

Cracker from Kilka

Amir H. Shojaei

Mazandaran Fisheries Research Centre
P.O. Box 961, Sari, Iran

A study was undertaken for the preparation of cracker by incorporating meat of kilka, an under utilised fishery resource of the Caspian sea. 17 formulae with varying amounts of ingredients were tried initially and a formula that was found to be the best was selected. The fish:flour ratio in the selected formula was optimised so that a product of maximum linear expansion, crispness and best organoleptic qualities was obtained. The cracker produced remained in acceptable condition for 4 months at room temperature.

Key words: *Clupeonella* spp, cracker.

Fishery resources of the Caspian sea is vast and varied. Despite this the level of consumption of fish in Iran is relatively low when compared with other countries of the region. The national diet is still heavily dependent on vegetable proteins (Shojaei & Gholami, 1966). The mean annual fish consumption in Iran is 4.4 kg which is very low in comparison with developed countries (Lima dos Santos, 1995). Kilka, a small fish comprising of three species of Clupeids, viz. *Clupeonella engrauliformis*, *C. grimmi* and *C. cultriventris caspia*, is the largest fishery of Caspian sea (Shojaei & Gholami, 1966). 10% of the landings is used for canning and the rest, for fish meal production. No efforts have been made so far for making better use of this valuable resource. Some products in minced and canned forms are being produced from kilka, but this was not taking into account the consumer perception or market requirements. Therefore there exists a need to explore the possibility of developing wider range of products from this fish for better utilization of this resource.

In this project, experiments were conducted to develop a method for the production of crackers by suitably modifying the sausage production technology. Crackers or keropok are popular snack foods in Malaysia, Thailand, Indonesia and other Asian countries. They are produced by gelatinization of starch with water to a dough which is shaped, cooked, sliced and then dried. Fish, shrimp or other food ingredients are also usually added (Yu, 1986; 1992). When immersed in hot oil, the slices expand into a low density porous product. The objective of the study was to develop a formula for crackers incorporating kilka mince.

Materials and Methods

Fish obtained fresh from the vessel was washed, beheaded, gutted and again washed 2-3 times with cold water containing 3% salt, minced and mixed with different ratios of flour and other ingredients (Table 1) employing a cutter until a uniform distribution of ingredients was achieved. The mixture was then stuffed using a machine into 45-55 mm diameter fibrous casing and tied at both

Table 1. Composition (% weight) of the 17 formulae for preparation of cracker

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
Fish	35	35	28	30	35	25	30	31	27	35	35	35	42	35	29	35	35
Flour	35	25	41	20	25	25	16	21	21	35	29	29	22	29	36	35	35
	W	W	W	W	W	W	W	W	W	C	E	P	W	W	W	S	T
Starch		5		8	6	13	14	10	13		6	6	6	6	5		
Ice	20	19	19	18	17	19	16	17	16	15	17	16	16	14	16	18	19
Egg	4	7	5	10	8	7	10	10	10	5	5	5	4	5	5	4	4
Oil	2.5	5	3	5		5			3								
Sugar	1	1	1	2	2.5	3.5	5	4	4	3	2.6	3	2	2	1.6	1.6	1.6
Salt	2	2	2	2.5	2.5	1.8	2.6	3	2	2	2	2	2.7	2	2	1.7	1.7

C, corn meal; E, extracted wheat; P, popcorn meal; S, Sardori flour; T, tapioca flour, W, whole wheat flour

ends. The stuffed rolls were steamed for two hours at atmospheric pressure and cooled by cold water. They were then chilled at 4-6°C overnight until firm and sliced mechanically to a thickness of 2-3 mm. The slices were dried initially at 45°C and then at a final temperature of 70°C. The slices were packed in cellophane.

17 formulations (Table 1) with predetermined amounts of ingredients were prepared and tested to select the best formula. The proportions of fish and flour in the selected basic formula were varied (60:40, 50:50 and 40:60) to find out the best combination. Products prepared in this way were stored at room temperature for four months for determining the shelf life.

The linear expansion of the dried cracker was determined using the method of Siaw & Yu (1985). Organoleptic evaluation of the samples fried at 200°C was carried out by 20 panellists who were asked to rate the colour, odour, crispness and flavour of products with a rating of 5 for excellent and 1 for poor (Yu & Mitchell, 1981).

Moisture, ash and peroxide value (PV) were determined following the methods of Hasegawa (1987). Crude protein and fat contents were determined by the AOAC (1990) method. Total volatile nitrogen (TVN) was determined as per the method of Parvanch (1992). Total viable count (TVC) was obtained by spread plate count at 37°C after 48 h (ISIRI, 1989; Marvin, 1984) and coliform count was determined at 37°C after 24 h (ISIRI, 1991). Fungal growth was estimated by the surface plate method at 22-25°C for 3-5 days (Karim, 1991; Marvin, 1984).

The data obtained were analysed by SPSS software. Analysis of organoleptic and microbiological data was carried out by Kraskal wallis method and chemical parameters, by analysis of variance (Bazigos, 1983; Howell, 1989).

Table 2. Organoleptic qualities and linear expansion of crackers prepared by using 17 different formulae

Formula	Linear expansion %	Crispiness*	Odour*	Flavour*	Colour*	
					Fried	Raw
A	20	2.10	3.0	2.0	2.00	1.00
B	15	2.80	4.0	3.0	2.00	3.00
C	25	2.60	4.0	2.0	3.00	3.00
D	10	2.30	4.1	4.0	3.25	2.10
E	20	2.90	4.2	3.0	3.10	3.20
F	20	3.20	4.0	3.0	3.72	3.10
G	30	3.20	4.1	4.0	3.70	3.85
H	37	3.30	4.5	4.1	3.81	3.45
I	35	3.20	3.9	3.8	3.80	4.30
J	2	1.20	4.1	3.2	2.80	3.10
K	20	3.80	4.2	4.1	3.92	4.40
L	3.5	1.30	3.9	2.8	3.00	2.80
M	32	3.50	3.9	3.7	3.63	3.65
N	43	3.60	3.8	3.7	4.00	4.10
O	46	3.60	3.8	3.5	3.90	4.20
P	65	4.20	4.0	3.9	3.98	4.30
Q	98	5.00	4.8	4.6	5.00	4.50

* 5, excellent; 4, good; 3, fair; 1, unacceptable

Table 3. Chemical and microbial qualities of cracker prepared by using 17 different formulae

Formula	Fungi cfu/g	Coliform cfu/g	TVC cfu/g	PV meq/kg	TVN mgN/100g	Protein %	Fat %	Ash %	Moisture %
A	200	0	20	1.04	8.8	38.6	17.3	5.6	14.7
B	0	0	10	0.96	9.7	34.3	26.8	5.7	9.8
C	100	0	30	1.67	10.0	26.1	21.1	5.1	12.5
D	0	0	100	0.97	10.5	26.0	26.5	4.5	16.4
E	0	0	820	1.12	10.3	30.2	9.7	4.5	16.1
F	0	0	100	0.86	10.6	35.3	28.1	8.5	9.5
G	0	100	200	2.00	9.8	10.5	8.2	7.3	17.6
H	0	0	10	2.46	5.5	28.6	21.4	7.3	15.0
I	0	200	20	1.69	8.4	22.2	15.1	4.6	19.9
J	400	0	600	1.10	7.9	32.1	12.0	-	13.4
K	0	0	200	0.98	8.1	28.6	6.7	-	15.1
L	300	0	500	1.16	6.3	35.4	10.8	-	11.4
M	0	0	20	1.35	11.9	33.2	7.9	8.1	14.5
N	0	0	30	1.06	10.9	26.1	7.7	7.1	17.7
O	0	0	10	1.97	9.9	32.4	6.1	5.7	13.6
P	0	0	10	1.12	11.9	26.1	6.9	3.0	15.2
Q	100	0	200	1.98	12.1	13.5	4.0	5.2	10.7

Results and Discussion

Mixing is the most critical step in the production of cracker as it affects the degree of gelatinization and hence the quality of the product (Yu, 1986). In this study mixing for 15 minutes yielded a product of good quality. The degree of gelatinization depends on the cooking process also. Cooking time varies with size and diameter of the roll and ingredients used. In the present study a temperature of 80°C was maintained for 2.5 hours for rolls of 55 mm thickness. Quality of the cracker, particularly expansion characteristic will be affected by the drying technique (Yu, 1986). An initial low temperature of 45°C was necessary to prevent case hardening and consequent poor expansion. A final temperature of about 70°C was used in order to maintain a moisture content of about 10 percent by weight.

The results of organoleptic evaluation of cracker produced using the different formulations are given in Table 2. It was seen that formulae P and Q were significantly different in colour, flavour and crispness ($P < 0.0001$) and were more acceptable. Out of these two, formula Q gave a product with better linear expansion, colour, crispness etc. The percentage of linear expansion of cracker of formula Q was the maximum. The degree of crispness was related to the nature and quantities of the flour used in the product. The crispness rating of product with tapioca flour

Table 4. Organoleptic qualities of crackers prepared from formula Q with varying ratios of fish to flour

Formula	Fish:Flour ratio	Crispiness	Odour	Flavour	Colour
1	60:40	3.00	3.00	3.75	4.25
2	50:50	3.20	3.80	3.90	4.50
3	40:60	3.80	3.90	3.00	4.60

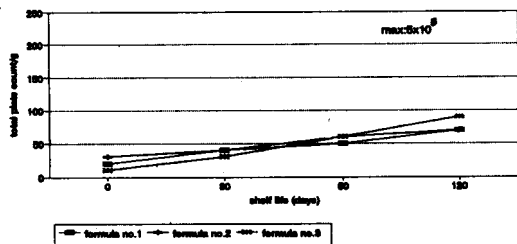


Fig. 1. TVC changes in cracker during 4 months of storage.

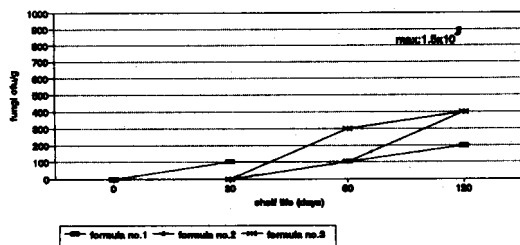


Fig. 2. Changes in fungal growth in cracker during 4 months of storage.

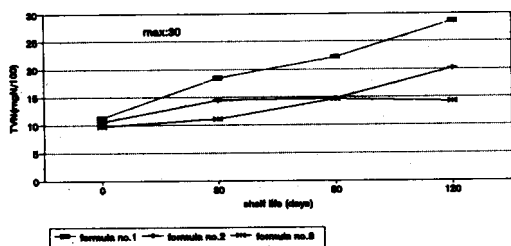


Fig. 3. TVN changes in cracker during 4 months of storage.

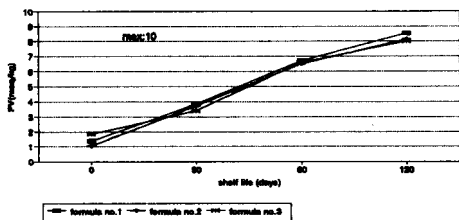


Fig. 4. Changes in PV in cracker during 4 months of storage

(formula Q) was much higher compared to the other samples (Table 2). Therefore

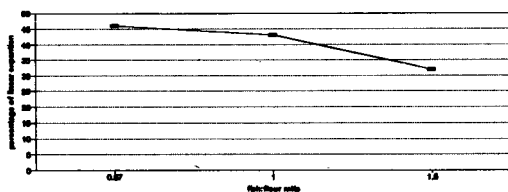


Fig. 5. The effect of fish: flour ratio on linear expansion of cracker

this formula was selected for further improvements.

The results of organoleptic evaluation of the 3 formulae (based on formula Q) with varying ratios of fish : flour are shown in Table 4. It was seen that formula 2 (50% fish + 50% flour) was more acceptable to panellists compared to formulae 1 and 3.

Products prepared based on formula Q were stored for 4 months. The changes in chemical and microbial parameters during storage are shown in Fig. 1 to 4. The level of microorganisms increased marginally and chemical parameters like TVN and PV also showed slight increase during this period. But these changes did not affect the acceptability of the products and it was seen that the differences between groups were not significant. There was not any change in colour of the samples during storage. It was therefore concluded that the formula Q with equal amount of fish and flour gave cracker of the best quality.

Linear expansion is a critical parameter determining the quality of the product. This depends on the kind of flour, physical properties of the fish - flour mixture, variation in the thickness of slices and the drying process. A linear

expansion greater than 77% was found to be the ideal level of crispness (Yu, 1992; Yu & Mitchell, 1981). Well mixed and homogeneous mixture of fish and flour will result in good expansion. There is a direct relation between the extent of expansion and the nature and quantities of flour in the product. Yu & Mitchell (1981) had observed that high level of fish in the product caused poor expansion. It can be seen from Fig. 5 that the results of the present investigation are in agreement with the above observations.

The author is indebted to Dr. R. Pourgholam, the former director and Dr. S.A. Hooseini the present director of MFRC. He also gratefully acknowledges the assistance provided by S. Solaimani the director and H. Shariatzadeh the production manager of Amol meat products company. The author also wishes to thank Dr. S. Subasinghe, Technical advisor of Infotech and M. Falahi, lecturer of Mashad Uni. for supervising the project. Special thanks are due to A. Salmani, S. Gholamipour, A. Zahedi, Z. Bankesaz, R., Safari, H. Fazli for technical assistance.

References

- AOAC (1990) *Official Methods of Analysis*, 15th edn., Association of Official Analytical Chemists, Washington, DC, USA
- Bakar, J. (1983) Keropok lekor-Boiling and Steaming Methods of processing, p. 56 Malaysia, Pertanika
- Bazigos, G.P. (1983) p. 164 *Applied fishery statistics*, FAO
- CPC/Conimex (1996) Prawn crackers, Recipe from far East, Holland, Conimex, p. 5
- Hasegawa, H. (1987) *Laboratory manual on Analytical Methods and Procedures for Fish and Products*, Marine Fisheries Research Department, Southeast Asian Development Centre, Singapore
- Howell, D.C. (1989) *Fundamental statistics for the Behavioural Sciences*, 2nd edn. p. 368, PWS-Kent publishing Co., USA
- ISIRI (1991) *Standard Methods for Isolation, Identification and Enumeration of Coliform Bacteria in Foods*, 5th edn. ISIRI, Iran, No. 437
- ISIRI (1989) *Methods for Preparation of Food Stuffs Samples and Enumeration of Different Micro Organisms*, 6th edn. ISIRI, Iran, No. 356
- Karim, G. (1991) *Microbial Examination of Food Stuffs*, p. 220, Tehran Uni. Iran
- Lima dos santos, C. (1995) *Marketing of Pelagic Fishes* (Translated by Sajadi, M.) p. 95, 5th National Conference of Fisheries, Iran
- Marvin L.S. (1984) *Compendium of Methods for Microbial Examination of Food*, p. 107, APHA, Washington, DC, USA
- Parvanch, W. (1992) *Quality Control and Chemical Examination of Food Stuffs*, p. 249, Tehran Uni., Iran
- Shojaei, A. & Gholami, S. (1996) *Kilka, Trade and Processing*, Sixth National Conference of Fisheries, Iran
- Siaw, C.L. & Yu, Y. (1985) *J. Food Technol.* 20, 17
- Yu, Y. (1986) *Infotech Marketing Digest* No. 6/86 Infotech, Malaysia
- Yu, Y. (1992) *Asian Food J.* 7, 51
- Yu, Y. & Mitchell, J. (1981) *J. Food Technol.* 16, 51