Canned Minced Fish

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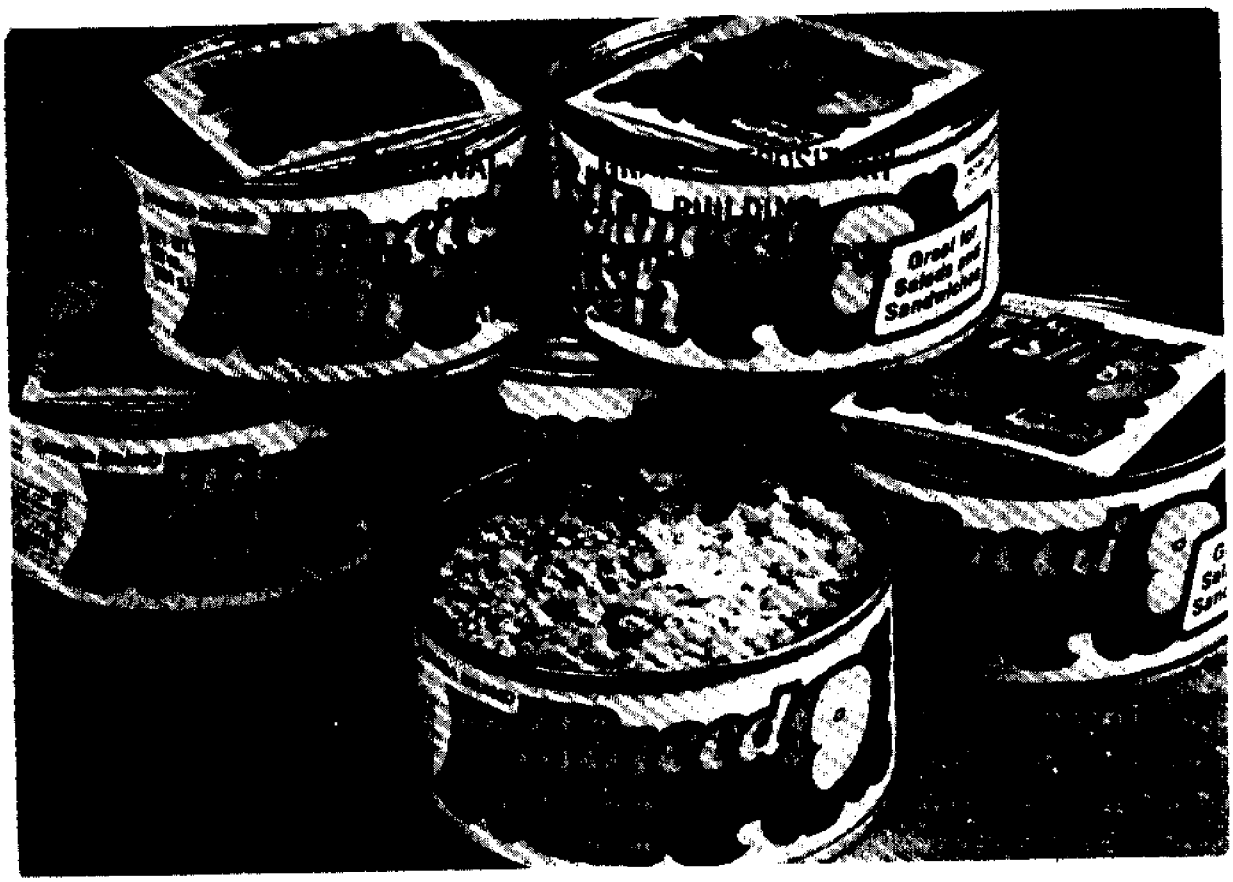

Development of Products from Minced Fish: Booklet 8

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DEVELOPMENT OF PRODUCTS FROM MINCED FISH:
8. CANNED MINCED FISH

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ABSTRACT

Canned minced mullet was developed as a lower priced alternative to canned grated tunafish. Precooking procedures were evaluated for precook yield, amount of drip (cookout) in cans,and the most desirable product in terms of color, texture, tenderness, juiciness, flavor, and overall acceptability. The procedure that produced the best product is described.

DEVELOPMENT OF PRODUCTS FROM MINCED FISH:

8. CANNED MINCED FISH

INTRODUCTION

Each year in the United States we waste thousands of tons of fish. These are underutilized fish known in the fishing industry as "trash" fish. One of the reasons certain fish are considered to be trash fish is because of the number and placement of the bones they contain. American consumers do not like bones in their fish. White sucker (Catostomus commersoni) is a fish with a good flavor but contains many y-bones and so it is put in the "trash fish" category. The solution to the problem of utilization of white sucker is to debone it mechanically. We have done this at Cornell, and made convenience products such as Seafood Crispies and Seafood Chowders as well as marketing it, uncooked, frozen, in a one pound package for consumers to thaw and cook as they desire.

Canned fish is an alternative way of marketing this fish. American consumers don't like bones and skin in fish, except in salmon and sardines, probably because the all-American canned fish, tuna, doesn't have bones or skin. Since the white sucker is deboned by machine, skin and bones are no longer a problem, and when it is cooked, the texture is reminiscent of grated tuna, but less fibrous. All in all, canned minced fish sounded promising, and a project to determine the best way to process it before canning was undertaken.

Canned Minced Fish

Before the project was started, we discussed the quality factors which we felt were important in a canned minced fish product, and we concluded that the following were most desirable:

1. The highest precook yield. In terms of economics, the higher the yield, the better.
2. A moderate amount of drip (liquid or juice) in the cans. Too little would result in a dry product but too much would reduce the amount of fish in the can, and probably result in unhappy purchasers.
3. The most desirable product obtainable organoleptically, in terms of color, texture, tenderness, juiciness, flavor, and overall acceptability.

GENERAL PROCEDURES

The minced fish which we used in these experiments was white sucker (Catostomus commersoni), called mullet in Canada and the Great Lakes area. It was headed and gutted, then deboned in a Bibun deboner, frozen in 25 pound blocks and stored at -28°C (-10°F) until needed. All the fish was thawed before cooking, by slicing into slabs approximately ½ inch thick on a band saw and allowing to thaw at room temperature, well covered, until just thawed. At this point it was refrigerated at 1-2°C (33-35°F) until used (the same day).

In the development of recipes for using frozen minced fish, we found that the addition of a tablespoon or two of vegetable

oil per pound of fish was necessary to prevent a "dry" mouth feel. Therefore, five percent vegetable oil was added to all batches. Salt was also added, at the level of five percent, to all batches.

After precooking, the fish was packed in tunafish-sized (303 x 113) cans, exhausted by heating in a water bath to 77°C (170°F), and sealed with a Dixie Can Sealer (Model 23-500, Dixie Can Co., Athens, GA 30603). The cans were processed at 121°C (250°F) (15 lb pressure), for 55 minutes, comparable to the schedule advised for canning tunafish in the same size cans (Jackson and Shinn 1979).

Testing Procedures

Yields were calculated by weighing the fish before and after being cooked and drained for 20 minutes. The drained-off drip was also weighed.

Can drip was calculated by weighing the contents of the unopened can (tared by a can and a lid), opening the can, inverting over a funnel inserted in a graduated cylinder, and draining for two minutes. The can contents and the drip were weighed and percent yields and percent can drip calculated.

A taste panel of eight interested people, all of whom had much experience in the evaluation of fish products, taste-tested the canned fish. The panel was composed of faculty members, technicians, and graduate students, both male and female. Tasting was done at individual booths and water, celery, and

unsalted crackers were provided for use between samples. The fish was always served at room temperature, in individual coded sample cups. The score sheet used a semi-structured scale from 9 to 1 for all attributes. A copy can be seen in Fig. 1.

All experiments were performed at least twice.

FIGURE 1. SCORE SHEET FOR CANNED MINCED FISH

Name:_____

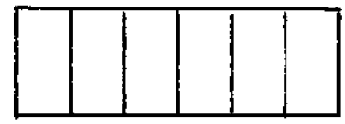
Product: Canned Minced Fish

Texture

9 8 7 6 5 4 3 2 1

Like extremely — On the fence — Dislike extremely

- X % V : =



Juiciness

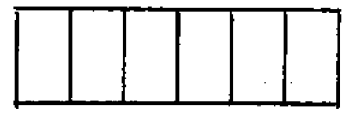
9 8 7 6 5 4 3 2 1

Like extremely — On the fence — Dislike extremely

Flavor

9 8 7 6 5 4 3 2 1

Like extremely — On the fence — Dislike extremely



Overall Desirability

9 8 7 6 5 4 3 2 1

Like extremely — On the fence — Dislike extremely

COMMENTS:

INDIVIDUAL EXPERIMENTS

Effect of precook method

In the first series of experiments we tried various methods of precooking the fish before canning. One percent salt and one percent FP88E (a blend of salt, sodium hexametaphosphate, and sodium erythorbate, from Stauffer Chemical Co., Westport, CT 06880) were added to all batches of fish. To half of the lots, one for each cooking method, five percent oil was added before cooking; to the other half, five percent oil was added after cooking (before packing in the cans). All batches were fully cooked before canning, and no precooking drip was added to the cans.

Precook methods were as follows:

A. Fry pan: The fish was cooked, with stirring, in an electric fry pan set at 163°C (250°F) until all fish was coagulated (about 10 minutes).

B. Bake 149°C (300°F): The fish was packed in a shallow pan, covered with aluminum foil, and baked for 20 minutes.

C. Bake 219°C (450°F): The fish was packed in a shallow pan, covered with aluminum foil, and baked for 15 minutes.

D. Steam: The fish was spread on a cheesecloth covered rack in a steamer and steamed until coagulated, 10 minutes for a one inch layer of fish.

TABLE 1. EFFECT OF COOKING METHOD AND TIME OF ADDITION OF OIL ON PRECOOK YIELDS AND CAN DRIP OF MINCED MULLET

Method	Oil addition	Precook yield (%)	Can drip (%)
Fry pan (250°F)	Before cook	94.6	18
	After cook	86.3	15
Bake (20 min; 300°F)	Before cook	96.5	22
	After cook	95.9	16
Bake (15 min; 450°F)	Before cook	91.2	18
	After cook	91.1	13
Steam	Before cook	97.5	35
	After cook	87.1	18

TABLE 2. EFFECT OF COOKING METHOD AND TIME OF OIL ADDITION ON TASTE PANEL SCORES OF CANNED MINCED MULLET

Cooking method	Oil addition	Taste panel scores			
		Texture	Juiciness	Flavor	Overall acceptability
Fry pan	Before	7.0	7.0	6.5	6.5
(250°F)	After	6.3	5.0	5.8	5.9
Bake	Before	5.5	5.3	4.3	4.3
(300°F)	After	5.9	6.6	5.8	5.7
Bake	Before	5.9	4.3	5.1	5.4
(450°F)	After	5.5	5.0	5.1	5.1
Steam	Before	6.6	6.6	6.0	6.1
	After	6.3	6.2	5.8	5.9

Results (Table 1) showed that adding the oil before precooking the fish gave a higher yield, when cooked in the fry pan or in steam, and made little difference when the fish was baked. In all cases adding the oil before cooking increased the percent can drip above 15 percent, whereas adding the oil after precooking brought the percent can drip down to a more desirable amount. The exception to this was cooking in steam, a moist heat method, in which case the can drip was excessive no matter when the oil was added. We decided at this time that percent drip above 20 percent would be considered excessive, and 15 percent drip is what we would prefer.

Taste panel scores (Table 2) indicated that cooking in a frying pan, adding the oil before cooking, was the preferred method of precooking the fish. This method received the highest scores on all factors. The next best rated method was cooking in steam with the oil added before cooking, but this method had an objectionably high percent drip (over 1/3 of the can contents). Cooking in the fry pan with oil added afterward was the next highest, and had an added advantage of a low percent of drip. We decided to use the frying pan method for future experiments. On a large scale this method was later adapted by using a steam-jacketed kettle, with agitation, for production of canned minced fish for a market test.

Effect of degree of cook, phosphate, and time of oil addition

In the next series of experiments, we investigated the following:

1. The effect of cooking lightly, moderately, or completely before packing in the cans;
2. The effect of phosphate addition;
3. The effect of time of oil addition, in combination with degree of cook.

The procedures were as follows:

Batch A.
1. Add 1% salt to minced fish, stir to mix, refrigerate overnight
2. Cook
   a. lightly coagulated
   b. moderately coagulated
   c. completely coagulated
3. Add 5% oil, fill cans, evacuate, seal, process.

Batch B.
1. Mix 1 1/2 minutes on low (#1 speed) using a Hobart K-50 mixer with 5% oil and 1% salt
2. Finish as for A.

Batch C.
1. Mix with phosphate (1% FP-88E)
2. Finish as for A.

Batch D.
1. Mix 1 1/2 minutes on low (#1 speed) using a Hobart K-50 mixer, with salt, oil, and phosphate
2. Finish as for A.

TABLE 3. EFFECT OF DEGREE OF COOK (BEFORE CANNING), PHOSPHATE ADDITION, AND TIME OF OIL ADDITION ON YIELDS AND CAN DRIP OF MINCED MULLET

Treatment		Degree of cook		
		Light	Moderate	Complete
CONTROL				
Oil before cook:	Cook yields			
	Total (%)	83.3	81.0	82.9
	Cook drip (%)	8.5	7.7	7.0
	Drip in cans (%)	25.5	25.6	20.2
Oil after cook:	Cook yields			
	Total (%)	86.7	83.2	84.3
	Cook drip (%)	3.7	7.0	1.9
	Drip in cans (%)	26.9	20.3	16.6
PHOSPHATED				
Oil before cook:	Cook yields			
	Total (%)	94.4	91.8	84.6
	Cook drip (%)	0	0	0
	Drip in cans (%)	26.0	23.7	19.4
Oil after cook:	Cook yields			
	Total (%)	92.7	92.3	74.4
	Cook drip (%)	0	0	1.7
	Drip in cans (%)	23.6	24.4	20.5

TABLE 4. EFFECT OF PHOSPHATE ADDITION AND DEGREE OF COOK BEFORE CANNING ON TASTE PANEL SCORES FOR CANNED MINCED MULLET

Treatment	Degree of cook		
	Light	Moderate	Complete
CONTROL			
Oil added before cooking			
Color	4.9	7.3	7.7
Texture	6.4	6.1	7.0
Tenderness	4.9	5.1	5.3
Juiciness	6.2	6.1	6.1
Flavor	5.9	6.5	6.6
Overall acceptability	5.0	5.8	6.9
Oil added after cooking			
Color	7.5	7.6	7.6
Texture	6.0	6.3	6.5
Tenderness	4.1	5.4	5.6
Juiciness	5.8	6.2	6.5
Flavor	5.7	5.4	6.1
Overall acceptability	5.9	6.1	6.2

(continued)

TABLE 4. EFFECT OF PHOSPHATE ADDITION AND DEGREE OF COOK BEFORE CANNING ON TASTE PANEL SCORES FOR CANNED MINCED MULLET (continued)

Treatment	Degree of cook		
	Light	Moderate	Complete
PHOSPHATED			
Oil added before cooking			
Color	6.4	6.6	7.5
Texture	7.3	7.1	6.9
Tenderness	4.3	4.8	5.0
Juiciness	6.5	7.0	6.6
Flavor	6.1	7.0	6.6
Overall acceptability	6.3	6.8	6.8
Oil added after cooking			
Color	7.0	7.0	7.5
Texture	5.8	6.0	6.6
Tenderness	4.8	4.6	5.3
Juiciness	6.1	6.0	6.7
Flavor	6.0	6.0	6.9
Overall acceptability	6.7	6.3	7.1

Results in Table 3 showed that the more completely we cooked the fish before canning, the lower the yield, and since the yield was lower the percent of drip in the cans was also lower. Adding phosphate to the fish before cooking increased the precook yield, and reduced the precook drip to zero in most cases, when cooked in small quantities. However, the percent of can drip showed no consistent benefit. The lowest percent can drip was obtained by cooking completely, with oil added after cooking, and no phosphate added.

Taste panel scores (Table 4) showed that in general all scores were higher for the completely cooked fish than for the lightly or moderately cooked fish. Overall acceptability scores were slightly higher for phosphated fish with the oil added after cooking, lowest for nonphosphate fish with the oil added after cooking. When the oil was added before cooking, the results were little different.

Optimization of amount of precook drip

The next series of experiments was designed to determine the optimum amount of precook drip to add to the cooked fish before canning. One-half of the fish was phosphated, the other half served as a control. Oil was added both before and after cooking, as a check on the previous series. The general procedure for each of the four batches described below is as follows:

The fish was cooked in a frying pan set at 163°C (250°F) until done (about 10 minutes), drained 20 minutes; then the

fish and the cookout were weighed. The batch was divided into thirds. One third was packed in cans with no cookout (drip), one third with 50 percent of the cooking cookout added, and one third with 100 percent of the cookout added, based on the weight of the drained cookout and the weight of the cooked fish.

Batch A. Five percent oil and one percent salt were added to the fish and the mixture mixed 1 1/2 minutes on #1 speed before cooking.

Batch B. Five percent oil was added to the cooked fish before packing into the cans.

Batch C. One percent salt and one percent phosphate plus five percent oil were added to the fish, which was then mixed at #1 speed for 1 1/2 minutes before cooking.

Batch D. Salt and phosphate as for treatment C were stirred into the fish before cooking and five percent oil was added to the cooked fish before weighing into the cans.

Taste panel scores (Table 5) showed that adding 100 percent of the cooking drip to the fish before canning resulted in higher scores for all factors (with very few exceptions) than when no drip or only 50 percent of the cookout drip was added. Texture and juiciness scores were higher, and flavor scores were also improved. In this series, higher scores in general were obtained by adding the oil before cooking. Phosphating made little difference when the oil was added after cooking, but when it was added after cooking the nonphosphated fish had higher scores.

TABLE 5. EFFECT OF PERCENT OF DRIP ADDED TO CANS ON TASTE PANEL SCORES* FOR CONTROL AND PHOSPHATED MINCED MULLET

Treatment	Percent of drip added to cans		
	0	50	100
CONTROL			
Oil added before cooking			
Texture	6.5	6.5	7.0
Juiciness	4.5	5.0	7.0
Tenderness	5.5	5.0	5.0
Flavor	5.5	5.5	7.0
Overall acceptability	5.0	5.5	7.5
Oil added after cooking			
Texture	4.5	5.5	5.5
Juiciness	3.5	6.0	6.0
Tenderness	5.5	5.5	5.5
Flavor	4.0	5.5	7.0
Overall acceptability	4.0	5.0	6.5

(continued)

TABLE 5. EFFECT OF PERCENT OF DRIP ADDED TO CANS ON TASTE PANEL SCORES* FOR CONTROL AND PHOSPHATED MINCED MULLET

Treatment	Percent of drip added to cans		
	0	50	100
PHOSPHATED			
Oil added before cooking			
Texture	6.5	6.0	7.5
Juiciness	4.5	6.5	7.5
Tenderness	5.5	5.0	5.0
Flavor	5.5	5.5	7.5
Overall acceptability	5.0	6.5	8.0
Oil added after cooking			
Texture	5.0	5.0	6.5
Juiciness	4.5	4.5	5.0
Tenderness	5.5	5.5	5.5
Flavor	4.0	6.0	6.0
Overall acceptability	4.10	5.0	5.5

*Taste panel scores were evaluated on a scale from 9 to 1, where 9 = like extremely and 1 = dislike extremely, for all attributes.

Addition of vegetable broth

In the course of the previous experiments a bitter flavor in the fish was occasionally noted by some of our taste panelists. In an experiment to find out how to avoid this, the precooking drip was drained off part of a batch of cooked fish and replaced with a vegetable broth. The broth was the liquid obtained by simmering 1/2 cup sliced carrots, 1/2 cup chopped celery, and 1/2 cup chopped onions in two quarts water for 20 minutes. Five percent oil and one percent salt were added to both the cans with vegetable broth and the cans with precook drip. Testing, using judges who had previously detected this bitter flavor, showed that when the precook drip was added to the cans the objectionable bitter flavor was noted. When the vegetable broth was substituted, this flavor was absent. The bitter flavor appears to be water soluble, and may be related to rancidity. In order to avoid the chance of its appearance in the canned fish, we feel that the substitution of vegetable broth for the precook drip is good insurance.

IN SUMMARY

On the basis of (1) the most acceptable product, organoleptically, (2) an acceptable amount of can drip, and (3) the most economical in terms of equipment we recommend the following procedure for canning minced mullet:

1. Thaw fish, if frozen, in a manner that keeps the bacterial population in the fish as low as possible.

2. Cook the fish in a steam-jacketed kettle, with constant stirring, until completely cooked.
3. Drain off the cookout liquid.
4. Pack in cans, adding one percent salt and five percent vegetable broth, prepared as described earlier.
5. Process according to the specifications from your can supplier, for your size cans.

REFERENCE

Jackson, J. M. & B. M. Shinn. 1979 Fundamentals of Food Canning Technology. Avi Publishing Co., Westport, CT.