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Development and Evaluation of Salmon Fish Incorporated Ready to Eat Product

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Abstract: ***Vitamin D deficiency is now recognized as a world-wide problem for both children and adults.*** *Vitamin D plays a classical hormonal role in skeletal health by regulating calcium and phosphorus metabolism. Salmon****Fish has been touted as an excellent source of vitamin D. The number of foods rich in vitamin D is limited.The present study aims to development and evaluation of salmon fish incorporated ready to eat product. Incorporation level of 50% salmon fish powder used in the preparation of thattai. Evaluate the nutrients like vitamin D, fatty acids, energy, protein and moisture content of the developed product. The vitamin D content of formulated product contain about 7.64 µg. the organoleptic properties of experimental product with its respective control were examined through sensory evaluation by semi-trained and untrained panel judges. The products were evaluated visually, palpatory, gustatory, olfactory and over all acceptance. The result of sensory evaluation showed salmon fish thattai rated equally well with the control thattai as judged by both panelists.***

Keywords: salmon fish, ready to eat product, salmonfish thattai, Vitamin D.

1. Introduction

Vitamin D deficiency is now recognized as a world-wide problem for both children and adults. Because of concern about sun exposure and skin cancer, both children and adults either avoid sun exposure or use sun protection which puts them at high risk for vitamin D deficiency. Thus, their only source of vitamin D is from the diet or supplements (Hollis et al., 2005). Low vitamin D levels have been associated with a wide range of conditions including heart disease, diabetes, cancer and multiple sclerosis (Holick, 2007).Fish has been touted as an excellent source of vitamin D especially oily fish including salmon and mackerel. The number of foods rich in vitamin D is limited. However, sea mammals and free-living fish such as salmon and cod are rich in vitamin D. In addition, some countries have foods fortified with vitamin D. Salmon is considered to be healthy due to the fish's high protein, high Omega-3 fatty acids, and high vitamin D (National Institutes of Health, 2013). There are two natural forms of vitamin D: ergocalciferol (vitamin D_2) synthesized by plants, and cholecalciferol (vitamin D_3) synthesized by the mammalian skin. Active vitamin D functions as a hormone, and its main biologic function in people is to maintain serum calcium and phosphorus concentrations within the normal range by enhancing the efficiency of the small intestine to absorb these minerals from the diet (Norman, 2008).One of the most important roles of vitamin D is to maintain skeletal calcium balance by promoting calcium absorption in the intestines, promoting bone resorption by increasing osteoclast number, maintaining calcium and phosphate levels for bone formation, and allowing proper functioning of parathyroid hormone to maintain serum calcium levels. Vitamin D deficiency can result in lower bone mineral density and an increased risk of reduced bone density (osteoporosis) or bone fracture because a lack of vitamin D alters mineral metabolism in the body (Bell et al, 2010). In this present research an effort was taken to formulate salmon fish powder and incorporate it in to thattai and compare the sensory characteristics along with the control product (without incorporation of salmon fish powder) and to determine its nutrient composition, sensory evaluation & microbial evaluation.

2. Review of Literature

Salmon is the common name for several species of fish in the family Salmonidae. Other fish in the same family include trout, char, grayling and whitefish. Salmon are native to tributaries of the North Atlantic (genus Salmo) and Pacific Ocean (genus Oncorhynchus) (Scholz et al., 1976). Six types of salmon are consumed in the United States including: Atlantic, Chinook, Chum, Coho, Pink, and Sockeye Salmon (National Marine Fisheries Service, 2011). The salmon fish contains various nutrients. It contains short protein molecules called peptides that have been shown to be bioactive and may have important anti-inflammatory properties. Salmon also provides important amounts of the antioxidant amino acid taurine. The unique protein and amino acid composition of salmon is often overlooked in its nutritional profile. Salmon contains short protein molecules called peptides that have been shown to be bioactive and may have important anti-inflammatory properties. Salmon also provides important amounts of the antioxidant amino acid taurine. Salmon is an excellent source of vitamin B_{12}, vitamin D, and selenium. It is a good source of niacin, omega-3 fatty acids, protein, phosphorus, and vitamin B_6. It is also a good source of choline, pantothenic acid, biotin, and potassium.

3. Materials and Methods

Salmon fish were collected from the market of Saidapet, Chennai, and Tamilnadu, India for the preparation of the fish powder. These are many varieties of salmon fishes present. Stealhead salmon fish selected for the preparation of salmon fish powder. The gills, bloods, guts and heads of salmon fish were removed, washed thoroughly and it was steamed to discard the bones and then roasted. The roasted fish powder was kept in air tight tupperware container in room temperature. The fortification of salmon fish powder into the thattai, maida and salmon fish powder in 1:1 ratio.Salmon

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fish powder and salmon fish thattai of about 100 g was sent to IICPT [(Indian Institute of Crop Processing Technology), Ministry of Food Processing Industries, Tanjore, Tamilnadu, India] for estimation of vitamin D using HPLC (High Performance Liquid Chromatography) method (Sathish et al, 2009) and about 100 g was given to Animal Feed Analytical and Quality Assurance Laboratory, Namakkal, Tamilnadu, India. To determine the macro nutrients such as energy, protein, moisture, total ash, omega 3 fatty acid. The methods used for estimation were AOAC official method of analysis (2005) for protein and fat. The experimental products were given for microbial analysis to A to Z, Food Testing Laboratory in Chennai, Tamilnadu, India. It was done at two stages on 0^{th} day (initial phase) and 30^{th} day (final phase).

4. Results and Discussion

In the present study, salmon fish incorporated thattai was developed. The developed products were analyzed for their nutrients such as energy, protein, omega 3 fatty acids, and vitamin D, ash and moisture. The sensory evaluation techniques followed to estimate the acceptability of the recipes. The results are discussed as follows:

Table 1: Mean values of nutrients content of formulated salmon fish powder

Nutrient parameters	Mean ± S.D	t-value	Level of significance
Energy	405.9 ± 4.18	0.74	1 %
Protein	58.6 ± 1.23	0.28	1 %
Moisture	30.15 ± 0.84	0.63	1 %
Total ash	2.67 ± 0.48	0.68	1 %
Vitamin D	22.30 ± 1.23	0.87	1 %

The differences among the three values of each of the nutrient were statistically analysed using student's t-test at 1per cent significant level. The statistical computation showed no significant difference in the nutrient content of formulated salmon fish powder.

Table 2: Mean values of fatty acids content of formulated salmon fish powder

Fatty acids composition	Mean ± S.D	t-value	Level of significance
Saturated			
Medium chain			
Myristic acid	1.60 ± 0.44	0.27	1 %
Long chain			
Palmitic acid	33.55 ± 1.10	0.36	1 %
Stearic acid	7.13 ± 1.65	0.28	1 %
Behenic acid	2.53 ± 0.2	0.69	1 %
Monounsaturated acids			
Oleic acid	17.48 ± 1.08	0.76	1 %
Palmitoleic acid	17.62 ± 1.24	0.36	1 %
Polyunsaturated acids			
Linoleic acid (n-6)	3.18 ± 1.16	0.56	1 %
Linolenic acid (n-3)	3.16 ± 1.64	0.33	1 %
Arachidonic acid (n-6)	1.54 ± 0.41	0.37	1 %
Eicosapentaenoic acid	2.53 ± 0.41	0.29	1 %
Docosahexaenoic acid	4.67 ± 2.05	0.29	1 %

The differences among the three values of each of the fatty acids were statistically analysed using student's t- test at 1per cent significant level. The statistical computation showed no significant difference in the fatty acids content of formulated salmon fish powder.

Table 3: Nutrient composition of control and salmon fish powder incorporated thattai

Nutrients	Amount per 100 gram		Amount per serving (12 gram)
	Control thattai	Salmon fish thattai	Salmon fish thattai
Energy (kcals)	787.26	818.3	98.19
Protein (g)	22.30	38.9	4.66
Fat (g)	46.42	40.23	5.57
Vitamin D (µg)	-	7.64	0.91
Saturated fatty acids (g)	11	22.97	2.83
Monounsaturated fatty acids (g)	5.02	15.68	2
Omega 3 fatty acids (g)	1	2.74	0.42
Omega 6 fatty acids (g)	0.9	2.44	0.35

The nutritional composition of control and salmon fish thattai as enlisted in the above table. Energy, protein, fatty acid composition was higher compared to control product. Higher vitamin d content present in experimental product there is not present in control product. Thus the researcher's product with possessed 9.55 microgram per 100 gram and 1.91 microgram per serving. The experimental product considered safer for the consumers.

Table 4: Sensory evaluation of Control thattai versus salmon fish thattai by semi trained panel judges

S.no	Products	Mean ± S.D	t-value	Level of significance
1.	Control thattai	83.80 ± 2.26	1.22	1 %
2.	Salmon fish thattai	85.76 ± 1.60		

The statistical illustration showed no significant difference between control and salmon fish thattai. The mean score value of the salmon fish thattai (85.76 ± 1.60) was higher than the control thattai (83.80 ± 2.26) which deplicted that the researcher's product was better than the control product.

Table 5: Sensory evaluation of Control thattai versus salmon fish thattai by untrained panel judges

S.No	Products	Mean ± S.D	t-value	Level of significance
1.	Control thattai	84.3 ± 2.62		
2.	Salmon fish thattai	85.77 ± 2.04	0.73	1 %

The statistical illustration showed no significant difference between control and salmon fish thattai. The mean score value of the salmon fish thattai (85.77 ± 2.04) was higher than the control thattai (84.3 ± 2.62) which depicted that the researcher's product was better than the control thattai as judged by the untrained panel members

Table 6: Correlation of the scores for specific organoleptic properties ofsalmon fish thattai by the panel judges

Organoleptic properties	*Scores*		*Correlation coefficient (r)*
	Semi-trained panels (n = 30)	Untrained panels (n = 30)	
Appearance	280	292	0.99
Texture	277	273	
Flavor	284	272	
Colour	287	293	
Crispiness	281	286	
Cracking pattern	279	281	
Taste	298	296	

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Chewiness	299	285	
Overall acceptance	288	295	

The thattai were evaluated based upon the specific organoleptic characteristics concerned with the thattai such as appearance, texture, flavour, colour, crispiness, cracking pattern, taste, chewiness, overall acceptance. These parameters got fairly good scores. The correlation coefficient showed a similar kind of scoring among both the judges and there existed no difference of opinion among them. The table showed that there existed a positive correlation in the total scores given by both the panel judges for the salmon fish thattai.

Table 7: Microbial analysis of the salmon fish powder incorporated product at two phases

Microbes	Phase I- 0th Day	Phase II - 30th Day
	Salmon fish thattai	Salmon fish thattai
Escherichia coli	Nill	Nill
Salmonella species	Nill	Nill
Pseudomonas aeruginosa	Nill	Nill
Staphylococcus aureus	Nill	Nill
Total yeast & mould	10 cfu/gm	35 cfu/gm
Total bacterial count	75 cfu/gm	120 cfu/gm

The total yeast and mould count of salmon fish thattai were reported to be phase I 10 colonies forming unit (cfu) to per gram present. Whereas on the end of the final phase of 30 days period 35 cfu per gram were noticed. The total bacterial count of salmon fish thattai were reported to be 75 cfu to per gram in the first phase, whereas on the end of the final phase of 30 days period 120 cfu per gram were noticed. But the total bacterial count results of the experimental products was very much meager to the acceptable limit of 100 cfu per gram. So, the shelf life of the thattai could be concluded to be 30 days period.

5. Conclusion

Salmon Fish is considered to be healthy due to its high protein, high omega 3 fatty acids and high vitamin D content. Vitamin D is the fat soluble nutrient for proper immune functioning, control of cell growth and bone development it also promotes calcium absorption in the body, leading to stronger bones. Since, salmon fish contain richest sources of vitamin D, the incorporation of salmon fish powder in to ready to eat forms can serve as suitable food vehicles for improved nutrient intake without compromising its organoleptic properties. Therefore they will surely have a better commercial value and easy reach and at an affordable price.

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7. Future Scope

Research can be pursued by evaluating vitamin D content of other processed foods. Experimental products of the research can be taken for supplementation for any diseased prevention.

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