



Formulation of Sweet Potato Flour and Cookies and Sensory Evaluation of Cookies for Consumer Perception

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ABSTRACT

Sweet potato flour contains less amount of protein, although rich in dietary fiber content and carbohydrate, so a successful combination with wheat flour for cookie production would be nutritionally advantageous. Cookies are one of the low cost processed snacks that are most widely consumed all over the world. It has some notable advantages over conventional snacks in that it is cheaper, easy to use, easily available in wide variety of shapes, sizes, tastes, packs, and appeals to all age groups. For this experiment Sweet Potato Tubers were bought from local market. The Tubers were then washed, peeled, sliced, blanched, dried, sieved, ground and stored. Sweet Potato Flour was blended with Wheat Flour in ratio of 60%, 100%. Wheat flour without Sweet Potato Flour was used as control (T₀). Wheat flour and Sweet Potato flour in ratio of 40:60 was used as (T₁) and Sweet potato flour and Wheat flour in ratio of 100:0 was used as (T₃). These blends were used to prepare cookies and the sensory evaluation of cookies was being conducted. For this Total 30 People were randomly selected among the whole population and were sensory evaluated on the basis of appearance, texture, flavor, taste and overall acceptability. The results of sensory analysis showed that the general acceptability of (T₁) sample cookies were best.

Keywords: Cookies, Sweet Potato Tubers, Sweet Potato Flour, Sensory Evaluation, Wheat Flour

1. INTRODUCTION

The Sweet Potato, also known as (*Ipomoea batatas* Lam) is part of the Convolvulaceae family, which is also called the morning glory family [1]. It is a highly significant and underutilized crop worldwide. In developing countries, it is often referred to as a crop that helps to reduce famine. Sweet Potato is the seventh most important food crop worldwide. It is grown in various tropical and subtropical regions. It produces the highest amount of edible energy per hectare per day compared to other major food crops [2].

In India, Sweet Potato cultivation has a long history and it's grown in almost all parts of the country. In 2005, the crop covered an area of 100,000 hectares with an annual production of 1.17 million tons in India, Sweet Potatoes are mainly grown in four states: Orissa, Bihar, Uttar Pradesh, and West Bengal. Uttar Pradesh alone contributes around 22% of the country's Sweet Potato production. Sweet Potato has great potential as a food source in developing nations with limited resources due to its quick maturity time and ability to grow in diverse climates and less fertile soil [3].

Sweet Potatoes are great source of vitamins C and E, along with dietary fiber, potassium, and iron, and they are low in fat and cholesterol. They are a vital protein source for many people worldwide and provide essential starch and other carbohydrates needed by the body [4]. The carbohydrate levels in the roots range from 25% to 30%, with the remaining content being predominantly water (58%-72%). Sweet potatoes are rich in various micronutrients. They contain moderate amounts of thiamin (vitamin B1), riboflavin (vitamin B2), niacin, some amounts of pantothenic acid (vitamin B5), pyridoxine (vitamin B6), folic acid, and satisfactory levels of vitamin E. Sweet potatoes also offer essential minerals and trace elements, particularly high levels of iron, potassium, and calcium [5]. They also contain moderate amounts of zinc, sodium, magnesium, and manganese [6].

It supports healthy vision, helps for good digestion. Helps to manage diabetes, helps to prevent the risk of cancer, helps to minimize the risk of heart health, may enhance brain function, may boost the immune system, helps to improve skin [7].

Fresh Sweet Potato roots are bulky and highly perishable. Therefore, slicing, drying, and grinding them can produce flour that remains in good condition for an extended period. Sweet potatoes, whether fresh, grated, cooked, mashed, or turned into flour, have the potential to successfully replace expensive wheat flour in making buns, and doughnuts. The flour acts as a dough conditioner in bread, biscuit, and cake processing. It is also used in gluten-free pancake preparation [8]. Sweet Potato Flour enhances processed food products with natural sweetness, color, and flavor. Additionally, it serves as a rich

source of energy, nutrients, and minerals, meeting daily nutrient requirements for β -carotene, thiamin, iron, vitamin C, and protein. Sweet potato flour supplies 14%-28% of the dietary reference intake (DRI) for magnesium and 20-39% for potassium [9].

The sweet potato flour can be stored for 6 months or longer in sealed containers, ensuring its long shelf life. It can effectively replace wheat flour in various food items: 100% in white sauces, 50-60 % in cookies, cakes, and flatbreads, and 15-20% in bread. Sweet potato flour can be marketed as a cost-effective alternative to imported wheat flour, particularly benefiting snack food and noodle producers. This substitution not only offers economic advantages but also introduces the nutritional benefits and unique flavor profile of Sweet Potatoes into a variety of food products [10].

In the current study, the focus was on substituting Wheat Flour with Sweet Potato Flour (a gluten-free alternative) in Cookies to enhance fiber content and overall nutritional value. The main goal was to create Cookies that not only offer increased nutrients but also maintain a similar taste, texture, and appearance to traditional wheat flour-based Cookies. The Sensory Quality of the Cookies was carefully evaluated to ensure that the final product meets high standards and provides a satisfying eating experience. By incorporating Sweet Potato Flour, The Cookies can offer a healthier option without compromising on taste and quality.

2. MATERIALS AND METHODS

The methodology used in the current study has been described below.

2.1 Area of the Study

The current study was conducted in Nutritional Laboratory of Department of Food and Nutrition, School of Home Science of Babasaheb Bhimrao Ambedkar University (BBAU), A Central University, Lucknow.

2.2 Study Design

A study design is the architecture of an experimental study and a description of how the study was conducted. The present study was carried by using the given Experimental Research Design.

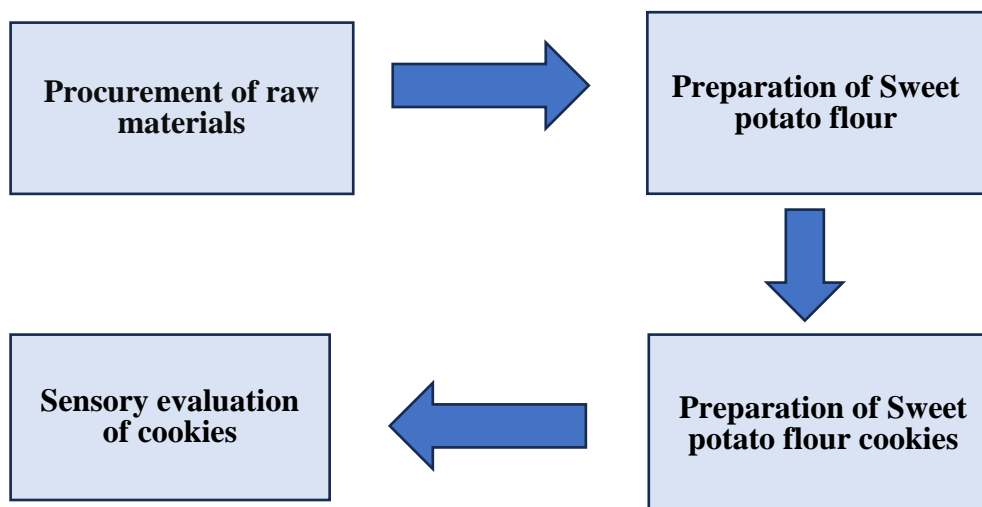


Figure 1. Experimental Research Design

2.3 Procurement of Raw Materials

All the ingredients such as Sweet Potato Tubers, Wheat Flour, Baking soda, Baking powder, Butter, Milk powder, Sugar, Vanilla essence, salt were purchased from the local market of Lucknow, Uttar Pradesh.

2.4 Preparation of Sweet Potato Flour

The sweet potato tubers underwent a multi-step process to produce high-quality sweet potato flour. First, they were thoroughly washed and peeled to remove any impurities and skin. Next, they were sliced into thin rounds, followed by a brief blanching treatment in hot water (95°C) for 5 minutes to inactivate enzymes and preserve color. After a quick rinse in cold water to stop the cooking process, the sliced sweet potatoes were dried to perfection in a dehydrator. Once completely dry, they were ground into a fine powder and sieved to produce a smooth, consistent sweet potato flour. Finally, the flour was carefully packaged and stored. A detailed flowchart of this process is given in Figure 2 and a Visual Presentation of same is given in Figure 3.

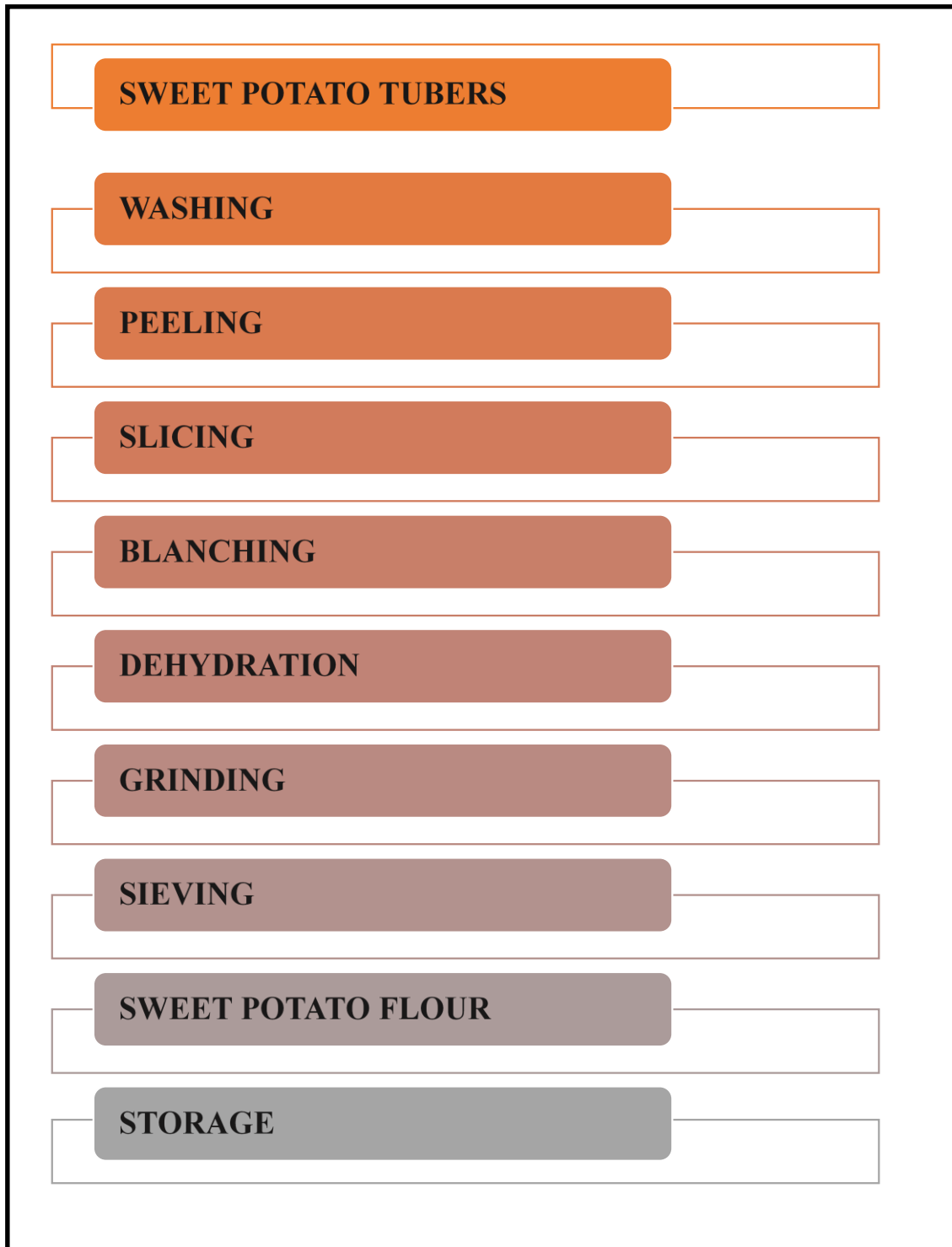


Figure 2. Flowchart of Preparation of Sweet Potato Flour

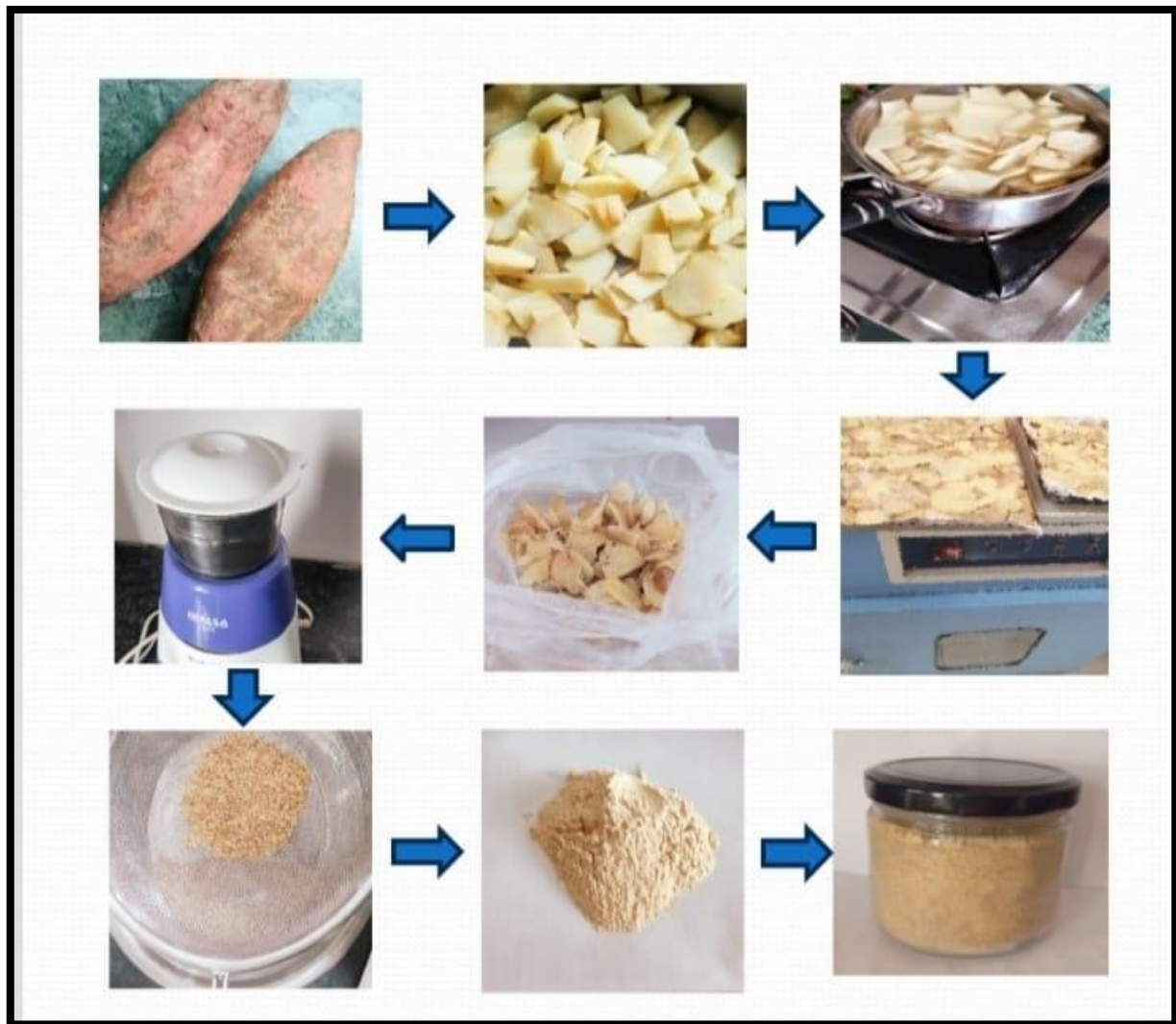


Figure 3. Visual presentation of Preparation of Sweet Potato Flour

2.5 Preparation of Sweet Potato Flour Cookies

The cookie preparation process involved several steps, starting with the creation of composite flours. Sweet potato flour was blended with wheat flour in different ratios to produce three distinct flour combinations. The first combination, labeled as T0, consisted of 100% wheat flour without any sweet potato flour, serving as the control sample. The second combination, T1, comprised 40% wheat flour and 60% sweet potato flour, while the third combination, T2, used 100% sweet potato flour without any wheat flour. Once the composite flours were prepared, they were mixed with additional ingredients, including milk powder, baking powder, baking soda, salt, and vanilla essence, in the quantities specified in the table. The dough was then kneaded to develop the gluten and sheeted to achieve the desired thickness. The sheeted dough was then shaped into cookie forms, baked in a microwave oven at 180°C for 15 minutes, and allowed to cool before being stored for sensory evaluation. A detailed flowchart of this process is given in Figure 4 and a Visual Presentation of same is given in Figure 5. Table 1 shows the Different combinations of both the flour used for different samples and Table 2 shows the Ingredients used for all the three samples.

Table 1. Different combination of Sweet Potato Flour and Wheat Flour

Treatment	Sweet Potato Flour %	Wheat Flour %
T0	00	100
T1	60	40
T2	100	60

Table 2. Ingredients used in the Preparation of Cookies (in gm)

S. No.	Ingredients	T0	T1	T2
1.	Sweet Potato Flour	00	60	100
2.	Wheat Flour	100	40	00
3.	Salt	0.5	0.5	0.5
4.	Sugar	40	40	40
5.	Butter	50	50	50
6.	Baking Soda	0.5	0.5	0.5
7.	Baking Powder	1.5	1.5	1.5
8.	Vanilla essence	2	2	2
9.	Milk Powder	20	20	20

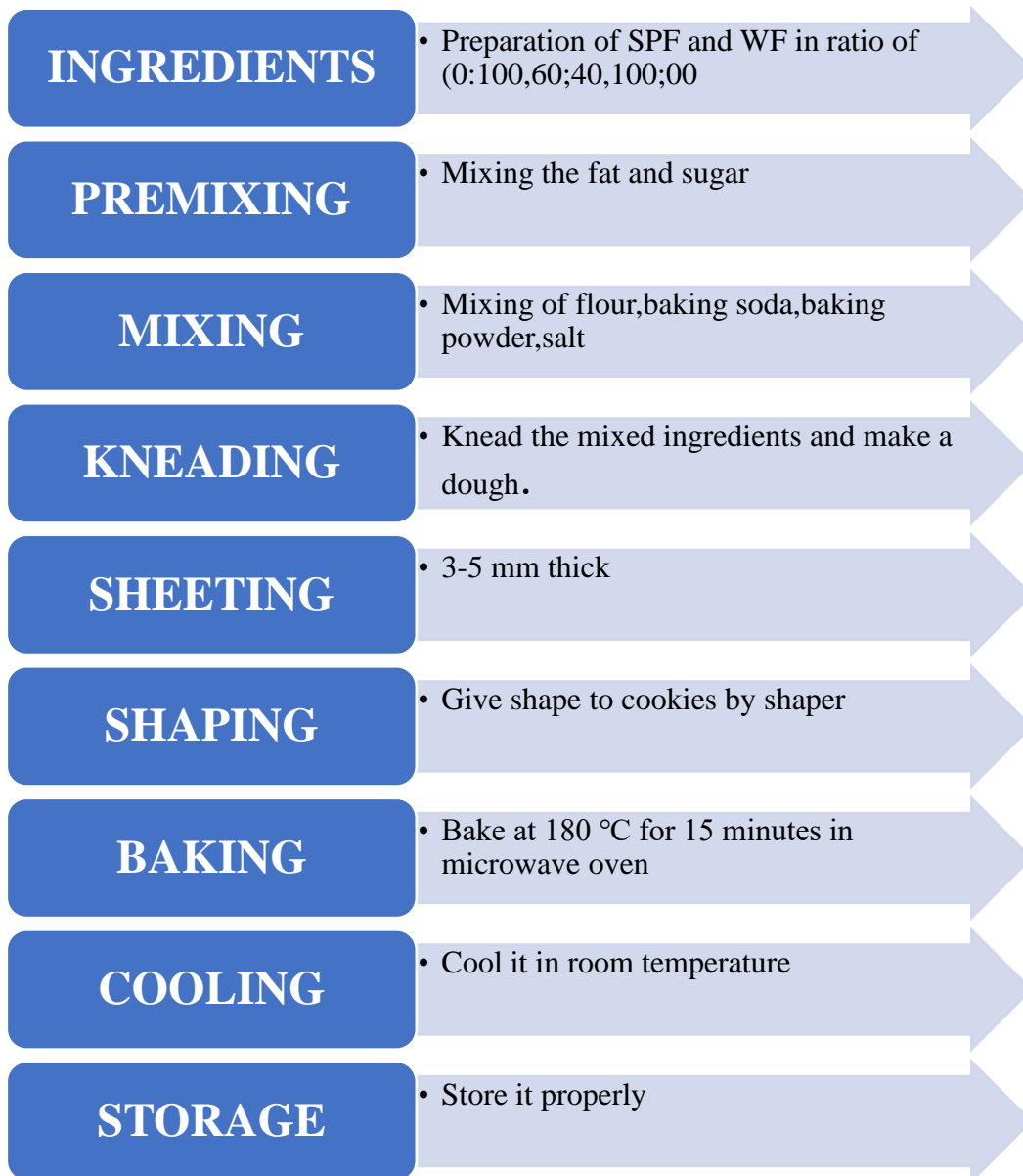
**Figure 4. Flowchart of Preparation of Cookies**



Figure 5. Visual Presentation of Preparation of Cookies

2.6 Sensory Evaluation

A composite sensory table was utilized for sensory evaluation, which was carried out by a team of trained panel members. The sensory scores of the standard control sample T0, T1 and T2 were evaluated by a total of 30 panel members. The evaluation process involved the use of a highly advanced composite sensory table, which was specifically designed to carry out sensory evaluations. The panel members who conducted the evaluations were carefully selected and extensively trained in sensory analysis. The sensory characteristics of the T0, T1 and T2, were meticulously evaluated, taking into account their appearance, texture, flavour, taste and overall acceptability.

Table 3. Sensory Attributes and Maximum Rating score

S.No.	Sensory Attributes	Maximum Rating Score
1.	Appearance	20
2.	Texture	20
3.	Taste	20
4.	Flavour	20
5.	Overall acceptability	20

3. RESULT AND DISCUSSION

The sensory evaluation of cookies with varying levels of sweet potato flour substitution revealed a significant finding, the cookies with 60% sweet potato flour were the most acceptable and well-received. At this optimal level, the cookies demonstrated exceptional performance in all attributes except texture, with the highest scores recorded for flavor, appearance, taste, and overall acceptability. The incorporation of sweet potato flour at 60% level had a profound impact on the sensory profile of the cookies, enhancing their flavor, visual appeal, and palatability. Moreover, the addition of sweet potato flour significantly improved the nutritional quality of the cookies, making them a healthier option for consumers. Notably, the best-performing sample was T1, which consisted of a blend of 40% wheat flour and 60% sweet potato flour, indicating that this combination offers the perfect balance of taste, texture, and nutrition. This study demonstrates that sweet potato flour can be effectively incorporated into cookie formulations, resulting in a product that is not only delicious but also offers enhanced nutritional benefits. The addition of sweet potato flour can increase the fiber, vitamin, and mineral content of cookies, making them a healthier option for consumers.

Table 5. Sensory Attributes with Average scores of all the sample

S. No.	Sensory Attributes	Avg. score of T0	Avg. score of T1	Avg. Score of T2
1.	Appearance	17.73	18.23	18
2.	Texture	18.17	17.93	17.57
3.	Flavour	17.73	18.27	17.7
4.	Taste	17.67	18.13	17.57
5.	Overall acceptability	17.93	18.43	17.63

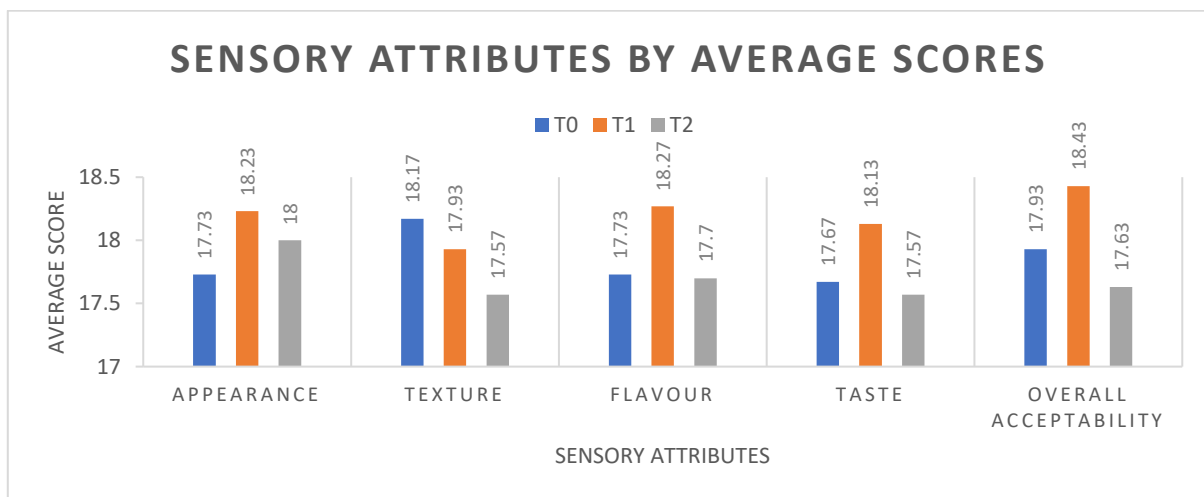


Figure 6. Comparative Graphical representation of T0, T1, T2 sample

4. CONCLUSION

The study was meant to develop a healthy cookies which would be nutritious along with taste. Blending Sweet Potato flour up to 60% with 40% Wheat Flour produced samples which can be used for production of bakery goods with improved functional properties. Sensory evaluation ranked T1 sample highest in sensory appeal, particularly in appearance, flavour, taste and overall acceptability, suggesting its superior consumer acceptance. The outcome of the present research can be used as valuable information for the development of high fiber low gluten cookies.

The results obtained could be very valuable in decision making for industries that want to take nutritional advantage of sweet potato flour as alternative or supplement to cereal flours so we can say that Sweet potato flour could be useful in the manufacture of highly nutritious cookies.

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