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RESTRUCTURED CAT FISH PRODUCT PROCESSED BY TUMBLING WITH EGG WHITE

H. YETIM and H.W. OCKERMAN

The Ohio State University, Department of Animal Science, Columbus, Ohio, United States

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INTRODUCTION

Processed fish currently produced consist of surimi type of gel, breaded, salted and dried, smoked, canned and frankfurter type products. Tumbling can be used to improve the adhesion of small fragments. This research attempts to transfer tumbling to seafood products to produce a new type of fish product. There is limited information on indigenous proteases and construction of restructured fish and their response to cooking but no studies on tumbling of fish. Objectives of this study were to produce an innovative restructured product, to observe textural and physicochemical attributes of fish that was tumbled with egg white.

MATERIALS AND METHODS

Fresh Channel Cat fish fillets utilized in this research were rinsed, drained, diced and ingredients (2% salt, 1% egg white, 1% sucrose, 0.5% white pepper, 0.1% garlic, 0.25% sodium tri-polyphosphate, 0.01% nitrite, and 0.01% natural lemon flavour) were placed on the product before intermittent tumbling (40 minute rest, 20 minute work) for 12 hours at 6°C, stuffed into a casing, cooked to 77°C in a 200°C oven, and stored under refrigeration for 20 days.

Total N, moisture, fat, ash and pH tests were conducted (Ockerman, 1985). The TBA test was performed by the extraction method (Pensel, 1990). Degree of proteolysis was determined (Aksnes, 1988). Trichloroacetic acid soluble nitrogen was analyzed by the micro kjeldahl technique (AOAC, 1980) and expressed as proteolysis. Protein fractionation was conducted by the method of Parrish and Paterson, (1988) and Toyahora *et al.* (1990). Collagen fraction was determined from hydroxyproline by the colorimetric method (Bergman and Loxley, 1963). Kramer shear hardness was measured by using an Instron Universal Testing Machine (Booren *et al.*, 1981). Quintuplicate sample (0.3cm thick and 4.0cm diameter) slices were evaluated by using a kramer cell plunger adapter. Organoleptic evaluations were conducted with 7 trained sensory panel members (Brennan, 1980). Yield was computed by evaluating the weight loss during cooking.

RESULTS AND DISCUSSION

Proximate Composition

There were statistically significant differences between some elements of proximate composition studied in this experiment (Table 1 and pH values in Figure 1). This agrees with Mustafa and Medeiros (1985) but is not fully in agreement with Nettleton and Exler (1992) for cooked fish. The reason for the differences in lipid and moisture content might come from the harvesting season, ingredients and cooking technique used.

Changes which occurred during processing and storage upon proteolysis, TBA, Kramer Shear Force (KSF) and yield values are shown in Figures, 2, 3 and 4.

Sensory Panel Evaluation Results

Table 2 indicates that egg white and tumbled samples received positive responses. The egg white but not tumbled samples received the second most desirable scores. These results support the findings of Reddy *et al.* (1990) in which incorporation of wheat flour gave the best acceptability. For all characteristics evaluated the general acceptability values were higher on the first and the 10th day of storage (Table 2 and Figure 5). Similar results were reported by Burgin *et al.* (1985). The pH of the product significantly decreased toward the end of storage while TBA number increased (Figure 1, 2).

The combination of egg white and the tumbling significantly altered the proximate, biochemical and textural properties of the restructured fish. Tumbling increased the amount of extracted myofibrilar protein (MfP), Kramer Shear Force (KSF), and yield while it reduced the proteolysis (TCA soluble nitrogen), sarcoplasmic protein (ScP), NPN, pH and TBA values compared to the non tumbled control. Yield findings are in agreement with the findings of Booren *et al.* (1981).

Abide *et al.* (1990) documented that as mixing time increased, higher instron values were measured for fish muscle. Egg white incorporation had a positive effect on KSF, % moisture and protein content, NPN, pH and yield but reduced the % lipid, NPN and proteolysis. Egg white accompanied by tumbling had a synergistic effect on maintaining moisture, extraction of MfP, KSF and Yield but had a reducing effect on proteolysis and NPN values. The protein and lipid contents and pH values of fish were only effected by egg white incorporation and not by tumbling (Table 1). As was expected, the kramer shear values with egg white addition was significantly higher and the yield was influenced by tumbling and egg white addition (Figures 3 and 4). There was not an appreciable alteration in the protein fractions of the cooked fish due to egg white or tumbling. Also no noticeable changes were observed in the electrophoretic patterns of the cooked proteins with egg white or tumbling.

There were statistically significant negative correlations between general acceptability and lipid content (-0.75), texture and lipid content (-0.59), hardness and lipid content (-0.65) and positive relations between kramer shear force and hardness (0.52), moisture and juiciness (0.38). These results indicated that lipid content has an influence on textural quality. There was a significant negative relationship (-0.44) between general acceptance and proteolysis (TCA Soluble Nitrogen) which could be associated with sensory evaluation results for desirability.

CONCLUSIONS

It could be concluded from chemical and organoleptic analysis that tumbling and egg white addition would be useful to increase functional properties and structure of fish during processing of an acceptable restructured product. Nutritional and sensory advantages of restructured fish should make it of interest to a large segment of the population.

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Table 1. Least Square Mean values with Standard Error for proximate composition and pH of the restructured, cooked and storaged fish product.

Treatment	Moisture % ±SD	Protein % ±SD	Lipid % ±SD
CNT 1	68.37ab 0.94	19.40 0.46	7.93a 0.53
10	68.10b 1.49	19.35 0.64	7.83a 0.28
20	68.65ab 1.78	19.19 0.96	7.80a 0.31
CT 1	68.78ab 0.88	19.43 0.43	7.67ab 0.52
10	68.68ab 1.69	19.46 0.74	7.71ab 0.42
20	69.17ab 1.61	19.34 0.43	7.33b 0.22
ENT 1	68.45ab 0.60	19.49 0.49	6.71c 0.45
10	68.95ab 1.41	19.44 0.33	6.56c 0.25
20	68.77ab 1.56	19.52 0.51	6.82c 0.50
ET 1	69.21ab 0.96	19.51 0.36	6.63c 0.50
10	69.61ab 1.44	19.52 0.29	6.46c 0.34
20	69.76a 1.22	19.47 0.47	3.12 0.20

Treatment	Ash % ±SD	pH % ±SD
CNT 1	3.44 0.30	6.84abc 0.10
10	3.38 0.54	6.82abc 0.11
20	3.47 0.26	6.72d 0.06
CT 1	3.36 0.36	6.83abc 0.09
10	3.38 0.30	6.83abc 0.09
20	3.37 0.31	6.73d 0.05
ENT 1	3.24 0.25	6.88a 0.09
10	3.18 0.12	6.87ab 0.09
20	3.17 0.11	6.77bcd 0.07
ET 1	3.16 0.35	6.86ab 0.07
10	3.22 0.21	6.83abc 0.08
20	3.12 0.20	6.76cd 0.03

* Treatment and Storage time (1, 10 and 20 days), SD: Standard deviation.
CNT: Control-Non-Tumbled, CT: Control-Tumbled,
ENT: Egg White Added-Non-Tumbled, ET: Egg White Added-Tumbled,
[a,b,c,d] Means with the same superscript letters in a column are not significantly different (P>0.05).

Table 2. Least Square Means for panel sensory evaluation results of restructured and cooked fish product.

Treat-ment	Colour	Texture	Hardness	Appear.	Flavour
CNT 1	5.15bc	4.33e	3.90c	5.35efg	5.70cd
10	5.09bc	4.80e	3.96c	5.37de	5.37de
20	4.88c	4.51e	4.31c	5.23fg	4.77e
CT 1	5.33bc	6.12cb	5.82b	5.92cdef	5.70cd
10	5.53abc	5.73bcd	6.05b	6.13abcd	6.00bcd
20	5.15bc	5.41d	4.83c	5.43ed	5.35ed
ENT 1	5.76abc	6.29bc	6.06b	6.03bcde	6.58ab
10	5.31bc	5.80bcd	6.77a	6.58abc	5.37ab
20	5.35bc	5.78bcd	6.07b	6.25abc	6.10bcd
ET 1	5.91ab	7.09a	6.63a	6.79ab	6.99a
10	6.39a	7.00a	6.92a	6.85a	7.13a
20	5.80abc	6.40b	6.62a	6.54abc	6.42abc

Treat-ment	Salt	Juiciness	Odour	General accept.
CNT 1	4.57c	6.38ab	4.97cd	4.90e
10	4.77cd	5.97b	4.87d	4.73e
20	4.85cd	6.70a	5.20bcd	4.61e
CT 1	4.61c	5.85b	5.42bcd	6.05cd
10	5.30b	5.73b	5.60ab	6.07cd
20	5.35ab	5.83b	5.65abcd	5.90d
ENT 1	5.05bc	5.84b	5.79abc	7.03a
10	5.37ab	5.88b	6.33a	6.93ab
20	5.30ab	5.92b	5.51abcd	6.46bc
ET 1	5.28ab	6.15ab	5.98ab	7.08a
10	5.65a	6.13ab	6.36a	7.20a
20	5.34ab	6.09ab	6.01ab	6.73ab

* Treatment and Storage times (1, 10 and 20 days), Hardn=Hardness, Salt= Saltines, Appear= General appearance, Juicin= Juiciness, G.Accpt= General Acceptance. (Sensory evaluation scales were 1 - 9 in which 1 equals dark in color, crumbly in texture, soft in hardness, unfavorable in appearance, unpleasant in flavor, not salty in saltiness, dry in juiciness, fishy in odor and unsatisfactory in overal acceptability).

CNT: Control-Non-Tumbled, CT: Control-Tumbled,

ENT: Egg White Added-Non-Tumbled, ET: Egg White Added-Tumbled,

[a,b,c,d,e,f,g] Means with the same superscript letters in a column are not significantly different (P>0.05).