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# TO DEVELOPAND EVALUATE AMORING A BASED SMOOTHIEASA NUTRITIOUS FUNCTIONAL BEVERAGE SUITABLE FOR ALL AGE GROUPS.

**Pooji tha Baswaraju*[1], P. Divya Roopa[2]**

[1]M.Sc. Nutrition and Dietetics, Department of Nutrition, Kasturba Gandhi Degree & PG College for Women, Affiliated to Osmania University, Secunderabad, Telangana, India.

[2]Assistant Professor, Department of Nutrition, Kasturba Gandhi Degree & PG College for Women, Affiliated to Osmania University,Secunderabad, Telangana, India.

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***Corresponding Author: Pooji tha Baswaraju**
M.Sc. Nutrition and Dietetics, Department of Nutrition, Kasturba Gandhi Degree & PG College for Women, Affiliated to Osmania University, Secunderabad, Telangana, India.

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## ABSTRACT

### INTRODUCTION

Moringaoleifera is a plant rich in nutrients, encompassing vitamins, minerals, antioxidants, and bioactive compounds. Due to its remarkable nutritional profile, it is extensively utilized in the development offunctional foods. This study focused on creating a moringa-based smoothie incorporating moringa leaves, banana, oats, chia seeds, and milk to enhance its nutritional value and health benefits.

### OBJECTIVE

The aim is to develop and assess a moringa smoothie that boasts improved nutritional quality and sensory acceptability, making it suitable for individuals across all age groups.

### MATERIALS & METHODS

Freshmoringaleaveswere thoroughlywashed andcleaned.Oatsweresoaked inmilk,whilechiaseeds were allowed to soak until they formed a gel. The banana was peeled and chopped. A blend of moringa leaves, banana, soaked oats, and milk was processed until smooth, after which the soaked chia seeds were incorporated.Thesmoothie wasevaluatedusing a5-pointhedonicscale,assessingappearance, color,aroma, taste, texture, and overall acceptability.

**RESULTS**

The moringa smoothie achieved high sensory ratings for taste, texture, color, and overall acceptability. The addition of moring a leaves significantly enhanced the nutritional profile by supplying vitamins, minerals, and antioxidants, while oats, banana, and chia seeds contributed to improved texture and energy content.

**CONCLUSION**

Themoringasmoothiedevelopedinthisstudyisanutritiousfunctionalbeveragethatdemonstratesfavorable sensory acceptability. It has the potential to enhance nutrient intake and is suitable for consumption by individuals of all ages.

**KEYWORDS:** Moringaoleifera, smoothie, functional food, oats, chiaseeds, banana, sensory evaluation.

## INTRODUCTION

Moringaoleifera Lam., often referred to as the drumstick tree, horseradish tree, or miracle tree, is a highly esteemed medicinaland nutritionalplantthatis indigenous to thenorthwestern parts of India. Itisamember of the Moringaceae family and has been widely cultivated in tropical and subtropical areas throughoutAsia, Africa, South America, and the Pacific Islands. For centuries, Moringa has been employed in traditional medicine and as a food source, owing to its remarkable nutritional profile and therapeutic benefits. Nearly every part of the plant, including its leaves, flowers, pods, seeds, bark, and roots, is deemed beneficial for human health.

Moringa is widely acknowledged as one of the most nutrient-rich plants available. The leaves are especially high in proteins, vitamins, minerals, essential amino acids, dietary fiber, and bioactive compounds.They are particularlyrichincalcium,iron,potassium,magnesium,vitaminA,vitaminC,andvitaminE.Additionally, Moringa leaves are plentiful in phytochemicals such as flavonoids, phenolic acids, tannins, saponins, glucosinolates, alkaloids, and isothiocyanates. These compounds enhance the plant's antioxidant, antiinflammatory, antimicrobial, antihypertensive, antidiabetic, hepatoprotective, and anticancer properties.

Scientific research has increasingly corroborated the traditional medicinal applications of Moringa. The antioxidantcompoundsfoundintheleavesassistin neutralizingfreeradicalsand mitigatingoxidativestress, which is linked to the onset of chronic diseases such as cardiovascular diseases, diabetes, cancer, and hypertension. Moringa has also demonstrated

the ability to enhance lipid metabolism by decreasing total cholesterol and triglyceride levels, thus lowering the risk of cardiovascular issues. Moreover, its antiinflammatory and immunomodulatory characteristics contribute to enhanced immune function and protection against various inflammatory conditions.

Among the numerous nutrients present in Moringa, calcium is of particular importance. Calcium is the most abundant mineral in the human body and plays a vital role in bone and teeth formation, muscle contraction, blood clotting, nerve transmission, and hormonal regulation. Adequate calcium intake is essential during childhood, adolescence, pregnancy, lactation, and old age to support growth and maintain bone health. Insufficient calcium intake can result in poor bone mineralization, growth retardation, osteoporosis, and an increased risk of fractures.

Researchhasdemonstrated thatMoringaleavescontainhighercalciumconcentrationsthanmanycommonly consumedgreenleafyvegetables.Moreover,thecalciumpresentinMoringaishighlybioavailable,making it an effective dietary source for improving calcium intake. This characteristic is particularly important in developing countries where calcium deficiency remains a major public health concern. The regular incorporation of Moringa into the diet may therefore contribute significantly to the prevention of calcium deficiency and related disorders.

Vitamin Disanotheressentialnutrientinvolvedin maintainingcalciumbalanceand bonehealth. Itenhances intestinal calcium absorption and supports proper skeletal development. Deficiency of vitamin D during childhood may lead to rickets, while long-term deficiency in adults can contribute to osteomalacia and osteoporosis. Since dietary sources of vitamin D are limited, ensuring adequate calcium intake through nutrient-rich foods becomes increasingly important for maintaining optimal bone health.

The increasing occurrence of micronutrient deficiencies and diseases related to lifestyle choices has heightenedinterest in the creationof functionalfoods.Functional foodsare definedas thosethatofferhealth advantages beyond basic nutrition, primarily due to the presence of bioactive compounds. Moringa-based food products have attracted significant attention due to their rich nutritional profile, cost-effectiveness, and Ease of access. Theintegration of Moringainto everyday foods can enhancenutrientconsumption and foster overall health.

This study centers on the development of a Moringa smoothie as a natural source of dietary calcium. The smoothie is composed of Moringa leaves, banana, dates, oats, milk, and chia seeds, each chosen for their

nutritionalandfunctionalattributes.Bananassupplycarbohydrates,potassium,vitaminB6,anddietaryfiber, whichareessentialforenergyproduction, musclefunction,and overall well-being.Datesaddnaturalsugars, fiber, minerals, and antioxidant compounds that improve nutritional quality and taste.

Oats serve as a significant source of complex carbohydrates, soluble fiber, proteins, vitamins, minerals, and bioactivecompoundslikebeta-glucan.Beta-glucanisrecognizedforitscholesterol-loweringandantidiabetic properties, making oats a crucial functional ingredient. Milk provides high-quality protein, calcium, phosphorus, vitamin D, and various bioactive compounds that aid in bone development and growth. Chia seedsareabundantinomega-3fattyacids,dietaryfiber,antioxidants,andessentialminerals,furtherboosting the smoothie's nutritional profile..

The combination of these ingredients results in a nutrient-rich beverage that provides calcium, protein, vitamins, minerals, antioxidants, and other health-promoting compounds. Such a formulation may be particularly beneficial for children, adolescents, women, and elderly individuals who are at greater risk of calcium deficiency and poor bone health.

Therefore, the development of a Moringa smoothie represents a practical and sustainable approach to improving dietary calcium intake and promoting overall nutritional well-being. This study aims to evaluate the nutritional significance and acceptability of Moringa smoothie as a functional food that can contribute to the prevention of calcium deficiency and support long-term health.

## MATERIALS AND METHODS STUDY DESIGN

The current research was conducted to create a nutrient-dense functional beverage utilizing Moringaoleifera leaves, as well as to assess itsnutritional profile and sensory appeal. This study encompassed the formulation and preparation of a moringa smoothie, sensory assessment, and laboratory analysis of its nutrient composition.

## SELECTION OF RAW MATERIALS

Fresh leaves of moringa (Moringaoleifera), along with banana, dates, milk, oats, and chiaseeds,weresourced from the local market. The selection of these ingredients was based on their nutritional benefits, freshness, quality, and compatibility for smoothie preparation.

## FORMULATION OFMORINGASMOOTHIE

Themoringasmoothiewasdevelopedbycombiningmoringaleaves,banana,dates,milk,oats,andchiaseeds in appropriate ratios to improve its nutritional value and sensory appeal. The

ingredients utilized in the smoothie preparation are detailed in Table 1.

**Table1.Ingredientsusedinthepreparationofmoringasmoothie.**

| INGREDIENTS | QUANTITY |
|---|---|
| **Moringaleaves** | 30g |
| **Banana** | 100g |
| **Dates** | 20g |
| **Milk** | 300ml |
| **Oats** | 20g |
| **Chia Seeds** | 10g |

**PREPARATIONOFMORINGASMOOTHIE**.

**Process Flow chart Of Moring asmoothie**

FreshMoringaLeaves(30g)

↓

WashingandCleaning

↓

Banana(100 g) – Peeland Slice Dates(20g)–DeseedandChop

Oats(20g) –SoakinMilk(300ml)for15–20min

ChiaSeeds (10g)–SoakSeparatelyUntilGelFormation

↓

BlendMoringaLeaves+Banana+Dates +SoakedOats +Milk

↓

ObtainSmoothandUniformConsistency

↓

AddSoakedChiaSeeds

↓

MixThoroughly

↓

MoringaSmoothie

↓

ServeImmediatelyforSensoryEvaluationandNutritionalAnalysis

## SENSORYEVALUATION

The sensory evaluation of the moringa smoothie was conducted with a panel of 50 student participants. The productwasassessedforitsappearance,color,aroma,taste, texture,andoverallacceptabilityusing a5-point hedonic scale, where 5 indicated "like extremely" and 1 indicated "dislike extremely." The sensory scores obtained from the panelists were documented and utilized to evaluate the acceptability of the developed product.

## NUTRITION ALANALYSIS

The moringa smoothie was analyzed for its nutritional content at Macana Analytical Laboratory Private Limited in Hyderabad, aNABL-accredited facility. Standard analytical methods wereemployed to ascertain the nutritional composition of the product. The parameters analyzed included energy, protein, total carbohydrates, total fat, dietary fiber, iron, and calcium. The nutritional composition of the smoothie was reported per 100 g of the product.

**Table2.Nutritionalcompositionofthedevelopedmoringasmoothie(per100g)**

| S.No | Parameter | Testmethod | Unit | Results | Limits |
|---|---|---|---|---|---|
| 1 | **Energy** | Calculation | Kcal/100g | 85 | 70-120 |
| 2 | **Protein** | KjeldahlMethod | g/100g | 3.5 | 22.0 |
| 3 | **Total carbohydrates** | By Calculation | g/100g | 15.0 | - |
| 4 | **Totalfat** | AOAC920.39 | g/100g | 2.2 | 1.0-4.0 |
| 5 | **Dietaryfiber** | AOAC985.29 | g/100g | 3.0 | ≥2.0 |
| 6 | **Iron** | ICP-OES/AAS | Mg/100g | 2.5 | ≥1.5 |
| 7 | **Calcium** | ICP-OES/AAS | Mg/100g | 120 | ≥80 |

## ENERGY

The energy content of the moringa smoothie developed was assessed through calculation and determined to be85kcal/100g.Thissuggeststhatthesmoothieoffersamoderateenergysupply,renderingitanappropriate functional beverage for everyday consumption. The energy primarily comes from carbohydrates, with additional contributions from the protein and fat present in the ingredients.

## PROTEIN

TheproteincontentwasevaluatedusingtheKjeldahlmethod,revealingavalueof3.5g/100g.Theproteinis chiefly sourced from moringa leaves, milk, oats, and chia seeds. Protein is vital for tissue growth, repair,

enzymeproduction,andthemaintenanceofmusclemass,therebyenhancingthesmoothie'snutritional profile.

**TOTAL CARBOHYDRATES**

The total carbohydrates were calculated and found to be 15.0 g/100 g. Carbohydrates act as the main energy sourceandenhancetheflavorandtextureofthesmoothie.Thecarbohydratecontentisprimarilyderivedfrom banana, oats, and milk.

**TOTALFAT**

ThetotalfatcontentwasanalyzedusingAOAC920.39andwasdetermined tobe2.2g/100g.Thissmoothie containsarelativelylowfatcontent,makingitidealforthoseseekingabalancedandnutritiousdrink.The fat is mainly sourced from chia seeds and milk, which also provide beneficial essential fatty acids.

**DIETARYFIBER**

Dietary fiber was assessed using AOAC 985.29 and found to be 3.0 g/100 g. The fiber content is largely contributedbymoringaleaves,oats,banana,andchiaseeds.Sufficientdietaryfiberisimportantfordigestive health, promotes feelings of fullness, and aids in the regulation of blood glucose and cholesterol levels.

**IRON**

Iron content was analyzed using ICP-OES/AAS and was found to be 2.5 mg/100 g. Iron is a crucial mineral necessary for hemoglobin formation and oxygen transport. The addition of moringa leaves significantly enhances the iron content, making the smoothie advantageous for supporting healthy iron levels.

**CALCIUM**

The analysis of calcium content was conducted using ICP-OES/AAS, revealing a level of 120 mg/100 g. Calciumisavitalmineralnecessaryforthedevelopmentandupkeepofstrongbonesandteeth.Additionally, it is crucial for muscle contraction, the transmission of nerve impulses, blood coagulation, and numerous metabolic functions. The calcium found in the smoothie mainly

comes from milk and moringa leaves. This elevated calcium level increases the nutritional benefits of the drink, making it especially advantageous for children in their growth phase, adults, and elderly individuals who need sufficient calcium intake.

## STATISTICALANALYSIS

Thesensoryevaluationdataweregatheredandanalyzedthroughdescriptivestatisticsandaone-samplettest.

Meanscoresandpercentageswerecomputedforvariousattributesincludingappearance,colour,aroma,taste, texture, and overall acceptability.

To assess the statistical significance of the overall acceptability score, a one-sample t-test was conducted, comparing the observed mean to the hypothesized mean value of 3 (indicating neutral acceptability).

Statisticalsignificancewasestablishedatp< 0.05.

## RESULTS

## SENSORYEVALUATIONOFMORINGASMOOTHIE

The sensory evaluation of the moringa smoothie that was developed was conducted using a 5-point hedonic scalewithapanelconsistingof50participants.Theproductwasassessedbasedonitsappearance,color,taste, texture, and overall acceptability. The findings regarding overall acceptability, which indicate the panelists' general preference for the product, are illustrated in Figure 1.

## OVER ALL ACCEPTABILITY

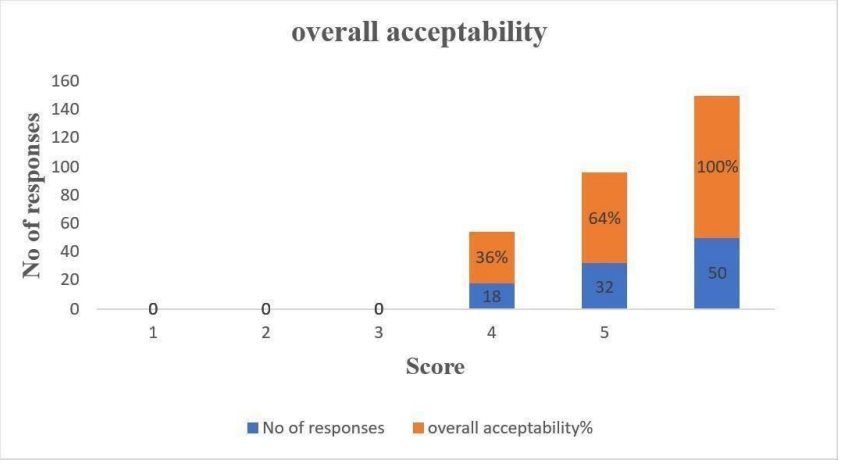


**Figure 1.**

Thegraphillustratestheoverallsensoryassessmentofthemoringasmoothiedeveloped,basedonthef

eedback from the panelists utilizing a 5-point hedonic scale. It was noted that none of the panelists assigned scores between1and3totheproduct,signifyingalackofdissatisfaction.Thedistributionofscoresrevealedthat18 panelists (36%) awarded the product a score of 4, while 32 panelists (64%) assigned it a score of 5. This suggests that the moringa smoothie developed has outstanding overall acceptability and was greatly favored by the panelists.

## PROXIMATECOMPOSITIONANDMINERALANALYSISOFMORINGA SMOOTHIE

Theproximatecompositionandmineralcontentofthemoringasmoothiedevelopedaredetailedin Table

This smoothie provides 85 kcal of energy, 3.5 g of protein, 15.0 g of carbohydrates, 2.2 g of fat, and 3.0 g of dietary fiber per 100 g of the product.Additionally, it contains 2.5 mg of iron and 120 mg of calcium per 100 g. The inclusion of moringa leaves, oats, chia seeds, banana, and dates has significantly enhanced the nutritional profile of the smoothie. The relatively high levels of calcium and iron suggest that this product could be avaluable dietary choice for increasing micronutrient intake. Moreover, the combination of dietary fiber, protein, and essential minerals further boosts the functional and nutritional benefits of the smoothie.

## DISCUSSION

The addition of moringa leaves notably boosted the calcium and iron levels in the smoothie, while oats and chia seeds further contributed to its functional benefits by supplying dietary fiber and healthy fats. Consequently, the smoothie developed can be regarded as a nutritious functional beverage that promotes improved nutritional health and supports bone health, especially among children, adolescents, women, and older adults.

## CONCLUSION

This study successfully created and assessed a moringa-based smoothie, establishing it as a nutritious functional beverage appropriate for individuals of all ages.

Theformulationincludedfreshmoringaleaves,banana,dates,oats,milk,andchiaseeds,resultingina product

thatboastsenhancednutritionalvalueandappealingsensoryattributes.Nutritionalanalysisindicatedthatthe

smoothieprovidessignificantamountsofenergy,protein,dietaryfiber,iron,andcalcium,categorizingitasa nutrient-rich beverage with potential health advantages.

The sensory evaluation revealed a high level of acceptability among the panelists, who rated the appearance, color,taste,texture,andoverallacceptabilitypositively.Theadditionofmoringaleavesnotablyenhancedthe nutritional profile of the smoothie without compromising its sensory quality. Furthermore, the inclusion of functionalingredientslikeoatsandchiaseedsaugmentedthehealth-promotingcharacteristicsoftheproduct.

In summary, the moringa smoothie developed in this study can be regarded as a healthy and functional beverage that may enhance nutrient intake, particularly in terms of calcium, iron, and dietary fiber. Its favorable sensory acceptance and rich nutritional profile render it an appropriate dietary choice for children, adolescents,adults,andtheelderly.Thisstudyunderscoresthepotentialofmoringaasasignificantingredient in the creation of functional food products aimed at fostering health and well-being.

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