Tropical Agricultural Research Vol. 6 1994

The Role of Palmyrah Tuber Flour (*Odiyal*) in the Preparation of Fish Fingers

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ABSTRACT. *Fish fingers were prepared using marine fish (Mugil cephalis). Palmyrah tuber flour was used as a binder instead of an imported binder or rusk that is generally used. Table salt and spices were also added to improve the taste and the flavour of fish fingers. All the samples were tested by a tasting panel. According to nonparametric statistical analysis of Experiment I, the sample mostly preferred by the tasting panel had a composition of 50% palmyrah tuber flour and 50% imported binder. The samples for Experiment II were prepared by adding higher amounts of spices and chillie powder. The sensory evaluation data revealed that the fish fingers with the same composition of binder were accepted more by the tasting panel than the other samples.*

All fish fingers were eventually stored at 5°C, and the changes in pH, TBA and water holding capacity were measured. All the samples generally showed an increase in their values with the increase of storage time. TBA values of these samples showed only a slight increase with the increase of storage time. In Experiment I there were significant differences in the water holding capacity values where as in Experiment II they were not significantly different.

INTRODUCTION

Present market trends reflect a rapidly growing market potential for ready to eat convenience products. Battered or breaded fish products are especially well suited to capture a bigger share of this developing market. Fish fingers continue to be popular and play a leading role among battered and breaded fishery products. In Sri Lanka there is a demand for marine

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fish, and it is consumed by most people. Because marine fish contain most of the essential nutrients for human beings, development of different fish products is economically important (Brogstrom, 1965).

Palmyrah (*Borassus flabalifer*) grows in dry zones of Sri Lanka, mostly in the Northern and Eastern parts of the island. In fish finger production, rusk or wheat flour or any imported flour is used as a binder. Substitution of palmyrah tuber flour (odiyal flour) for wheat flour up to a certain level, could save foreign exchange.

The palmyrah tuber contains a high percentage of organic matter (43.89 g/100 g). It has a sufficient amount of crude fibre (5 g /100 g) and crude protein (5.41 g/100 g). Small amounts of sugar and lipid found in this tuber might affect the quality of fish fingers. This study was conducted to find out the possibility of substituting palmyrah tuber flour for traditional binders in making fish fingers, and to evaluate the keeping quality (Berk, 1976).

MATERIALS AND METHODS

In Experiment I, five different types of fish fingers were prepared by using bread crumbs, palmyrah tuber flour, binder flour, fish, spices (pepper powder), sodium chloride and sodium nitrate salts (Roessink, 1989). The composition of fish fingers is given in Table 1.

Table 1. Formulation of different types of fish fingers in Experiment I.

Ingredients	Samples				
	A	B	C	D	E
Bread crumbs	628 g	-	-	-	-
Palmyrah tuber flour	-	628 g	314 g	159 g	-
Binder flour (cere bind)	-	-	314 g	471 g	628 g

The following ingredients were the same for all the forms of treatment.

Ingredients	Amounts
Fish	1900 g
Spices (Pepper powder)	22 g
Sodium Chloride	7 g
Sodium Nitrate	18 g

In Experiment II, in addition to the constituents added in Experiment I, garlic powder, chillie powder and cummin powder were also added; and the amount of spicy powder was increased to improve the taste. Both the experiments were carried out at John Keels food processing factory in Ja-Ela.

Five different types of fish fingers were prepared according to Table 2.

Table 2. Formulation of different types of fish fingers in Experiment II.

Ingredients	Samples				
	P	Q	R	S	T
Palmyrah tuber flour	330 g	330 g	165 g	165 g	-
Binder	-	-	165 g	165 g	330 g
Pepper powder	40 g			40 g	40 g
Spicy powder (Cardamon, cinnamon, cloves and nutmeg)	50 g	-	50 g	50 g	50 g
Garlic powder	-	40 g	40 g		-
Chillie powder	-	30 g	30 g		-
Cummin powder			-	22 g	22 g-

The following ingredients were the same for all the forms of treatment.

Ingredients	Amounts
Fish	1000 g
Sodium Chloride	4 g
Sodium Nitrate	10 g

Preparation of fish fingers

The preparation of fish fingers is an automated machine process. Marine fish (*Mugil cephalis*) were used to prepare fish fingers. The fish was cleaned, skins were peeled off and muscle parts were removed from bone. These muscle parts were washed with water, ground in a mincer (Kaliya Auto mincer, 7 mm) and used to make fish fingers. According to Table 1, five types of fish fingers were prepared in Experiment I. Salts were added to the minced fish mixture, followed by palmyrah tuber flour, binder flour (cere bind) and bread crumbs. Finally, spicy powder was added to the mixture as indicated above (Roessink, 1989).

The final mixture was mixed for 15 minutes to get a uniform batter and formed into finger like shapes by specially designed forming machines. The fish portions were passed on a fish belt through a falling curtain of flour in the preduster and a batter applicator, to coat the whole surface. The batter was usually a paste of water, flour, salt and other flavourings. The product was held by a submerger. Care was taken to keep the coated products from touching one another to prevent adhesion. The fish portions were dropped into a bed of dry crumbs in a breading machine. They were either turned over to ensure complete coating or passed through a falling curtain of breading material. The coated portions were then passed through a fryer (180°C) in which they remained for not longer than 1 minute. This flash frying treatment fixed the coating, reduced the loss of crumbs during handling and improved the colour. Slightly cooked fish fingers were frozen (-21°C) before packing. After half an hour the fish fingers were taken from the cold room, packed in plastic boxes and stored in a deep freezer (-4°C). Frying is the most popular way of cooking fish fingers. Partially fried fish fingers were taken from the freezer, fried in oil between 180°C and 250°C for 3 minutes (Su-Poh, Chen and Lisac, 1989). After frying these fish finger samples were evaluated by the taste panelists. Stored fish finger samples were analyzed at five day intervals.

In Experiment II, palmyrah tuber flour was soaked in water to reduce bitterness of the flour, and this flour was used to make fish fingers. In this experiment more spices were added to enhance the flavour of the products.

Analysis of fish finger samples

All fish fingers were stored at 5°C, and the changes in pH, TBA and water holding capacity were measured. All these samples were evaluated by a tasting panel. These experiments were conducted at the Animal Science Department, University of Peradeniya.

The oxidation of lipid in fish fingers was measured by determining thiobarbituric acid contents (TBA), and pH of each fish finger sample was measured using a pH meter (Novikov, 1979).

The water holding capacity was measured by the modified method (Lawrie, 1979).

RESULTS AND DISCUSSION

The pH values of fish fingers generally increased with the increase of storage time for all the samples in Experiments I and II. As given in Table 3, the pH increase was observed in all the treatments. This is probably due to the release of ammonia and alkaline substances during denaturing of fish muscular protein (Novikov, 1979).

TBA values of all the samples showed in Table 4 indicate a slight increase with the increase in storage time in both experiments. This slight increase in TBA values would be due to oxidation of lipids (Suzuki, 1981).

The water holding capacity of fish fingers decreased significantly during storage in all the samples as given in Table 5. In Experiment I there were significant differences in the water holding capacities of all the samples during the storage period; but in Experiment II there were no significant differences in the water holding capacities of all the samples. This decrease in the water holding capacity would be due to the denaturing of protein (Lawrie, 1979).

Table 3 : Changes in pH during different storage times at 5°C in Experiment I and II

Experiment	Treatment	Duration of storage (days)				
		3	8	13	18	23
Experiment I	A	5.64±0.05	5.67±0.02	5.69±0.01	5.70±0.01	5.87±0.02
	B	5.66±0.01	5.66±0.02	5.87±0.02	5.88±0.02	5.88±0.01
	C	5.69±0.01	5.80±0.13	5.92±0.03	5.96±0.01	5.98±0.01
	D	5.70±0.01	5.73±0.02	5.83±0.01	5.90±0.00	5.93±0.00
	E	5.67±0.02	5.82±0.04	5.89±0.01	5.90±0.04	6.00±0.01
Experiment II	P	5.41±0.01	5.43±0.42	5.67±0.02	5.75±0.08	6.00±0.10
	Q	4.90±0.01	4.95±0.00	5.25±0.01	5.53±0.02	5.68±0.17
	R	4.84±0.01	4.85±0.01	5.13±0.03	5.61±0.46	5.74±0.02
	S	4.89±0.01	4.91±0.01	5.05±0.07	5.42±0.15	5.70±0.21
	T	4.60±0.01	4.62±0.01	5.16±0.49	5.52±0.02	5.65±0.05

Table 4 : TBA value of fish fingers during different storage times at 5°C in Experiment I and II

Experiment	Treatment	Duration of storage (days)				
		3	8	13	18	23
Experiment I	A	0.027±0.002	0.038±0.000	0.039±0.004	0.087±0.002	0.140±0.010
	B	0.028±0.001	0.039±0.001	0.058±0.002	0.090±0.001	0.141±0.060
	C	0.027±0.000	0.041±0.000	0.063±0.003	0.091±0.001	0.150±0.010
	D	0.028±0.001	0.040±0.001	0.070±0.001	0.091±0.020	0.170±0.020
	E	0.029±0.009	0.041±0.001	0.072±0.001	0.089±0.002	0.170±0.010
Experiment II	P	0.018±0.003	0.044±0.000	0.071±0.002	0.091±0.003	0.112±0.009
	Q	0.023±0.006	0.041±0.002	0.064±0.002	0.093±0.001	0.012±0.021
	R	0.016±0.001	0.039±0.002	0.012±0.004	0.073±0.000	0.081±0.091
	S	0.028±0.000	0.030±0.001	0.071±0.002	0.084±0.002	0.018±0.010
	T	0.022±0.002	0.033±0.000	0.072±0.001	0.091±0.005	0.172±0.001

Table 5: Water Holding Capacities of fish fingers during storage at 5°C in experiment I and II

Experiment	Treatment	Duration of storage (days)				
		3	8	13	18	23
Experiment I	A	43.96±0.05	35.05±0.03	31.18±0.01	29.38±0.01	24.70±0.01
	B	50.05±0.03	48.67±0.02	43.63±0.03	38.07±0.02	32.89±0.01
	C	59.42±0.02	41.90±0.10	35.87±0.02	29.96±0.02	
	D	61.66±0.01	46.88±0.09	42.51±0.02	41.88±0.02	37.85±0.02
	E	55.89±0.07	42.03±0.02	39.14±0.07	38.74±0.08	30.91±0.04
Experiment II	P	49.67±0.55	48.87±0.13	44.51±0.50	40.75±0.25	35.94±0.09
	Q	43.01±0.08	42.98±0.04	41.49±0.41	38.02±0.11	23.72±0.06
	R	45.02±0.03	43.04±0.01	37.52±0.48	33.52±0.29	30.10±0.02
	S	43.46±0.16	42.35±0.61	39.58±0.49	32.58±0.44	28.56±0.44
	T	39.79±0.59	39.38±0.02	33.89±1.82	30.50±0.46	25.66±0.45

Sensory evaluation test

Twelve panelists participated in the sensory evaluation test for Experiment I. The sensory evaluation test was conducted according to a non parametric statistical test. Appearance, colour, texture, taste, juiciness and general acceptability of fish fingers were evaluated (Brogstrom, 1961). Fifteen panelists participated in the sensory evaluation test for Experiment II.

The sensory evaluation test, results given Table 6 shows that samples B and C recorded the highest values for appearance. Sample C recorded the highest values for taste, general acceptability and texture. Sample D recorded the highest value for colour. Juiciness was best in Samples A and E. Sample C which had the combination of 50% binder and 50% palmyrah tuber flour was the best out of five types of fish fingers prepared.

Table 6: Sensory evaluation scores for fish finger samples in Experiment I

	Treatment				
Characters	A	B	C	D	E
Appearance	5.41±1.03	6.00±1.02	6.00±0.75	5.50±1.20	5.08±0.89
Colour	5.16±0.93	5.60±0.83	5.15±0.86	5.75±1.09	5.25±0.96
Texture	4.91±0.74	5.41±1.01	5.58±1.25	5.35±0.93	5.33±1.06
Taste	4.16±1.01	4.83±0.99	5.58±0.95	5.16±0.91	5.08±1.21
Juiciness	5.41±0.66	5.25±0.71	5.25±0.81	5.33±0.68	5.41±0.74
General acceptability	4.91±1.22	5.68±0.88	5.75±0.72	4.91±0.54	5.16±0.42

In Experiment II, as given Table 7, treatment R had the highest scores for appearance, colour, texture, taste and general acceptability. High scores for general acceptability and taste would be due to the addition of higher amounts of pepper, garlic, chillie and cummin and the seasoning of fish.

Table 7: Sensory evaluation scores for fish finger samples in Experiment II

Characters	Treatment				
	P	Q	R	S	T
Appearance	5.06±1.02	5.13±1.08	5.66±1.20	5.13±1.08	5.53±0.96
Colour	5.00±0.76	5.53±0.72	5.80±1.35	4.73±0.05	4.93±0.72
Texture	4.86±0.82	4.93±0.69	5.60±0.65	4.53±0.06	5.13±1.03
Taste	4.73±1.06	4.60±0.45	5.73±0.46	4.60±1.35	4.80±1.12
Juiciness	4.93±0.95	4.73±0.56	5.01±0.56	4.80±0.59	4.67±0.98
General acceptability	5.27±1.85	5.07±1.85	5.80±0.72	4.93±0.74	4.80±0.78

CONCLUSIONS

The appearance, colour, and texture did not vary very much when compared with such sensory characters of the control sample. However, the sensory evaluation scores recorded were highest when a combination of binder flour (50%) and palmyrah tuber flour (50%) was used. Juiciness was better in Samples A and E. The over-all acceptability was best for the sample with the composition of 50% imported binder flour and 50% palmyrah tuber flour as binder. This was true in both experiments. Therefore, it can be inferred that palmyrah tuber flour can be used as a binder in the preparation of fish fingers.

REFERENCES

Berk, Z. (1976). The Biochemistry of Foods. Elsevier Scientific Publishing Company, Amsterdam. pp. 292-996.

Brogstrom, G. (1965). Fish as Food. Academic Press, New York. 2: 281-283.

Brogstrom, G. (1961). Fish as Food. Academic Press, New York. 3: 235-239.

Lawrie, R.A. (1979). Meat Science, Rehert Maxwell, M.C. pp. 189-192.

Novikov, V.M. (1979). Hand Book of Fishery Technology. Amerind Publishing Co. Pvt. Ltd., New York. 1: 3-33.

Roessink, C.L. (1989). Battered and breaded products. Infofish International. 4: 17-20.

Su-Poh Chen and Lisac (1989). Fish Floss. Infofish Marketing Digest. 2: 31-33.

Suzuki, T. (1981). Fish and Krill Protein Processing Technology. Applied Science Publishers Ltd., London. 4: 1-60.