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Salmon Belly Flaps Processing towards Sustainable By-Product Valorisation

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Abstract: In the current context of circular economy principles and the need to reduce food waste, the comprehensive valorisation of by-products generated during fish processing represents a strategic priority for the food industry. This study investigates the potential utilization of salmon belly flaps, by-products obtained after filleting, through their conversion into raw meat, thermally processed meat, and fish oil, with subsequent applications in food product development. It evaluated the technological yields associated with these fractions, supported by descriptive statistical analyses. The results indicated a raw meat yield (%) of 56.16 ± 2.413 relative to the initial belly flap mass, a thermally processed meat yield (%) of 46.51 ± 1.506 relative to raw meat, and an oil yield (%) of 13.83 ± 0.841 . When expressed relative to the initial raw material, the overall yields (%) were 26.04 ± 1.070 for thermally processed meat and 7.78 ± 0.608 for oil. Additionally, waste and technological losses were quantified, highlighting the effect of processing stages on overall efficiency. The results demonstrate that salmon belly flaps represent an underutilized resource with potential for valorisation through appropriate processing technologies. The integration of secondary streams into the production chain can contribute to improved sustainability, yield optimization, and waste reduction in the fish processing industry.

Keywords: meat and oil yields, raw salmon meat, salmon oil, technological losses, thermally processed salmon meat, waste.

• Introduction

The full valorisation of food resources represents an important direction for the modern food industry, in the context of concerns regarding sustainability, waste reduction, and the efficient use of raw materials. In the fisheries and aquaculture sector, the increase in the production and consumption of aquatic foods implicitly leads to a growing amount of by-products generated during processing, which can be considered not only an environmental challenge but also a valuable resource for obtaining value-added ingredients. Salmon, a fish species appreciated for its economic and nutritional value as well as its high consumer acceptance, generates a series of by-products following filleting and trimming operations. Among these, belly flaps are of particular interest due to their high lipid and protein content, which makes them suitable as raw material for the simultaneous recovery of the edible muscle fraction and oil.

Material and method

The study aims to evaluate the valorisation potential of salmon belly flaps through the extraction of raw meat, its thermal treatment, and oil recovery. Six experimental samples (P1, P2, P3, P4, P5, P6) were analysed, each being subjected to the same stages: weighing of the raw material, separation of raw meat, thermal treatment, separation of thermally treated meat and oil, weighing of the obtained fractions, and calculation of yields, waste, and losses. The yields of raw meat were calculated relative to the mass of belly flaps, while the yields of thermally treated meat and oil were calculated both relative to the mass of belly flaps and to the mass of raw meat. Waste was calculated by subtracting the raw meat from the total mass of belly flaps, while technological losses were calculated by subtracting the waste, thermally treated meat, and oil from the total mass of belly flaps. The formulas used were adapted to the objectives of the study, based on the specialized literature. The mean, standard deviation, and coefficient of variation were calculated according to the statistical formulas reported in the specialized literature.

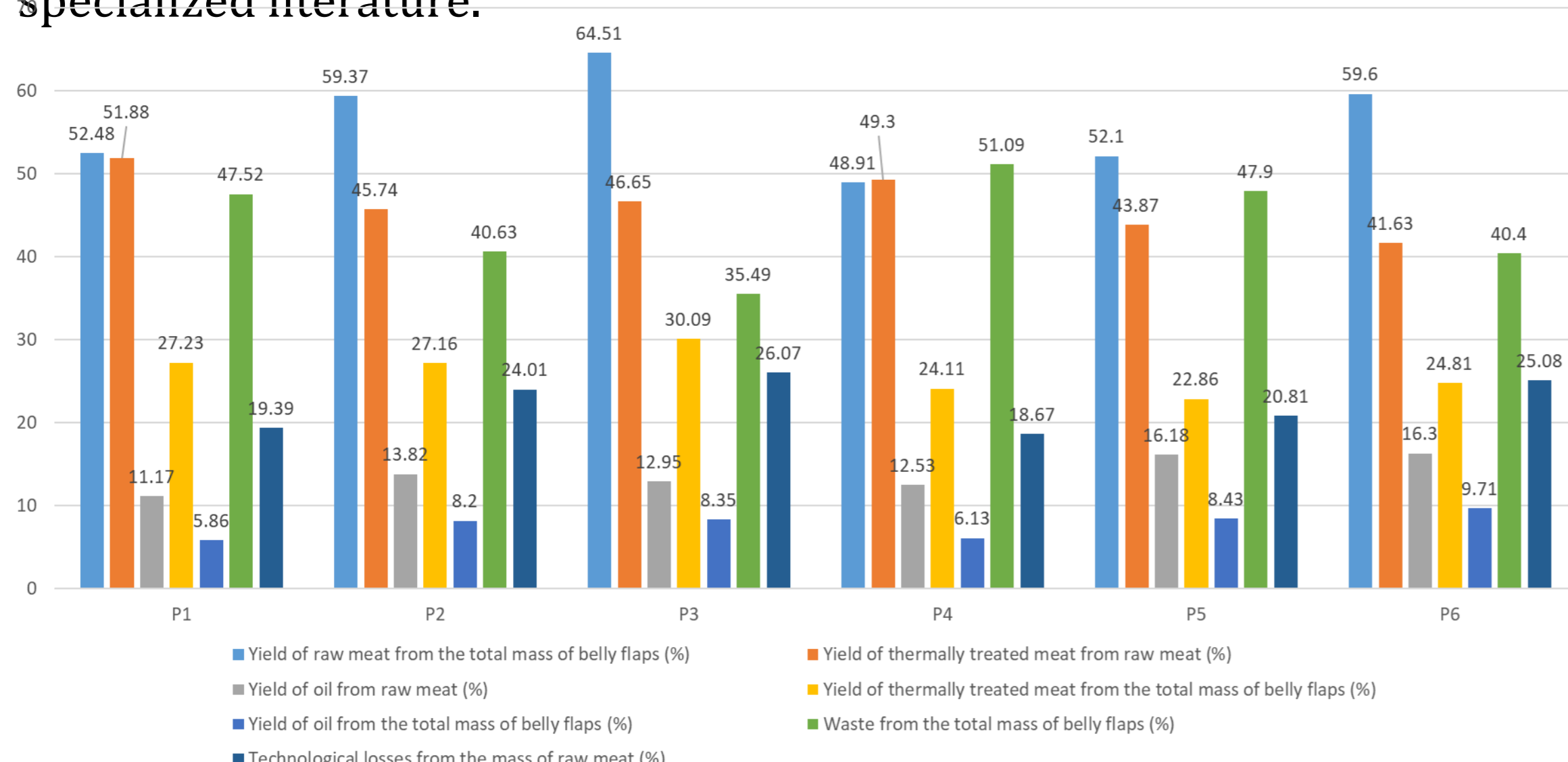


Fig. 1. Graphical representation of the calculated yields, waste, and technological losses

Table 1. Mass of the analysed samples

Sample	Total mass of belly flaps (g)	Raw meat mass (g)	Cooked meat mass (g)	Salmon oil mass (g)
P1	545.26	286.15	148.45	31.96
P2	475.30	282.18	129.07	38.99
P3	510.12	329.08	153.52	42.62
P4	547.26	267.66	131.96	33.54
P5	520.21	271.03	118.90	43.85
P6	590.01	351.65	146.39	57.30

Table 2. Calculated statistical indicators

Indicator	Mean (%)	Standard deviation	Coefficient of variation (%)
Yield of raw meat from the mass of belly flaps	56.16±2.413	5.91	10.52
Yield of thermally treated meat from raw meat	46.51±1.506	3.69	7.93
Yield of oil from raw meat	13.83±0.841	2.06	14.88
Yield of thermally treated meat from the mass of belly flaps	26.04±1.070	2.62	10.07
Yield of oil from the mass of belly flaps	7.78±0.608	1.49	19.11
Waste	43.84±2.413	5.91	13.47
Technological losses	22.34±1.274	3.12	13.97

• Results and discussions

In the study, 6 samples of salmon belly flaps were analysed, with initial masses ranging from 475.30 g to 590.01 g, with an average of 531.36 g. From these, raw meat was obtained in amounts ranging from 267.66 g to 351.65 g, with an average of 297.96 g; cooked meat ranged from 118.90 g to 153.52 g, with an average of 138.05 g; and salmon oil ranged from 31.96 g to 57.30 g, with an average of 41.38 g.

From a statistical point of view, the lowest coefficient of variation was recorded for the yield of cooked meat from raw meat, namely 7.93%, indicating good repeatability of the thermal treatment. The highest variability was observed for the oil yield from the mass of belly flaps, with a coefficient of 19.11%, suggesting the influence of natural differences in lipid content among the samples.

Among the analysed samples, P3 showed the highest yield of raw meat from the mass of belly flaps, namely 64.51%, as well as the highest yield of cooked meat from the initial mass, 30.09%. P6 had the highest oil yield, both from raw meat, 16.30%, and from the total mass of belly flaps, 9.71%. P1 recorded the highest yield of cooked meat from raw meat, 51.88%, while P4 had the highest waste level, 51.09%, but the lowest technological losses, 18.67%.

• Conclusions

The average yield of raw meat shows that more than half of the initial mass can be recovered as raw meat, although with a low commercial appearance.

After thermal treatment, a large amount of cooked meat and a smaller amount of oil were obtained, both of which can be used in the food industry.

Variability was lower for the solid fraction, namely for the yield of thermally treated meat from raw meat, compared to the oil yield from the initial mass, which showed the highest variability.

Overall, the process enables the efficient valorisation of salmon belly flaps through the simultaneous production of two useful products: thermally treated meat and salmon oil.

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