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The Influence of the Ikejime Technique on Sea Bass (*Dicentrarchus labrax*) quality

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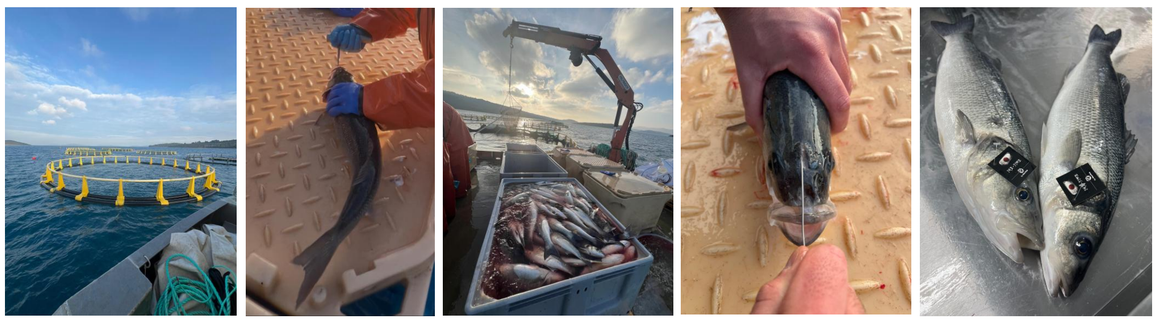
INTRODUCTION & AIM

- Ikejime is a technique originated in Japan that is used to kill fish by inserting a spike into its brain cavity, thoroughly bleeding and spinal cord destruction (*shinkei jime*) before getting iced down. It aims to reduce stress and prevent uncontrolled muscle contractions after the catch, thereby producing a biochemically superior grade seafood product as the process helps to eliminate stress, preserve muscle quality, and freshness. This not only preserves the original flavour and texture of the fish, but also creates a rich “umami” taste.
- The aim of this study was to determine the effect of killing methods (asphyxia/bleeding+ikejime) on the proximate composition, amino acid profile and fatty acid profile as well as the degree of lipid oxidation in farmed sea bass *(Dicentrarchus labrax*) and to compare the results to wildly caught seabass.

METHOD

- Farmed sea bass samples were collected in December 2024 from the MARTINOVIĆ-FISH aquaculture farm on the island of Iž, and wild samples were collected from a local fisherman. Four sample groups were analyzed: farmed sea bass killed using the ikejime technique (IK0); farmed sea bass killed using the ikejime technique and aged for five days at 0 - 2 °C (IK5); farmed sea bass killed by asphyxia in a water-ice mixture (FSJ); wild sea bass killed by asphyxia in a water-ice mixture (D). Fish killed using the Ikejime method were brain spiked, bleedin an ice–seawater mixture and spiked through the spinal cord with a metal wire, and then chilled.
- The samples were analysed for the proximate composition (lipids, protein, ash, and moisture), amino acid profile, fatty acid profile, and lipid oxidation (thiobarbituric acid test – TBARS).



RESULTS

Table 1. Proximate composition

Sample	Lipids %	Protein %	Ash %	Moisture %
D	5.4 ± 0.02	19.0 ± 1.00	1.3 ± 0.01	71.6 ± 2.14
IK0	7.5 ± 0.03	18.1 ± 0.81	1.2 ± 0.01	70.7 ± 1.97
IK5	10.7 ± 0.03	18.6 ± 0.73	1.2 ± 0.01	66.4 ± 1.43
FSJ	8.3 ± 0.02	18.7 ± 1.22	2.6 ± 0.02	68.8 ± 1.72

Table 2. Lipid oxidation

Sample	TBARS (mmol MDA*/100 g)	± SD
D	0.33	0.01
IK0	0.76	0.01
IK5	0.57	0.00
FSJ	0.62	0.01

*malondialdehyde

Table 3. Amino acid profile

Amino acid	D %	D ±	FSJ %	FSJ ±	IK0 %	IK0 ±	IK5 %	IK5 ±
ASP	4.41	0.04	4.40	0.07	2.27	2.92	4.33	0.21
SER	4.02	0.03	3.88	0.03	2.37	2.87	4.39	0.34
GLU	6.56	0.25	6.67	0.05	3.56	4.70	6.88	0.23
GLY	7.06	0.22	6.15	0.01	3.63	4.77	7.00	0.25
HIS	2.82	0.10	2.74	0.07	1.82	2.04	3.26	0.38
ARG	1.06	0.03	0.98	0.00	0.73	0.83	1.32	0.15
THR	10.14	0.20	10.51	0.60	6.20	7.74	11.67	0.72
ALA	9.81	0.20	9.35	0.29	5.44	0.47	5.11	5.77
PRO	2.15	0.05	1.85	0.18	1.22	1.29	2.12	0.31
GABA	0.14	0.01	3.24	0.11	0.07	0.09	0.14	0.01
CYS	1.43	0.04	1.37	0.09	0.83	1.02	1.55	0.10
TYR	3.20	0.09	3.30	0.29	2.09	2.65	3.96	0.21
VAL	5.74	0.12	5.50	0.03	2.93	4.02	5.77	0.08
MET	3.75	0.04	3.76	0.11	1.86	2.39	3.55	0.17
LYS	5.92	0.15	4.94	0.30	2.45	3.42	4.87	0.03
ILEU	6.53	0.05	6.37	0.32	3.73	4.13	6.64	0.81
LEU	16.38	0.52	16.38	0.10	9.35	11.55	17.52	1.18
PHE	8.88	0.44	8.61	0.12	5.35	6.46	9.92	0.78

Table 4. Fatty acid profile

Fatty acid	D %	D ±	IK0 %	IK0 ±	IK5 %	IK5 ±	FSJ %	FSJ ±
SFA	**16.51**	**0.23**	**16.79**	**0.35**	**17.20**	**0.10**	**17.96**	**0.92**
C12-0	0.02	0.00	0.02	0.00	0.02	0.00	0.01	0.00
C13-0	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C14-0	1.48	0.01	1.76	0.03	1.68	0.03	1.84	0.21
C15-0	0.24	0.00	0.22	0.00	0.22	0.00	0.25	0.02
C16-0	11.40	0.03	11.49	0.12	11.81	0.05	12.38	0.61
C17-0	0.23	0.00	0.22	0.01	0.23	0.00	0.24	0.01
C18-0	2.47	0.01	2.52	0.01	2.79	0.01	2.72	0.04
C20-0	0.12	0.17	0.12	0.16	0.02	0.00	0.01	0.00
C21-0	0.03	0.00	0.00	0.00	0.02	0.00	0.00	0.01
C22-0	0.16	0.00	0.10	0.01	0.11	0.00	0.11	0.01
C23-0	0.28	0.00	0.28	0.00	0.26	0.00	0.33	0.01
C24-0	0.08	0.00	0.05	0.00	0.05	0.00	0.05	0.01
MUFA	**48.98**	**0.18**	**48.02**	**0.37**	**49.16**	**0.11**	**46.83**	**2.91**
C14-1 *n-5*	0.38	0.01	0.44	0.07	0.34	0.03	0.56	0.11
C15-1 *n-10*	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C16-1 *n-7*	2.35	0.01	2.92	0.03	2.70	0.01	1.49	2.08
C17-1 *n-8*	0.24	0.00	0.22	0.01	0.22	0.00	0.27	0.01
C18-1 *n-9*	0.09	0.00	0.06	0.01	0.08	0.01	0.08	0.02
C18-1 *n-7*	42.91	0.13	40.98	0.05	42.86	0.04	41.26	0.63
C20-1 *n-9*	2.68	0.02	2.97	0.05	2.65	0.02	2.89	0.04
C22-1 *n-9*	0.30	0.00	0.33	0.01	0.28	0.00	0.28	0.01
C24-1 *n-9*	0.02	0.00	0.12	0.15	0.02	0.00	0.02	0.00
PUFA	**34.52**	**0.09**	**35.19**	**0.17**	**33.65**	**0.09**	**35.21**	**0.61**
C18-2 t *n-6*	0.01	0.00	0.00	0.01	0.01	0.00	0.02	0.01
C18-2 c *n-6*	20.61	0.02	22.25	0.03	21.33	0.02	22.25	0.41
C18-3 *n-6*	0.17	0.00	0.17	0.00	0.15	0.00	0.16	0.00
C18-3 *n-3*	7.52	0.01	7.20	0.01	7.20	0.03	6.97	0.15
C20-2 *n-6*	0.80	0.01	0.82	0.01	0.73	0.02	0.75	0.01
C20-3 *n-6*	0.07	0.00	0.08	0.00	0.08	0.00	0.08	0.00
C20-3 *n-3*	0.18	0.00	0.17	0.00	0.17	0.00	0.17	0.00

Saturated fatty acids (SFA), monounsaturated fatty acids (MUFA), polyunsaturated fatty acids (PUFA)

CONCLUSION

- The results showed that the killing method did not lead to significant differences in the fatty acid composition, oxidative stability, or proximate composition of sea bass meat.
- The proximate composition results showed a higher fat content and lower moisture in farmed samples (IK0, IK5, FSJ) compared to wild ones (D), while the protein content remained relatively stable for all samples.
- The recorded saturated and unsaturated fatty acids values in all samples were within the expected range for fish and exhibit a favorable nutritional fatty acid profile.
- The TBARS test results were within the acceptable quality limits for fish intended for human consumption, while the IK0 sample (0.76 mmol MDA/100 g) reached the upper limit of acceptability, which ranges between 0.5 and 0.8 mmol MDA/100 g.
- The lower levels of ASP, HIS, GABA, MET and LYS found in ikejime-treated sea bass indicate lower stress and delayed proteolysis, which can enhance overall muscle quality.
- A larger number of samples slaughtered using the ikejime technique, especially those aged for longer periods (10, 15, 20 days), are needed to further determine whether a correlation exists between the killing method and the aging period on the oxidative stability of sea bass meat.