



## Research Article

# STUDY ON PREPARATION AND EVALUATION OF COOKIES SUPPLEMENTED WITH DRIED MORINGA LEAF POWDER

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**Abstract:** Moringa is a leafy vegetable used in human diet. It contains more amount of minerals, iron and amino acids. It helps to enhance the nutritive status of childrens, adolescent, pregnant and lactating women. UNFCC reported that 480 million people suffers due to malnutrition and hunger in the past 2 years. So, this study is mainly focussed on the reduction of malnutrition through supplement of dried moringa leaf incorporated cookies. The main objective of this study to standardize the concentration of Dried Moringa Leaf Powder (DMLP) incorporated in the cookies for consumer acceptability and the sensory evaluation of DMLP incorporated cookies by different age groups. Cookies were prepared by using required ingredients along with different concentration of DMLP 0 g, 0.5g, 1.5g and 2g respectively. The sensory evaluation of cookies was carried out using 9-point hedonic with various age group people namely group A (10-30 years old) and group B (30-60 years old). The sensory evaluation was done to assess the colour, texture, aroma, taste and overall acceptability. This research concludes that T<sub>3</sub> (1.5 g of DMLP) was accepted by all sensory evaluators irrespective of the age group.

**Keywords:** Moringa, DMLP, leafy vegetable, Sensory evaluation, Cookies

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**Academic Editor / Reviewer:**

## Introduction

Moringa is having more medicinal values and also rich in all mineral constituents especially iron content. So, it is called as "Miracle tree". *Moringa oleifera* is the botanical name of Moringa native to tropical Asia, coming under the family of Moringaceae and order Brassicales. The other common name of Moringa is drumstick trees, Horseradish tree and cabbage tree [1].

India shares 80 percent in global moringa production and it stands in first rank in cultivable area and production. Total production of moringa is 51 tonner per ha with an area of 43,600 ha. In India, Andhra Pradesh is the leading state in area and production of Moringa followed by Tamil Nadu [2]. Moringa are rich in vitamins like A, B, C, D and E, folic acid, pyridoxine and nicotinic acid [3].

World Health Organization reported that the iron deficiency is one of the important factors in causing anemia in many developing countries. More than 48% of the pregnant women affected with anemia due to low consumption of iron content in their daily diet. The anemia prevalence during pregnancy causes maternal mortality and premature birth (WHO, 2017 World Health Organization) [4]. Mostly young child under the age of 5 are greatly affected due to anemia [5].

The storability of fresh moringa leaves is very less because the fresh moringa leaf contains more amount of moisture. The availability of fresh leaves in the market is also getting difficult due to its lesser shelf life. The dried moringa leaf powder can be stored up to 6 months without any deterioration the nutritional value. So, this study was planned to prepare a dried moringa leaf powder and make it to consume by all the people.

Moringa leaf powder cookies help to increase the level of hemoglobin in pregnant women because it contains iron and zinc [6-7]. Cookies are easiest way to consume, carry and process [8]. Consumption of cookies is the alternate way to stabilize the nutritional status of the body for diabetes and weight reduction planners [9].

Keeping in view of the above aspects, the present study aimed to meet the requirements of Iron in day to day life and efforts has taken to reduce the nutritional deficiencies. The present study focused the following objectives are standardisation of different concentration of Dried Moringa Leaf Powder (DMLP) incorporated in the cookies for consumer acceptability and assessment of Dried Moringa Leaf Powder (DMLP) incorporated cookies by sensory evaluation with different age groups.

## Materials and Methods

This study was conducted at Ramakrishna Mission Vivekananda Educational and Research Institute, Faculty Centre for Agriculture, Department of Horticulture in the laboratory of Food Science and Nutrition Department, Coimbatore. This experiment was designed with 5 treatments (Control (0 g of DMPL), T<sub>1</sub> (0.5 g of DMPL), T<sub>2</sub> (1 g of DMPL), T<sub>3</sub> (1.5 g of DMPL), and T<sub>4</sub>(2 g of DMPL)) with 5 replications of each treatment respectively. Completely Randomized Block design statistical design was followed in this experiment.

## Experiment-I

Standardisation of different concentration of Dried Moringa Leaf Powder (DMLP) incorporated in the cookies for consumer acceptability

## Preparation of Dried Moringa Leaf Powder (DMLP)

Fresh and tender Moringa leaves were harvested from the crop cafeteria, Department of Horticulture (RKMVERI FAR, CBE) and then washed with water to remove dust and debris. 750 grams of fresh Moringa leaves taken and allow to dehydrate in Food dehydrator (Model No: EFD 313B, Elite Gourmet, China) at 140° F for 4 hours.

The dried leaves are immediately transfer into blender (Sujata, India) to get a fine powder and sieved through Stainless sieve (US Standard Mesh No.70) at 212  $\mu\text{m}$ . (Codex Alimentarius. Codex standard 152-1985 "Wheat flour"). Dried Moringa Leaf Powder (DMLP) stored in polythene bag (thickness of the bag- 100 gauge).

### Preparation of Dough

Allowing the butter to stand at room temperature for 30 minutes will brings it to right consistency for mixing. Butter was beaten until get smoothed. It may give preferred texture and softness to the cookies. All-purpose flour (Maida) and Dried Moringa Leaf Powder (DMLP) were added in different concentration. Powdered Sugar and Baking powder were mixed in same proportions for control and treatments. The softness of the dough can be identified by touch feel by our fingers. All ingredients used in the cookie's formulation were given below.

Ingredients	Control	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>
Maida (g)	100	99.5	99	98.5	98
Moringa leaves powder (g)	0.0	0.5	1.0	1.5	2.0
Butter (g)	20	20	20	20	20
Country sugar (g)	40	40	40	40	40
Baking soda (g)	0.4	0.4	0.4	0.4	0.4
Baking powder (g)	0.5	0.5	0.5	0.5	0.5
Choco chips(g)	30	30	30	30	30

### Preparation of Moringa Cookies

The prepared dough was spread like a sheet with a thickness of 2 cm and cut the dough in a circular shape at a diameter of 5 cm using mould. The small pieces of cookies dough are placed in a butter paper sheet. The oven (Model NO: 2021, Stove Kraft Limited, China) should be preheated for 10 min and then place the dough into the oven, bake the cookies for 17 min at 180°C. Keep the baked cookies at rest for 10 min in a room temperature. Moringa cookies are packed in polythene bags with the thickness of 200 gauge. Cookies were prepared by using the AACC method [10] with slight modifications.

### Determination of Chemical Composition in the Moringa Cookies

Moringa cookies were chemically analysed for moisture, crude protein, fat, crude fibre and ash [11]. Moisture content was determined by the gravimetric method. The moisture content was estimated by placing 2g of DMLP cookies at 150  $\pm$  1°C for 3 hours in hot air oven and the cooled. The Moisture content by weight basis was estimated by using the formula:

$$\text{Moisture (\%)} = \frac{W3 - W1}{W2 - W1}$$

Where,

W1 = Weight of the container (g)

W2 = Weight of the container with sample before drying (g)

W3 = Weight of the container with sample after drying (g)

### Estimation of Mineral Content in the Moringa Cookies

DMLP cookies were digested by using di-acid (nitric acid and perchloric acid -5:1). The atomic absorption spectrophotometry was used to determine the amount iron content present in the sample [12].

### Experiment-II

#### Assessment of Dried Moringa Leaf Powder (DMLP) by sensory evaluation with different age groups

The sensory characteristics of cookies were assessed by using group of evaluators from Ramakrishna Mission Vidyalaya campus, Coimbatore. They are randomly selected based on the age level. The Evaluates were separated into two groups based on the age. The group A consist of 20 members within the age group of 10-30 years old and group B consist of 20 members within the age group of 30-60 years old. The Evaluates were provided with 9 points hedonic scale scoring sheet. DMLP cookies was served to the evaluators from each treatment. The evaluates were instructed to evaluate the DMLP Cookies for colour appearance, flavour, taste, shape, texture and overall acceptability using the 9-point hedonic scale ranging from 9 (like extremely) to 1 (dislike extremely) [13]. Scoring Sheet was collected immediately after evaluation and statistical analyses were done.

### Statistical analysis

The statistical software SPSS and Minitab were used to analyses the data and the analyzed data was statistically interpreted and results were furnished.

### Results

In South India, most of the persons prefer cookies throughout the day with coffee or tea. So, this initiative has taken to incorporate DMLP in the cookies it will help the population to reduce deficit of nutrition.

#### Impact of DMLP in cookies on Nutrient composition

The moisture content of DMLP cookies in T<sub>4</sub> treatment was 6.08 percentage whereas the control recorded maximum value up to 7.29 percentage. The moisture content was decreased while adding more amount of DMLP in cookies. It shows that the increment level of DMLP will decrease the moisture content in cookies and it cures dryness in cookies. The highest protein content is measured in T<sub>4</sub> (12.04%). The reduction percentage of protein in control is 2.40 percentage when compared to all the treatment. The fat content of control and different level of DMLP incorporated in cookies ranged between 20.98 percentage to 20.84 Percentage. The slight increase was observed in the Fat content when more addition of DMLP in cookies. The highest fat content was observed in T<sub>4</sub> (20.98%). The average mean value of fat content is 20.92 percentage. Addition of more DMLP in cookies shows more ash content. There is no much variation was shown in ash content among the all treatments. The average mean value of ash content 2.52 percentage.

Commonly, most of the leafy vegetable contains more amount of fiber and Iron. The result shows that maximum level of DMLP in cookies shows highest rate of fiber (3.24%) and iron (2.33 mg/100g) in the treatment T<sub>4</sub>. The iron content was gradually increased from 1.74, 1.94, 2.05, 2.19 and 2.33 (mg/100g) with addition of DMLP of 0, 0.5, 1.0, 1.5, 2g respectively [Fig-1]. The maximum energy (KCAL) was found in T<sub>3</sub> (457.2) and T<sub>4</sub> (457.66) treatments. There was a significant enhancement in nudity value was observed in addition of DMLP in various levels in cookies. Hence, more DMLP incorporated in the cookies shows higher nutritive value.

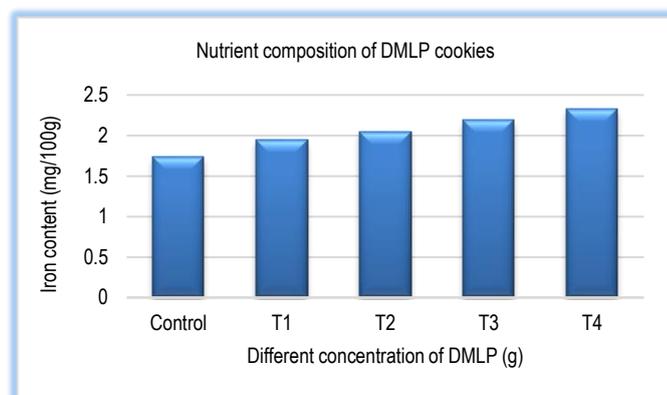


Fig-1 Nutrient composition of DMLP Cookies

#### Overall Sensory evaluation of DMLP cookies by the age Group A (10 -30 years old) and Group B (30-60 years old)

The sensory evaluation of MLP cookies was evaluated by using Group A (10-30 years old) and Group B (30-60 years old). The overall acceptability decreased with increasing level of DMLP in cookies. A similar trend was observed in color, appearance, flavor and texture. The color of cookies was changed from light brown to greenish brown but T<sub>3</sub> shows brown color with green tinge [Fig-2]. It does not show any variation when compared to common cookies. T<sub>3</sub> records 8.50 on 9-point hedonic scale in color and appearance. The texture was very hard in T<sub>4</sub> treatment varies easily cookies were broken in control. Hence the consumer preference was more towards the treatment T<sub>1</sub>, T<sub>2</sub>, and T<sub>3</sub>. The taste was very sweet in T<sub>3</sub> treatment where it is too bitter in T<sub>4</sub> treatment 8.20 points on 9-point scale. Hence consumer prefers was more towards T<sub>3</sub> (8.70). The overall acceptability score for T<sub>3</sub> was 8.41 on nine-point hedonic scale but decreased significantly in all other treatments [Fig-3].



Fig-2 Different levels of DMLP incorporated Cookies

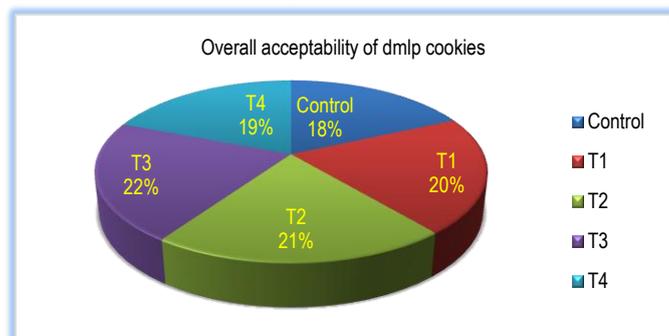


Fig-3 Overall acceptability percentage of DMLP cookies

## Discussion

The high iron content was recorded in the 2g of DMLP incorporated cookies but concern to acceptability of the consumer 1.5g of DMLP incorporated cookies was preferred by all the age group. *Moringa oleifera* leaves have more percentage of moisture, ash, fat, protein, fibre content when compared to the nutrient composition of sweet potato leaves [14]. In addition, moringa dried leaves contains more amount of iron content. So, consumption of DMLP cookies helps to reduce the anemia and other iron deficiency related problems.

The sensory characteristics were evaluated to analyse the average preference of the evaluators to DMLP incorporated cookies. This evaluation also carried without any modification of 9-point hedonic scale. The points were given to each characteristic such as colour, appearance, texture, taste and aroma from highest point 9 (like extremely) to the lowest point 1 (dislike extremely) [12].

This study also intended to assess the heterogeneity nature in the consumer preference. Moreover, DMLP incorporated cookies preference to different age group was also assessed by sensory analysis. This study investigated the nutritive status of the DMLP cookies. The moringa leaves contains more amount of essential amino acids especially methionine and leucine [15]. Dried Moringa Leaf Powder (DMLP) which is incorporated into cookies to provide major health benefits from younger to elder and to control malnutrition for upcoming generation.

## Conclusion

The Moringa leaves were dried at 140°C for 4 hours and it should not exceed beyond it and it should not be reduced as if it is exceeded it leads the leaves to over dry with burnt odour and it tastes bitter. Hence, the optimum temperature is preferred. It also reports that DMLP added in cookies is rich in iron content. The increment of DMLP increase the level of iron content and more amount of iron content in cookies leads the healthy life as iron is a basic need in our daily needs. The sensory evaluation was done on the basis of 9 points hedonic scale with slight modification. The sensory evaluators are grouped based on the age criteria. In sensory evaluation, irrespective of age groups preferred and accepted T<sub>3</sub> treatment as well as T<sub>3</sub> has consumer acceptable level of DMLP was found. This research concludes that T<sub>3</sub> is the best and most suitable cookies for adults and children. T<sub>3</sub> (1.5g of DMLP) is widely accepted by all sensory evaluators because of its taste, texture, colour and it is easy palatability.

**Application of research:** The nutritive rich food products are required to alleviate the deficiency and meet out the nutrient require of day today life. The product development or value addition of any product should focus on the nutritive values.

**Research Category:** Post harvest technology, Value added product development

**Abbreviations:** DMLP- Dried Moringa leaf powder, WHO- World Health Organization, FPO-Food Product order, UNFCCC-United Nations Framework Convention on Climate Change.

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**\*\*Principal Investigator or Chairperson of research: C. Partheeban**

University: Ramakrishna Mission Vivekananda Educational and Research Institute, Coimbatore, 641020, India

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**Study area / Sample Collection:** Food Science and Nutrition Department, Coimbatore

**Cultivar / Variety / Breed name:** *Moringa oleifera*

**Conflict of Interest:** None declared

**Ethical approval:** This article does not contain any studies with human participants or animals performed by any of the authors.

Ethical Committee Approval Number: Nil

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