

Available online on 15.04.2025 at <http://jddtonline.info>

# Journal of Drug Delivery and Therapeutics

Open Access to Pharmaceutical and Medical Research

Copyright © 2025 The Author(s): This is an open-access article distributed under the terms of the CC BY-NC 4.0 which permits unrestricted use, distribution, and reproduction in any medium for non-commercial use provided the original author and source are credited



Open Access Full Text Article



Research Article

## Study on Formulation and Evaluation of Nutritional Fruit Peel Bar

Tahura Juned Shaikh<sup>1</sup>, Supriya Fakkad Vabale<sup>1</sup>, Sakibjiya Mujjafar Shaikh<sup>1</sup>, Sanket Pandurang Shinde<sup>2\*</sup> 

<sup>1</sup> Research Scholar, Department of Pharmaceutics, Dr. Babasaheb Ambedkar Technological University, Pune, Maharashtra, India-412216.

<sup>2</sup> Assistant Professor, Department of Quality Assurance Techniques, Dr. Babasaheb Ambedkar Technological University, Pune, Maharashtra, India-412105.

### Article Info:



#### Article History:

Received 10 Jan 2025  
Reviewed 03 March 2025  
Accepted 24 March 2025  
Published 15 April 2025

#### Cite this article as:

Shaikh TJ, Vabale SF, Shaikh SM, Shinde SP, Study on Formulation and Evaluation of Nutritional Fruit Peel Bar, Journal of Drug Delivery and Therapeutics. 2025; 15(4):48-51  
DOI:

<http://dx.doi.org/10.22270/jddt.v15i4.7080>

#### \*Address for Correspondence:

Sanket Pandurang Shinde, Assistant Professor, Department of Quality Assurance Techniques, Dr. Babasaheb Ambedkar Technological University, Pune, Maharashtra, India-412105.

### Abstract

The peels of vegetables and fruits can result as nutritional components of food or medicinal components of pharmaceutical products, as they contain various phytochemicals and nutrients. Sapota is bioactive compound that have many biological activities including Antioxidant, antidiabetic, antimicrobial, anti-inflammatory, psytotoxic and antiarthretic properties. These properties may help prevent chronic degenerative disease like cancer, diabetes, neurological infection and cardiovascular disease. The calcium and phosphorus in the sapota peel are essential for maintaining strong bones. Using it as nutritional weight loss bar contain many benefits like no added sugar, extra fat as this bar contains only natural sugar and essential fat. Fruit bars are prepared by combining different ingredients which are wholesome and nutritional rich.

**Keywords:** Sapota peel, Fruit peel bar, Weight loss bar, Nutrition supplement, Fruit waste, Chicoo Peel bar.

## 1. INTRODUCTION

In recent years, food industries have drawn much attention of the public to achieve a balanced and healthy diet, due to this recently fruit bars market has grown significantly, due to trend of consumption of healthy foods<sup>1</sup>.

This product includes natural ingredients like Dates, Sapota (also known as chicoo or chiku) peel, flax seeds, ragi, oats, gulkand (Rose petal jam) which are good for health and due to its appearance and added natural ingredient it can be consume by teenager and older people. The particular attention has been given to reusing or minimizing fruit waste produce in various industrial processes and creating new food sources<sup>2</sup>.

Chiku peel contains Vitamin A, E, kernol oil and nutrients and it is useful for reduce skin inflammation and soreness. Not consuming the peel or skin of these fruit could prevent us from getting its benefit of these healthy fruit, because of this reason we have specifically used its peel due to its nutritional value<sup>3</sup>.

Hence, many researchers are utilizing the fruit peel waste generated by agro-industries for the development of value added food products<sup>4</sup>. The new functional food product like fruit bars can be developed with the addition of fruit peels. It can provide supplemental calories and essential nutrients namely protein, lipids, fiber, vitamins, and minerals, and contains significant number of polyphenols, dietary fibers, polyunsaturated fatty acids, proteins, essential amino acid and potassium<sup>5</sup>. Multiple bioactive compounds and their high nutritional value in fruit waste can be further exploited to ensure food security<sup>6</sup>. Effective utilization of fruit waste of by product has been used as natural food additives to avoid the disposal of fruit waste & to mitigate environmental problems<sup>7</sup>. More strategies are needed for further exploitation of food additives or supplements with high nutritional value in economical range<sup>8</sup>.

Scientific innovations in previous decades make things possible in explorations of more biologically active molecules & their proper utilization of fruit processing by-products. Thousands of molecules derived from fruit

waste can be employed in the food, cosmetics or pharma industry<sup>9</sup>.

Fruit leather, also called a fruit bar or a fruit slab, is a dehydrated fruit-based confectionery dietary product which is often eaten as snack or dessert. It is chewy and flavorful, naturally low in fat and high in fiber and carbohydrates; it is also lightweight and easily stored and packed<sup>10</sup>. Most fresh fruits have a short harvest season and are sensitive to deterioration and even when stored under refrigerated conditions; therefore, making fruit leather from fresh fruits is an effective way to preserve fruits<sup>11</sup>.

Oats (*Avena sativa L.*) is unique among all cereal crops because it possesses many nutrients that bear value for human food, animal feed, health care, and cosmetics<sup>12</sup>. It is an annual crop cultivated for more than 2000 years in different parts of the world and is one of the oldest crops known to human civilization<sup>13</sup>. It appeared in cultivation several thousand years later than other grains such as wheat and barley<sup>14</sup>. This cereal is an important source of carbohydrates, dietary soluble fiber, balanced protein, lipids, different phenolic compounds, vitamins, and minerals<sup>15</sup>.

## 2. MATERIAL AND METHODS

### 2.1. PROCUREMENT OF RAW MATERIALS

The raw ingredients include sapodilla peel, oats, ragi, flax seeds, dates, and, gulkand were purchased from the local market of Pune, Maharashtra.

### 2.2. PREPARATION OF FRUIT PEEL BAR

The fruit (Sapota) was washed under running tap water and cleaned by hands to remove seasonal pesticides and dirt. The fruits were peeled using a stainless-steel knife and the peel was blended into blending jar. The blended fruit peel was kept in airtight container for further use. The nutritive bar was prepared by accurately weighing the required amount of all dry ingredients like oats, ragi, flax seeds in one container and mix evenly. Dates were ground to paste. The fruit peel which was kept into air tight container weighed and taken. Then required amount of gulkand was added to it. Then the mixture was mixed to make dough. Then it was transferred into the silicon molds to give a proper shape. Then the molds were covered with aluminum foil to avoid contamination<sup>16</sup>.

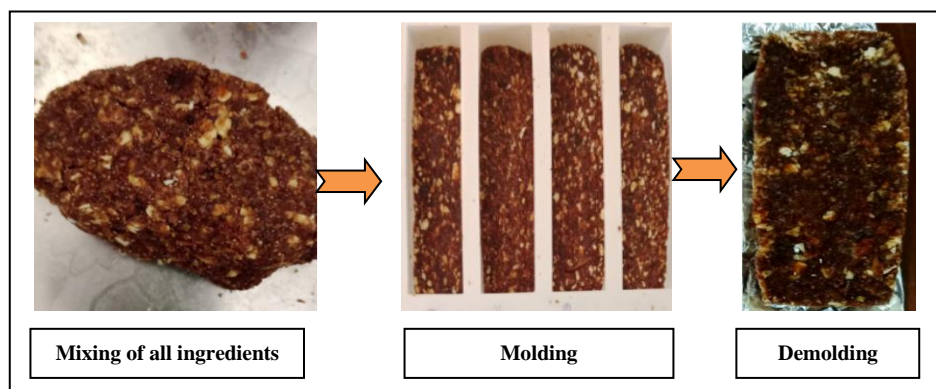


Figure 1: Preparation Chart of Bar

Table 1: Formulation Table

Ingredients	Quantity(gm)
Chiku Peels	10
Dates	15
Oats	7.5
Flax Seeds	7.5
Ragi	5
Gulkand	5

Table 2: Formulation Study

Sr. No.	Factor 1 (g)	Factor 2 (g)
1	7	18
2	7.5	15
3	8	12
4	8.5	9
5	9	6
6	9.5	3

### 2.3. FORMULATION STUDY

Formulation of the nutritive bar was done on the basis of amount of Flax seeds and Dates used. Flax seeds were marked as Factor 1 and Dates was marked as Factor 2. These factors were responsible for the stability of the bar and sweetness of bar required. On the basis of formulation, amount of ingredients of bar were selected. Table.2. describes the formulation study of the bar.

### EVALUATION TEST

#### 1. Sensory Analysis

Prepared products were evaluated for sensory characteristics in terms of appearance, color, flavor, after- taste texture and overall acceptability by 10 members comprised of using a 9 point Hedonic scale. Judgment was made by rating the product on a 9 point Hedonic scale with corresponding descriptive terms

ranging from 9 to 1 dislike extremely, the obtained results were recorded in sensory score card<sup>16</sup>.

## 2. Evaluative studies of Bar

Various factors like ash value, moisture content, fibre content and fat content were evaluated on the bar. These factors were undertaken to find out its nutritional value. Values were determined by using methods described by AOAC.

### 2.1. Estimation of Ash value<sup>17</sup>

Ash value was determined by placing a 2gm of sample of the bar in Muffles furnace for 1 hour at 500-700 °C.

### 2.2. Estimation of moisture content<sup>18</sup>

Moisture content was determined by placing a 2gm of sample in a Hot Air Oven for 1 hour at 100°C.

### 2.3. Estimation of Fibre content<sup>19</sup>

Fibre content was determined by adding 10% NaOH solution into the sample and then filtering it. The residue is placed into the Muffles furnace for 1 hour at 500-700°C.

## 2.4. Estimation of Fat content<sup>19</sup>

Fat content was determined by dissolving a 2gm of sample into n-hexane or petroleum ether. The mixture was then placed in Soxhlet's apparatus. After that the mixture was evaporated and the content remaining was measured and fat content was determined.

## 3. Stability study of bar<sup>20</sup>

Bars prepared as per formulation study were kept for 7 days at room temperature and evaluated for stability. Other bars prepared after proper formulation as per formulation study were kept at two different conditions i.e. at room temperature and at 0-4°C in the refrigerator.

## 4. RESULT AND DISCUSSION

The bar as per formulation study showed different stability and taste, from which 3rd number bar formulation was selected as it had overall acceptability. Fig.2. shows the stability of bar after a week at room temperature.

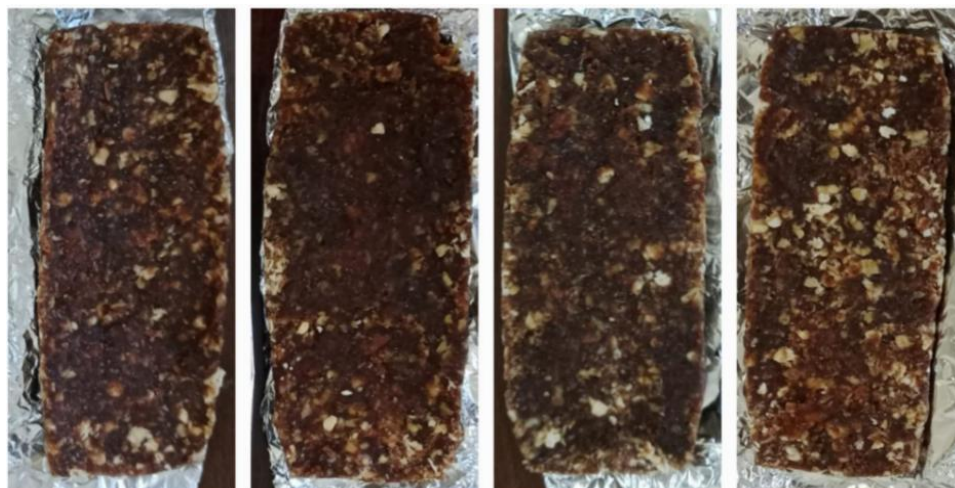


Figure 1: Stability study of different formulations of bar

The organoleptic study of the bar evaluated by panel members showed an average overall acceptability score of 8.9. Texture, colour, appearance and taste were evaluated and resulted in acceptance of the bar by 9 panel members out of 10 panel members. An evaluative study of the bar was found out by various methods as per AOAC in which moisture content, ash value, fibre content, and fat content of the bar. This study was done to find the nutritive value of the bar. Table.3. contains chemical properties of the bar.

Table 3: Chemical properties of bar

Chemical properties	Observations
Ash value	65%
Moisture	33%
Fibre	09%
Fat	08%

The stability study of various bars showed that the bar prepared to have less concentration of flax seeds and high concentration of dates had a high stability for 7 days at room temperature. This formulation was then selected and bars were prepared and were at room temperature which showed less stability than the bar stored in the refrigerator. The one kept at room temperature, showed a very small amount of microbial growth with adverse changes in taste and appearance but the bar stored at 0-4°C showed no microbial growth and there was a slight change in taste, but palatable.

## CONCLUSION

Fruits serve as a rich source of energy, minerals, vitamins, and dietary fiber. One of the barriers to increasing fruit and vegetable consumption is the time required to prepare them and they are high perishable. Hence, fruit bars can be a good, convenient and natural alternative to junk foods or foods that are high in salt, sugar and fat. Fruit bars are a concentrated form of food

source with rich nutritional value as compared to fresh counterparts. Nowadays, health-conscious consumers are looking for products which support health, wellness and functional properties which may be met through fortified fruit bars. Further, fruit bars can also act as a suitable matrix for the incorporation of prebiotics as well as probiotics. Sugar is an important component of traditional fruit bar preparation. However, there is a lot of scope to use alternate sweeteners and other sugar substitutes for the preparation of fruit bars to meet the increasing demands of low-calorie snack food. There is also great potential for the use of solar energy as well as alternate drying techniques for the popularization of fruit bar processing in rural areas.

**Declaration of Competing Interest:** The authors declare that they have no known competing financial or personal relationships that could have appeared to influence the work reported in this paper.

**Acknowledgement:** I would like to extend my sincere gratitude to Prof. Sanket Pandurang Shinde for his support throughout the research. I would also like to thank the study participants who generously contributed their time and insights.

**Author Contributions:** All authors have equal contribution in the preparation of manuscript and compilation.

**Source of Support:** Nil

**Funding:** The authors declared that this study has received no financial support.

**Informed Consent Statement:** Not applicable.

**Data Availability Statement:** The data presented in this study are available on request from the corresponding author.

**Ethical approval:** This study does not involve experiments on animals or human subjects.

## REFERENCES

- Jorge DA, Solis L, Rojas-Verde G, Salas N, Sustainability and challenges minimally processed goods washing packing and cutting of fresh and fruits & vegetables, Food Engineering Series, 2015. Doi. 10.1007/978-3-319-10677-9\_12.
- Ayala-Zavala JF, Rosas-Domínguez C, Vega-Vega V, González-Aguilar GA, Antioxidant enrichment and antimicrobial protection of fresh-cut fruits using their own by products: looking for integral exploitation, Journal Of Food Science, 2010; 75(8):175-181. Doi. <https://doi.org/10.1111/j.1750-3841.2010.01792.x>.
- Sun-Waterhouse D, The development of fruit-based functional foods targeting the health and wellness market: A review, International Journal of Food Science & Technology, 2011; 1365-2621. Doi. <https://doi.org/10.1111/j.1365-2621.2010.02499.x>
- Gupta E, Meith A, Gupta K, Mishra P, Singh P, Fruit peels: A strong natural source of antioxidants & prebiotics, Carpathian Journal of Food Science & Technology, 2020; 12(5):134-143. Doi. <https://doi.org/10.34302/crpfjst/2020.12.5.10>.
- C Lucarini M, Durazzo A, Bernini R, Campo M, et al., Fruit waste as a valuable source of value-added compounds a collaborative perspective Molecules 2021; 26: 6338. Doi: <https://doi.org/10.3390/molecules26216338>.
- Gowri C, Review on potential use of fruit & vegetables by-products as a valuable source of natural food additives, Food Science and Quality Management, 2015; 45:47-61.
- Mourtizinos I, Goula A, Polyphenols in agricultural by products & food waste. In : Wahm RR editor, polyphenols in plants, London Academic press, 2019; 23-44. Doi. <https://doi.org/10.1016/B978-0-12-813768-0.00002-5>.
- Maskan A, Kaya S, Maskan M, Hot air and sun drying of grape leather (pestil), Journal of Food Engineering, 2002; 54(1):81-88. Doi. [https://doi.org/10.1016/S0260-8774\(01\)00188-1](https://doi.org/10.1016/S0260-8774(01)00188-1).
- Ayotte E, Fruit Leather, Publication no. P-228, University of Alaska Cooperative Extension Service, Fairbanks, Alaska, USA, 1980.
- Joyce SA, Kamil A, Fleige L, Gahan CGM, The Cholesterol-Lowering Effect of Oats and Oat Beta Glucan: Modes of Action and Potential Role of Bile Acids and the Microbiome, Frontiers and Nutrition, 2019; 6:171. Doi. <https://doi.org/10.3389/fnut.2019.00171>.
- Butt MS, Tahir-Nadeem M, Khan MKI, Shabir R, et al., M.S. Oat: Unique among the cereals, European Journal of Nutrition, 2008; 47:68-79. Doi. <https://doi.org/10.1007/s00394-008-0698-7>.
- Varma P, Bhankharia H, Bhatia S, Oats: A Multi-Functional Grain, Journal of Clinical and Preventive Cardiology, 2016; 5:9-17. Doi. <https://doi.org/10.4103/2250-3528.183984>.
- Sang S, Chu Y, Whole grain oats, more than just a fiber: Role of unique phytochemicals, Molecular Nutrition and Food Research, 2017; 61:1600715. Doi. <https://doi.org/10.1002/mnfr.201600715>.
- Lásztity R, Oat grain—A wonderful reservoir of natural nutrients and biologically active substances, Food Reviews International, 1998; 14:99-119. Doi. <https://doi.org/10.1080/87559129809541150>.
- Murphy JP, Hoffman LA, Marshall HG, Sorrells ME. "Oat science and technology, 1992: 1-28. Doi. <https://doi.org/10.2134/agronmonogr33>.
- Bagade SD, Handal PB, Lobo CB, Shinde SP, Banana Peel Bar: An Effective Nutritional Supplement, Journal of Drug Delivery and Therapeutics, 2025; 15(3):105-109. doi: <https://doi.org/10.22270/jddt.v15i3.7051>
- Stone HS, Sidel J, Oliver S, Woolsey A, Singleton RC, Sensory evaluation by quantitative descriptive analysis Food technology, JFT, 1974;28(11): 24-26. Doi. <https://doi.org/10.1002/9780470385036.ch1c>.
- Crocker LM, Depeters EJ, Fadel JG, Essex SE, et al., "Ash Content of Detergent Fibers in Feeds, Digesta, and Feces and Its Relevance in Fiber Digestibility Calculations" Journal Of Dairy Science, 1998; 81(4):1010-1014. Doi. [https://doi.org/10.3168/jds.S0022-0302\(98\)75662-0](https://doi.org/10.3168/jds.S0022-0302(98)75662-0).
- Bouraoui M, Richard P, Fichtali J, "A review of moisture content determination in foods using microwave oven drying", Food Research International, 1993;26(1): 49-57. Doi. [https://doi.org/10.1016/0963-9969\(93\)90105-R](https://doi.org/10.1016/0963-9969(93)90105-R).
- Fahey G, Novotny L, Layton B, Mertens D, "Critical Factors in Determining Fiber Content of Feeds and Foods and Their Ingredients" JAOACI, 2018; 102. Doi. <https://doi.org/10.5740/jaoacint.18-0067>.