Short Paper

Differentiation of Freeze-Thawed Fish from Fresh Fish by the Determination of Hematocrit Value*¹

At present, not small amount of freeze-thawed fish is at the final stage of marketing. Since a practicable method for differentiating freeze-thawed fish from fresh fish has not been established, thawed fish has not been easily distinguished from fresh fish on the market. In frozen storage of blood, the addition of protective agents such as glycerol is required, because blood cells are destroyed without the agents. Some destruction of blood cells in thawed fish was found out by microscopic observation.¹⁾ Recently, an enzymatic method was proposed to differentiate fresh and thawed fish fillets.²⁾

In the present study, the author tried to use a hematological method to differentiate freeze-thawed fish from fresh fish. Although hematocrit value has been determined originally for the evaluation of the oxygen carrying capacity, it is simple to determine and showed an obvious difference between them. So the author employed it as index of blood cell destruction in freeze-thawed fish. For this purpose, the changes in hematocrit values for refrigerated carp and frozen carp were followed.

The carp (600 g–800 g) kept for one day in a water tank at the laboratory were killed by a heavy blow on the head, wrapped in polyethylene bags in the round and then stored at 5, 0, –3, –5, and –20°C for 10 days. Those which were allowed to freeze to –70°C at central part in dry ice-ethyl alcohol were stored at –20°C for one day. The blood was drawn from the bulbus arteriosus and the ventricle with a syringe coated with heparin sodium solution and divided into blood cells and blood plasma in a hematocrit capillary by centrifugation at 11,000 rpm for 5 min. Hematocrit values for frozen carp were determined after they were thawed in running water.

Hematocrit values of refrigerated carp and frozen

carp are shown in Table 1. All the hematocrit values of the frozen carp were 0% even only after one day, while those of the refrigerated carp reached 0% barely after 10 days. The carp refrigerated for more than 7 days decayed, judging from the flesh color and smell of them. Thus, the refrigerated fish having 0% hematocrit value were not acceptable as food.

Table 2 shows hematocrit values for frozen sea bream and Pacific mackerel on the market which had been stored at –25 and –27°C for one to five months. All the freeze-thawed fish showed hematocrit value of 0%, while fresh sea bream and Pacific mackerel showed hematocrit values of $32.9 \pm 7.9\%$ and $43.3 \pm 4.1\%$ respectively. It is clear that blood cells were destroyed perfectly in freeze-thawed fish. Moreover, the contents of hemoglobin which were determined for the blood from the thawed fishes by cyanmethemoglobin method³⁾ were almost corresponding to the values reported on these fresh fishes.⁴⁾ This fact indicated that the blood could be drawn from the thawed fish, too. In conclusion, the author proposed that the determination of hematocrit value should be applied to the differentiation of freeze-thawed fish from fresh fish, because hematocrit value for the former is completely 0%.

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References

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Table 1. Hematocrit values for refrigerated carp and frozen carp

Storage (°C) (day)	Hematocrit value (%)					
	5	0	–3	–5	–20	–70
0			25.7 ± 3.8			
1	30.0 ± 6.2	31.0 ± 5.9	0	0	0	0
3	29.4 ± 8.0	28.0 ± 6.9	0	0	0	—
7	21.0 ± 4.3	22.8 ± 7.9	0	0	0	—
10	0	0	0	0	0	—

Mean $\pm$ s.d., six determinations for each sample.

Table 2. Hematocrit values for frozen fish and fresh fish on the market

	Frozen fish			Fresh fish
	Storage (°C) (month)	Hematocrit value (%)	Hemoglobin (g/dl)	Hematocrit value (%)
Sea bream	–25 3	0	8.0 ± 0.3	32.9 ± 7.9
	–25 5	0		
Pacific mackerel	–27 1	0	13.6 ± 2.0	43.3 ± 4.1
	–27 2	0		

Mean $\pm$ s.d., six determinations for each sample.

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