscellaneous costs in producing 100 g of the product. The total cost of production was ₹18.24 in which raw materials comprised failure ₹11.$.45 of which butter was the most expensive input at ₹5.20, followed sweet potato flour at ₹3.75. The processing costs ₹2.29 (20% of raw materials), packaging ₹3.00 and miscellaneous costs were ₹1.50. The proposed sales price of ₹20.00 for 100 g of biscuits amounted to a profit of ₹1.76 or 9.65%. The profit margin for the product appears to be low but the use of sweet potato flour which is nutritious and locally available has allowed to have an acceptable priced snack with market potential as a functional food. Therefore, based on this techno-economic feasibility assessment of producing sweet potato biscuits indicated that the product is economically viable and has potential as a competitive snack food in the market.

VII. CONCLUSION

This study has documented that sweet potato biscuits were successfully produced incorporating sweet potato flour up to 50% (T2) without sacrificing sensory, physical or storage attributes. The nutritional profile of the T2 biscuits improved, having significantly greater carbohydrates, fibre and ash and less fat than the control. Sensory evaluation and texture analysis confirmed these products were accepted by consumers, and storage studies indicated the products have reasonable shelf stability of 60 days. The techno-economic investigation found the formulations to be low-cost and developed from locally sourced sweet potato, making it suitable for small scale production. This research implies that sweet potato flour can be used as a functional ingredient in bakery products, which support better nutrition and sustainability, and in turn, rural economic development.

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