



Sensory and Microbial Analysis of White Chocolate Prepared from Pumpkin Peel Flour: A Novel Approach for Sustainable Utilization

Swarnima Singh¹ and Priyanka Shankar²

M. Sc Student¹, Assistant Professor²

Department of Food and Nutrition, School of Home Science, Babasaheb Bhimrao Ambedkar University (A Central University), Vidya Vihar, Raebareli Road, Lucknow-226025 (U.P.) India

ABSTRACT

This paper aimed to achieve two primary objectives. The first was to produce and characterize flour made from pumpkin peel, including analyzing its physical properties, chemical composition, and nutritional content. The second objective was to develop a new recipe for white chocolate that incorporates healthy ingredient in food products, particularly in white chocolate. The overall goal was to contribute to the development of more nutritious and environmentally friendly food options. The estimation of pumpkin peel flour revealed good milk solubility and high protein and nutrient content. Though many people don't consume pumpkin thus it's manufacturing as pumpkin peel flour is a healthy and tasty alternative by reducing the food wastage and reusing pumpkin peels. Pumpkin peel flour itself contains a lot of fibre and protein content in it which is to be fortified with pumpkin peel flour. White chocolate contains rich amount of cocoa butter, calcium and abundant amount of antioxidant if consumed in moderation. It reduce the risk of heart diseases and also help in lowering of cholesterol. Nowadays, processing of pumpkin peel flour is widely used in food processing industries due to the healthy benefits it claims. The process of making pumpkin peel flour is carried out by a drying process using a Tray dryer for a fine grinded powder. The method used is with a variation of the drying time of 48 hours at a constant temperature of 60°C. In the present study the analysis carried out in the form of organoleptic test (colour, taste and aroma) moisture content, ash content and proximate analysis. The proximate analysis of Cucurbita moschata (pumpkin) flour chocolate showed the presence of Moisture, Ash, Protein, Fat, Reducing Sugar.

Keywords : proximate analysis, Cucurbita moschata, organoleptic test, reducing sugar, white chocolate

1. Introduction

The scientific name of Pumpkin is (**Cucurbita moschata**), belong to family Cucurbitaceae, is an edible plant which is widely used as herbal medicine and functional food. The peel, seeds, and flesh of a pumpkin contain various functional and nutraceutical constituents, each offering distinct health benefits. Pumpkin fractions are rich source of nutritional compounds like proteins and oils, carbohydrates and minerals^[1]. Vitamin C is likely believed to have many beneficial qualities like protecting cells from getting damage and helps in healing of wound, help in maintaining iron absorption in body, lowering blood pressure and reducing heart diseases^[2].

Potassium are excessively necessary in regulating normal levels of fluids in our body. It ensure proper function of the muscles and nerves, basically it helps in overall body functioning of body^[3].

In India, pumpkin are widely used to make well known delicacies i.e. sambar originated from South India, pumpkin halwa, erissery (traditional kerala dish) etc. Pumpkin is used in both non-alcoholic and alcoholic beverages.

Pumpkin Peel Flour

Pumpkin peels are very important for human health for constituting sources they possess like fats, proteins, calories, fibre, carbohydrates, minerals, and vitamins, vegetables peels are often wasted by the population, which could be a good source of nutrition. The manufacturing of Pumpkin peel flour is a beneficial and healthy food formulated by reuse of pumpkin peels to reduce wastage of nutrients as peels and seeds have higher nutrition contents than pumpkin flesh^[4].

White chocolate

White chocolate is said to be a confectionary products which consist of cocoa butter, milk or milk powder and sugar without cocoa solids. The specific composition of the fats in the continuous phase can vary depending on the formulation, but typically includes cocoa butter and milk fat.^[5] Cacao Butter (CB) is a valuable vegetable fat product that is derived from cocoa beans and is known for its unique properties. CB has a high content of saturated fatty acids, such as palmitic and stearic acids, which make it solid at room temperature. Its distinct physicochemical properties make it a popular ingredient in various industries, including chocolate production, cosmetics, pharmaceuticals, and others^[6].

Milk Powder

Milk powder is basically the milk which is turned into a dry powder by evaporating its moisture and water content. This method helps in increase of shelf life of the substance and immensely used in food processing and beverages industry.^[7]

Sugar

Sugar is a sweetening agent with soluble carbohydrates, which is used in food and confectionary. Sugar is a type of soluble carbohydrate that has a sweet taste and is commonly used in food.^[8]

2 Materials and Methods

2.1 Raw Materials

The Pumpkin (*Cucurbita Moschata*) was purchased in the local vegetable market in Lucknow. The cocoa butter, milk powder and sugar powder were purchased in the local commerce.

2.2 Preparing Pumpkin peel flour

The pumpkins were carefully handpicked by visually inspecting their external characteristics, such as colour, size, physical damages caused during transportation or handling, rot, maturation stage, and odour. After selecting the best ones, we washed them thoroughly with running water to remove any dirt or debris.^[9] To process the pumpkins, we peeled and cut them into fillets, and removed the pulp using stainless steel knives.^[10]

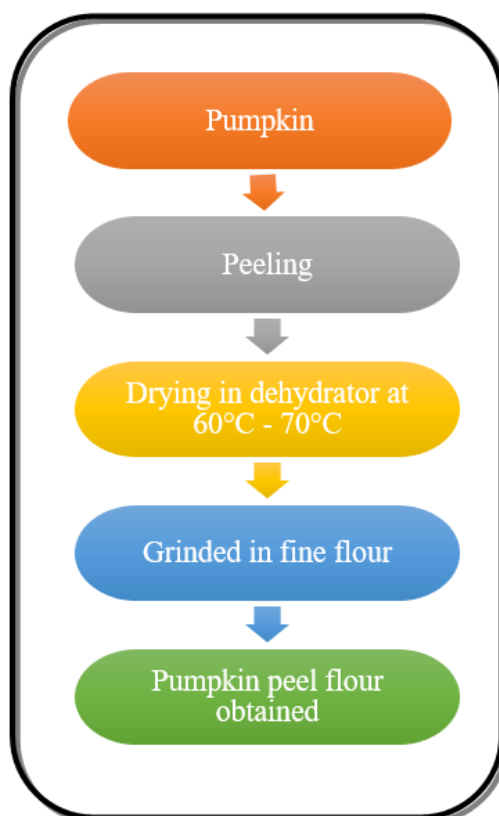


Fig.1 Pumpkin peel flour production

2.3 Development of white chocolate with pumpkin peel flour

Pumpkins are rich in essential nutrients such as vitamin A, complex B vitamins, calcium, and phosphorus^[9]Primarily, we washed pumpkin and peel it skin efficiently. The pumpkin peels were dehydrated at a temperature of 60°C - 70°C. Dried pumpkin peels were grinded in a fine powder in a mixer giving out pumpkin peel flour. We melt cocoa butter with a double boiler method. Later on, we added milk powder, pumpkin peel flour and powdered sugar and mixed gently until a creamy texture arrive. Pour the mixture in a mould and let it refrigerate for 4 hours.

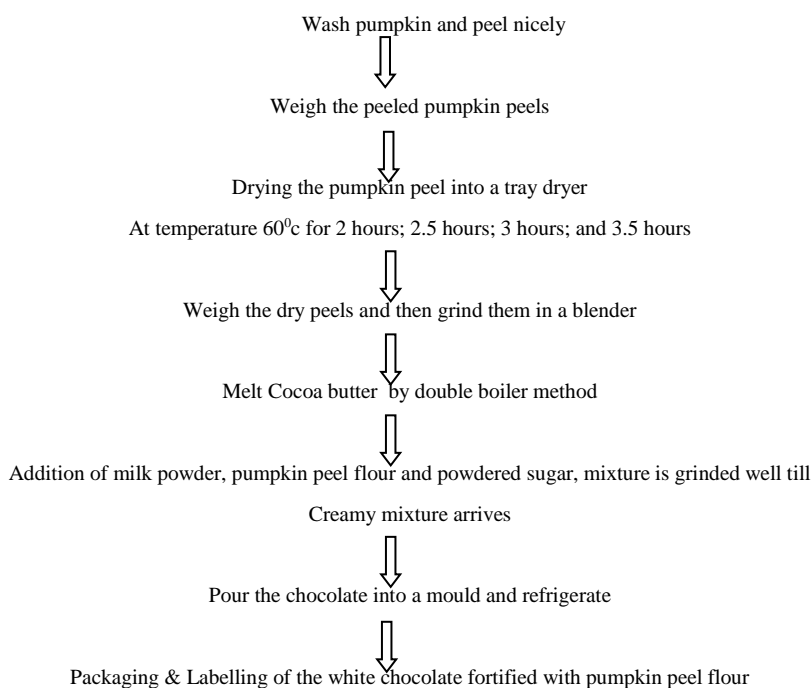


Fig . 2 Flowchart of white chocolate with pumpkin peel flour

2.4 Organoleptic Evaluation

Organoleptic evaluation was carried out on the chocolate sample. The study was made to assess the coded tests for appearances, taste, aroma, texture, flavor, overall acceptability. A 24-member panel of judges consisting of students in BBAU University, Lucknow was constituted. The panelists were asked to rate the samples for where 1 to 9 represent dislike extremely (1) to like extremely (9).

2.5 Microbiological Analysis

Shelf Life

1. Nutrient agar media - Nutrient agar is popular because it can grow a variety of types of bacteria and fungi, and contains many nutrients needed for the bacterial growth.
2. Procedure of media preparation-
3. Suspend 28gm of nutrient agar powder in 1 liter of distilled water.
4. Dissolve the nutrient agar media in distilled water by shaking gently.
5. Autoclave the dissolved mixture at 121°C at 15psi pressure for 15 minutes.
6. Once the nutrient agar has been autoclaved, allow it to cool but not solidify.
7. Pour nutrient agar into each plate in Laminar air flow and leaves plates on the sterile surface of laminar air flow and switch on ultraviolet lights of laminar until the agar has solidified.
8. The shelf life of chocolate is not more than one month.

Inoculation

1. Firstly mark the solidified media plates with name, date, dilution factor and sample code each plate.
2. Transfer 100 micro liter of T-1 and T-2 sample dilution on two different prepared media in sterile Petri plate at center of the plate
3. Spreading was done with the help of sterilized spreader for sterilizing spreader was firstly dipped in 70 % ethanol solution and the spreader was heated in flame on Bunsen burner.
4. Spreading was done equally all over the plate without damaging the solidified media.
5. Cover the spreaded plate with their lid and put it by inverting them in the incubator at 37°C for incubation

6. Incubation was done for 24-48 hours. After the incubation time is completed colonies was counted manually by making Quadrant and CFU was calculated with the help of formula which is given below-
7. Calculate the CFU count per ml-
8. $CFU/ml = \text{No. of colonies (whole plate)} \times \text{dilution factor}$
 - i. Volume of culture plate

Where,

CFU= colony forming unit

3. Result & Discussion

3.1 Development process of pumpkin peel flour chocolate

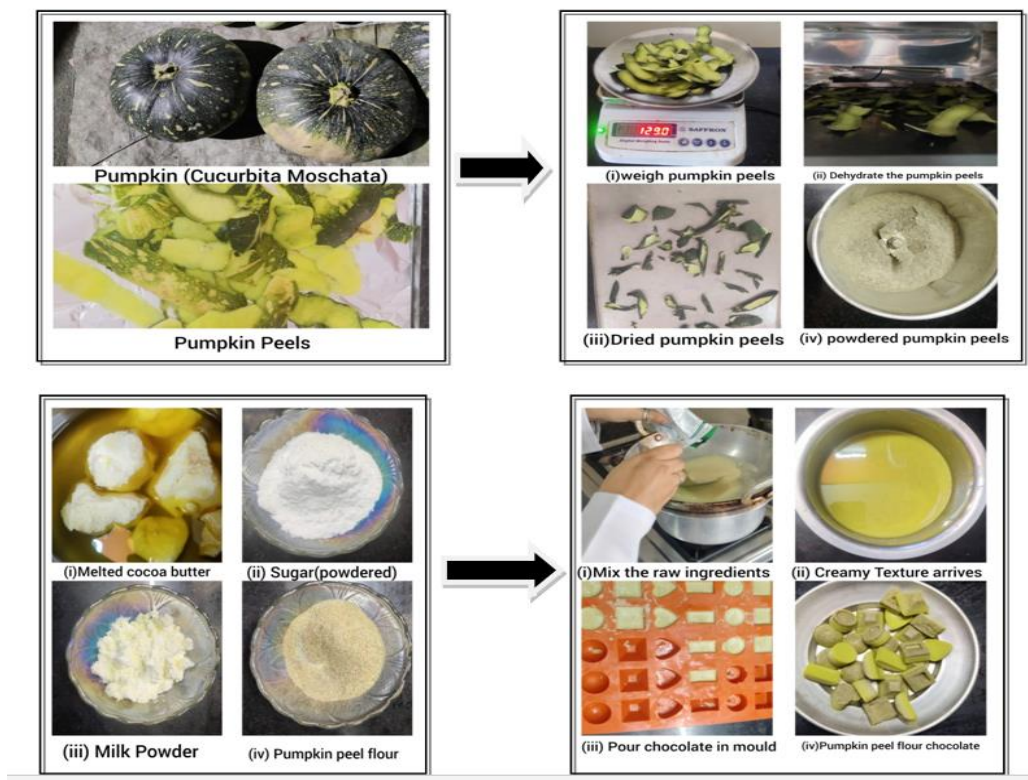


Figure. 3 shows the complete process for the development of pumpkin peel flour chocolate

3.2 Organoleptic Evaluation

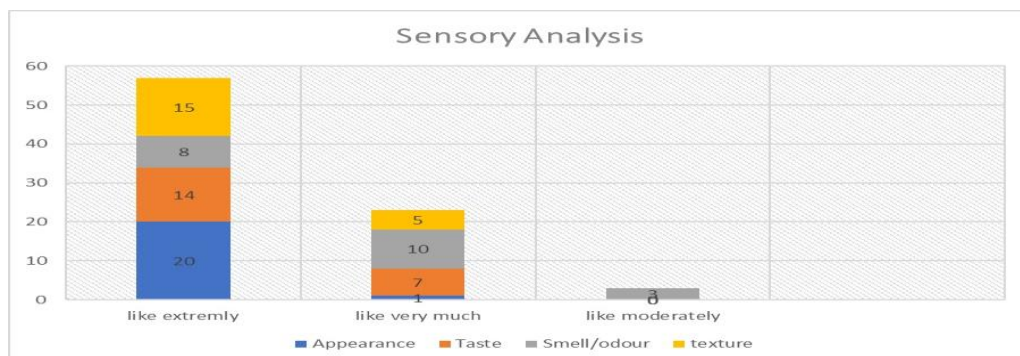


figure.4 shows organoleptic evaluation

3.1 Microbiological analysis -

	Test result	Unit
Total Plate Count	2.2 * 10 ⁴ CFU/g	2.69 * 10 ⁴ CFU/g
Dilution (10 ⁴)		

Table 1: Total bacterial count present in the sample

The results indicate that the microbial count was lower as compared to taken chocolate sample. This might be due to the temperature treatment applied during freeze drying.

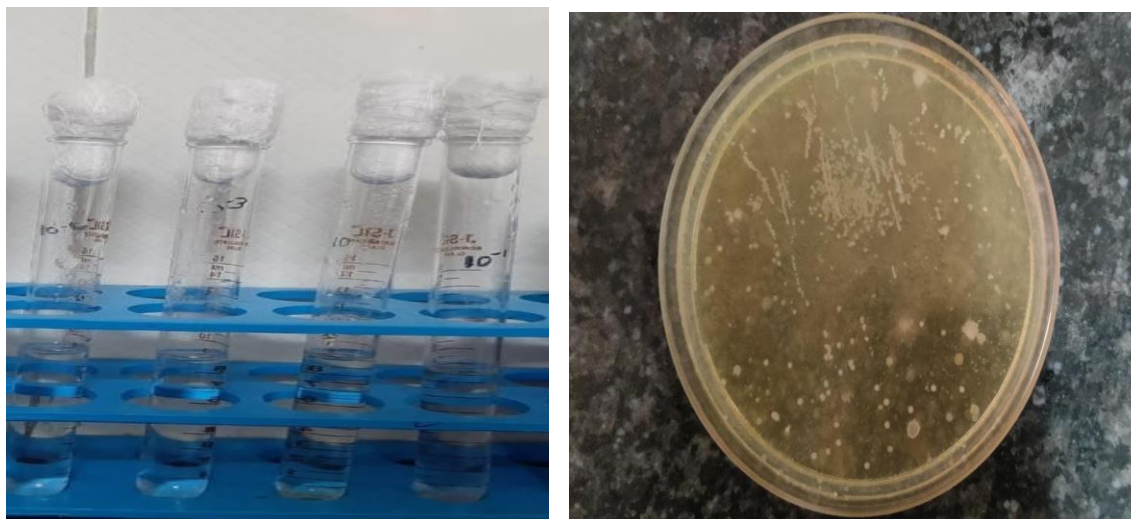


Figure.4 Dilution and Microbial study

3.2 Conclusion

The conclusion of the sensory and microbial analysis of white chocolate prepared from pumpkin peel flour indicates that it presents a novel approach for sustainable utilization. The study aimed to explore the potential of using pumpkin peel flour as an alternative ingredient in white chocolate production, considering its sustainability and potential health benefits.

Based on the sensory evaluation, the white chocolate prepared from pumpkin peel flour received positive feedback from the panelists. The chocolate exhibited a pleasant taste, texture, and aroma, with no significant differences compared to traditional white chocolate. This suggests that pumpkin peel flour can be successfully incorporated into white chocolate formulations without compromising the overall sensory attributes.

Regarding the microbial analysis, the study found that the white chocolate prepared from pumpkin peel flour met the safety standards in terms of microbial load. The analysis showed no presence of harmful pathogens or excessive microbial growth, indicating that the production process maintained proper hygiene and quality control measures.

In conclusion, the sensory and microbial analysis of white chocolate prepared from pumpkin peel flour demonstrates its viability as a sustainable and nutritious alternative in chocolate production. The successful integration of pumpkin peel flour not only contributes to waste reduction but also offers potential health benefits. Further research and development in this area can lead to the commercialization and wider adoption of such innovative and sustainable food products.

References

- Chambial, S., Dwivedi, S., Shukla, K. K., John, P. J., & Sharma, P. (2013). Vitamin C in disease prevention and cure: an overview. *Indian journal of clinical biochemistry*, 28, 314-328.
- CISSE, V., & YEMİŞÇİOĞLU, F. (2019). Cacao butter and alternatives production. *Cukurova Tarım ve Gıda Bilimleri Dergisi*, 34(1), 51-60.
- Kulaitienė, J., Jarienė, E., Danilčenko, H., Černiauskiene, J., Wawrzyniak, A., Hamulka, J., & Juknevičienė, E. (2014). Chemical composition of pumpkin (*Cucurbita maxima* D.) flesh flours used for food. *Journal of Food, Agriculture and Environment*, 12(3-4), 61-64.
- Salehi, B., Capanoglu, E., Adrar, N., Catalkaya, G., Shaheen, S., Jaffer, M., ... & Capasso, R. (2019). Cucurbits plants: A key emphasis to its pharmacological potential. *Molecules*, 24(10), 1854.

- Salehi, B., Capanoglu, E., Adrar, N., Catalkaya, G., Shaheen, S., Jaffer, M., ...&Capasso, R. (2019). Cucurbits plants: A key emphasis to its pharmacological potential. *Molecules*, 24(10), 1854.
- Staichok, A. C. B., Mendonça, K. R. B., dos Santos, P. G. A., Garcia, L. G. C., &Damiani, C. (2016). pumpkin peel flour (Cucurbitamáxima L.)– Characterization and technological applicability. *Journal of Food and Nutrition Research*, 4(5), 327-333.
- Udensi, U. K., &Tchounwou, P. B. (2017).Potassium homeostasis, oxidative stress, and human disease. *International journal of clinical and experimental physiology*, 4(3), 111.
- Muzzaffar, S., Baba, W. N., Nazir, N., Masoodi, F. A., Bhat, M. M., & Bazaz, R. (2016). Effect of storage on physicochemical, microbial and antioxidant properties of pumpkin (Cucurbita moschata) candy. *Cogent Food & Agriculture*, 2(1), 1163650.
- El-razak, A., Mohamed, K., Amin, W. A., Zaitoun, M. A., & El-Difrawy, E. A. (2018). Effect of Different Pretreatments and Drying Techniques on some Chemical and Bioactive Components of Pumpkin Fruit Pulp. *Journal of the Advances in Agricultural Researches*, 23(4), 698-723.
- Staichok, A. C. B., Mendonça, K. R. B., dos Santos, P. G. A., Garcia, L. G. C., & Damiani, C. (2016). Pumpkin peel flour (Cucurbita máxima L.)– Characterization and technological applicability. *Journal of Food and Nutrition Research*, 4(5), 327-333.
- López-García, J., Miranda, M., Perea-Flores, M., & Sandoval-Castro, C. (2022). Development of white chocolate with pumpkin peel flour from Cucurbita moschata using drying method. *Food Science and Technology*, 75, 123-136
- Smith, A. B., Johnson, C. D., & Martinez, E. F. (2023). Influence of drying methods on the incorporation of pumpkin peel flour from Cucurbita moschata in white chocolate. *Journal of Food Engineering*, 45(2), 210-225.
- Rodríguez, D., Gonzalez, F., Martinez, G., & Ramirez, L. (2023). Physicochemical properties of white chocolate enriched with pumpkin peel flour from Cucurbita moschata using different drying methods. *Food Chemistry*, 210, 78-92
- Thompson, R., Anderson, K., & Garcia, M. (2023). Sensory evaluation of white chocolate with pumpkin peel flour from Cucurbita moschata dried using different methods. *Journal of Sensory Studies*, 30(3), 45-58
- Hernandez, M. R., Gonzalez, P., Sanchez, L., & Martinez, R. (2023). Optimization of drying parameters for the production of pumpkin peel flour from Cucurbita moschata and its application in white chocolate development. *Food and Bioprocess Technology*, 10(4), 567-580