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Standardization and organoleptic evaluation of sweet potato chips (*Ipomoea Batatas* L.)

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Abstract
The Present study focuses on Development and Standardization of Sweet Potato Chips (*Ipomoea Batatas* L.). The goal was to develop a convenient, health-forward food option tailored for individuals who prioritize balanced nutrition in their daily diets. The formulations for preparation of sweet potato chips were developed with both blanched and unblanched treatments, each having three different combinations (T1, T2, and T3), along with a control sample (T0). These three different combinations prepared, varying in the addition of ingredients such as sodium chloride and spice seasoning. For blanched sample: T1 (97:03:00:00), T2 (95:02:00:03), T3 (93:02:05:00) whereas for unblanched sample the proportions are T1 (98:02:00:00), T2 (94:02:00:04), T3 (90:02:08:00). After conducting sensory evaluations, formulation Unblanched T3 emerged as most favourable in terms of taste, texture, and overall appeal. Nutritional analysis of Unblanched T3 showed it contains 4% moisture, 27.5% fat, 4.3% protein, 57.3% carbohydrates, 4.8% dietary Fiber, and 3% ash per 100 grams. Overall, this formulation Unblanched T3 proved to have excellent sensory and nutritional qualities, making it a healthy snack option for the health-conscious individuals.

Keywords: Sweet Potato, Blanched and Unblanched, Sodium Chloride, Spice Seasoning, organoleptic evaluation

Introduction
Sweet potato (*Ipomoea batatas* L.), a member of the family *Convolvulaceae*, originated from Central America and is widely cultivated in tropical and subtropical regions due to its high yield and adaptability. There are over 6,500 varieties globally, differing in skin and flesh color, root shape, and origin. The crop shows great morphological diversity in leaves, stems, and tubers. Productivity varies among varieties even under similar conditions, emphasizing the importance of selecting suitable cultivars. Morphological identification helps in utilizing genetic diversity for breeding programs. Low yields in farmers' fields are mainly due to the use of local genotypes, which can be improved through new or improved clones. CIP-SEA clones require evaluation for morphological and yield traits under organic and medium highland conditions. Tuber formation begins around 28 days after planting, with 80% visible by 49 DAPS. Tuber shapes range from round to oval with varying skin and flesh colours—white, cream, yellow, orange, or purple—of which orange, white, and cream types are most common (M. Hayati *et al.*, 2020) [3]. Sweet potato (*Ipomoea batatas*) has been recognized as a functional food with significant medicinal potential due to its rich content of anthocyanins, carotenoids, flavonoids, and polysaccharides, which exhibit strong antioxidant, anti-inflammatory, hepatoprotective, and neuroprotective effects (Nguyen *et. al.*, 2021; Laveriano-Santos *et. al.*, 2022) [5, 6]. The leaves, abundant in vitamins, minerals, and phytochemicals, possess anticancer, immune-boosting, and hepatoprotective properties, making them valuable as low-cost medicinal vegetables (Nguyen *et. al.*, 2021) [6]. A 2024 U.S. study also demonstrated that sweet potato leaf extracts, rich in chlorogenic acids and quercetin derivatives, show strong antioxidant and antimicrobial activities against *Staphylococcus aureus*, *E. coli*, and *Candida albicans*. Additionally, *Laveriano-Santos et. al.* (2022) [5] reported that root and peel extracts have notable antidiabetic effects by lowering blood glucose, improving lipid profiles, and enhancing insulin activity.

Collectively, these studies highlight sweet potato's dual nutritional and therapeutic value as a natural functional food. Sweet potato is a globally consumed, highly nutritious food rich in vitamin C, vitamin A (in orange-fleshed varieties), fiber, potassium, and B vitamins, serving as an excellent energy source (Cartabiano-Leite *et. al.*, 2020) [1]. Coloured-fleshed varieties contain bioactive compounds that promote health. The crop is valued for its high starch and dry matter content, with starch comprising 65-89% of its dry weight, making it a key energy reserve and an indicator of good quality varieties (M. Hayati *et. al.*, 2020) [3]. Sweet potato starch, composed of amylose and amylopectin, provides energy when cooked as starch converts into maltose, raising the glycaemic index. Nutritionally, it contains 77.28 g water, 86 kcal energy, 1.57 g protein, 20.12 g carbohydrates, and 3.0 g dietary fiber per 100 g (Cartabiano-Leite *et. al.*, 2020) [1].

Sweet potato chips are considered one of the emerging value-added snacks produced from sweet potatoes (*Ipomoea batatas L.*), which are known for their unique sweet taste and attractive colour. They are prepared by slicing the tubers into thin pieces, followed by processes such as frying, baking, or air-drying to obtain a crispy and palatable product. sweet potato chips represent a convenient ready-to-eat snack with better nutritional attributes compared to conventional potato chips, as they retain higher levels of carotenoids and dietary fibre. The increasing consumer demand for healthier snacks has promoted the utilization of sweet potato in the form of chips, making it a promising alternative in the snack food industry Ulus and Allen (2020). Sweet Potatoes are an excellent source of beta-carotene, ascorbic acid, and dietary fibre, which are partly retained during chip processing. The high beta-carotene content, which is a precursor of vitamin A, makes sweet potato chips more beneficial compared to potato-based snacks, especially in regions where vitamin A deficiency is prevalent. Nutritionally, sweet potato chips are rich in carbohydrates, moderate in protein, and contain essential vitamins and minerals Senthilkumar *et. al.*, (2020) [8]. Studies on sweet potato chip formulations revealed that moisture, ash, fat, protein, and carbohydrate contents vary with processing and seasoning, influencing both nutrition and consumer acceptance (Domingos *et. al.*, 2023) [2]. Freeze-dried chips showed the highest protein (5.65 g/100 g), fiber (3.56 g/100 g), and ash (1.77 g/100 g) with low fat (1.51 g/100 g), while deep-fried chips had the highest fat content (45.85 g/100 g) but were most preferred for taste. This indicates a trade-off between nutritional quality and sensory appeal. Baking and freeze-drying retain more nutrients and are better for health-conscious consumers. Developing optimized formulations using organic seasonings and suitable processing can enhance both health value and market acceptance of sweet potato chips (Domingos *et. al.*, 2023) [2].

Materials and Methods

This study was conducted in the Department of Food Chemistry and Nutrition at K.K. Wagh College of Food Technology, affiliated with Mahatma Phule Krishi Vidyapeeth, Nashik, Maharashtra. The research focused on formulate an innovative snack food product-crispy sweet potato chips—using locally sourced ingredients.

These nutrient-rich ingredients were carefully selected from the local market of Nashik and the main aim was to create a healthier alternative to conventional chips by maintaining its nutritional profile and quality of sweet potato chips.

Methodology

Recipe Standardization for preparation of sweet potato chips

For recipe standardization of sweet potato chips the formulations for preparation of sweet potato chips were developed with both blanched and unblanched treatments, each having three different combinations (T1, T2, and T3), along with a control sample (T0). The sweet potato slices were deep fried in oil and then salt and spice seasoning was given.

Table 1: Recipe Standardization for preparation of sweet potato chips (ingredients g/100 gm)

Formulations							
Ingredients	**T0**	**Blanched**			**Unblanched**		
		T1	T2	T3	T1	T2	T3
Potatoes	98	00	00	00	00	00	00
Sweet Potatoes	00	97	95	93	98	94	90
Salt	02	03	02	02	02	02	02
Spice Seasoning	00	00	00	5	00	00	8
Red Chilli	00	00	03	00	00	04	00

Organoleptic evaluation of sweet potato chips

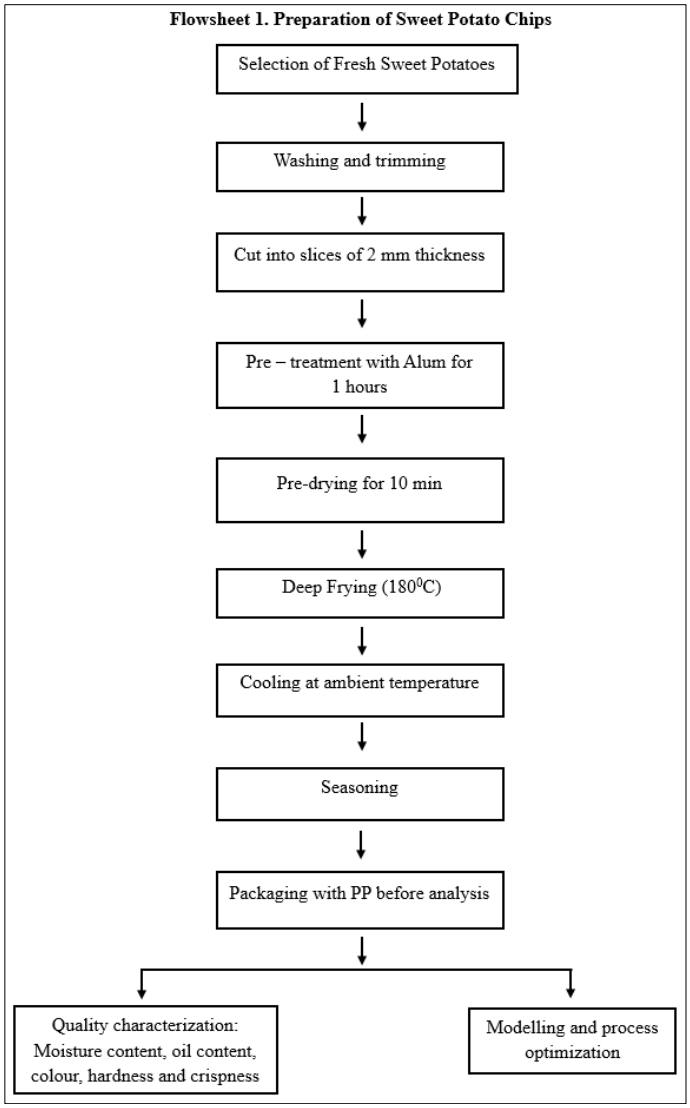
Hedonic scale test was conducted based on randomly picked evaluators of 65 volunteers. This test was carried out in the Sensory Analysis Laboratory in the individual booths to give privacy for the evaluators to do the sensory. These evaluations had the acceptability scale varying from 7 (like very much) till 1 (dislike very much). The acceptability level was based on texture, taste, appearance and aroma of the processed sweet potatoes. The panels were given water to rinse, a pencil, five samples and score card. The panels were asked to rinse their mouth every time they taste the next sample.

Preparation of sweet potato chips

The raw sweet potatoes were properly washed with water. Then the sweet potatoes were sliced at appropriate thickness i.e. 0.2mm thickness using potato slicer. Then the alum treatment was given to the slices for 1 hour at room temperature. After the excess water was removed from the slices and then the slices are deep fried into the oil. Later the salt and spice seasoning were given to the chips.

Sweet potato chips elaboration

The steps used to prepare the sweet potato chips are shown in Figure 1. The pre-dried sweet potato slices were deep-fried in sunflower oil with a slice to oil ratio of 1:10 (w/v) at varying frying temperatures and frying times as per CCRD. After frying, the fried sweet potato slices were removed from the oil and placed on a wire screen to drain the surface oil and cooled to room temperature. The sweet potato chips were then packed in poly - propylene (PP) bags to store for quality characterization. (Pratiksha Timalsina, *et. al.*,2019), Kumari, S., Kumar, A., & Singh, N. (2019) [7, 4].



Flow Chart 1: Processing technology for preparation of sweet potato chips

Results and Discussion

Sensory evaluation of sweet potato chips: Sensory evaluation of the pasta samples assessing attributes such as colour, appearance, taste, flavour, texture, and overall acceptability was conducted by a semi-trained panel, as presented in Table No. 2

Parameter for 9-point Hedonic scale

Dislike extremely	Dislike very much	Dislike moderately	Dislike Slightly	Neither like nor dislike	Like slightly	Like Moderately	Like very much	Like extremely

Table 2: Mean sensory values for the sweet potato chips

Sample	Organoleptic Score					
	Color	**Taste**	**After Taste**	**Texture**	**Appearance**	**Overall Acceptability**
Control Sample (T0)	9	9	9	9	9	9
Blanched Sample						
T1	7	6	5	8	7	7
T2	6	6	5	6	7	6
T3	6	6	5	7	7	6
Unblanched Sample						
T1	8	8	8	8	8	8
T2	7	7	7	7	7	7
T3	9	9	9	9	9	9

*Each value an average of three determinations

The results are revealed from the Table 2 that the sensory evaluation score is given by the semi trained panellist showed that the textural scores were significantly increasing from T1 blanched to T3 unblanched. The taste and appearance of the all-blanched samples rating are similar whereas the sensory evaluation score of control sample T0 and unblanched sample T3 are significantly similar score. When the data analysed statistically it was found that control sample T0 and unblanched sample T3 was significantly superior to the rest of the samples.

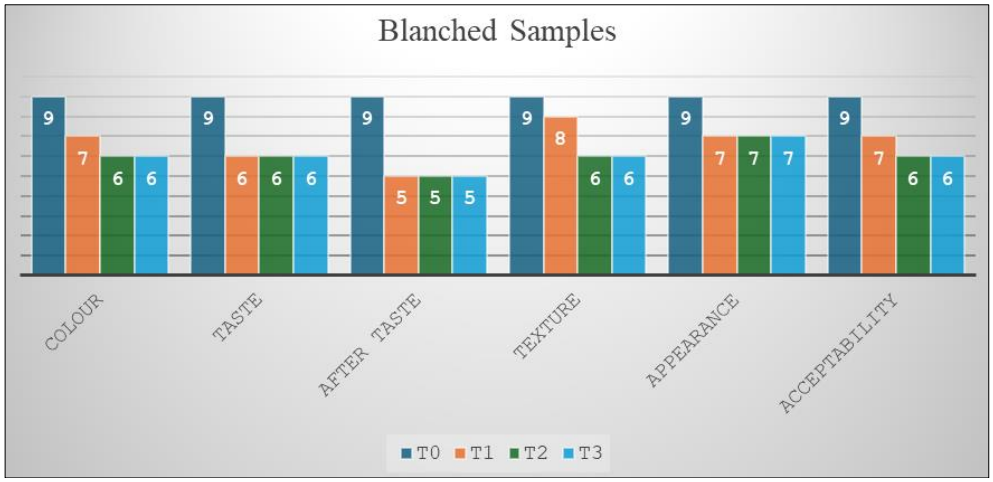


Fig 1: Graphical Representation of Sensory evaluation chart of Blanched samples

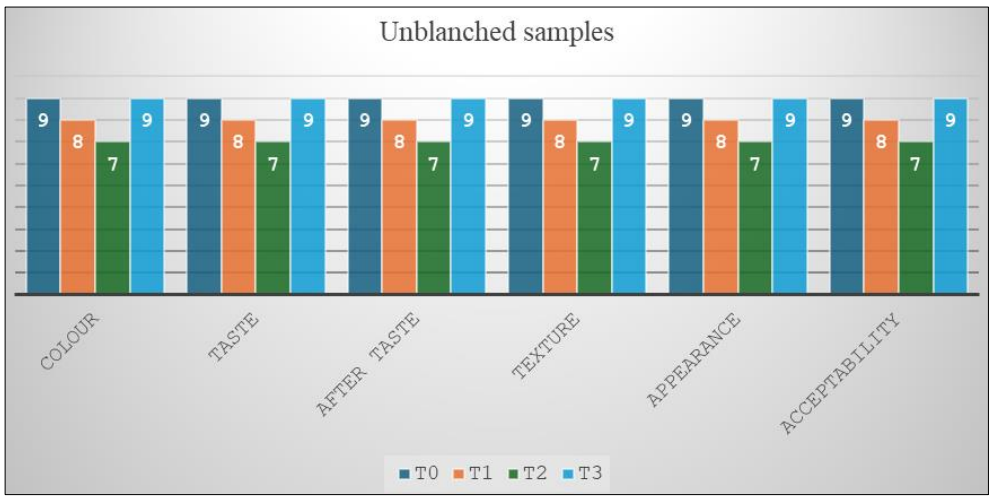


Fig 2: Graphical Representation of Sensory evaluation chart of Unblanched samples

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