

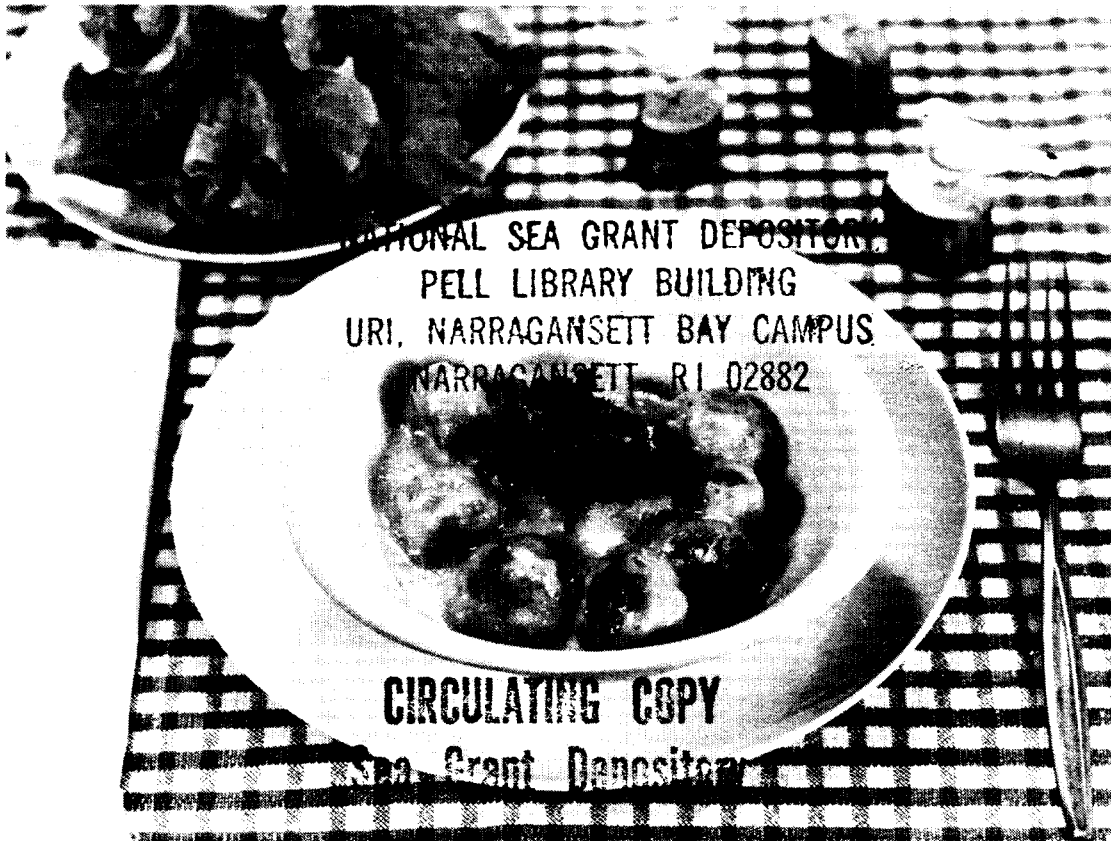
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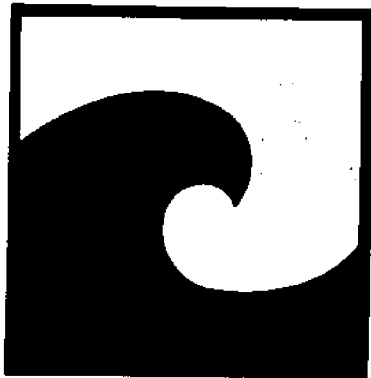
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Creamy Fish Bites

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*Development of Products
from Minced Fish: Booklet 4*



This is one in a series of booklets on minced fish products written for people in the food processing industry.

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DEVELOPMENT OF PRODUCTS FROM MINCED FISH:

4. CREAMY FISH BITES

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ABSTRACT

Since most fish muscle is light colored, it seemed logical to use it in a "Swedish meat ball" type of product, which is traditionally made from beef and pork and is light colored. Using both a taste panel and a sensory profile panel, a satisfactory product, suitable for either freezing or canning, was obtained.

DEVELOPMENT OF PRODUCTS FROM MINCED FISH:

4. CREAMY FISH BITES

INTRODUCTION

In the course of a continuing project on the development of new convenience products from minced fish of underutilized species, it was decided to explore the possibilities of using this material in "meatball" products. The tender texture, mild flavor and light color of most fish muscle seemed particularly adaptable to a "Swedish meatball" type of product which we have called "Creamy Fish Bites."

PART I. DEVELOPMENT OF THE PRODUCT

TESTING PROCEDURES

Materials

The product was developed using deboned white sucker (Catostomus commersoni) which is also called mullet in Canada and parts of the United States. The fish was commercially headed and gutted, washed, and then run through a belt type deboning machine. After freezing, the product was shipped to this laboratory in polyethylene bags and stored in a walk-in freezer at -25°C (-11°F) until used. In one study, several other species of fish were also used for comparison. Other ingredients were obtained from either suppliers of ingredients to the food industry or a local supermarket.

Taste Paneling

Products were evaluated by a trained taste panel of eight members, composed of both male and female faculty members, housewives and technicians. A score sheet using a semistructured scale from 9 to 1, the highest numbers denoting the more desirable attributes, was generally used. A sample score sheet can be seen in Figure 1. Occasionally a modified triangle test score sheet was used on which the judges were instructed to identify the odd sample, tell on what factor(s) they based their decision and to indicate preference for the pair or for the odd sample (Figure 2).

Taste paneling was done at individual booths in a well lighted room, with soda crackers and water available for use between samples.

FIGURE 1 REPRESENTATIVE SCORE SHEET FOR EVALUATION OF CREAMY FISH BITES

NAME: _____

DATE: _____

PRODUCT: CREAMY FISH BITES

Sample Codes

Texture of fish bites

9	8	7	6	5	4	3	2	1
Like extremely			On the fence			Dislike extremely		

V	S	=

Flavor of fish bites

9	8	7	6	5	4	3	2	1
Like extremely			On the fence			Dislike extremely		

--	--	--

Flavor of sauce

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:

FIGURE 2 SCORE SHEET FOR THE MODIFIED TRIANGLE TEST

NAME: _____

DATE: _____

PRODUCT: CREAMY FISH BITES

You will be given three samples to taste. Two of the samples are the same and one is different. Please circle the symbol indicating the one sample in the group that is different.

Circle one:

 X

 O

 □

On what did you base your decision?

Flavor _____

Tenderness _____

Juiciness _____

Other (name) _____

Which sample(s) do you prefer?

Odd sample _____

Pair _____

Shear Press Determinations

Shear values were obtained as follows: the cream sauce was removed from the fish bites by rolling in paper towels. Then each "bite" was trimmed to a constant weight of 8 ± 0.05 grams. Three "bites" were inserted in the standard shear cell of an Allo-Kramer Shear Press and sheared, using a 20 second downstroke and the two percent range of a 2500 pound proving ring. Maximum force values were calculated as pounds of force per gram required to shear the samples.

Microbiological Procedures

Microbiological quality was evaluated as follows: Total aerobic mesophiles - prepreured plates of Standard Methods Agar (BBL) were spread with the appropriate sample dilution, then incubated 24 to 36 hours at 21°C (69°F) for the raw product and at 37°C (99°F) for the cooked product.

Coliforms - Coliforms were quantitated by using the most probable number (MPN).

Staphylococci - Coagulase positive Staphylococcus aureus were enumerated on Baird-Parker Medium (Oxoid), incubated at 37°C (99°F) for 24 to 30 hours.

DEVELOPMENT OF THE PRODUCT

By adapting a homestyle recipe for Swedish meatballs, a basic starting formula was arrived at (Table 1). Table 2 shows the type and proportion of texturing agents which were valuated. Soy protein fiber (SPF) was added to provide a fibrous texture and "bite," textured soy protein (TSP) for a "lumpy" texture and for its absorbtive qualities, and bread crumbs (BC) for their absorbtive qualities and their tenderizing effect.

TABLE 1 BASIC STARTING FORMULA FOR CREAMY FISH BITES

<u>Ingredient</u>	<u>Percent</u>
<u>Bites</u>	
Minced fish	65.0
*Texturizing agents	14.0
Water	8.0
Egg	5.0
Onion (fresh, chopped)	4.0
Non-fat milk solids	2.0
Salt	1.0
Monosodium glutamate	0.8
Pepper	0.1
Nutmeg	0.1
Vegetable oil for frying	
<u>Gravy</u>	
Milk	85.0
Vegetable oil	10.0
Cornstarch	3.0
Soy sauce	1.0
Salt	0.8
Onion powder	0.2

*See Table 2

Procedure: Mix all fish ball ingredients for about two minutes in a Hobart K5 mixer with paddle attachment at medium speed (#2). Shape into balls, approximately 10 grams in size. Fry in a small amount of oil until slightly brown, removing as they are browned. When all the "bites" are done use the remaining oil for the gravy adding enough additional oil to make the required amount. Stir cornstarch with a small amount of milk. Add remaining ingredients to pan, bring to a boil, stir in cornstarch slurry. Cook until thickened. Add fish bites and simmer slowly for 20 minutes. Cool covered, package, and freeze.

TABLE 2 EFFECT OF TYPE AND LEVEL OF TEXTURIZERS ON TASTE PANEL SCORES
AND SHEAR VALUES FOR CREAMY FISH BITES

<u>Ingredient (%)</u>	<u>Formula</u>				
	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>E</u>
TSP	0	5.0	7.0	0	10.0
SPF	7.0	5.0	0	10.0	0
BC	7.0	4.0	7.0	4.0	4.0

<u>Parameter</u>					
Taste panel scores					
Texture	5.4	7.3	4.9	6.7	6.4
Flavor of fish bites	5.5	6.8	5.4	6.6	5.9
Overall desirability	5.5	6.9	5.3	6.6	6.4
Shear values (lb/g)	1.2	2.4	1.7	2.0	2.2

TSP: Textured soy protein, Promate III, Griffith Labs

SPF: Fibrous soy protein, SPF 200, Ralco Foods

BC: Bread crumbs, Arnold Bakers

Table 2 also shows the taste panel scores and shear values for these formulations. The TSP appeared to increase firmness slightly compared to SPF (A vs C and D vs E) because it absorbed part of the juices of the fish and the milk that was added. The formula with SPF (A) was not quite so firm. Equal parts of each, with the least bread crumbs (B), made a product which was firmer than any of the others, and had the highest scores for texture and for overall desirability.

Samples of the highest rated Formula B, which had been frozen for one month at -25°C (-11°F) in rigid plastic containers covered with waxed cardboard lids, were thawed and held in a 4°C (40°F) refrigerator for zero, four and six days, then heated in a covered casserole dish for serving to the taste panel. As can be seen in Table 3, although the desirability of texture did not change, the flavor of both fish bites and sauce became less desirable, and therefore the overall desirability scores also decreased with storage time. These fish bites, like other frozen foods, should be used as soon as possible after thawing.

TABLE 3 EFFECT OF REFRIGERATED STORAGE ON TASTE PANEL SCORES AND TBA VALUES FOR CREAMY FISH BITES (FORMULA B)

<u>Parameter</u>	<u>Days of storage</u>		
	<u>0</u>	<u>4</u>	<u>6</u>
Texture	6.4	6.3	6.4
Flavor of fish bites	6.6	6.0	5.3
Flavor of sauce	6.0	5.6	5.1
Overall desirability	6.1	5.6	5.1

Since it has been found that the addition of phosphate to fish has a beneficial effect (Baker et al., 1977) particularly in the prevention of drip loss and in some cases flavor and texture deterioration, Creamy Fish Bites were made by (1) formula B and (2) the same formula with the addition of one percent of a phosphate mixture formulated for use with fish (Stauffer FP88E) containing sodium hexametaphosphate (0.45%), salt (0.45%) and sodium erythorbate (0.1%). The products were evaluated by means of a modified triangle test. Results (Table 4)

show that the difference between the samples was significant at the five percent level, and twice as many of the people who were able to distinguish the difference preferred the phosphated sample. On the basis of these results and of other experiments, it seems worthwhile to have the fish treated with phosphate soon after deboning, and before freezing.

TABLE 4 EFFECT OF PHOSPHATING OF FISH ON CREAMY FISH BITES

<u>No. of judgements</u>	<u>No. of "correct" decisions</u>	<u>Preference</u>	
		<u>Phosphated</u>	<u>Nonphosphated</u>
16	9*	6	3

*Significant at the 5% level (P <.05) i.e., results are not due to guessing.

Reasons for decision:

Tenderness 6 judgements

Juiciness 3 judgements

In order to test the frozen shelf life of the fish bites, samples of three formulas (A, B, and C) packaged in rigid plastic containers with waxed cardboard lids were held in frozen storage at -25°C (-11°F) for three months. A fresh lot of each formula was made at this time, and samples of each were presented to the taste panel. Results can be seen in Table 5. Since little or no change had occurred in any of the parameters, it can be concluded that these products can be frozen and held frozen at -25°C (-11°F) for at least three months with little or no apparent change.

TABLE 5 EFFECT OF STORAGE AT -25°C FOR THREE MONTHS ON ACCEPTABILITY OF CREAMY FISH BITES

Parameter	Formula					
	A		B		C	
	Months		Months		Months	
	0	3	0	3	0	3
Taste panel scores						
Texture	5.5	6.1	6.1	6.6	6.4	6.7
Flavor of fish bites	6.9	6.1	6.7	7.1	5.7	5.3
Overall desirability	6.7	6.1	6.7	6.9	5.9	5.1
Shear values (lb/g)	1.4	1.7	2.0	2.2	2.3	2.0

Although this product had been treated throughout development as a frozen product, it may also have potential as a canned product. To evaluate this method of preservation, a triangle test was again used. The taste panel found a significant difference at the five percent level between the treatments (Table 6) but the frozen was only slightly preferred over the canned product. It appears that canning can be used as an alternate method of preserving Creamy Fish Bites.

TABLE 6 CREAMY FISH BITES: CANNED VS. FROZEN

No. of judgements	No. of "correct" decisions	Preference	
		Frozen	Canned
12	7*	4	3

*Significant at the 5% level ($P < .05$) i.e., results were not due to

Reasons for decision:

Tenderness 4 judgements

Flavor 4 judgements

Juiciness 1 judgement

Although white sucker had been used in previous work on this product, other fish may be more available. Minced yellowtail flounder racks (Limanda ferruginae), pollock (Pollachius virens), and cod (Gadus morhua) were compared with white sucker, and the results can be seen in Table 7. White sucker and flounder made fish bites with very similar ratings, while pollock and cod were definitely not as good. Species of fish apparently cannot be interchanged without a probability of changing the end result. However, with some reformulation, it may be possible to make a fully acceptable product.

TABLE 7 EFFECT OF SPECIES OF FISH ON TASTE PANEL SCORES AND SHEAR VALUES FOR CREAMY FISH BITES

Parameter	Fish Species			
	<u>Flounder</u>	<u>Sucker</u>	<u>Pollock</u>	<u>Cod</u>
Taste panel scores				
Texture	5.9	5.1	4.8	4.3
*Tenderness	5.4	5.3	3.4	2.9
**Juiciness	5.4	5.5	5.0	4.5
Flavor of fish bites	5.5	5.4	4.6	4.4
Overall desirability	5.6	5.1	4.8	4.1
Shear values (lb/g)	1.7	1.7	1.7	1.3

*Tenderness: 9 = too tough, 5 = just right, 1 = too tender

**Acceptability of juiciness: 9 = like extremely, 5 = on the fence, 1 = dislike extremely

An evaluation of the product using several kinds of meats and combinations thereof can be seen in Table 8. The 50/50 fish and pork

combination was very slightly preferred, for overall desirability and acceptability of texture and juiciness. Formulas containing beef were slightly less desirable, mostly in the area of flavor and tenderness. It appears that in comparison with more traditional meats, the fish rated well; and in view of economics and low fat content. it is logical to use it as a substitute.

TABLE 8 EFFECT OF MEATS AND MEAT COMBINATIONS ON TASTE PANEL SCORES AND SHEAR VALUES FOR CREAMY "MEAT" BITES

Parameter	Meats and Combinations*				
	F	B	F-B	P	F-P
Taste panel scores					
Texture	4.7	5.2	5.2	5.5	5.8
**Tenderness	3.2	6.7	6.0	4.3	3.7
***Juiciness	5.3	5.2	5.0	5.8	6.0
Flavor of fish bites	5.7	4.7	4.5	5.8	5.3
Overall desirability	5.2	5.0	4.7	5.5	5.7
Shear values (lb/g)	2.0	2.5	2.5	2.5	2.0

*F: Fish

B: Beef

P: Pork

All combinations were 50/50

**Tenderness: 9 = too tough, 5 = just right, 1 = too tender

***Acceptability of juiciness: 9 = like extremely, 5 = on the fence,
1 = dislike extremely

Based on these results, a final formulation was arrived at, and can be found in Table 9.

TABLE 9 FINAL FORMULA FOR CREAMY FISH BITES

<u>Ingredient</u>	<u>Percent</u>
<u>Bites</u>	
Minced fish	65.0
Water	8.0
Textured soy protein (Promate III, Griffith Labs)	5.0
Fibrous soy protein (SPF 200, Ralcon Foods)	5.0
Bread crumbs (Arnold Bakers)	4.0
Egg	5.0
Onion (fresh, chopped)	4.0
Non-fat milk solids	2.0
Salt	1.0
Monosodium glutamate	0.8
Pepper	0.1
Nutmeg	0.1
Vegetable oil for frying	
<u>Gravy</u>	
Milk	85.0
Vegetable oil	10.0
Cornstarch	3.0
Soy sauce	1.0
Salt	0.8
Onion powder	0.2

Procedure: Mix all fish bite ingredients for about two minutes in a Hobart K5 mixer with paddle attachment at medium speed (#2). Shape into balls, approximately 10 grams in size. Fry in a small amount of oil until slightly brown, removing as they are browned. When all the "bites" are done, use the remaining oil for the gravy adding enough additional oil to make the required amount. Stir cornstarch with a small amount of milk. Add remaining ingredients to pan, bring to a boil, stir in cornstarch slurry. Cook until thickened. Add fish bites and simmer slowly for 20 minutes. Cool covered, package, and freeze.

MICROBIOLOGICAL TESTING

A microbial examination of the Creamy Fish Bites from the raw fish to the cooked product (final formula) can be seen in Table 10. Cooking decreased the aerobic mesophile (total) count nearly two logs and the coliform count to nearly zero. Coagulase positive staphylococci were not found at any stage. Canning the product, of course, will result in "commercial sterilization," or essentially a zero population.

TABLE 10 EFFECT OF PROCESSING ON THE MICROBIAL QUALITY OF CREAMY FISH BITES

Sampling Time	Count/gram		Total Coliform (MPN)*
	Total Count	Coagulase positive staphylococci	
Raw fish	4.2×10^5	N.D.**	2.1×10^2
Raw product	5.0×10^5	N.D.	2.4×10^2
Cooked product	7.0×10^3	N.D.	3.6

*MPN = most probable number.

**N.D. = not detected.

PART II USE OF TEXTURE PROFILE IN THE EVALUATION OF CREAMY FISH
BITES' INGREDIENTS

A texture profile is "the sensory analysis of the texture complex of a food in terms of its mechanical, geometrical, fat and moisture characteristics, the degree of each present and the order in which they appear from first bite through complete mastication" (Szczesniak, 1963). In the process of developing this product, we had the opportunity to use the texture profile to identify and quantify the textural differences between Creamy Fish Bites, with and without the addition of soy protein fibers, as compared to a similar formula made with beef.

In this procedure, the mechanical parameters are qualified and quantified by means of standard rating scales for hardness, fracturability, adhesiveness, gumminess, viscosity and chewiness. Foods which are selected as the points on these scales are generally commercially available products which are expected to remain relatively consistent through time in terms of the characteristic which they represent. Geometrical parameters are divided into those related to particle shape and orientation (flaky, fibrous, cellular, etc.). In addition, other characteristics are evaluated such as moisture and fat content, rate of particle breakdown and mouth coating effects. The result of the evaluation of the food, on the basis of the above factors, first individually by the panel members, and then by group discussion, led by the panel leader, is a texture profile of the food.

The food sample which is the "Standard" and the sample or samples being tested can then be compared and the differences quantified.

Formulas for the fish bites and the Swedish meat balls can be found in Table 11.

TABLE 11 FORMULAS FOR MEAT BALLS AND FISH BITES

<u>Ingredients</u>	<u>Swedish meat balls</u>	<u>Fish bites (without SPF)</u>	<u>Fish bites (with SPF)</u>
	(g)	(g)	(g)
Ground chuck	450	---	---
Minced fish	---	500	450
Cracker meal	50	50	50
Eggs	100	100	100
Double NFMS ¹	---	100	100
Onion (fresh, chopped)	30	30	30
Salt	10	10	10
Pepper	1	1	1
Nutmeg	1	1	1
Monosodium glutamate	10	10	10
Fibrous soy protein	---	---	50
(SPF 220, Ralco Foods)			
Milk	150	---	---

¹Double NFMS is reconstituted non-fat dry milk prepared with one-half the recommended amount of water, or 20% dry milk to 80% water.

The standard texture profile ballot as developed for Swedish meat balls made from beef is shown in Figure 3. The values are panel scores for the Swedish meat balls.

FIGURE 3 TEXTURE PROFILE BALLOT

Product: Swedish meat balls made with beef

I. INITIAL (perceived on first bite)

- a) Mechanical
 - Hardness 3.37
 - Fracturability 0.7
 - Viscosity not applicable
- b) Geometrical lumps, with a grainy surface
- c) Other characteristics moist, uncut surface is slippery and cut surface is not slippery

II. MASTICATORY (perceived during chewing)

- a) Mechanical
 - Gumminess 1.2
 - Chewiness 17.7 chews
 - Adhesiveness 1.2
- b) Geometrical coarse, grainy, some fibrous particles present
- c) Other characteristics moist

III. RESIDUAL SENSATIONS (just before, during and after swallowing)

Rate of breakdown - Large lumps break down fast. Grains break down at a medium rate.

Type of breakdown - Lumps turn into a non-homogenous paste that is grainy, and grain size decreases. Some stringy fibrous grains are present that become more noticeable towards the end and require more effort to chew.

Moisture absorption - Initially moist. Saliva mixes easily with slurry and the bolus becomes progressively more moist. Residual grains feel dry.

Mouthcoating - Slight residual oiliness. A few fibrous particles stick between the teeth and around the mouth.

By separate comparisons with the standard or control, each fish bite was rated for difference from the control on a score sheet as shown in Figure 4.

FIGURE 4 SCORE SHEET FOR THE COMPARATIVE TEXTURE PROFILE FOR MEAT BALLS AND FISH BITES.

	- Control	+
I. INITIAL SENSATIONS (place in mouth, bite once)		
a) hardness		
b) fracturability		
c) lumpiness		
d) scratchiness of grains		
e) slipperiness (uncut surface)		
f) moistness		
II. MASTICATORY		
g) gumminess		
h) chewiness		
i) adhesiveness		
j) coarseness		
k) graininess		
l) amount of fibrous grains		
m) moistness		
III. RESIDUAL SENSATIONS		
n) rate of breakdown of lumps		
o) rate of breakdown of grains		
p) rate of loss of cohesiveness between particles		
q) homogeneity of bolus		
r) appearance of stringy, fibrous grains		
s) chewiness of fibrous grains		
t) dryness of residual grains		
u) ease of mixing of saliva and slurry		
v) oily mouthcoating		
w) residual fibrous particles		
x) residual sandy particles		

INSTRUCTIONS:

Put an X in CONTROL column if sample is equal to control. Put one to five X's in (+) column if sample is more than control, and in (-) column if sample is less than control.

X = slightly different
 XXXXX = strongly different

Using this form the results for the two types of fish bites (with and without ten percent protein fibers) are shown in Table 12.

TABLE 12 COMPARATIVE TEXTURE PROFILE FOR MEAT BALLS AND FISH BITES

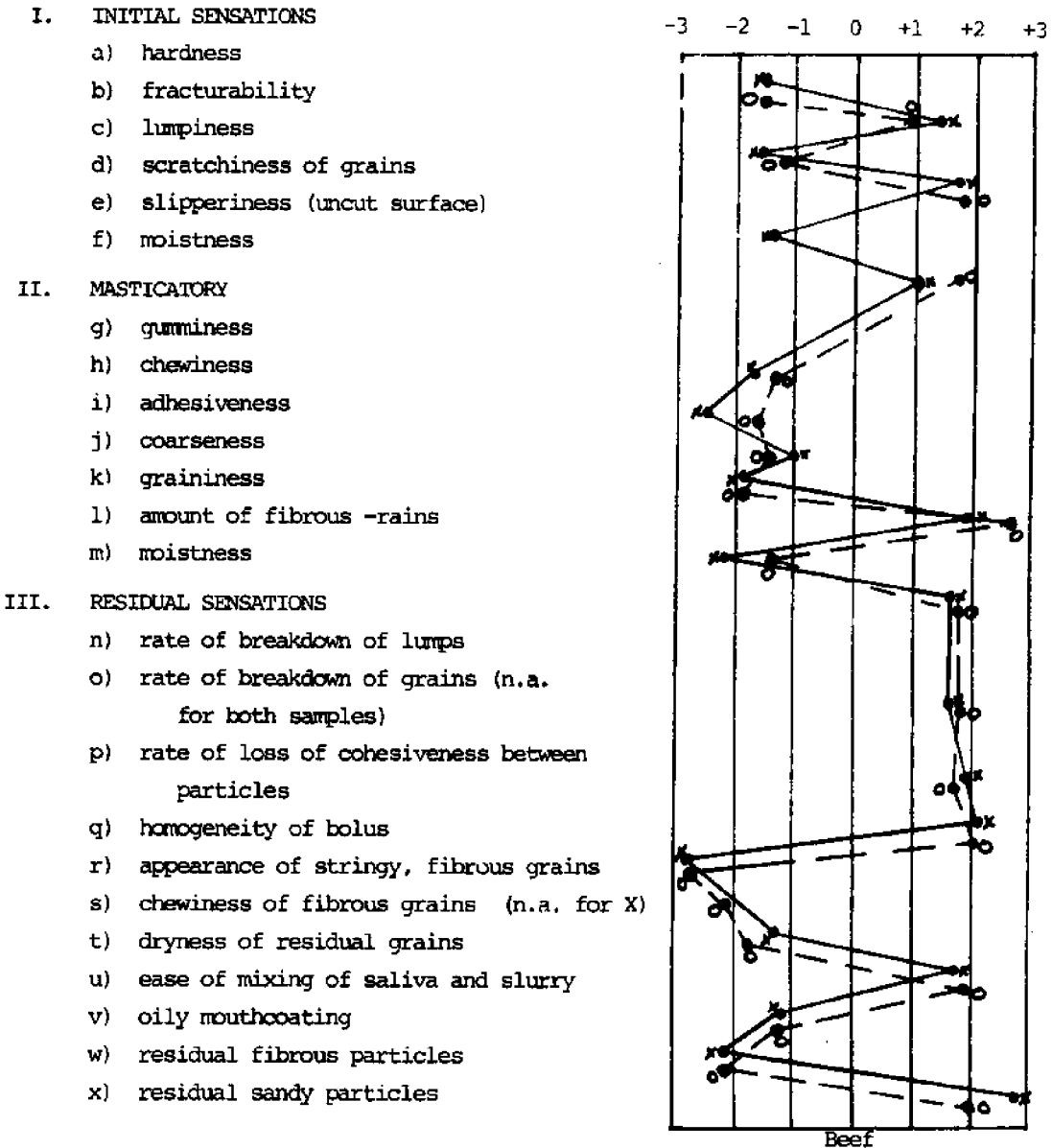
	Fish bites (without SPF)	Fish bites (with SPF)
I. INITIAL SENSATIONS (place in mouth, bite once)		
a) hardness	-1.7	-1.7
b) fracturability	+1.3	+1.0
c) lumpiness	-1.8	-1.3
d) scratchiness of grains	+1.7	+1.7
e) slipperiness (uncut surface)	-1.5	(undecided)
f) moistness	+1.1	+1.7
II. MASTICATORY		
g) gumminess	-1.8	-1.4
h) chewiness	-2.6	-1.7
i) adhesiveness	-1.1	-1.5
j) coarseness	-2.0	-1.9
k) graininess	+2.0	+2.7
l) amount of fibrous grains	-2.3	-1.5
m) moistness	+1.6	+1.7
III. RESIDUAL SENSATIONS		
n) rate of breakdown of lumps	+1.6	+1.7
o) rate of breakdown of grains	n.a.	n.a.
p) rate of loss of cohesiveness between particles	+1.8	+1.6
q) homogeneity of bolus	+2.0	+2.0
r) appearance of stringy, fibrous grains	-2.9	-2.7
s) chewiness of fibrous grains	n.a.	-2.1
t) dryness of residual grains	-1.4	-1.8
u) ease of mixing of saliva and slurry	+1.8	+1.9
v) oily mouthcoating	-1.3	-1.3
w) residual fibrous particles	-2.3	-2.2
x) residual sandy particles	+2.7	+2.0

Swedish meat balls were used as control.

n.a. = not applicable.

The results of these comparisons are also shown graphically in Figure 5.

FIGURE 5 COMPARATIVE TEXTURE PROFILE FOR MEAT BALLS AND FISH BITES



Swedish meat balls were used as control. Sample "X" is fish bites.
 Sample "O" is fish bites with 10% replacement of fish with soy protein fibers.

n.a. = not applicable.

Addition of soy fibers to the fish bite appeared to bring the product closer to the control (the scores were lower, indicating less difference) in the areas of lumpiness, gumminess, chewiness, amount of fibrous grains, chewiness of fibrous grains (these were not found in the other fish bites), and residual sandy particles. The soy fibers made the fish bites less like the control in the areas of moistness, adhesiveness, graininess and dryness of residual grains. Other factors appeared not to be affected.

Bearing in mind that most of the panel did not know in which way the two test samples differed, the differences that showed up were logical differences, based on formulation changes. The addition of a fibrous soy product could be expected to make the fish bite more like the meat ball in fibrousness and chewiness, and the panel found those differences. Factors in which the soy addition made the fish bite more different from the control, moistness and graininess, seem related to the ability of the soy product to absorb and hold moisture making the product seem dryer. Other factors received scores which were very similar, despite the fact that the two products were compared with the control separately, and were never compared with each other.

By the use of the texture profile as a tool, it was found that the addition of the soy protein fibers made the creamy fish bites more like the product made from beef, a texture familiar to many people.

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