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DEVELOPMENT OF OMEGA 3 ENRICHED PIZZA BASE AND EVALUATION OF ITS QUALITY CHARACTERISTICS

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Flax seed is only omega-3 source of vegetables. Its chewy seeds are packed with full of nutrients, omega-3 fatty acids, antioxidants, minerals and essential vitamins. And it is outstanding source of protein and fiber and it is also acts as a health protector and reduces the risk of coronary disease and cancer. Pizza is one of the most popular family foods worldwide and has gained wide spread consumer acceptance as a healthy and convenience foods. It is a multicomponent product with composite number of toppings and provides an array of nutrients in significant amounts, in relation to its energy and fat content, making it a nutrient-dense food. The present investigation was carried out to standardize pizza base enriched with flax seed powder and evaluation of its quality characteristics. Three variants of nutritious pizza base were prepared from flax seed flour. Nutrient analysis of most acceptable pizza base indicates the high fiber and rich in omega-3 fatty acids supplements were found to be excellent as compared to control. The results of the present study goes to emphasis that pizza base fortified with flax seed powder were not only rich in fiber and omega-3 amino acids and also rich in minerals like iron, calcium.

Keywords: Flaxseeds, Omega-3, Pizza, Crude fiber, Antioxidants

INTRODUCTION

Pizza was introduced in the middle of 20th century. Gradually it gained huge popularity and now a day's it ranks among the world's most widespread fast foods. Pizzas are known for their wide variety and attractive appearance. It is liked by all aged groups especially in youth. Pizza is a type of flat bread, leavened chemically or by yeast and it contains different types of toppings, essentially comprising of cheese, chicken and tomato sauce with some other variables depending on the choice of the consumers. About 40% of the weight of the pizza is dough base or shell and remaining 60% consists of topping (David Antonio, 2007). It is also known as linseed, and botanically named as (Lignum Usitatissimum). It contains Lignums, a class of phytoestrogens considered to have antioxidant and cancer preventing properties. It is a food and fiber crop that grown in cooler regions of the world. The oil is known as linseed oil. In flax seeds anti nutritional protein factors (trypsin and chymotrypsin, lectins, pancreatic and salivary amylase inhibitors) are present these factors are eliminate by the Pressure cooking process for 30 mints (Peterson, 2005). The addition of flax seeds provided all of these health benefits and these are richest source of micronutrients, dietary fiber, manganese, vitamin B1, vitamin E especially rich in gamma-

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tocopherol and the essential fatty acids alpha-linolenic acid, also known as ALA or Omega-3. Flax seeds also helps with heart health supports a person's mood and emotional .Regular intake of small portions of flax seeds in the diet helps to lower total as well as Low Density Lipoprotein (LDL) or "bad cholesterol" and increases High Density Lipoprotein (HDL) or "good cholesterol" levels in the blood. The present investigation was carried out to standardize the pizza base enriched with flax seed powder and to evaluate the quality characteristics of it.

Developing new pizza base product from flax seed flour will provide novel uses for under utilized seeds. It will further provide consumers with new alternatives to pizza. Moreover the research will bring to light the potential of the underutilized seeds for food product development.

The main objective of the study is to explore alternative uses for flax seeds by powdering in different proportions to produce a pizza base with acceptable sensory properties.

MATERIALS AND METHODS

Procurement of Raw Materials

Flax seeds (Lignum usitatissimum) were procured from local super market in ananthapuramu. Refined flour, Milk powder, sugar, salt, and refined sunflower oil was purchased in SP super market near tower clock ananthapuramu. Yeast is purchased in Arabian pizza hut in ananthapuramu.

Product Development

Flax seeds were carefully inspected and all foreign materials were removed. The seeds were allowed to water bath cooking for (15 min) to eliminate the anti nutritional factors. And then allowed to roasted for 5 min. The seeds were spread on the tray and then cooled it. After cooling those seeds were grinded and then allowed to sieving to remove the unsized particles and finally collected fine flax seed powder. The powder was packed in HDPE covers and stored for analysis.

Figure 1: Flow Diagram of Preparation of Flax Seed Powder

Cleaning and Sorting of flax seeds
↓
Water Bath cooking (15 mins)
↓
Roasting (5 mins)
↓
Cooling
↓
Grinding and Sieving
↓
Collect the powder
↓
Packaging
↓
Storage

Processing Flow Chart for Pizza Base

Figure 2: Flow Chart for Processing of Pizza Base

Maida/Roasted flax seed flour
↓
Addition of all ingredients
↓ [yeast, salt, sugar, milk powder, oil]
Make a dough
↓
Kneading (10 min)
↓
Proofing for 45 min
↓ [at room temp]
Rolling in to round shapes
↓ [proofing for 10 min]
Baking (180 ^{o}C for 10 min)

Formulations of Pizza Base

The flax seed powder mixed in varying proportions to obtain three different formulations. In first sample 30% of flax seed powder was taken, in second sample 40% of flax seed powder was taken, and in third sample 50% of flax seed powder was taken. Refined wheat flour (100%) was used as control by the preparation of pizza base. And take other ingredients same ratios in all samples and control.

Physico-Chemical Analysis

Physic-chemical analysis (moisture, ash, acidity, percentage of protein, crude fiber content, calcium, and iron) were performed for three different formulations and one control sample using the Official Methods of Analyses (AOAC, 1990), I.S.I Handbook of food Analysis (I.S.I, 1984) and Handbook of analysis and quality control (Ranganna, 2001).

Microbial Analysis

Enumeration of Standard Plate Count (SPC) coliform and yeast count of samples were performed by the method as

Table 1: Formulation of the Pizza Base

Ingredients (gm)	Composition			
	Control	Trial-1 (a)	Trial-2 (b)	Trial-3 (c)
Maida	100	70	60	50
Flax seed flour	0	30	40	50
Milk powder	1.5	1.5	1.5	1.5
Yeast	1.5	1.5	1.5	1.5
Sugar	10	10	10	10
Salt	1.5	1.5	1.5	1.5
Refined sunflower oil	10	10	10	10
Water	Required amount	Required amount	Required amount	Required amount

described by Houghtby *et al.* (1993). Colonies was counted and expressed as cfu/g of the product.

Sensory Evaluation

Sensory evaluation of pizzas were carried out by 13 semi-trained panelists on a 9 point hedonic scale as per Murray *et al.* (2001) to establish the overall acceptability of the product.

RESULTS AND DISCUSSION

Moisture content and ash analysis during nutritional analysis are very important since it directly affects the nutritional content of the food, its stability and storage, etc. The physic-chemical markers were evaluated for three different formulations and control during storage. The date is represented in the Table 2.

Moisture Content

The data in Table 2 reveals that the mean values of moisture content in four samples for zeroth day, seventh day, and fourteenth day. The results shown that moisture content was found to be decreased in control and as well as in samples during storage period of 15 days. Studies conducted by Khattab *et al.* shown that there was no significant change in moisture content in flax seed fortified cookies in comparison with control.

Ash Content

The data in Table 2 shown that the ash content was found to be increased in samples in comparison with control. The reason may be due to the fact that addition of flax seed powder resulted in increase in ash content in samples. At the storage period of 15 days there was no change in ash content in pizza base. The results are in accordance with those of lnyang and Wayo (2005) who found that there was significant increase in ash levels on fortification of cookies with dehulled sesame meal.

Total Fat Content

The data in Table 2 reveals that the mean values of total fat content in four samples. In samples total fat content were found to be increased when compared with control. The reason may be due to the fact that addition of flaxseed increases in fat content in samples. At the storage period of 15 days it was found to be decreased due to hydrolysis reactions. Studies conducted by Khattab *et al.* shown that there was significant increase in fat content in flax seed fortified cookies when compared to control.

Crude Fiber Content

The data in Table 2 reveals that the crude fiber content was found to be increased in samples when compared to control and this may be due to the reason that incorporation of flax seeds increases the fibre content in samples. It didn't change during storage period of 15 days. Studies conducted by Khattab *et al.* shown that there was significant increase in crude fiber content in cookies fortified with flax seed.

Protein Content

The results shown that the protein content of samples were more when compared with control. This may be due to the fact that addition of flax seed increased the protein in

Table 2: Physico-Chemical Analysis of Pizza Base During Storage Periods

Parameters	Samples	Storage Period (Days)		
		0	7	14
Moisture	Control	11.2±0.15	11±0.35	10.8±0.48
	A	4.3±0.22	4.1±0.44	3.9±0.77
	B	5.6±0.35	5.4±0.28	5.2±0.28
	C	6.3±0.10	6.1±0.33	5.9±0.30
Protein	Control	10.5±0.55	9.9±0.14	9.7±0.19
	A	14.1±0.87	13.9±0.64	13.7±0.68
	B	15.2±0.67	14.9±0.25	14.7±0.99
	C	17.2±0.44	16.7±0.11	16.2±0.46
Fat	Control	1.5±0.67	1.3±0.04	1.1±0.02
	A	11.6±0.12	11.1±0.77	10.9±0.76
	B	14.4±0.32	14±0.93	13.9±0.33
	C	16.2±0.22	15.9±0.97	15.8±0.87
Ash	Control	1.8±0.02	1.8±0.05	1.8±0.05
	A	2.4±0.08	2.41±0.11	2.4±0.14
	B	2.7±0.01	2.7±0.09	2.7±0.05
	C	2.8±0.05	2.8±0.05	2.8±0.20
Crude fibre	Control	0.9±0.01	0.7±0.01	0.6±0.01
	A	3.8±0.15	3.8±0.40	3.7±0.44
	B	4.6±0.34	4.6±0.33	4.5±0.69
	C	6.6±0.88	6.6±0.17	6.5±0.38

samples. It was found to be decreased during storage period of 15 days. Studies conducted by lnyang and Wayo (2005) was found that the protein content was significantly increased in samples.

Acidity of Flaxseed Pizza Base

The data represented in Figure 3 reveals that the mean values of acidity content in four samples. The results shown the acidity was found to be increased in control and samples and during storage period of 15 days. The reason may be due to addition of flax seed added fatty acid profile to samples.

Calcium Content in Pizza Base

The Figure 4 reveals that the mean values of calcium content in four samples. Calcium content was more in samples A, B, and C when compared to control and it didn't change during storage period of 15 days. The reason may be due to the fact that addition of flax seed increased the calcium content in samples. The results are in accordance with those of Khattab and Zeitoun (2007) who found that there was significant increase in Calcium levels on fortification of cookies with defatted flax seed and dehulled sesame meal.

Figure 3: Changes in Acidity of Pizza Base During Storage

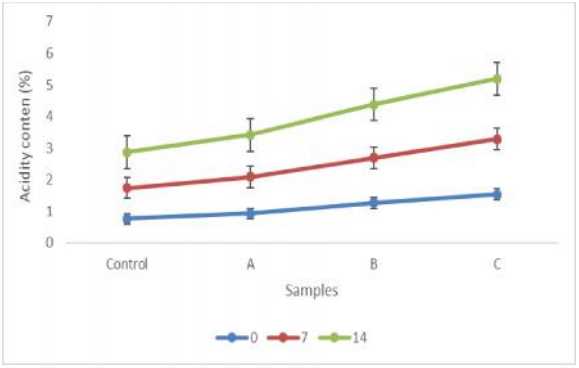
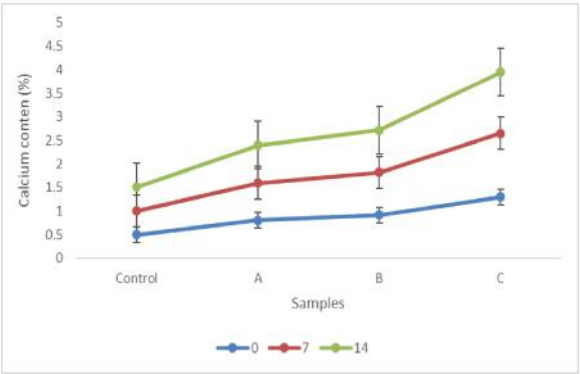


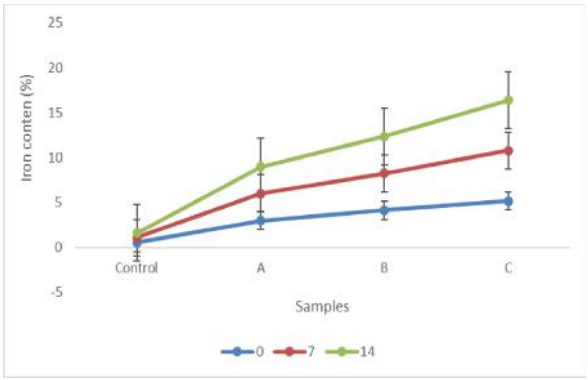
Figure 4: Changes in Calcium Content During Storage of Flaxseed Pizza Base



Changes in Iron Content in Flaxseed Pizza Base

The data in Figure 5 reveals that the mean values of iron content in four samples. Iron content is more in samples A, B and C when compared to control and didn't change during storage period of 15 days. This may be due to reason that addition of flax seed increased the iron content in samples.

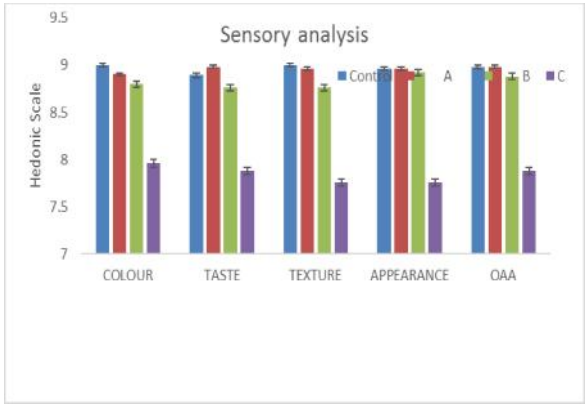
Figure 5: Changes in Iron Content During Storage of Flaxseed Pizza Base



Sensory Analysis

The three formulations and one control products were presented to each panel members. The results showed in Figure 6 Consumer appetite for food is stimulated or dampened by its colour. The data in fig no 4 reveals that the control was most preferred colour (9), followed by sample A (8.90), Sample B (8.80) and sample C (7.96) in that order. The data reveals the results that sample A and control scored same mean value (8.98) for overall acceptability when compared to sample B and sample C. Studies conducted by Khattab *et al.* (2007) shown that defatted flax seed fortified cookies were highly acceptable than control.

Figure 4: Sensory Analysis of Flaxseed Pizza Base



Microbiological Analysis

The data in Table 3 reveals that microbial analysis of control and three formulated samples for Total viable count,Yeast count and E.coli count was done. It was observed in sample A had the least total bacterial count of 1.3 x 10^4 cfu/g, followed by sample B with 2.38 x 10^5 cfu/g, followed by sample C with 4.7 x 10^4 cfu/g and while control sample got highest value of 7.2 x 10^6 cfu/g. Sample A had the least yeast count of 2.5 x 10^6 cfu/g followed by sample B with 2.8 x 10^4 cfu/g, followed by sample C with 5.0 x 10^3 cfu/g and while control sample had highest value of 10.4 x 10^4 cfu/g. The data in Table 3 reveals that *E. coli* count was absent in all samples.

Table 3: Microbial Analysis for Flaxseed Pizza Base

Samples	cfu/g		
	TVC	Yeast and Moulds	*E. coli*
Control	$7.2x10^6$	$10.4x10^4$	Nill
A	$1.3x10^4$	$2.5x10^6$	Nill
B	$2.38x10^5$	$2.8x10^4$	Nill
C	$4.7x10^4$	$5.0x10^3$	Nill

CONCLUSION

The study was conducted in three phases. In the first phase the flax seed flour was processed and three variants samples were formulated with flax seed flour, i.e., sample A (30%) flax seed flour, sample B (40%) with flax seed flour, sample C (50%) with flax seed flour and control (100%) with maida and subjected to physic- chemical analysis. In the second phase three variants and control were subjected to sensory and microbial analysis. In the third phase the shelf life of the control and samples A, B, C were analyzed at refrigeration conditions for 15 days. Three variants of nutritious pizza base were prepared from flax seed flour, i.e. (30%, 40%, 50%). This effort was done to ensure the quality and to improve nutritive value of the pizza base. Mean scores of overall acceptability of pizza base reveals that among all sample A of pizza base were most acceptability at 9-points hedonic scale. Studies on microbial analysis revealed that there was no change on microbial studies upon addition of flax seed flour and stored good for 4 days without spoiled. Nutrient analysis of most acceptable pizza base indicates the high fiber and rich in omega -3 fatty acids supplements were found to be excellent as compared to control. The results of the present study goes to emphasis that pizza base fortified with flax seed powder were not only rich in fiber and omega-3 amino acids and also rich in minerals like iron, calcium, sodium, etc.

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