RESEARCH PAPER

OPTIMIZATION OF GROUND AND SPROUTED FLAXSEED (*LINUM USITATISSIMUM* L.) INCORPORATION IN SELECTED SOUTH INDIAN DISHES USING SENSORY EVALUATION

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ABSTRACT

Background: Flaxseed (*Linum usitatissimum* L.) is a nutrient-rich functional food ingredient containing omega-3 fatty acids, dietary fibre, lignans, and antioxidant compounds that provide numerous health benefits. However, its incorporation into traditional foods is often limited because higher levels may adversely affect sensory quality. The present study evaluated the sensory acceptability of selected traditional South Indian foods fortified with ground and sprouted flaxseed.

Methods: A completely randomized experimental design was employed to develop flaxseed-enriched food products. Ground flaxseed was incorporated into masala dosa, masala roti, upma, and bisibelebath at 5%, 10%, and 15% (w/w), while sprouted flaxseed was incorporated into vegetable korma and vegetable pulao. Sensory evaluation was conducted using a nine-point hedonic scale by a panel of 30 participants comprising 15 semi-trained and 15 untrained panelists. Data were analysed using one-way analysis of variance (ANOVA) and independent sample *t*-tests at a significance level of $p < 0.05$.

Results: Ground flaxseed incorporation significantly influenced the sensory characteristics of the developed products. Formulations containing 5% ground flaxseed consistently achieved the highest overall acceptability and produced sensory scores comparable to the control samples, whereas 15% incorporation resulted in a significant decline in taste, aroma, appearance, and overall acceptability. Sprouted flaxseed significantly improved several sensory attributes of vegetable korma, including appearance, taste, aroma, and overall acceptability, while vegetable pulao exhibited significant improvements in taste, texture, and overall acceptability compared with the control formulations ($p < 0.05$).

Conclusion: The findings demonstrate that flaxseed can be successfully incorporated into traditional South Indian foods without compromising sensory quality when used at appropriate levels. Ground flaxseed incorporation at 5% was found to be the most acceptable for cereal-based products, whereas sprouted flaxseed enhanced the sensory quality of vegetable korma and pulao. These results support the potential application of flaxseed as a functional ingredient for developing nutritionally enriched traditional foods with high consumer acceptability.

Keywords: Flaxseed; *Linum usitatissimum*; Functional foods; Sensory evaluation; Traditional South Indian foods; Ground flaxseed; Sprouted flaxseed; Hedonic scale.

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INTRODUCTION

The increasing prevalence of non-communicable diseases (NCDs), including cardiovascular diseases, type 2 diabetes mellitus, obesity, and hypertension, has intensified research on functional foods capable of delivering health benefits beyond basic nutrition. Functional foods enriched with bioactive ingredients have emerged as an effective dietary strategy for reducing the risk of chronic diseases while improving overall nutritional status. Consequently, there is growing interest in incorporating nutrient-rich plant-based ingredients into traditional foods to enhance their nutritional quality without adversely affecting their sensory characteristics and consumer acceptance [1,2].

Flaxseed (*Linum usitatissimum* L.) is recognized as one of the most valuable functional food ingredients because of its unique nutritional composition and diverse health-promoting properties. It is an excellent source of α-linolenic acid (ALA), an essential omega-3 fatty acid that constitutes approximately 50–60% of its total fatty acids, along with high-quality protein, soluble and insoluble dietary fibre, lignans, vitamins, minerals, and several phenolic compounds [3–5]. These bioactive constituents contribute to the

antioxidant, anti-inflammatory, hypocholesterolemic, antihypertensive, antidiabetic, and cardioprotective effects of flaxseed. Regular dietary intake of flaxseed has been associated with improvements in lipid metabolism, glycaemic control, intestinal health, and immune function, as well as a reduced risk of cardiovascular diseases, obesity, metabolic syndrome, and certain hormone-dependent cancers [4–7].

Among the bioactive compounds present in flaxseed, secoisolariciresinol diglucoside (SDG) is the predominant lignan and serves as a precursor of the mammalian lignans enterodiol and enterolactone following intestinal microbial metabolism. These metabolites exhibit antioxidant, anti-inflammatory, and phytoestrogenic activities that have been implicated in the prevention of chronic diseases. In addition, the substantial dietary fibre content of flaxseed promotes gastrointestinal health, enhances satiety, delays glucose absorption, and contributes to improved lipid homeostasis, thereby increasing its potential as an ingredient for the development of functional foods [5, 7, 8].

Despite its exceptional nutritional profile, the incorporation of flaxseed into conventional cereal-based food products remains limited. The high oil and fibre contents of flaxseed can influence dough rheology, colour development, flavour, texture, and overall palatability, particularly when incorporated at higher concentrations. These sensory alterations may reduce consumer acceptance and limit the commercial application of flaxseed-enriched foods. Therefore, optimizing the incorporation level of flaxseed is essential to achieve an appropriate balance between nutritional enhancement and desirable sensory attributes [9, 10].

Processing techniques play a crucial role in improving the nutritional quality and technological functionality of flaxseed. Among these, germination (sprouting) has received considerable attention because it activates endogenous hydrolytic enzymes that reduce antinutritional compounds such as phytic acid, enhance mineral bioavailability, improve protein digestibility, and increase the concentration of antioxidant compounds and other bioactive metabolites [11,12]. Germination has also been reported to improve the functional properties of flaxseed, including water absorption, emulsifying capacity, and digestibility, thereby making sprouted flaxseed a promising ingredient for the formulation of nutritionally enhanced food products [12, 13].

Traditional South Indian foods constitute a major component of the daily diet in many regions of India and are increasingly consumed worldwide owing to their nutritional value and cultural significance. Dishes such as dosa, roti, upma, bisibelebath, pulao, and korma provide suitable matrices for the incorporation of functional ingredients because they are consumed regularly across different age groups and socioeconomic populations. Fortifying these commonly consumed foods with flaxseed may represent an effective and culturally acceptable strategy for increasing dietary intake of omega-3 fatty acids, dietary fibre, and lignans without requiring substantial changes in habitual eating patterns.

Although several studies have investigated the nutritional and functional properties of flaxseed, research examining its incorporation into traditional South Indian foods remains limited. In particular, comparative information regarding the use of ground and sprouted flaxseed in these foods and their influence on sensory quality is scarce. Identifying acceptable incorporation levels is essential for the successful development of functional foods that combine enhanced nutritional value with high consumer acceptability.

Therefore, the present study aimed to develop selected traditional South Indian dishes fortified with ground and sprouted flaxseed at different incorporation levels and to evaluate their sensory characteristics using a standardized hedonic assessment. The findings are expected to provide scientific evidence for the development of nutritionally enriched traditional foods with improved functional attributes and acceptable sensory quality, thereby supporting the promotion of healthier dietary practices through culturally familiar food products.

MATERIALS AND METHODS

Study Design

The study employed a completely randomized design (CRD) to develop flaxseed-enriched traditional South Indian food products and evaluate their sensory acceptability. The experimental work was conducted in two phases. In the first phase, ground flaxseed (*Linum usitatissimum* L.) was incorporated into selected traditional South Indian dishes at three supplementation levels (5%, 10%, and 15%) to determine the optimum incorporation level based on sensory evaluation. In the second phase, sprouted flaxseed was incorporated into selected recipes to assess its sensory acceptability. Control formulations without flaxseed served as the reference for comparison. All formulations were prepared independently in triplicate under standardized laboratory conditions.

Procurement of Raw Materials

Food-grade brown flaxseeds were procured from a certified retail outlet in Mysuru, Karnataka, India. Fresh vegetables, cereals, pulses, spices, edible oil, and other ingredients required for recipe preparation were purchased from local supermarkets. All raw materials were inspected for quality, cleaned to

remove foreign materials and damaged seeds, and stored under ambient laboratory conditions until use.

Preparation of Ground and Sprouted Flaxseed

Whole flaxseeds were washed thoroughly with potable water and air-dried at room temperature. The dried seeds were ground into a fine powder using an electric laboratory grinder immediately before incorporation into the food products to minimize lipid oxidation. The ground flaxseed was stored in airtight containers until use.

For sprouting, flaxseeds were soaked in potable water (seed-to-water ratio 1:3, w/v) for 8 h at room temperature and drained. The hydrated seeds were evenly spread on sterile germination trays lined with moist muslin cloth and maintained at 27 ± 2°C for 4–7 days. Moisture was maintained by spraying sterile water twice daily. Germination was continued until sprouts reached approximately 1–2 cm in length. The sprouted flaxseeds were gently rinsed with potable water, drained, and used immediately for product preparation.

Development of Flaxseed-Enriched South Indian Dishes

Six traditional South Indian dishes, namely masala dosa, masala roti, upma, bisibelebath, vegetable pulao, and vegetable korma, were selected based on their widespread consumption and suitability for flaxseed incorporation.

Ground flaxseed was incorporated into masala dosa, masala roti, upma, and bisibelebath at 5%, 10%, and 15% (w/w) of the total formulation. The flaxseed powder was added during the final stage of mixing to ensure uniform distribution and minimize thermal degradation of heat-sensitive bioactive compounds. Ground flaxseed was introduced into each of 100g dough/ batter at 5g, 10g & 15g respectively just before rolling/spreading. Similarly for other dishes.

Sprouted flaxseed was incorporated into vegetable pulao and vegetable korma at standardized levels established through preliminary optimization trials.

Control samples containing no flaxseed were prepared simultaneously using identical formulations and processing conditions. All food products were prepared using standardized recipes, identical cooking equipment, and uniform processing conditions to minimize batch-to-batch variation.

Sensory Evaluation

Sensory evaluation was conducted using 30 panelists (15 semi trained and 15 untrained panelists) comprising male and female participants aged between 25 and 65 years. Panelists were recruited through convenience sampling from students, faculty members, staff, and residents of Mysuru, Karnataka, India. Individuals with known allergies or intolerance to flaxseed or any ingredients used in the formulations were excluded from the study. All panelists participated voluntarily after providing informed consent, and the confidentiality of participant information was maintained throughout the study.

Freshly prepared samples were served warm in identical disposable containers and identified using randomly generated three-digit codes. Samples were presented in a randomized order under standardized sensory evaluation conditions to minimize positional and order bias. Drinking water was provided between successive samples to cleanse the palate.

Each formulation was evaluated for appearance, colour, aroma, texture, taste, and overall acceptability using the nine-point Hedonic scale, where 9 = "like extremely" and 1 = "dislike extremely." Sensory evaluation was performed immediately after preparation to ensure that all products were assessed under optimum serving conditions.

Statistical Analysis

All product formulations were prepared independently in triplicate, and sensory evaluation data were expressed as mean ± standard deviation (SD). Statistical analyses were performed using IBM SPSS Statistics version 20.0.

RESULTS AND DISCUSSION

The present study was undertaken to understand the acceptability as well as acceptability levels of grounded flaxseed and sprouted flaxseed respectively in selective south Indian food items, as not many studies have been done in this region of food research. The data has been collected from 30 panelist with 15 semi trained (panelists who received orientation on the hedonic scale and evaluation procedure) and 15 untrained panelists for each of the six dishes.

The sensory evaluation of flaxseed dishes was carried out using a 9-point hedonic scale. Further, the package of SPSS 20 version has been used for statistical analysis and independent‘t’ test used to compare mean scores of sensory evaluation on control and experimental groups. To test the attributes on ach of the organoleptic characteristics ANOVA test employed (F-test) to evaluate the final results.

Table 1: Sensory Evaluation of Masala Dosa Incorporated with 5%, 10%, and 15% of Ground Flaxseed.

Attribute	Response (Mean ± SD)				
	Appearance	Taste	Texture	Aroma	Overall Acceptability
Control	7.33 ±1.81	7.23 ± 1.79	7.53 ± 1.83	7.46 ± 1.76	7.38 ± 1.87

5 % Flax Powder	7.63 ±1.81	7.63 ± 1.79	7.43 ± 1.83	7.36 ± 2.06	7.51 ± 1.87
10 % Flax Powder	7.63 ± 1.73	7.56 ± 1.61	7.36 ± 1.58	7.46 ± 1.67	7.50 ± 1.65
15 % Flax Powder	7.60 ± 1.91	7.36 ± 1.83	7.26 ± 1.72	7.16 ± 1.86	7.35 ± 1.83
F – Test	3.12*	3.14*	2.15 NS	2.19 NS	2.11 NS
SE ±	0.09	0.11	0.13	0.14	0.12
CD at 5%	0.23	0.31	-	-	-

*Significant at 5% level, NS : Non-significant, F (3 ;116 df, at 0.05) = 2.68
SE : Standard error, CD : Critical difference

The mean sensory scores of masala dosa incorporated with ground flaxseed at different levels are presented in Table - 1. The mean sensory evaluation indicated that incorporation of flax powder influenced the organoleptic properties of the product to varying degrees. Significant differences ($p < 0.05$) were observed for appearance (F=3.12*) and taste (F=3.14*), whereas texture, aroma, and overall acceptability did not differ significantly ($p>0.05$) among the treatments under study. The 5 % and 10 % flaxseed formulations recorded the highest appearance scores (7.63 ± 1.81 and 7.63 ± 1.73, respectively), while the 5 % formulation achieved the highest overall acceptability score (7.51 ± 1.87), closely followed by the 10% formulation (7.50 ± 1.65).

Sensory scores declined slightly at the 15 % incorporation level, indicating that higher flaxseed concentrations negatively affected product acceptability. These findings suggest that incorporation of ground flaxseed up to 10 % can be achieved without compromising the sensory quality of masala dosa, with the 5 % level being the most acceptable.

Table 2. Effect of Ground Flaxseed Incorporation (5%, 10%, and 15 %,) on the Sensory Attributes of Masala Roti

Attribute	**Response (Mean ± SD)**				
	Appearance	**Taste**	**Texture**	**Aroma**	**Overall Acceptability**
Control	7.53 ± 1.81	7.43 ± 1.79	7.73 ± 1.83	7.56 ± 1.76	7.56 ± 1.80
5 % Flax Powder	7.60 ± 1.97	7.30 ± 1.76	7.60 ± 1.85	7.20 ± 2.15	7.43 ± 1.96
10 % Flax Powder	7.63 ± 1.99	7.36 ± 1.97	7.56 ± 1.77	7.13 ± 1.77	7.42 ± 1.88
15 % Flax Powder	7.33 ± 1.91	7.13 ± 1.83	7.10 ± 1.72	6.93 ± 1.86	7.12 ± 1.83
F – Test	2.98*	3.10*	3.64*	3.75*	2.91*
SE ±	0.10	0.09	0.13	0.14	0.12
CD at 5%	0.28	0.25	0.36	0.39	0.33

*Significant at 5% level, NS : Non-significant, F (3 ;116 df, at 0.05) = 2.68
SE : Standard error, CD : Critical difference

Table - 2 depicts the effect of ground flaxseed incorporation on the Sensory attributes of Masala Roti. The sensory evaluation of masala roti showed statistical significant differences ($p<0.05$) among treatments for all sensory attributes. The control sample received the highest mean scores for texture (7.73), aroma (7.56), appearance (7.53) and overall acceptability (7.56), reflecting the familiarity of the traditional formulation. Among the flaxseed-enriched formulations, the 5 % and 10 % incorporation levels produced sensory mean scores comparable to those of the control, indicating satisfactory consumer acceptance. In contrast, the 15 % formulation exhibited the lowest scores for all sensory attributes from the study.

Finally, the results suggesting that higher flaxseed incorporation adversely affected flavour, texture, and aroma aspects. The reduction in acceptability at higher levels may be attributed to the characteristic nutty flavour and coarse texture imparted by flax powder. Nevertheless, moderate incorporation maintained satisfactory consumer acceptance while enhancing the nutritional value of the product. Masala roti incorporated with 5 % or 10 % flax powder was acceptable, whereas incorporation at 15 % reduced product acceptability.

Therefore, finally moderate flax powder incorporation is recommended for preparing acceptable masala roti as per the final finding evaluated.

Table 3. Sensory Characteristics of Upma Prepared with Different Levels (5%, 10%, and 15 %,) of Ground Flaxseed

Attribute	Response (Mean ± SD)				
	Appearance	Taste	Texture	Aroma	Overall Acceptability
Control	7.78 ± 1.81	7.54 ± 1.79	7.51 ± 1.83	7.06 ± 1.76	7.47 ± 1.80
5 % Flax Powder	7.66 ± 1.81	7.66 ± 1.79	7.66 ± 1.49	7.36 ± 1.67	7.46 ± 1.97
10 % Flax Powder	7.36 ± 1.75	7.26 ± 1.61	7.33 ± 1.75	6.66 ± 1.80	7.15 ± 1.73
15 % Flax Powder	6.93 ± 1.60	6.36 ± 1.9	6.60 ± 1.61	6.16 ± 1.93	6.51 ± 1.76
F – Test	2.47 ^{NS}	3.76*	2.19 ^{NS}	3.74*	3.95*
SE ±	0.18	0.29	0.26	0.32	0.33
CD at 5%	-	0.80	-	0.88	0.91

*Significant at 5% level, NS : Non-significant, F (3 ;116 df, at 0.05) = 2.68
SE : Standard error, CD : Critical difference

The sensory evaluation of upma demonstrated statistical significant differences ($p < 0.05$) in taste (F=3.76*), aroma (F=3.74*), and overall acceptability (F=3.95*), while appearance (F=2.47 ^{NS}) and texture (F=2.19 ^{NS}) remained statistically non-significant and comparable among treatments (Table-3). The 5 % flaxseed formulation achieved the highest taste (7.66 ± 1.79) and texture (7.66 ± 1.49) scores among the experimental samples and exhibited overall acceptability (7.46 ± 1.97) comparable to the control (7.47 ± 1.80). Increasing flaxseed incorporation to 10 % and 15 % resulted in a gradual reduction in sensory scores, with the 15 % formulation showing the lowest acceptability. These findings indicate that low-level flaxseed incorporation preserves desirable sensory attributes in upma.

Incorporation of 5% flax powder produced the most acceptable upma among the experimental samples. Higher levels reduced sensory acceptance, indicating that lower incorporation levels are preferable for maintaining product quality.

Table 4: Response of the Sensory evaluation of Bisibelebath incorporated with 5%, 10%, and 15% of ground flaxseed respectively.

Attribute	Response (Mean ± SD)				
	Appearance	Taste	Texture	Aroma	Overall Acceptability
Control	7.58 ± 1.81	6.54 ± 1.79	6.51 ± 1.83	6.16 ± 1.76	6.70 ± 1.80
5 % Flax Powder	7.24 ± 1.57	6.34 ± 1.90	6.72 ± 1.90	7.03 ± 1.61	6.83 ± 1.75
10 % Flax Powder	6.93 ± 1.30	6.31 ± 1.71	6.51 ± 1.55	6.17 ± 2.00	6.49 ± 1.64
15 % Flax Powder	6.34 ± 1.26	5.55 ± 1.90	6.00 ± 1.73	5.62 ± 2.17	5.88 ± 1.77
F – Test	4.10*	3.46*	2.15 ^{NS}	3.93*	3.57*
SE ±	0.35	0.26	0.39	0.34	0.31
CD at 5%	0.97	0.72	-	0.94	0.86
Diff	1.24	0.99	0.72	1.41	0.95

* Significant at 5% level, NS : Non-significant, F (3 ;116 df, at 0.05) = 2.68
SE : Standard error, CD : Critical difference

Table - 4 reveal the response of the Sensory evaluation of Bisibelebath incorporated with 5, 10 & 15 g of ground flaxseed respectively. The findings reveal that statistical significant differences were observed in appearance, taste, aroma, and overall acceptability ($P<0.05$), while texture remained statistically non-significant ($P>0.05$). Among the flaxseed-incorporated samples, the 5 % formulation recorded the highest mean scores of aroma (7.03 ± 1.61) and overall acceptability (6.83 ± 1.75) scores.

Although the control sample received slightly higher appearance and taste scores, differences between the control and the 5 % treatment were minimal. The 15 % formulation consistently received the lowest sensory scores, indicating that excessive flaxseed incorporation adversely affected product quality. Therefore, the 5 % flex powder incorporation level was considered the most suitable for bisibelebath.

The results indicate that incorporation of 5 % flax powder is most suitable for bisibelebath as it provides good sensory acceptability while maintaining desirable quality characteristics. Higher incorporation levels reduce consumer acceptance.

Figure. 1: Response on the Sensory evaluation on the Attributes of Sprouted Flaxseed Korma

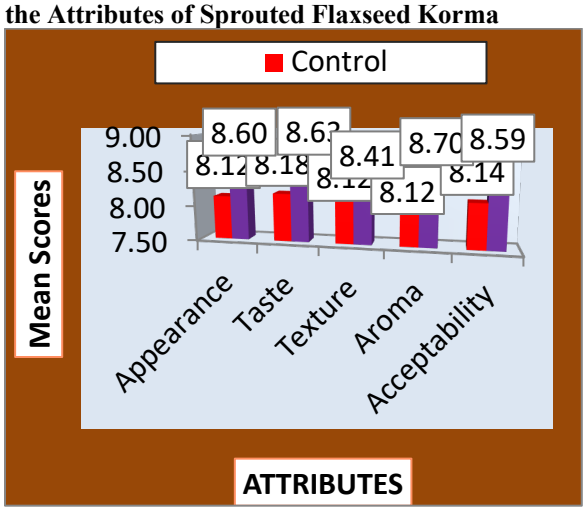

Table 5. Sensory Evaluation of Vegetable Korma Incorporated with 10% of Sprouted Flaxseed

Attribute	Response (Mean ± SD)		't' Test
	Control (n=30)	Experimental (n=30)	
Appearance	8.12 ± 1.04	8.60 ± 0.66	2.13*
Taste	8.18 ± 0.96	8.63 ± 0.67	2.11*
Texture	8.12 ± 0.94	8.41 ± 0.74	1.33 NS
Aroma	8.12 ± 1.00	8.70 ± 0.76	2.53*
Overall Acceptability	8.14 ± 0.99	8.59 ± 0.71	2.02*

* Significant at 5% level, NS : Non-significant, t (58 df, 0.05) = 1.96

The sensory characteristics of vegetable korma prepared with sprouted flaxseed are presented in Table-5 and Figure-1. The sensory evaluation of sprouted flaxseed korma demonstrated significantly higher mean scores on appearance, taste, aroma, and overall acceptability in the experimental sample compared with the control group ($P < 0.05$). Further, mean scores for appearance increased from 8.12 to 8.60, taste aspect from 8.18 to 8.63, aroma from 8.12 to 8.70, and overall acceptability from 8.14 to 8.59.

However, Texture did not differ significantly between the control and experimental formulations ($P>0.05$). These results demonstrate that incorporation of sprouted flaxseed significantly enhanced the sensory quality of vegetable korma without affecting its texture.

Further, sprouted flaxseed incorporation significantly improved the sensory quality of korma, particularly appearance, taste, aroma, and overall acceptability. The product was highly accepted by the sensory panel and can be recommended as a nutritious value-added preparation.

Figure. 2: Response on the Sensory evaluation on the Attributes of Sprouted Flaxseed Pulao

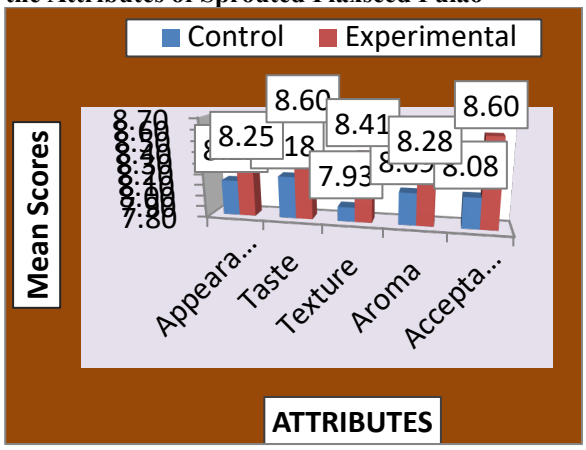

Table 6: Response of the Sensory evaluation of Vegetable Pulao incorporated with 10% of Sprouted flaxseed respectively.

Attribute	Response (Mean ± SD)		't' Test
	Control (n=30)	Experimental (n=30)	
Appearance	8.12 ± 0.97	8.25 ± 0.67	0.60 NS
Taste	8.18 ± 0.93	8.60 ± 0.61	2.07*
Texture	7.93 ± 1.01	8.41 ± 0.72	2.12*

Aroma	8.09 ± 0.89	8.28 ± 0.77	0.88 NS
Overall Acceptability	8.08 ± 0.95	8.60 ± 0.69	2.43*

* Significant at 5% level, NS : Non-significant, t (58 df, 0.05) = 1.96

The sensory evaluation of vegetable pulao incorporated with sprouted flaxseed is presented in Table-6 and Figure-2. The data subjected for statistical test implies the existence of significant improvements ($p < 0.05$) were observed in taste, texture, and overall acceptability compared with the control. Further, the mean scores of taste increased from 8.18 to 8.60, texture from 7.93 to 8.41, and overall acceptability of mean scores from 8.08 to 8.60.

However, appearance and aroma did not differ significantly between the treatments ($P>0.05$). The higher sensory scores obtained for the experimental formulation indicate that sprouted flaxseed can be effectively incorporated into vegetable pulao while maintaining desirable sensory quality and improving overall consumer acceptance.

Sprouted flaxseed pulao was highly acceptable to the sensory panel. The incorporation of sprouted flaxseed significantly enhanced taste, texture, and overall acceptability while maintaining acceptable appearance and aroma, making it a promising functional food product.

SUMMARY

The present study evaluated the sensory acceptability of selected traditional South Indian food products fortified with ground and sprouted flaxseed (*Linum usitatissimum* L.) to identify incorporation levels that enhance nutritional value while maintaining desirable sensory characteristics. Ground flaxseed was incorporated into masala dosa, masala roti, upma, and bisibelebath at 5g, 10g, and 15g levels, whereas sprouted flaxseed was incorporated into vegetable korma and vegetable pulao. Sensory evaluation was conducted using a nine-point hedonic scale with 30 panelists, and the data were statistically analysed using one-way ANOVA and independent sample *t*-tests.

The findings demonstrated that the incorporation level significantly influenced the sensory attributes of the developed products. Among the ground flaxseed formulations, incorporation at 5g consistently achieved the highest overall acceptability and produced sensory scores comparable to the control samples. Although 10g incorporation maintained acceptable sensory quality in most products, a further increase to 15g resulted in a significant decline in taste, aroma, appearance, and overall acceptability, indicating that excessive flaxseed addition adversely affected consumer preference.

In contrast, products prepared with sprouted flaxseed exhibited superior sensory performance. Vegetable korma fortified with sprouted flaxseed showed significant improvements in appearance, taste, aroma, and overall acceptability, while vegetable pulao demonstrated significantly higher taste, texture, and overall acceptability than the corresponding control formulations. These results suggest that the germination process enhances the sensory characteristics of flaxseed, thereby improving its suitability for incorporation into traditional food products.

CONCLUSION

Overall, the study indicates that flaxseed can be successfully incorporated into traditional South Indian foods without compromising consumer acceptability when used at appropriate levels. Ground flaxseed incorporation of approximately 5g is recommended for products such as masala dosa, masala roti, upma, and bisibelebath, whereas sprouted flaxseed is particularly suitable for vegetable korma and vegetable pulao owing to its superior sensory acceptance.

The development of flaxseed-enriched traditional foods offers a practical and culturally acceptable strategy for increasing the dietary intake of omega-3 fatty acids, dietary fibre, and lignans through commonly consumed foods. Such value-added products have considerable potential for promoting healthier dietary habits and supporting the prevention of lifestyle-related non-communicable diseases.

Future studies should investigate the nutritional composition, physicochemical properties, bioactive compound retention, shelf-life stability, and consumer acceptance in larger and more diverse populations. Additionally, evaluating the health benefits of regular consumption through clinical or intervention studies would further support the use of flaxseed-fortified traditional foods as functional foods for public health promotion.

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