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## DEVELOPMENT AND FORMULATION OF VEGAN SPREADS USING OATMILK

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### Abstract

Continual development of novel nutrimental foods is the response of science and industry to the increased consumer awareness regarding health and the role of foods for improving quality of life. In the current review, efforts have been made to use vegan milk for preparation of two differently flavored spread like products. In certain, the food product of development is a spread fundamentally, for table use which is vegan and has a flavor, appearance, uniformity, and spread ability fewer calories. The cereal milk, oat milk is used as the base for the development of lemon flavored and garlic flavored spreads. Rolled oats are used to extract milk. Healthy ingredients like rolled oats, sesame seeds, garlic, lemon, mixed herbs and dates are selected. Shelf-life assessment, sensory evaluation has been conducted based on statistical results of sensory attributes, including proximate nutrient analysis of the spread were conducted professionally. The sensory acceptable scores for garlic flavored spread were: Appearance (4.22), Aroma (4.34), Taste (4.56), Mouth feel (4.42), Texture (3.92). The microbiological quality of garlic flavored spread was inspected for coliform (<10 cfu), Ecoli (<10 cfu), salmonella and staphylococcus aureus (absent), yeast and mould (<10 cfu).

**Keywords:** Garlic, Oatmilk, Spread, Vegan.

### Introduction

Spreads are the products which blend with the idea of healthy nutrition. At the same time, they have good taste and very good spread ability at refrigeration temperature and are able to retain their stand-up property even at surrounding temperatures<sup>[1]</sup>.

Development of fat spread, continued along the lines of attaining lower and lower fat levels without losing the sensory appeal of the high fat product viz., conventional table butter and margarine.<sup>[2]</sup>

The increase in the number of vegetarians, meat avoiders and meat reducers has restored the use of vegan elements which can expand meat products while providing an inexpensive, utilitarian, and high-protein meat replacements.<sup>[3]</sup>

The plant-based diet has gained strength in latest years, with more individuals transforming to the diet, either for good health or more ethical reasons<sup>[4]</sup>. And so, oats have been used as a primary, plant-based milk source in the present study.

Vegan or non-dairy milk substitutes are the rapid growing segment in newer food product development category of special beverage and functional across the world<sup>[5]</sup>.

For its benefits, known for a prolonged time, oats is becoming popular as part of healthy diet and new oat products emerge at the functional food market<sup>[6]</sup>. Conventionally, oats have been in use since long and are considered as antidepressant, antispasmodic, anti-tumor, stimulant, and neurotonic. Oat possesses different pharmacological activities like antioxidant, anti-inflammatory, wound healing, immunomodulatory, antidiabetic and anticholesterolaemic. A wide spectrum of biological activities indicates that oat is a potential therapeutic agent<sup>[7]</sup>.

In an incessantly expanding market of traditional and non-conventional milk and milk products oat milk occupies a principal position and is competing really hard among various substitutes and with dairy milk.<sup>[8]</sup>

Oat milk is made from oat groats(oats that have been cleaned, toasted, and hulled), water. It has a mild taste and is mildly sweet. Its thickness is indistinguishable to that of 1% or skim milk. Oat milk is low in net calories, cholesterol, and saturated fat. It also contains iron and folic acid. At the same time naturally, present sugars give this beverage a quite higher carbohydrate content<sup>[9]</sup>.

Oat milk is exempt from lactose and is a fair source of antioxidant vitamin E, Phytic acid, phenolic acid and avenanthramides and soluble fibre beta-glucan<sup>[10]</sup>.



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Keeping these points in mind, the current study aimed to develop a low-fat vegan spread using oat milk. Oat milk spread can be considered as a semi soft cereal based product when subjected to heat.

Materials and Methodology

1. Oat milk preparation

The preparation of oat milk is primarily based on soaking of oats about for 10 minutes in the water with the ratio of 1:3. The drained oats were ground in a mixer grinder with the ratio of 1:2.5 of oats and water respectively. The prepared milk was filtered using a nut milk bag/sieve. 30gm of oats were used as a standard portion which provided 100ml of oat milk after the extraction.

2. Spread preparation

Plant-based milk alternatives are prepared by disintegration of plant material, which makes the particle composition and size as non-uniform. The size of particles and the stability of the final product depend on the nature of the raw material, the method used for disintegration and storage conditions. Starch constitutes the major portion of the oats (55-60%) with a gelatinization temperature range of 44.7-73.7°C. Heating at high temperature above gelatinization temperature, the oat milk thickens and the desired spread consistency can be obtained. The gelatinization temperature is however increased, as the oats were soaked to remove excess starch before extraction of the milk.

Garlic flavored spread- To the extracted oat milk, garlic cloves (7 in number)(washed, peeled and crushed) were added. Sesame seeds paste (5gm), mixed herbs(5mg), refined sunflower oil(15 ml), salt (pinch), sunflower oil(15ml) were added and subjected to heat(for a boil at 100°C) and allowed to cool.

Lemon flavored spread- To the extracted oat milk, Lemon juice (10 ml), dates paste (4 in number), salt (pinch), sunflower oil(15ml) were added and subjected to heat (for a boil at 100°C) and allowed to cool.

The spread was poured in an air tight container, and stored in the refrigerated conditions.

3. Sensory evaluation

Hedonic scaling is one of the oldest scales used for the sensory evaluation. The present study was conducted using a 5-point hedonic scale. Sensory evaluation test was conducted for parameters such as Appearance, Aroma, Taste, Mouth feel, and Texture. A total of 50 untrained evaluators were randomly opted, served as panelists. Organoleptic evaluations were carried out on 2 products(garlic flavored and lemon-flavored spread) using 5-hedonic scale, the scale ranges from 5-like a lot to 1- dislike a lot in a storage period of 0 to 7 days.

4. Shelf life study

Based on the results of sensory attributes of the garlic flavored and lemon-flavored spread, garlic flavored spread was subjected to microbial, chemical and organoleptic analysis. The results of shelf-life study are presented in the table 3.

Materials

Oats used for the study were rolled oats from the company 'quaker oats'. These are lightly processed whole oats, along with other necessary ingredients purchased from the local market of Hyderabad, India.

Ingredients used in spread preparation- Oats, garlic, sesame seeds, mixed herbs ('keya'), refined sunflower oil, lemon, salt.

Results and Discussion

To know the significant difference between the 2 products from the information obtained from sensory evaluation (where n=50) statistically, chi square test, standard deviation, tests were performed for lemon flavored and garlic flavored spread. Advance tests like Krushkal-Wallis test were also performed.

The results of statistical analysis are presented in the following tables:

Table 1: Mean and Standard deviation						
Product		Appearance	Aroma	Taste	Mouth feel	Texture
Garlic flavor	Mean	4.22	4.34	4.56	4.42	3.92
	N	50	50	50	50	50



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	Std. Deviation	.582	.717	.577	.609	.724
Lemon flavor	Mean	3.82	3.82	3.76	3.88	3.78
	N	50	50	50	50	50
	Std. Deviation	.850	.800	.822	.773	.790
Total	Mean	4.02	4.08	4.16	4.15	3.85
	N	100	100	100	100	100
	Std. Deviation	.752	.800	.813	.744	.757

Figure 1: Mean ranks of sensory attributes

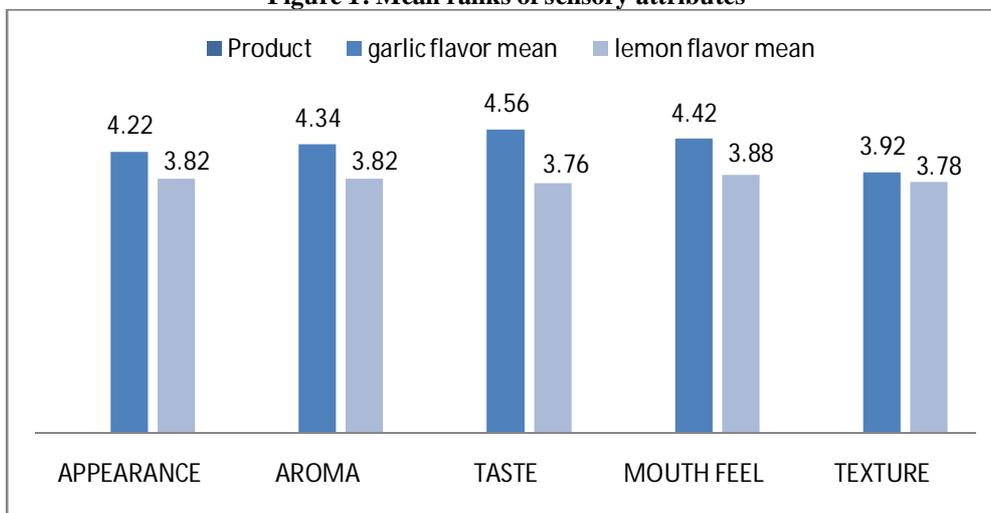
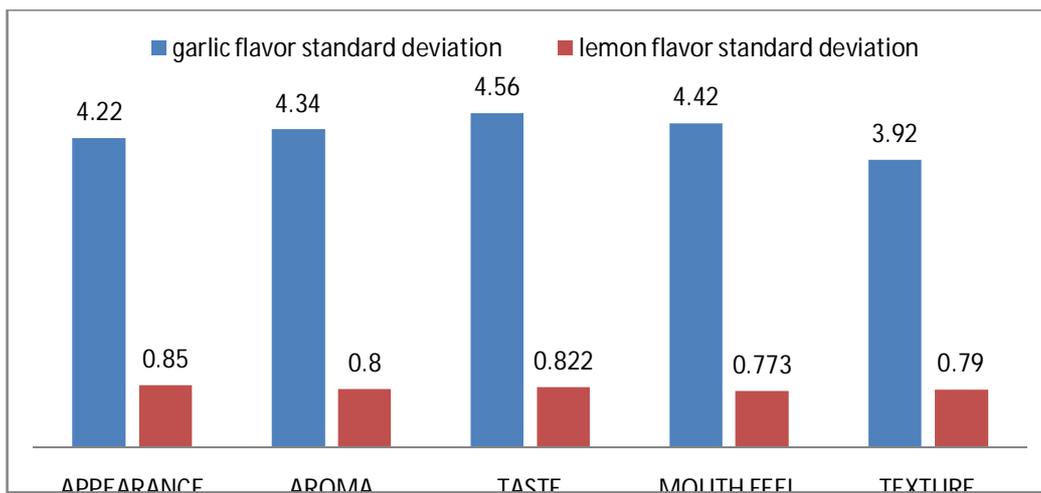


Figure 2: Standard deviation of the spreads



**Appearance-** The appearance percentage within the product was more for garlic flavor which accounted 62% attributing for 'like a little', followed by lemon flavored with 40% of 'neither like nor dislike'. This indicates the difference of acceptability in terms of appearance among two products. The Pearson chi square value is 16.597<sup>a</sup> and Likelihood ratio is 18.045. The asymptomatic significance of Pearson chi-square and likelihood ratio is .001 and .000. **As the values are less than 0.05, all the values are statistically significant.** This indicates the difference of acceptability among two products (garlic flavored and lemon-flavored spread).



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**Aroma** - The percentage within the product of aroma for lemon flavored spread was 52% whereas garlic flavored spread accounted for 38%. This indicates that the aroma of lemon-flavored spread was preferred over garlic flavored spread attributing to ‘like a lot’ and like a little respectively. Sensory attribute ‘aroma’ was found to be statistically significant.

**Taste**- The taste percentage within the product for garlic flavored spread was 60% whereas, lemon flavored spread was 46%. This indicates that the taste of garlic flavored spread was preferred over lemon flavored spread attributing to ‘like a lot’ and ‘like a little’ respectively. The asymptomatic significance values were found to be >0.005 making it statistically not significant.

**Mouth feel**- The mouth feel of garlic flavored spread was preferred over lemon flavored spread as the percentages within the product were 48% and 46% which indicates ‘like a lot’ and ‘like a little’ respectively. The asymptomatic values indicate that the mouth feel attribute is statistically significant.

**Texture**- The percentages within the products were 48% for garlic flavored spread and 38% for lemon flavored spread. This indicates that the garlic flavored spread was preferred over lemon flavored spread and asymptomatic value of significance is found to be >0.005 making it statistically not significant.

All the values were significant and statistically different except taste and texture where the values were found similar.

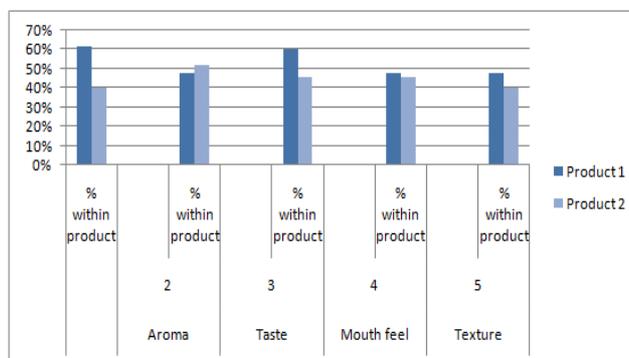
As per the results obtained from one way ANOVA and Krushkal-Wallis test, it is evident that **garlic flavored spread is preferred over lemon flavored spread** statistically.

Table 2: Percentages within products

Crosstab			Product	
			1	2
Appearance	1	Count	31	20
		% Within product	62%	40%
Aroma	2	Count	24	26
		% Within product	48%	52%
Taste	3	Count	30	23
		% Within product	60%	46%
Mouth feel	4	Count	24	23
		% Within product	48%	46%
Texture	5	Count	24	20
		% Within product	48%	40%

Figure 3: Percentages within product

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Table 4: Nutritional analysis results of garlic flavored spread:

S.no	Parameters	Units	Methods	Results of analysis
1.	Energy	Kcal/100g	SOP-CHM-29-00	76.85
2.	Carbohydrates	g/100g	SOP-CHM-28-00	6.79
3.	Proteins	g/100g	By FSSAI Manual-1 (7.5):2016	1.87
4.	Fat	g/100g	By FSSAI Manual-1(1.3.4.3): 2016	4.69
5.	Sugar	g/100g	By FSSAI Manual-1(9.4): 2016	3.66
6.	Dietary Fibre	g/100g	AOAC 985.29 20 <sup>th</sup> Ed.	4.30

The scores of sensory attributes for garlic flavored spread were found higher than lemon flavored spread. The mean ranks of the respected sensory attributes are presented in **table1**.The laboratory results of the nutrient analysis are presented in **table 4**.The garlic flavored spread provided 76.85 Kcal/100g of Energy, estimated by adding non-protein calories and calories provided by protein together, Protein- 1.87g/100g was estimated by the method given by FSSAI manual 1 (7.5):2016, Fat- 4.69g/100g estimated by using method given by FSSAI Manual-1(1.3.4.3): 2016, Sugar - 3.66g/100g estimated by using method given by FSSAI Manual- 1(9.4): 2016, Dietary Fiber -4.30/100g estimated by using method AOAC 985.29 20<sup>th</sup> Ed.

Table 5: Microbial analysis results

Phase	Units	Value	Specified limits
Total viable count	cfu/g	<10	Max 10 <sup>5</sup>
Coliform	cfu/g	<10	Max 10 <sup>2</sup>
Ecoli	Org/g	Absent	-
Salmonella	Org/g	Absent	-
Staphylococcus aureus	Org/g	Absent	-
Yeast	Cfu/g	<10	Max 10 <sup>2</sup>
Mold	Cfu/g	<10	Max 10 <sup>2</sup>

The total viable count was found to be less than 10cfu/g where the maximum limits were 10<sup>5</sup>, coliform count was found less than 10cfu/g where maximum limits specified were Max 10<sup>5</sup>. The E.coli species, Salmonella, and Staphylococcus aureus, were found to be completely absent. The yeast and mould count was reported less than 10cfu/g.

Table 6: Chemical analysis results

pH(5% aqueous sol)	-	6.02	Not specified
Acidity as Lactic acid	g/100g	0.14	Not specified
Moisture	g/100g	81.64	Not specified

The chemical tests which contain ph(5% aqueous sol), Acidity as lactic acid and Moisture were analyzed and their values were 6.02(units not mentioned), 0.14g/100g, 81.64g/100g respectively.

Table 7: Organoleptic analysis results

Phase	Value	Specified limits
Appearance	4	3 to 5
Odour	5	3 to 5
Taste	5	3 to 5
Texture/consistency	5	3 to 5

(1- dislike very much; 2- dislike moderately; 3- neither like nor dislike; 4- like moderately; 5- like very much)



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The sensory attribute score was 5(like very much) for odour, taste, and texture/consistency, 4(like moderately) for Appearance.

From the above discussed points, it is evident that garlic flavored spread is preferred over lemon flavored spread in consumer acceptability. Development of such Plant based vegan products has the emerging and growing market in the food industry. Innovative approaches in formulation and development of aforesaid products can influence the consumer choice in procuring.

### Conclusion

Long known for its benefits, oats is becoming popular as part of healthy diet and new oat products emerge at the functional food market. Oat milk has recently attracted its research and commercial attention mainly due to its high nutritional value. Plant – based milk alternatives represents an enormous expansion prospective for health food market, and needs to be widely investigated through the development of advanced processing, technological interventions, for formulation and development of new and nutritionally adequate products food products with high acceptability. Therefore, the present study was under taken to formulate vegan spreads using oat milk. In the view of statistically analyzed results obtained through sensory evaluation of two products, it can be concluded that garlic flavored oat milk spread was preferred over lemon flavored spread as per 5-point hedonic scale (appearance, aroma, color, mouth feel and texture) which falls between liking of good and very good. The garlic flavored spread stored in refrigerated conditions for seven days was well accepted. There was no microbial growth seen while in the storage period. It is assumed that the fat content of the product subjected to nutrient analysis was lower compared to the other dairy spreads available in the market which fulfils one of the objectives of the present study. Further studies can be carried out in formulating such vegan products with improved nutritional value, longer the shelf life for better marketing.

### Suggestions

- The color of the product can be improved by addition of fruits or certain spices to enhance the appeal of the product.
- The present product, garlic flavored oat milk spread has a shelf life of 7 days under refrigerated conditions and 2 days under room temperature. The shelf life can be improved by addition of permissible food grade additive/ preservatives.
- The market for such innovative vegan products is emerging in the field of food industry. Marketing aforesaid products can be very successful. Attractive packaging methods and use of natural material can be sustainable for marketing.
- Use of plant-based milk in formulation of several other food products like flavored spreads, beverages, desserts, can provide varied healthy options for vegetarians. Such simple and innovative products influence the choice of consumers while procuring.
- The present study included sesame seeds as a natural thickener, selection and addition of such natural bland products can limit artificial thickeners and emulsifiers if intended to avoid chemical preservatives and additives.

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