

Development of an Immune Booster Turmeric *Curcuma longa* Infused Mango Ginger *Curcuma amada roxb* Rice Paste

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Abstract

In India, specifically in the southern states, rice is one of the highly consumed staple foods. To reduce the cooking time, rice pastes have been profoundly innovated and are manufactured in quite a few industries. Rice paste, that is considered as Ready-To-Eat (RTE) food product can be instantly mixed with a bowl of rice and can be consumed without much of preparation and it don't require much cooking time. The aim is to formulate an instant, ready to eat Rice paste using fresh turmeric, mango ginger, apple pulp and spices. The study involved preparation of rice paste by varying the ratio of mango ginger and apple pulp. The sensory quality of the developed rice paste was then assessed, and the proximate composition of both the modified version and control was estimated for comparison, further cost calculation was carried out. Main ingredients such as apple pulp, mango ginger, turmeric and ginger were obtained locally at Mysore. Additional ingredients like spices, Oil, salt were also locally sourced. 9-point Hedonic scale was used for sensory analysis and standard A.O.A.C (2005) methods were applied for proximate analysis. Among the variations tested, considering cost as an attribute, MGRP2 emerged as the most preferred sample in terms of sensory evaluation, with superior nutritional aspects on par with the control and it was constituted with quite higher levels of fibre, protein, calcium and phosphorus than control. The study successful in developing an immune booster, RTE Mango Ginger Rice Paste (MGRP2) with superior nutritional profile characterized by higher protein, fibre, calcium and phosphorus than that of control.

Keywords: Mango Ginger; Apple Pulp; Rice Paste; Anti-inflammatory; Anti-oxidant.

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INTRODUCTION

Over the past two decades, Indian cuisine and lifestyle have undergone significant changes due to factors like economic liberalization, dual incomes, nuclear families, creative cooking methods, media proliferation, and shifting eating habits. With long work hours during the week and weekends spent outside with family, people now have limited time for cooking, leading to a growing reliance on prepared foods.¹ This increased demand for ready-to-eat (RTE) options has expanded the processed and packaged food sectors, offering a wide array of products such



as instant breakfast items, bakery goods, meats, and prepared vegetables. Additionally, there's a rising preference for vegetarian and vegan RTE meals, driven by ethical considerations and health awareness. Consumers actively research RTE brands to find products that align with their nutritional requirements and taste preferences.²

Mango ginger, scientifically known as (*Curcuma amada roxb*), is a spice that thrives in tropical soils and is considered underutilized. Referred to as Mango Ginger in English, Karpuraharidra in Sanskrit, Amada in Bengali, Ambehaldi or MangaiShunti in Kannada, and Manga Inchi in Malayalam, it is native to Bengal but widely cultivated across India. Despite its morphological and phylogenetic similarities to ginger (*Zingiber officinale*), mango ginger boasts a unique mango like flavor, attributed in part to cis-ocimene, a volatile aromatic compound found in its essential oil.

In culinary applications, raw Mangoginger is prized for its exotic taste and finds use in pickles, curries, salads, and other dishes, particularly in peninsular India. Beyond its culinary allure, Mangoginger holds significant ethnobotanical importance. Traditionally, it has been employed in treating various ailments such as abdominal pain.³⁻⁵

Turmeric, derived from the (*Curcuma longa*) herb, is widely utilized as an herbal remedy across South Asia. It addresses various health concerns such as rheumatoid arthritis, uveitis, conjunctivitis, skin conditions and infections. Additionally, it aids in wound healing and supports liver function. Its medicinal properties extend to digestive issues like indigestion, flatulence, and abdominal discomfort. Turmeric's anti-inflammatory, antimicrobial, and carminative qualities make it effective for managing conditions such as colic and dyspepsia. Particularly beneficial for digestive health, turmeric targets intestinal disorders like inflammatory bowel disease and colon cancer.⁶

For the base ingredient, we used apple pulp. The reason behind using apple pulp is that, it is rich in

polyphenols and dietary fibers and also bland in taste which does not alter the flavours.

For the development of rice paste initially we procured the apple and processed into pulp. For the large scale production, we can procure the apple pulp from Kashmir region which will cost less, making the product cost effective.

Objectives of the study

- Formulation of ready-to-eat (RTE) mango ginger rice paste by blending mango ginger and fresh turmeric into the recipe.
- Assessment of the sensory attributes of the newly developed rice paste.
- Determination of the nutritional composition of both the experimental variation and the control sample.
- Calculation of the production costs associated with manufacturing the RTE mango ginger rice paste.

Procurement of raw materials

The research took place at the Department of Food Processing and Engineering, JSS College of Arts, Commerce & Science in Mysore, with the objective of creating mango ginger rice paste. Locally sourced ingredients such as apple pulp, mango ginger, turmeric, and ginger were utilized in the study. Furthermore, supplementary components including red chili powder, pepper powder, coriander powder, salt, citric acid, mustard oil, sunflower oil, mustard seeds, cumin seeds, asafoetida, and curry leaves were also obtained from the local area in Mysore.

Formulation of the product

The rice paste formulation primarily consisted of apple pulp and mango ginger as key ingredients. By adjusting the proportions of mango ginger and apple pulp, a total of six different variants were developed to explore various compositions and their potential effects on the final product.

Table 1: Product formulation for preparation of Mango Ginger Rice

Ingredients (G)	Control	MGRP 1	MGRP 2	MGRP 3	MGRP 4	MGRP 5
Mango Ginger	–	15	30	45	60	75
Apple Pulp	75	60	45	30	15	-
Fresh Turmeric	2	2	2	2	2	2
Ginger	4	4	4	4	4	4
Chilly Powder	11	11	11	11	11	11

table cont....

Coriander	5	5	5	5	5	5
Pepper	3	3	3	3	3	3

Method of preparation

The fresh produce, like apple, mango ginger, turmeric rhizome and ginger were pre-processed. They were cleaned thoroughly, sorted, peeled, cut into required size, blanched, and were packed in aseptic conditions and further stored using freezing technique.

The Mango Ginger Rice Paste was prepared by sautéing the above-mentioned fresh produce in sunflower oil, followed by addition of spices and seasonings. The tempering is prepared and added at the end of the cooking process to enhance the overall flavour and increase the shelf life by using mustard oil.

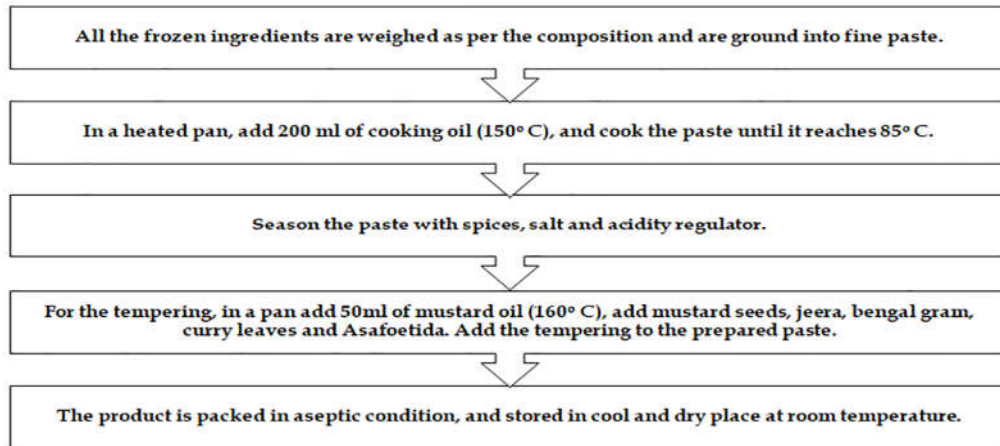


Fig. 1: Flow Chart of preparation of Mango Ginger Rice Paste (gm/100gm) Paste (gm/100gm).

Evaluation of organoleptic properties of Rice Paste

The developed product was subjected for the organoleptic properties using nine point hedonic scale which ranges from (0-9) by semi-trained panellists. All six formulations, including control were evaluated to consider for further analysis.⁷

Proximate analysis of Mango Ginger Rice Paste

The proximate analysis was conducted in triplicate using established A.O.A.C. (2005)

methods. Crude fiber content was assessed using a Crude Fiber Analyzer. Carbohydrate content was calculated by subtracting the combined moisture, protein, fat, and ash content from 100 per 100g of the sample. Moisture content was determined using a hot air oven at temperatures ranging from 98 to 100°C, ash percentage was measured through high-temperature incineration (600°C) in a muffle furnace, and fat content was estimated using the Soxhlet apparatus. Energy values were computed using the formula: Energy value = Protein × 4 + Carbohydrate × 4 + Fat × 9.⁸⁻¹¹



Fig. 2: Mango Ginger Rice Paste prepared from partial replacement of apple pulp with mango ginger in different proportions

Additionally, mineral analysis of iron and phosphorus was conducted using Atomic Absorption Spectrometry (AAS) due to its recognized accuracy and precision.¹²

Statistical analysis:

The data obtained from this study underwent statistical analysis using the Holm Sidak method to assess significance, with a predetermined level of $p \leq 0.05$. This approach allowed for rigorous examination of the results, ensuring robust conclusions regarding the impact of variables on the outcomes of the study.¹³

RESULT AND DISCUSSION

Sensory evaluation of Mango Ginger Rice Paste

The research aimed to develop Mango Ginger Rice Paste by substituting apple pulp with varying proportions of Mango Ginger (15%, 30%, 45%, 60%, 75%). Table 2 displays the impact of these substitutions on the sensory qualities of the Rice Paste. Results show that MGRP 1, MGRP 2, and MGRP 3 scored similarly to the control, indicating comparable sensory attributes. However, MGRP 4 and MGRP 5 received lower scores, suggesting they were less acceptable compared to the other variations.

Table 2: Sensory Evaluation of Mango Ginger Rice Paste, values are mean \pm SD (n=30), p value ≤ 0.05

Variation	Appearance	Colour	Texture	Flavour	Taste	Overall
Control	7.17 \pm 0.80	7.29 \pm 0.91	7.11 \pm 1.05	7.05 \pm 1.08	7.32 \pm 0.93	7.11 \pm 1.36
MGRP 1	7.11 \pm 1.11	7.05 \pm 0.96	7.17 \pm 1.01	6.76 \pm 1.14	7.29 \pm 0.91	7.17 \pm 1.01
MGRP 2	8.01 \pm 0.61	7.88 \pm 0.92	7.88 \pm 0.85	7.82 \pm 1.01	7.17 \pm 0.95	7.94 \pm 0.82
MGRP 3	7.41 \pm 0.93	7.29 \pm 1.64	7.29 \pm 1.31	7.17 \pm 1.33	7.31 \pm 0.86	7.47 \pm 1.23
MGRP 4	6.64 \pm 1.05	6.17 \pm 0.80	6.76 \pm 0.97	6.52 \pm 1.17	7.29 \pm 0.98	6.58 \pm 1.22
MGRP 5	6.28 \pm 0.91	6.11 \pm 1.05	7.17 \pm 1.01	6.41 \pm 1.00	7.29 \pm 0.92	6.23 \pm 0.97

Proximate Composition of Mango Ginger Rice Paste

Table 3: Nutritional composition of Mango Ginger Rice Paste (30%) compared with control, values are mean \pm SD (n=3), p value ≤ 0.05

Nutrients	Control	MGRP 2
Moisture (%)	31.34 \pm 0.29	30.42 \pm 0.18
Energy (Kcal)	102.26 \pm 0.16	95.81 \pm 0.13
Carbohydrate (g)	17.12 \pm 0.24	15.03 \pm 0.34
Protein (g)	2.69 \pm 0.06	3.04 \pm 0.10

Table Cont...

Fat (g)	2.19 \pm 0.11	2.22 \pm 0.19
Total fibre (g)	8.85 \pm 0.04	9.65 \pm 0.09
Ash (g)	8.11 \pm 0.34	9.07 \pm 0.29
Calcium (mg)	31.28 \pm 0.09	35.66 \pm 0.11
Phosphorous (mg)	62.9 \pm 0.14	80.87 \pm 0.26
Iron (mg)	3.26 \pm 0.26	3.88 \pm 0.19

The proximate analysis was conducted to determine the composition of the accepted Mango Ginger Rice Paste (MGRP 2) and the control, and the results are displayed in Table 3. MGRP 2 showed higher values for protein, compared to the control, and fat remained same, whereas carbohydrate content was lower. Additionally, the fibre, ash, and other minerals such as calcium, phosphorous, iron and sodium content were higher in MGRP 2.

Cost analysis of Mango Ginger Rice Paste:

The total cost of producing MGRP2 amounts to Rs. 40 per 100g. This computation encompasses the combined expenses of procuring all ingredients from the market, as well as factoring in costs related to labor, gas, taxes, electricity, and packaging materials.

CONCLUSION

The study aimed to develop a Ready-to-Eat (RTE) Rice paste enriched with turmeric, ginger,

mango ginger, and apple pulp, enhancing its nutritional value. Mango ginger, known for its mango like aroma, contributes to traditional medicine and adds a unique flavor dimension. Ginger's antioxidant properties and turmeric's antimicrobial benefits further enhance the product's health benefits. Additionally, the inclusion of apple pulp, rich in polyphenols and dietary fibers, boosts nutritional content without compromising taste. MGRP2 emerged as the favored variation, offering comparable nutritional benefits to the control at a cost-effective price point. This innovation addresses

the demand for convenient, nutritious RTE options in regions where rice is a dietary staple, marking a significant advancement in culinary convenience and health consciousness.

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