



**INTERNATIONAL JOURNAL OF  
PHARMACEUTICAL SCIENCES**  
[ISSN: 0975-4725; CODEN(USA):IJPS00]  
Journal Homepage: <https://www.ijpsjournal.com>



## Research Article

# Formulation and Evaluation of Herbal cookies containing Moringa Leaves

Shetal B. Desai\*, Sachin B. Narkhede, Khushi P. Patel, Krupa K. Bhanushali, Nisha V. Yadav, Richa D. Singh, Jinal B. Vanjara

Smt. B.N.B. Swaminarayan Pharmacy College, National Highway No. 48, Shree Swaminarayan Gurukul, Salvav – Vapi (Gujarat) - 396191

## ARTICLE INFO

Received: 17 May 2024

Accepted: 22 May 2024

Published: 29 May 2024

### Keywords:

Anti-oxidant capacity, Anti-inflammatory, Blood sugar regulation, Malnutrition

### DOI:

10.5281/zenodo.11381483

## ABSTRACT

The aim of this work is the evaluation of the addition of Moringa leaf powder (MLP) in cookies in terms of antioxidant properties, dough processability and sensorial properties of the cookies. The total content of biophenols and flavonoids in MLP was detected and the identification of the bioactive molecules was performed by HPLC-ESI-TOF-MS measurements, before and after oven treatment at 180 °C for 20 min. After a preliminary evaluation of the MLP water soluble fraction (MLPsf) cytotoxicity, its protective effect against an oxidative injury induced in the SH-SY5Y cells was assessed. Data evidence that the bioactive molecules present in MLPsf are effective in preventing ROS production and in protecting neuronal cells against oxidative stress. Prototypes of cookies containing MLP in different concentrations were then produced and evaluated by a consumer panel. Selected doughs containing MLP were analysed to determine the total content of biophenols in the cookies after baking and their enrichment in terms of valuable chemical elements. The influence of MLP on the viscoelastic behaviour and morphology of the doughs was also assessed. Finally, the potential role in counteracting the insurgence of not treatable neurodegenerative pathologies of two main MLP components, glucomoringin and kaempferol derivatives, present also after the thermal treatment, was discussed.

## INTRODUCTION

### INTRODUCTION TO COOKIES

The term “cookie” refers to “small cakes”, and having interesting origin. The word itself is derived from the Dutch word “koekje” or “koekie.

Cookies share many ingredients with cakes, but they differ in their proportions. Unlike cakes, cookies have a lower proportion of liquid and a higher proportion of sugar and fat relative to flour. These delightful treats come in many shapes,

\*Corresponding Author: Shetal B. Desai

Address: Smt. B.N.B. Swaminarayan Pharmacy College, National Highway No. 48, Shree Swaminarayan Gurukul, Salvav – Vapi (Gujarat) – 396191

Email ✉: [shetaldesai091@gmail.com](mailto:shetaldesai091@gmail.com)

Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.



flavors, and textures, and they can be beautifully decorated. There are many benefits of Cookies like Weight Loss, Non-GMO Food, High Nutrition, Natural & Healthy Sweeteners. There are many advantages of cookies are Manufacturing Advantages like Efficiency, Variety, Tradition and Technology Blend and Consuming Advantages Energy Boost, Fiber Content, Protein Enrichment, Mood Improvement, Portion Control, Vitamins and Minerals.

### **INTRODUCTION OF DRUG:**

Moringa oleifera is a fascinating plant known for its nutritional benefits. It's often called the "drumstick tree" or "miracle tree" due to its various uses in traditional medicine and as a food source. The plant that is native to parts of Africa & Asia and cultivated in various tropical & subtropical regions around the world. The leaves, pods, seeds, and flowers of the Moringa tree are all edible and packed with nutrients, including various bioactives like Beta-sitosterol, Zeatin, Rutin, Chlorogenic Acid, Glucositol, Kaempferol, Isothiocyanates Vitamins, Minerals, and Antioxidants. It's been studied for its potential to combat malnutrition and its medicinal properties. M. oleifera is a fast-growing, deciduous tree that can reach a height of 10–12m (33–39 ft) and trunk diameter of 46 cm (18 in). The bark has a whitish-gray color and is surrounded by thick cork. Young shoots have purplish or greenish-white. M.O. leaves in traditional system have been long utilized moringa for its medicinal properties. It has been used to treat various ailments such as inflammation, infections, digestive disorders, diabetes, hypertension, and even malnutrition. Many of these potential health benefits are attributed to the plant's high antioxidant content and anti-inflammatory compounds. Moringa is renowned for its exceptional nutritional content. It contains significant amounts of vitamins, including vitamin A, vitamin C, vitamin E, and various B vitamins. It's also a rich source of

minerals such as calcium, potassium, iron, and magnesium. Additionally, moringa leaves are a complete protein source, containing all nine essential amino acids. The leaves are commonly consumed as a nutritious green vegetable either cooked or dried and powdered for use in soups, sauces, smoothies, or teas. The leaves of the Moringa tree are rich in essential nutrients. They contain high levels of vitamins A, C, and E, which are powerful antioxidants that help combat oxidative stress and inflammation. Moringa leaves are also an excellent source of several B vitamins, including B1 (thiamine), B2 (riboflavin), and B3 (niacin), which are essential for energy production and metabolic processes. Additionally, they provide a significant amount of minerals such as calcium, potassium, iron, magnesium, and phosphorus.

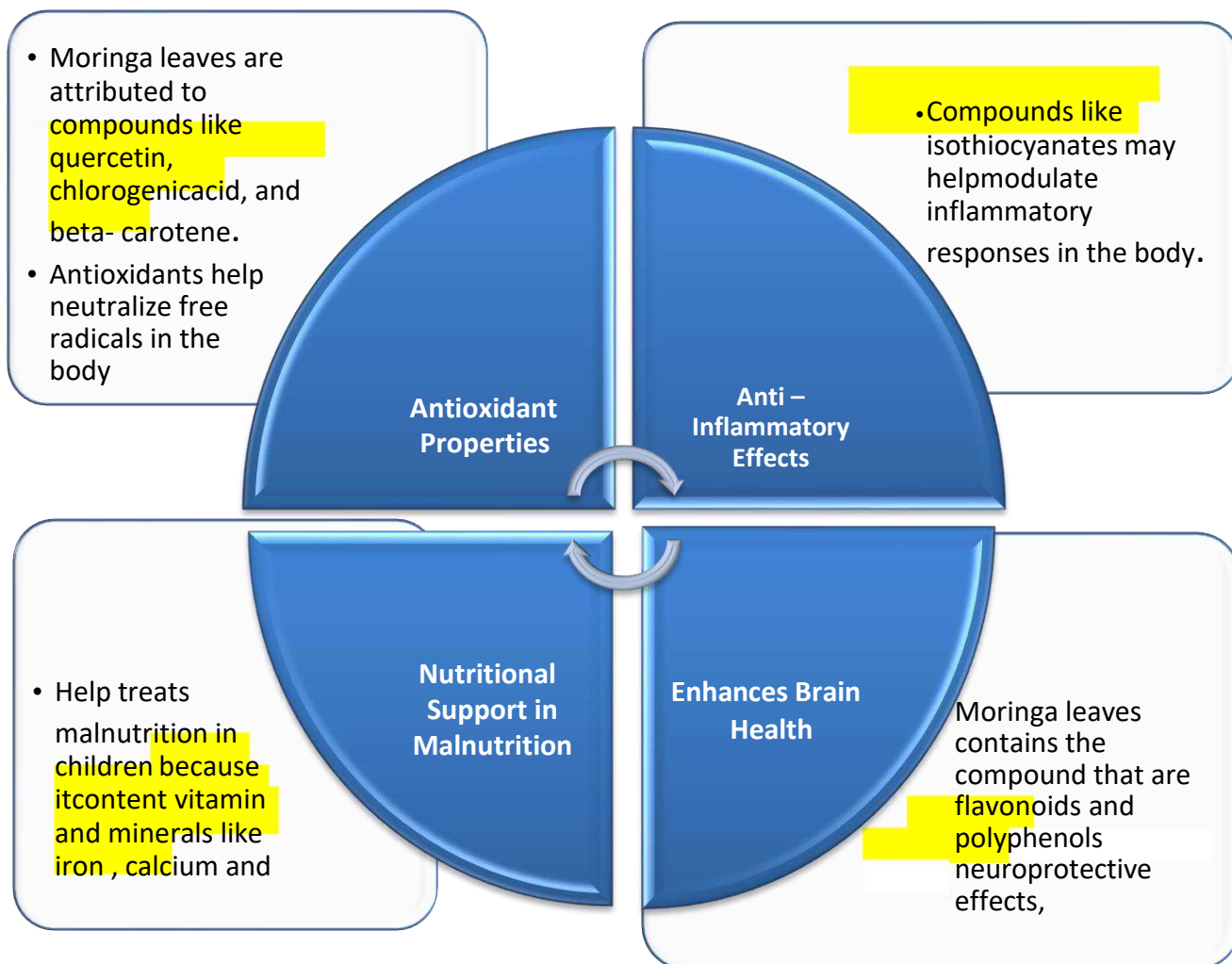
**Aim: Formulation and Evaluation of Herbal cookies containing Moringa leaves.**

### **Objectives:**

- Anti-oxidant capacity
- Anti-inflammatory
- Blood sugar regulation
- Malnutrition



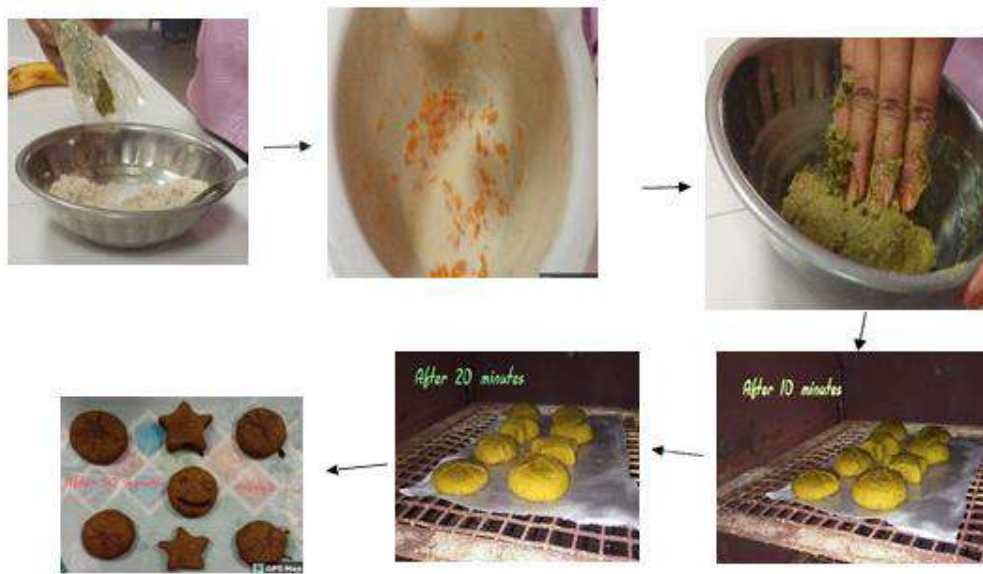
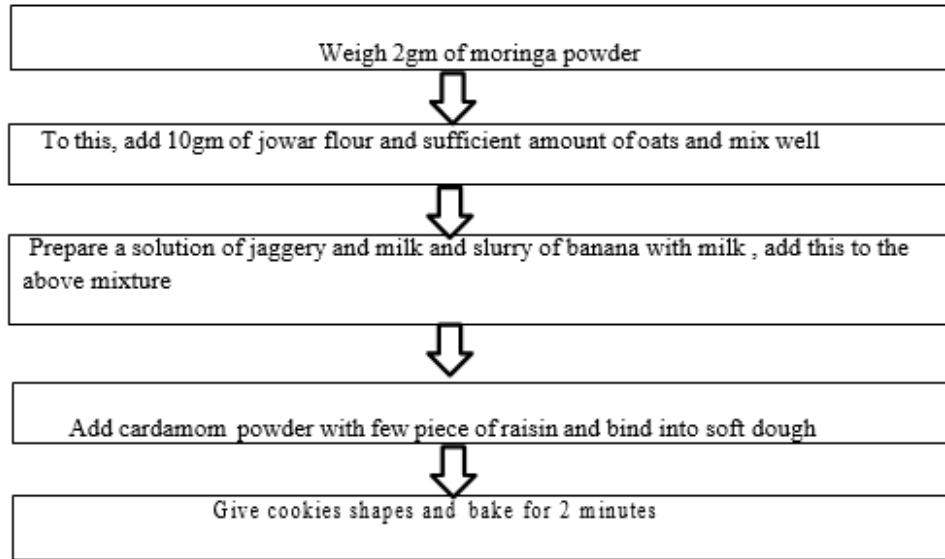
**Rationale:**



**Material Used:**

Sr. No	COMMON NAME	CATEGORY	QUANTITY
1.	Moringa oliefera	Antioxidant, enhance memory power	12g
2.	Jowar	Immunity Booster	24g
3.	Oats	Antioxidant	6g
4.	Jaggery	Anti neuroprotective	6g
5.	Milk	Protein source	12ml
6.	Banana	Antioxidant	1 piece
7.	Cardamom	Promotes digestion	¾ teaspoon
8.	Raisins	Benefits heart health	4-5 piece

**Method of Preparation:**



**Phytochemical Screening:**

**Table 2 Result of Phytochemical Screening**

Tests for Phytochemical	Chemical test	Moringa	Combination
Carbohydrate	Molish Test	+ve	+ve
	Benedict Test	+ve	+ve
Protein	Biuret Test	-ve	-ve
Amino Acid	Ninhydrin Test	-ve	-ve
Glycoside	Killer-Killani Test	+ve	+ve
Steroid	Salkowski Test	+ve	+ve
	Dragendroff Test	+ve	+ve
	Mayer Test	+ve	+ve

Alkaloid	Wagner Test	+ve	+ve
Flavonoid		+ve	+ve



Tests of moringa leaves

**Pre- compressional Parameters:**

**Table 3 Result of Micromeritic Properties of Powder**

Sr No.	Parameters	Moringa	Combination
1.	Bulk volume	25	22
2.	Tapped volume	20	18
3.	Bulk Density	0.4	0.6
4.	Tapped Density	0.5	0.7
5.	Angle of repose	13.42	12.5
6.	Hausner's ratio	1.367	0.83
7.	Carr's index	0.4	0.14

**1. Carbohydrate determination**

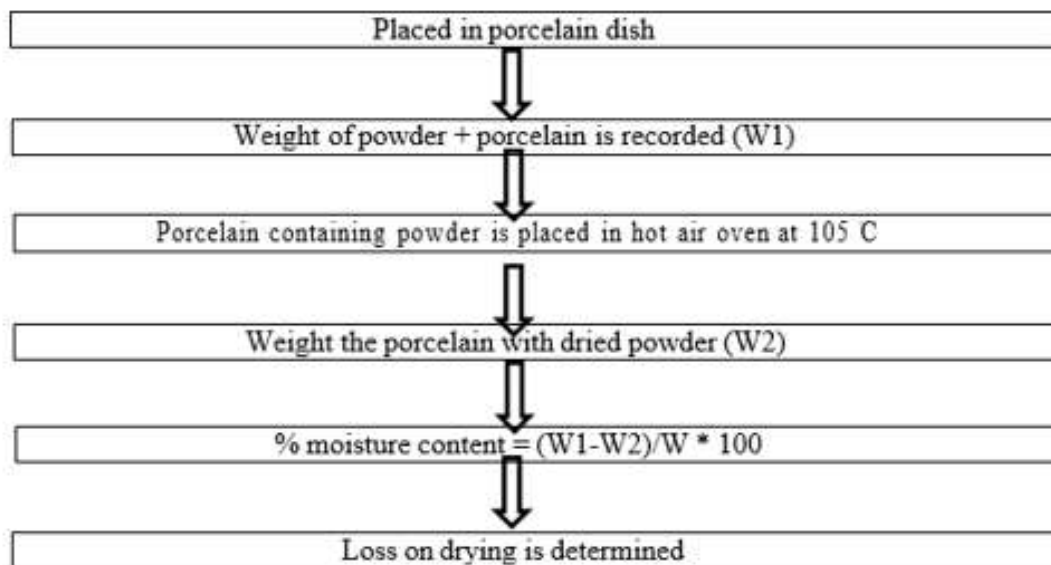
- The total carbohydrate determined by 100 - (Moisture + protein + fat + ash + fiber)
- International Journal of Food Science and Nutrition 158

- Determination of Energy Energy (Kcal) = Fat×4+ Protein×9+ Carbohydrates×4

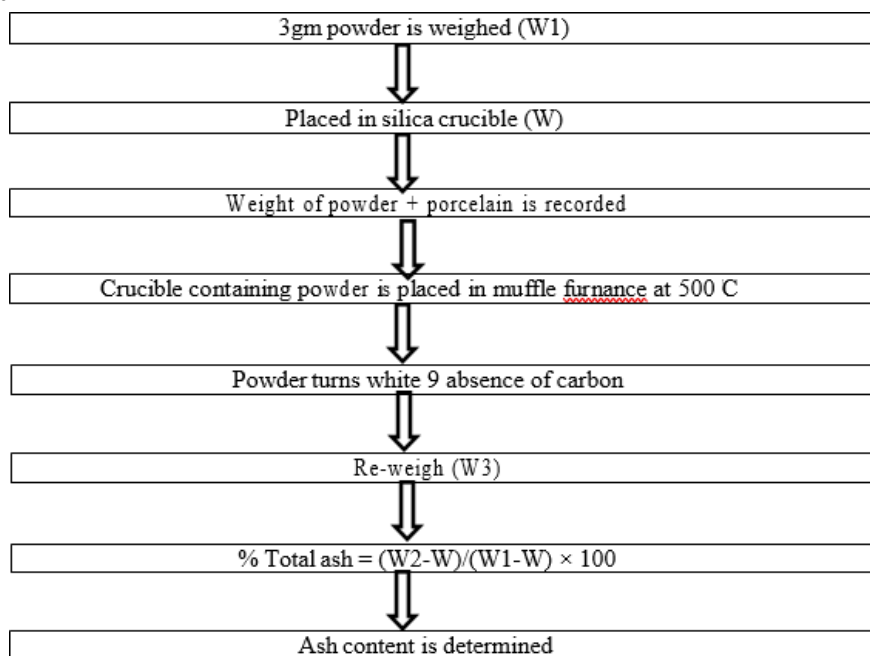
**2. Protein content in grains was determined using Bradford method**

**Protein concentration = amount of sample in microgram x 1000/ volume**

### 3. Moisture Content



### 4. Ash Content



## RESULT AND CONCLUSION:

### RESULT

Sr. No.	Parameter	Observation
1	Colour	Greenish brown
2	Oduor	Herbaceous
3	Taste	Earthy
4	Dough mixing time	10 minutes
5	Texture	Crispy
6	Baking temperature	170°C



7	Baking time	15 minutes
8	Moisture content	2.36%
9	Ash Content	1.2%
10	Protein	0.19%
11	Carbohydrates	98.145g
12	Energy	407.65
13	Overall Acceptability	8

## CONCLUSION

Moringa cookies offer a multitude of health benefits due to the inclusion of moringa, a nutrient-rich plant known for its medicinal properties. Firstly, they are rich in vitamins, minerals, and antioxidants, which support overall health and immune function. Moringa is particularly high in vitamins A, C, and E, as well as iron, calcium, and potassium, contributing to improved energy levels, bone health, and blood pressure regulation. Furthermore, moringa is recognized for its anti-inflammatory and anti-cancer properties, potentially reducing the risk of chronic diseases such as heart disease and cancer.

## REFERENCES

1. Peñalver R, Martínez-Zamora L, Lorenzo JM, Ros G, Nieto G. Nutritional and antioxidant properties of Moringa oleifera leaves in functional foods. *Foods*. 2022 Apr 12;11(8):1107.
2. El Sohaimy SA, Hamad GM, Mohamed SE, Amar MH, Al-Hindi RR. Biochemical and functional properties of Moringa oleifera leaves and their potential as a functional food. *Global Advanced Research Journal of Agricultural Science*. 2015 Apr;4(4):188-99.
3. Islam Z, Islam SM, Hossen F, Mahtab-ul-Islam K, Hasan MR, Karim R. Moringa oleifera is a prominent source of nutrients with potential health benefits. *International Journal of Food Science*. 2021 Aug 10;2021.
4. Kashyap P, Kumar S, Riar CS, Jindal N, Baniwal P, Guiné RP, Correia PM, Mehra R, Kumar H. Recent advances in Drumstick (Moringa oleifera) leaves bioactive compounds: Composition, health benefits, bioaccessibility, and dietary applications. *Antioxidants*. 2022 Feb 16;11(2):402.
5. Sahay S, Yadav U, Srinivasamurthy S. Potential of Moringa oleifera as a functional food ingredient: A review. *Magnesium (g/kg)*. 2017;8(9.06):4-90.
6. González-Burgos E, Ureña-Vacas I, Sánchez M, Gómez-Serranillos MP. Nutritional value of Moringa oleifera Lam. leaf powder extracts and their neuroprotective effects via antioxidative and mitochondrial regulation. *Nutrients*. 2021 Jun 26;13(7):2203.
7. Mahmood KT, Mugal T, Haq IU. Moringa oleifera: a natural gift-A review. *Journal of Pharmaceutical Sciences and Research*. 2010 Nov 1;2(11):775.
8. Grosshagauer S, Pirkwieser P, Kraemer K, Somoza V. The future of moringa foods: A food chemistry perspective. *Frontiers in nutrition*. 2021 Nov 2;8:751076.
9. Fahey JW. Moringa oleifera: A review of the medicinal potential. In *International Symposium on Moringa* 1158 2015 Nov 15 (pp. 209-224).
10. Isitua CC, Lozano MJ, Jaramillo C, Dutan F. Phytochemical and nutritional properties of dried leaf powder of Moringa oleifera Lam. from machala el oro province of ecuador. *Asian J. Plant Sci. Res*. 2015;5(2):8-16.
11. Chaudhary K, Chaurasia S. Neutraceutical properties of Moringa oleifera: a review. *Eur. J. Pharm. Med. Res*. 2017;4:646-55.
12. Emelike NJ, Uwa FO, Ebere CO, Kiin-Kabari DB. Effect of Drying Methods on the Physico-



- Chemical and Sensory Properties of Cookies Fortified with Moringa (*Moringaoleifera*) Leaves. *Asian Journal of Agriculture and Food Sciences*. 2015 Aug 14;3(4).
13. Stohs SJ, Hartman MJ. Review of the safety and efficacy of *Moringa oleifera*. *Phytotherapy Research*. 2015 Jun;29(6):796-804.
  14. Kasolo JN, Bimenya GS, Ojok L, Ochieng J, Ogwal-Okeng JW. Phytochemicals and uses of *Moringa oleifera* leaves in Ugandan rural communities.
  15. Yaméogo CW, Bengaly MD, Savadogo A, Nikiema PA, Traore SA. Determination of chemical composition and nutritional values of *Moringa oleifera* leaves. *Pakistan journal of nutrition*. 2011 Feb 9;10(3):264-8.
  16. Vergara-Jimenez M, Almatrafi MM, Fernandez ML. Bioactive components in *Moringa oleifera* leaves protect against chronic disease. *Antioxidants*. 2017 Nov 16;6(4):91.
  17. Kashyap P, Kumar S, Riar CS, Jindal N, Baniwal P, Guiné RP, Correia PM, Mehra R, Kumar H. Recent advances in Drumstick (*Moringa oleifera*) leaves bioactive compounds: Composition, health benefits, bioaccessibility, and dietary applications. *Antioxidants*. 2022 Feb 16;11(2):402.
  18. Xu Y, Chen G, Muema FW, Xiao J, Guo M. Most Recent Research Progress in *Moringa oleifera*: Bioactive Phytochemicals and Their Correlated Health Promoting Effects. *Food Reviews International*. 2024 Feb 17;40(2):740-70.
  19. Islam Z, Islam SM, Hossen F, Mahtab-ul-Islam K, Hasan MR, Karim R. *Moringa oleifera* is a prominent source of nutrients with potential health benefits. *International Journal of Food Science*. 2021 Aug 10;2021.
  20. Grosshagauer S, Pirkwieser P, Kraemer K, Somoza V. The future of moringa foods: A food chemistry perspective. *Frontiers in nutrition*. 2021 Nov 2;8:751076.
  21. Su X, Lu G, Ye L, Shi R, Zhu M, Yu X, Li Z, Jia X, Feng L. *Moringa oleifera* Lam.: a comprehensive review on active components, health benefits and application. *RSC advances*. 2023;13(35):24353-84.
  22. Rode SB, Dadmal A, Salankar HV. Nature's gold (*Moringa oleifera*): miracle properties. *Cureus*. 14: e26640.
  23. Thakur SB, Bajagain A. *Moringa*: Alternative for the food security, climate resilience and livelihood improvement in Nepal. *Int. J. Res. Granthalayah*. 2020;8:190-200.
  24. Liu R, Liu J, Huang Q, Liu S, Jiang Y. *Moringa oleifera*: a systematic review of its botany, traditional uses, phytochemistry, pharmacology and toxicity. *Journal of Pharmacy and Pharmacology*. 2022 Mar 1;74(3):296-320.
  25. Thapa K, Poudel M, Adhikari P. *Moringa oleifera*: A review article on nutritional properties and its prospect in the context of Nepal. *Acta Sci. Agric*. 2019 Oct 17;3(11):47-54.
  26. Dixit S, Tripathi A, Kumar P. Medicinal properties of *Moringa oleifera*: A review. *International Journal of education and Science research review*. 2016 Apr 3;3(2):173-85.
  27. Bhattacharya A, Tiwari P, Sahu PK, Kumar S. A review of the phytochemical and pharmacological characteristics of *Moringa oleifera*. *Journal of Pharmacy and Bioallied Sciences*. 2018 Oct 1;10(4):181- 91.
  28. Padayachee B, Baijnath HJ. An updated comprehensive review of the medicinal, phytochemical and pharmacological properties of *Moringa oleifera*. *South African Journal of Botany*. 2020 Mar 1;129:304- 16.
  29. Kumar PS, Mishra D, Ghosh G, Panda CS. Medicinal uses and pharmacological



- properties of Moringa oleifera. International Journal of Phytomedicine. 2010 Jul 1;2(3).
30. Chaudhary K, Chaurasia S. Neutraceutical properties of Moringa oleifera: a review. Eur. J. Pharm. Med. Res. 2017;4:646-55.
31. Mishra G, Singh P, Verma R, Kumar S, Srivastav S, Jha KK, Khosa RL. Traditional uses, phytochemistry and pharmacological properties of Moringa oleifera plant: An overview. Der Pharmacia Lettre. 2011;3(2):141-64.
32. Jaiswal D, Rai PK, Kumar A, Mehta S, Watal G. Effect of Moringa oleifera Lam. leaves aqueous extract therapy on hyperglycemic rats. Journal of ethnopharmacology. 2009 Jun 25;123(3):392-6.
33. Pandey A, Pandey RD, Tripathi P, Gupta PP, Haider J, Bhatt S, Singh AV. Moringa oleifera Lam. Sahijan)-A Plant with a Plethora of Diverse Therapeutic Benefits: An Updated Retrospection. Medicinal and Aromatic Plants. 2012;1(1):1-8.
34. Hamza AA. Ameliorative effects of Moringa oleifera Lam seed extract on liver

**HOW TO CITE:** Shetal B. Desai, Sachin B. Narkhede, Khushi P. Patel, Krupa K. Bhanushali, Nisha V. Yadav, Richa D. Singh, Jinal B. Vanjara, Formulation and Evaluation of Herbal cookies containing Moringa Leaves, Int. J. of Pharm. Sci., 2024, Vol 2, Issue 5, 1598-1606. <https://doi.org/10.5281/zenodo.11381483>

