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Ragi Millet Based Paneer as a Sustainable Plant Based Protein Alternative

A Study on Consumer Perception and Purchase Intention

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Abstract: This study examines ragi millet–based paneer as a sustainable plant-based protein alternative and analyses consumer perception and purchase intention. Ragi (finger millet) is rich in calcium, iron, dietary fibre, and essential amino acids and provides several health benefits. However, millet consumption has declined in urban areas due to changing food habits. At the same time, paneer remains an important protein source in vegetarian diets in India. Integrating ragi with paneer may improve the nutritional value of traditional foods and promote millet consumption.

Keywords**:** Ragi millet, Ragi paneer, Plant-based protein alternative, Millet-based foods, Functional foods, Sustainable nutrition

1.1 INTRODUCTION

Ragi, or finger millet (Eleusine coracana), is a highly nutritious cereal extensively cultivated in India and parts of Africa. Known for its health benefits, it is rich in calcium, iron, dietary fibre, and essential amino acids, making it a valuable addition to a balanced diet. Research indicates that finger millet has more calcium than most other cereals, supporting bone health and nutritional security, especially in developing nations (Gopalan, Rama Sastri & Balasubramanian, 2012; Kumar et al., 2018; Devi, Vijayabharathi, Sathyabama, Malleshi & Priyadarisini, 2014; Shobana, Krishnaswamy & Sudha, 2013).

Finger millet, also called ragi, is recognised for its therapeutic and functional benefits. Its high content of dietary fibre and polyphenols enhances antioxidant activity, helping prevent chronic conditions such as diabetes, heart disease, and obesity. Because of its slow digestion and low glycemic index, ragi helps maintain stable blood sugar levels and supports metabolic health (Sharma & Kapoor, 2023; Chethan & Malleshi, 2007; Pandey et al., 2016; Srivastava & Singh, 2020).

Despite its health advantages, millet consumption has decreased in urban areas due to lifestyle shifts, food system modernisation, and increased intake of processed foods. However, interest in millets is resurging, fueled by increased awareness of healthy eating and government initiatives to promote millets within sustainable agriculture and food security. Experts emphasise the need to develop innovative, value-added millet products to enhance their appeal to modern consumers (Kumar et al., 2018; Gupta, Shrivastava & Sharma, 2021; Saleh, Zhang, Chen & Shen, 2013; Taylor & Emmambux, 2008).

Paneer has become one of India's most popular dairy products and a key protein source in vegetarian diets. Its widespread use spans household cooking, restaurants, and food services, thanks to its versatility and nutritional value. The boom in demand for protein-rich foods, urbanisation trends, and the growth of organised retail have all fueled the rapid expansion of the paneer industry in India (Bansal & Rajorhia, 2012; Aneja, Mathur, Chandan & Banerjee, 2002; Gupta & Mandal, 2016; IMARC Group, 2024).

The rapid growth of the paneer market has spurred innovation in dairy products. As consumers become more health-conscious, there is increased demand for functional and fortified foods that blend traditional ingredients with modern dietary requirements. Adding nutritionally dense ingredients like ragi to paneer can enhance its nutritional profile and promote millet intake. These value-added products can help address nutritional deficiencies and meet the growing demand for healthy, protein-rich foods (Kumar et al., 2018; Pandey et al., 2016; Gupta et al., 2021; Sharma & Kapoor, 2023).

Integrating ragi with paneer to create ragi-panneer is a promising innovation in the food industry. This blend could offer increased nutritional benefits and encourage the consumption of millets among urban consumers. Developing and assessing such products necessitates understanding consumer awareness, perception, and acceptance, which underpins this study.

1.2 NEED FOR THE STUDY

Paneer is a key protein source for vegetarians in India. Its popularity has surged because of its taste, versatility, and high nutritional content. The rise of organised retail, restaurants, and ready-to-eat foods has further boosted the growth of the paneer market. Research shows that India's paneer market is projected to expand rapidly, driven by growing consumer demand and innovation in dairy products. (IMARC Group)

The rapid increase in paneer consumption has raised several concerns, including rising dairy production costs, limited shelf life, and occasional adulteration and quality issues. As a result, researchers and food technologists are exploring alternative and fortified products. Creating innovative foods that blend plant-based nutrients with dairy could help solve these issues and enhance nutritional value. Ragi offers a great chance for value addition. High in calcium, fibre, and important micronutrients, it can boost the nutritional content of traditional foods. Adding ragi to paneer products could create healthier options that support weight control, improve digestion, and provide additional nutritional benefits. (Lippincott Journals)

Additionally, promoting ragi-based value-added products can boost millet consumption, crucial for sustainable agriculture and nutritional security. Exploring ragi paneer as a functional food is important for assessing consumer acceptance, market potential, and product development opportunities.

1.3 SCOPE OF THE STUDY

This study examines consumer perception and acceptance of ragi paneer as a value-added food product. As awareness of healthy eating and functional foods grows, the demand for innovative, nutritious options is increasing rapidly. The study investigates consumer awareness of millet-based foods, their eating habits related to paneer, and their willingness to try ragi-based paneer products. Understanding these preferences is crucial for assessing the potential success of launching such a product in the market. The study also analyses consumer concerns regarding the taste, price, shelf life, packaging, and branding of ragi paneer. These elements significantly influence purchasing decisions and product acceptance.

Market trends indicate that the expanding paneer industry, combined with growing consumer interest in health foods, points to significant potential for value-added dairy products. As India's paneer market grows quickly, innovative options like ragi paneer could present opportunities for entrepreneurs and food companies to create healthier choices. (IMARC Group). The study aims to evaluate the feasibility and market acceptance of ragi paneer and to support the promotion of millet-based functional foods.

1.4 OBJECTIVES OF STUDY

To analyse the willingness, purchase intention, and factors influencing the acceptance of ragi paneer as a healthier alternative product.

1.5 RESEARCH METHODOLOGY

Research methodology is the structured approach used to gather, examine, and interpret data to fulfil the study's goals.

TYPE OF DATA

The research employed both primary and secondary data sources.

Primary data were gathered directly from respondents via a structured questionnaire that assessed awareness, perceptions, and willingness to purchase ragi paneer products.

Secondary data was collected from research journals, books, government reports, and online databases concerning millets, ragi nutrition, and paneer market trends.

SAMPLE SIZE

The main data for the study were gathered from 35 respondents.

RESPONDENT PROFILE

The respondents were professors from the Government Arts College (Autonomous) in Coimbatore.

DATA COLLECTION METHOD

A structured questionnaire was used to gather responses from the participants.

Sampling Technique

The study used convenience sampling by selecting respondents who were available and willing to participate.

Data Analysis

The collected data were analysed using simple percentage calculations and descriptive statistics to understand consumer awareness, perception, and purchase intent regarding ragi paneer.

Table 1 Gender

S.No	Gender	Frequency	Percent
1	Male	14	34.1
2	Female	21	51.2
	Total	41	100.0

Table 1 indicates that among 41 respondents, 21 (51.2%) are female and 14 (34.1%) are male, showing that most respondents are female.

Table 2 Age

S.No	Age	Frequency	Percent
1	18-24	5	12.2
2	25-34	1	2.4
3	35-44	8	19.5
4	45 ABOVE	21	51.2
5	Total	41	100.0

Table 2 shows that most respondents are aged 45 years and above, with 21 respondents (51.2%). The next largest group is 35–44 years, with 8 respondents (19.5%). The smallest group is 25–34 years, comprising only 1 respondent (2.4%).

Table 3 Education

S.No	Education	Frequency	Percent
1	UG	3	8.6
2	PG	3	8.6
3	PHD	29	82.9
4	Total	35	100.0

Table 3 shows that the majority of respondents hold a PhD (29, 82.9%), while undergraduate and postgraduate respondents each number 3, accounting for 8.6%

Table 4 Monthly Income.

S.No	Monthly Income	Frequency	Percent
1	10000	3	8.6
2	25000	2	5.7
3	50000	1	2.9
4	50000 ABOVE	29	82.9
	Total	35	100.0

Table 4 indicates that most respondents earn over ₹50,000 per month, with 29 respondents (82.9%). A smaller portion falls into the income groups of ₹10,000 (8.6%), ₹25,000 (5.7%), and ₹50,000 (2.9%).

Table 5 Place Of Residence

S.No	Place of Residence	Frequency	Percent
1	Metropolitans	35	100.0

Table 5 shows that all respondents (100%) live in metropolitan regions.

Table 6 Region

S.No	Region	Frequency	Percent
1	Tamil Nadu	35	100.0

Table 6 indicates that all respondents (100%) are from Tamil Nadu.

Table 7 Food Preference

S.No	Food Preference	Frequency	Percent
1	Strict vegetarian	8	22.9
2	Eggetarian	11	31.4
3	Occasional non vegetarian	9	25.7
4	Regular non vegetarian	7	20.0
	Total	35	100.0

Table 7 shows that the most respondents are egg eaters, with 11 (31.4%), followed by occasional non-vegetarians (9, 25.7%), strict vegetarians (8, 22.9%), and regular non-vegetarians (7, 20.0%).

Table 8 How often do you consume paneer

S.No	Consume	Frequency	Percent
1	Weekly	9	25.7
2	Monthly	16	45.7
3	Occasionally	10	28.6
	Total	35	100.0

Table 8 shows that 16 respondents (45.7%) eat paneer monthly, 10 (28.6%) eat it occasionally, and 9 (25.7%) eat it weekly.

Table 9 Why do you consume paneer

S.No	Why do you consume paneer	Frequency	Percent
1	Protein	12	34.3
2	Taste	17	48.6

3	Diet	6	17.1
	Total	35	100.0

Table 9 indicates that taste is the primary reason for consuming paneer, cited by 17 respondents (48.6%). This is followed by its protein content, mentioned by 12 respondents (34.3%), and dietary reasons, noted by 6 respondents (17.1%).

Table 10 Are you satisfied with existing paneer products

S.No	Satisfication	Frequency	Percent
1	Highly satisfied	2	5.7
2	Satisified	19	54.3
3	Neutral	12	34.3
4	Dissatisfied	2	5.7
	Total	35	100.0

Table 10 shows that 19 respondents (54.3%) are satisfied with current paneer products, 12 (34.3%) are neutral, 2 (5.7%) are highly satisfied, and 2 (5.7%) are dissatisfied.

Table 11 Do you look for plant-based

S.No	Protein alternatives	Frequency	Percent
1	Sometimes	17	48.6
2	Rarely	14	40.0
3	Never	4	11.4
	Total	35	100.0

Table 11 shows that 17 respondents (48.6%) sometimes seek plant-based protein options, 14 respondents (40.0%) rarely do so, and 4 respondents (11.4%) never search for them.

Table 12 Are you aware of millet-based food products

S.No	Millet-based food	Frequency	Percent
1	Yes	2	5.7
2	No	33	94.3
	Total	35	100.0

Table 12 indicates that awareness of millet-based food products is quite minimal, with only 2 respondents (5.7%) aware and 33 respondents (94.3%) unaware.

Table 13 Have you consumed ragi-based products

S.No	Ragi-based product	Frequency	Percent
1	Occasionally	20	57.1
2	Onec	15	42.9
	Total	35	100.0

Table 13 shows that 20 respondents (57.1%) have consumed ragi-based products occasionally, while 15 respondents (42.9%) have tried them only once.

Table 14 Perception about ragi/millets

S.NO	Perception	Frequency	Percent
1	Strong	11	31.4
2	Disagree	17	48.6
3	Neutral	7	20.0
	Total	35	100.0

Table 14 shows that 17 respondents (48.6%) disagree with the perception statements about ragi or millets, whereas 11 respondents (31.4%) strongly agree, and 7 respondents (20.0%) are neutral.

Table 15 STATEMENT

S.No	Statement	Mean	SD	Rank
1	Millets are healthy	4.9143	0.28403	2
2	Millets are rich in protein	5.0000	0.00000	1
3	Millet products are tasty.	3.6286	0.73106	4
4	Millet foods are suitable for fitness	4.8857	0.32280	3

Table 15 shows that respondents strongly agree that millets are high in protein, with a mean score of 5.0000. They also consider millets healthy (Mean 4.9143) and suitable for fitness (Mean 4.8857). In contrast, the statement that millet products are tasty has a lower mean value of 3.6286.

Table 16 How appealing is this concept

S.No	Appealing	Frequency	Percent
1	Very appealing	3	8.6
2	Appealing	7	20.0
3	Neutral	21	60.0
4	Unappealing	2	5.7
5	Very unappealing	2	5.7
	Total	35	100.0

Table 16 indicates that 21 respondents (60.0%) hold a neutral view of the concept, 7 respondents (20.0%) find it appealing, 3 respondents (8.6%) consider it very appealing, and 4 respondents (11.4%) perceive it as unappealing or very unappealing.

Table 17 Would you try Ragi Paneer

S.NO	Ragi paneer	Frequency	Percent
1	Not sure	11	31.4
2	Probably no	15	42.9
3	No	9	25.7
	Total	35	100.0

Table 17 shows that 15 respondents (42.9%) probably would not try ragi paneer, 11 respondents (31.4%) are uncertain, and 9 respondents (25.7%) definitely would not try it.

Table 18 What motivates you to try this product

S.NO	Motivates	Frequency	Percent
1	High protein	2	5.7
2	Lactose free	4	11.4
3	Weight management	27	77.1
4	Curiosity	2	5.7
	Total	35	100.0

Table 18 shows that the primary motivation for trying the product is weight management, cited by 27 respondents (77.1%). Lactose-free benefits are noted by 4 respondents (11.4%), while high protein content and curiosity each motivate 2 respondents (5.7%).

Table 19 What concerns you about this product

S.NO	**Product**	**Frequency**	**Percent**
1	Price	3	8.6
2	Shelf life	26	74.3
3	Availability	6	17.1
	Total	35	100.0

Table 19 indicates that shelf life is the primary concern for 26 respondents (74.3%), availability for 6 respondents (17.1%), and price for 3 respondents (8.6%).

Table 20 Likelihood of Purchase

S.No	Purchase	Frequency	Percent
1	Very unlikely	2	5.7
2	Unlikely	8	22.9
3	Neutral	13	37.1
4	Likely	10	28.6
5	Very likely	2	5.7
	Total	35	100.0

Table 20 shows that 13 respondents (37.1%) have a neutral likelihood of buying the product. Additionally, 10 respondents (28.6%) are likely to buy, 8 (22.9%) are unlikely, and 2 respondents (5.7%) each are very unlikely and very likely.

Table 21 Preferred Packaging Size

S.No	Packaging	Frequency	Percent
1	100	4	11.4
2	200	6	17.1
3	250	8	22.9
4	500	12	34.3
5	1kg	5	14.3
	Total	35	100.0

Table 21 shows that the most popular packaging size is 500 g, chosen by 12 respondents (34.3%). This is followed by 250 g (8 respondents, 22.9%), 200 g (6 respondents, 17.1%), 1 kg (5 respondents, 14.3%), and 100 g (4 respondents, 11.4%).

Table 22 Where would you prefer to buy it

S.No	Prefer to buy	Frequency	Percent
1	Supermarket	10	28.6
2	Local grocery store	8	22.9
3	Organic store	9	25.7
4	Online platform	4	11.4
5	Direct form producer	4	11.4
	Total	35	100.0

Table 22 reveals that supermarkets are the preferred shopping option, with 10 respondents (28.6%) selecting them. Organic stores come next with 9 respondents (25.7%), followed by local grocery stores with 8 respondents (22.9%). Both online platforms and direct purchases from producers are equally mentioned by 4 respondents (11.4%).

Table 23 Would branding influence your purchase decision

S.No	Purchase	Frequency	Percent
1	Yes	24	68.6
2	No	9	25.7
3	Maybe	2	5.7
4	Total	35	100.0

Table 23 indicates that branding affects the purchase decision for 24 respondents (68.6%), while 9 respondents (25.7%) say branding does not influence them, and 2 respondents (5.7%) are uncertain.

Table 24 Current price of panner (200g approx.) = ₹80–₹120

S.No	Price	Frequency	Percent
1	100-120	8	22.9
2	120-150	20	57.1
3	ABOVE 150	7	20.0
4	Total	35	100.0

Table 24 shows that most respondents favour a price range of ₹120–₹150 for paneer, with 20 respondents (57.1%). This is followed by ₹100–₹120, chosen by 8 respondents (22.9%), and above ₹150, preferred by 7 respondents (20.0%).

Table 25 Would you pay more for a healthier alternative

S.No	Alternative	Frequency	Percent
1	Yes	27	77.1
2	No	3	8.6
3	Depends on quality	5	14.3
4	Total	35	100.0

Table 25 shows that 27 respondents (77.1%) are willing to pay a premium for a healthier option, while 5 respondents (14.3%) say it depends on quality, and 3 respondents (8.6%) are not willing to pay extra.

FINDINGS

- The study indicates that women make up the majority of the sample.
- Most participants are aged 45 or older.
- A significant number are highly educated, with many holding a PhD.
- The majority earn over ₹50,000 monthly, suggesting they are financially stable consumers.

- All participants live in metropolitan areas within Tamil Nadu.
- The analysis of food preferences shows that vegetarians constitute the largest group, with occasional non-vegetarians and strict vegetarians following. Most respondents consume paneer monthly, while fewer do so weekly or occasionally.
- Taste is the primary reason for eating paneer, with protein content and dietary needs also playing roles. Although many respondents are satisfied with current paneer products, a significant number remain neutral.
- Nearly half of the respondents occasionally seek plant-based protein options, showing moderate interest in alternative sources. Awareness of millet-based foods is quite low among the participants. While many have tried ragi-based products at times, their overall exposure remains limited.
- The perception analysis shows that respondents view millets as healthy, high in protein, and suitable for fitness enthusiasts, although they rate the taste of millet products somewhat lower.
- Most respondents feel neutral about the idea of ragi paneer. A significant number are reluctant to try ragi paneer, while others are unsure.
- Weight management is the primary motivation for trying the product, while shelf life is the main concern among respondents.
- Most respondents display a neutral or moderate intent to purchase.
- The majority of respondents favour a 500 g packaging size.
- Supermarkets are the top choice for buying the product.
- Branding significantly impacts purchase decisions.
- Most respondents are willing to spend between ₹120 and ₹150 on paneer.
- Additionally, a large number of respondents are prepared to pay extra for a healthier version.

SUGGESTIONS

- Awareness programs should be organised to educate consumers about the nutritional advantages of millet-based products.
- Marketing efforts should emphasise the health benefits and high protein content of ragi paneer.
- Enhancing the taste and texture of millet-based paneer can boost consumer acceptance.
- Manufacturers need to address shelf-life concerns through better packaging and preservation methods.
- Promoting these products in supermarkets and organic stores can increase visibility and reach.
- Attractive branding and packaging can influence consumers' purchase decisions positively.
- Offering a variety of package sizes, especially the popular 500 g pack, can attract more buyers.
- Pricing should stay within the ₹120 to ₹150 range to promote sales. Promotional campaigns highlighting weight management and health benefits can motivate consumers to try the product.

CONCLUSION

The study finds that while consumers generally recognise the health benefits of millets, their familiarity with millet-based products like ragi paneer is limited. Although they see millets' nutritional value, their interest in trying ragi paneer is only moderate, mainly due to concerns about taste, shelf life, and product familiarity. Nonetheless, most respondents are willing to pay more for healthier options, suggesting a promising market potential. With increased awareness, better product quality, effective branding, and suitable pricing, ragi paneer could be accepted by consumers and become a successful, value-added dairy alternative.

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