

Production of Imitation Caviar Using Yellow Fin Tuna Fish Species: *Thunnus albacares* – A Novel product using Fish Roe in Sri Lanka

I.G.S.N.K. Abeyrathna, N.P.P. Liyanage, G.G.N. Thushari and S.C. Jayamanne
Uva Wellassa University, Badulla, Sri Lanka

Introduction

Caviar is defined as salted fish roe that basically prepared with eggs or roe of sturgeon fish. Imitation caviar is defined as roe that comes from a fish other than the sturgeon, and it can be classified as a caviar substitute. This product is not so popular among Sri Lankans, because of lack of knowledge regarding processing of caviar and its cost.

In Sri Lanka, fish roe is discarded from processing plants and sold in the local market. Therefore it is important to add value to fish roe and make them a high demanded product. Since discarded fish roe is used for this product, there will be no threat of over exploitation by production of imitation caviar. Local people can acquire nutritional benefits from the imitation caviar due to high nutritional quality.

Yellow fin tuna: (*Thunnus albacares*) was selected as the resource fish species for the present study. *T. albacares* is a species in family Scombridae found in pelagic water of tropical and subtropical oceans waters. In Sri Lanka, it is considered as a commercially important food fish that represent considerable portion of tuna fishery. Therefore, main objective of present study is to develop proper methodology and select suitable maturity stage of fish roe for production of imitation caviar.

Methodology

Roe samples of *T. albacares* were collected from Ceylon Fresh sea food (Pvt) Ltd. and Jay sea food (Pvt) Ltd. in *Ja-Ela*, Sri Lanka. Then collected samples were transported to the Animal Science laboratory of Uva Wellassa University using cooler boxes with ice. First, ovary sacks with fish roe were separated according to maturity stage as immature roe, half mature roe and mature roe using external features of ovary sac. Then fish roe were separated from the ovary sac using manual screening method. Blood and other connective tissue on the roe were removed by rinsing with 5 % brine solution and fish roe were sieved using the sieve set.

Prepared roe samples were subjected to “dry salting method” separately. Surface moisture of the roe samples were removed using clean cloth and arranged in plastic boxes with one layer of powder form Iodized salt and one layer of roe alternatively. Three different salt (g): fish roe (g) ratios as 0.05:1, 0.25:1 and 0.45:1 were used to determine the best ratio/s of each maturity stage after preliminary experimental trials (S:immature roe : S1 -0.05:1, S2-0.25:1 S3-0.45:1/ X:half mature roe: X1-0.05:1, X2- 0.25:1, X3-0.45:1, Y: mature roe: Y1- 0.05:1, Y2- 0.25:1, Y3- 0.45:1). Three replicates were used for each treatment. Salted roe samples were kept for two and half hours. During this period they were pressed gently by fingers for five minutes for effective absorption of salt. Afterwards they were dipped in tap water bath to remove excess salt and then covered with a wet cloth for 4-4.5 hours. Then the caviar were placed in a dry cool place (approximately 20 °C) to be dried (Celic *et al.*, 2012). Final products were filled into glass jars manually and pasteurized using hot water bath at 68 °C for 45 minutes. Final products were analyzed for different parameters. Protein and fat contents were determined using Kjeldahl method (6.25×N) and Soxhlet method respectively (AOAC, 1990). Moisture content was determined by drying the sample at 105 °C to a constant weight (AOAC, 1990). The pH values of the samples were determined with a pH meter and microbial Count (TPC) of the final products was determined. pH and TPC values were recorded once in 07 days for 02 months of storage period (0, 07, 14, 21, 28 days). All final products were evaluated using 30 untrained

panelists in terms of color, texture, aroma, salty taste, mouth feel and overall acceptability on a 5 point hedonic scale to identify the organoleptic properties. Differences between mean values of proximate composition, pH values and microbiological factors were analyzed using ANOVA. Friedman non parametric test was used to analyze the results of sensory evaluation. MINITAB statistical package (16 Version) was used for analysis of results at 0.05 probability level.

Results and Discussion

Based on the results obtained from protein level, lipid content, sensory evaluation and microbial count studies, three samples (Salt: Fish roe by weight) 0.05:1 g, 0.25:1 g and 0.45:1 g of each maturity stage were separately compared to select best sample. Treatment that shows highest protein level, lowest lipid content, greatest consumer preference and lowest microbiological content was selected as the best sample for each maturity stage. S1 (0.05:1; salt: fish roe) was selected for immature stage, whilst X1 (0.05:1; salt: fish roe) and Y2 (0.25:1; salt: fish roe) were selected for half mature stage and mature stage respectively. The ratio of 0.45: 1 (salt: fish roe) was recorded having lowest nutritional quality, unsatisfactory consumer preference and greater microbial count for each maturity stages compared to other two treatments.

Table 1. Proximate composition of final imitation caviar products.

Proximate composition (%)	Samples of each maturity stage		
	S1	X1	Y2
Protein	15.12±0.74	17.70±0.49	16.21±0.03
Fat	14.87±0.10	19.91±0.61	19.66±1.15
Moisture	75.81±0.55	73.43±0.35	61.23±1.02

Chemical composition of the imitation caviar was significantly different according to maturity stages and salt level at 0.05 level. Protein and fat level of S1 is significantly different from other two samples. Highest protein level and fat is recorded for X1 (Table 01). Lowest pH value was recorded at the initial day for Y2 (6.08±0.02), while highest pH was observed for S1 (6.65±0.29) at initial day. pH of Y2 is reported as 6.80±0.03 in 28th day and pH for S1 was 8.17±0.00 at 28th day. At the initial stage, minimum TPC was observed in X1 (5.15×10 cfu/g),⁵ while maximum was in Y2 (5.30×10 cfu/g). At the 28th day, greatest TPC was recorded for S1 (7.17×10 cfu/g), while X1 (6.33×10 cfu/g) represents the lowest value. Altogether TPC of samples were changed significantly with the time (p < 0.05). According to results of sensory evaluation, highest values of sum of ranks for Color, Texture, Aroma, Salty taste, Mouth feel and Overall acceptability were recorded for X1 with significant difference for only Aroma (P = 0.002) and salty taste (p=0.049) (Figure 1).

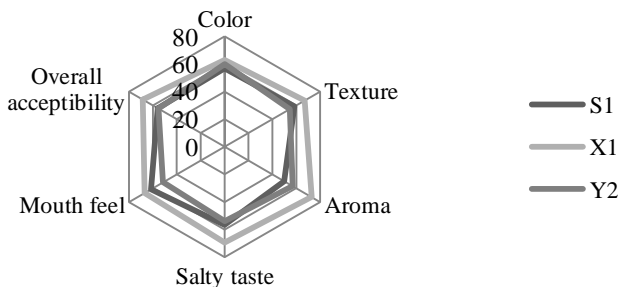


Figure 1. Results of the sensory evaluation test for organoleptic parameters of final products.

Moisture percentage declined significantly in final samples with applied salt levels since salt has absorbed much of the water in the product. There was a variation of protein and lipid level of final products compared with past findings. Inanli et al. (2010) has reported that chemical composition of the caviar varies according to fish species as well as processing techniques. The difference in chemical composition of fish roes is also mainly attributed to biological factors, including species, maturity stages, diet, season, harvest area and processing condition (Mahmoud et al., 2008). Increasing trend of pH values is recorded in all three samples during storage time period. Inanli et al. (2010) found the difference of pH in final products can be changed due to different treatments applied. Therefore, pH values of final three samples can be different according to maturity stages as well as different salt treatments. Microbial counts of all three samples were increasing during the storage time period. Since X1 represents minimum microbiological count for storage period, it can be concluded that chemical and physical factors are not in satisfactory level for growth of pathogenic microorganisms in X1 compared to other two. According to results of sensory evaluation, highest consumer preference was reported by X1. Salt is the major factor affecting flavor of the imitation caviar. Therefore, salt level should be determined with precision (Inanli *et al.*, 2010). Lowest fat and protein percentage is recorded by S1 and its microbial count is highest than other samples. Consumer satisfaction is also lowest for S1 for all sensory parameters. Therefore it is not a suitable treatment for production of imitation caviar. Y2 records greater fat percentage and microbial count is superior to X1. C consumer preference is also not in acceptable level for all sensory parameters. Production cost of Y2 is relatively greater, since required salt level is higher during processing. Therefore, Y2 is not the acceptable method for imitation caviar production. Among all three samples, X1 recorded highest protein percentage and lowest microbial count for storage time period. X1 sample also exhibits best consumer acceptance for all sensory parameters. Since this product is required less amount of salt (0.05 salt:1 fish roe), production cost is low. Therefore, X1 (0.05 salt:1 fish roe) with eggs of half maturity stage is concerned as best final treatment.

Conclusion

According to satisfactory nutritional value (highest protein value), lowest microbial count, inferior production cost (less salt requirement) and best consumer preference for all sensory parameters, X1 (0.05 salt: 01 fish roe by weight) with eggs of half maturity stage can be considered as the best treatment for preparation of imitation caviar using Yellow fin tuna roe.

References

- AOAC. 1990. Official Methods of Analysis of the Association of Analytical Chemist, 15th edition, Washington DC, USA. 66-88.
- Bledso, G. E., Bledso, C. D., Rasco, B. 2003. Caviars and fish roe products. Critical Reviews in Food Science and Nutrition, 43(3), 317-356.
- Celic, U., Altinelataman, C., Dincer, T., Acarh D. 2012. Comparison of fresh and dried flathead Grey Mullet (*Mugilcephalus*, Linnaeus 1758) caviar by means of proximate composition and quality changes during refrigerated storage at 4±20C. Turkish Journal of Fisheries and Aquatic Science, 12, 1-5.
- Inanli, A. G., Coban, O. E., Dartay, M. 2010. The chemical and sensorial changes in rainbow trout caviar salted in different ratios during storage. Fish Science and Technology 76, 879-883.
- Mahmoud, K. A., Linder, M., Fanni, J., Parmentire, M. 2008. Characterization of the lipid fraction obtained by proteolytic and chemical extractions from rainbow trout (*Oncorhynchus mykiss*) roe. Process Biochemistry, 43(4), 376-383.