Valorisation of horse mackerel, a discard fish

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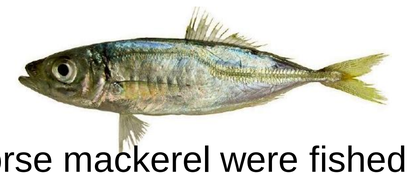
In Italy, only few caught species are commercialized and appreciated by consumers thus resulting in the production of high volumes of discards. Despite its high nutritional value, Atlantic horse mackerel (*Trachurus trachurus*) is one of the most underutilised species. Recently, mechanical separation process (MSM) has demonstrated to be successfully applied in fish sector. Thus, **this study focused** on the chemical changes, antioxidant content as well as oxidative stability of horse mackerel subjected to mechanically separation process and stored up to three months at -20 C.

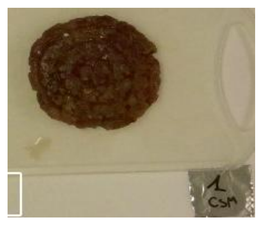
MATERIAL & METHODS

n. 12 fillets (right) were stored as fillet (**WF** samples)



n. 36 horse mackerel were fished in the Tyrrhenian Sea

n. 12 fillets (left) were grounded in order to obtain n. 6 burgers (**FB** samples)



n. 12 fish were minced by the MSM machine and utilised for obtaining n. 6 MSM burgers (**MSM** samples)

Chemical analyses were conducted at the star of the storage (T0) and after 90 days of frozen storage (-20 C, T90)

Analyses performed

- *Proximate composition,* by AOAC (2012) methods
- *Fatty acids profile* of lipids extract (Folch et al., 1957), by modified method of Morrison & Smith (1964)
- *Primary (Conjugated Dienes, CD)* and *secondary (TBARS) oxidation products* (Srinivasan et al., 1996; Vincke, 1970)
- *Antioxidant capacity* (Mancini et al., 2015)

RESULTS

Data of proximate composition of samples are reported in **Fig. 1**. Interestingly, MSM resulted the treatment with the less ash content (1.26% against 1.44, and 1.48 for WF and FB, respectively). This parameter indeed could be influenced by the presence of frame fragments, so lower the ash content better the quality of the mechanical separation process. Thus, the low content quantified in the present work suggests that no fragment exceeding has been extracted during the MSM process. Horse mackerel have remarkably high percentage of PUFA (**Table 1**), especially PUFAω3, and almost 53% of total fatty acids is represented by EPA and DHA. Mechanical separation process did not significantly alter fatty acid composition. A slight increase of SFA together to a decrease of PUFAω3 was due to the frozen storage.

Fig. 1 - Proximate composition (%) of whole fillets (WF), minced burgers (FB), and MSM burgers (MSM)

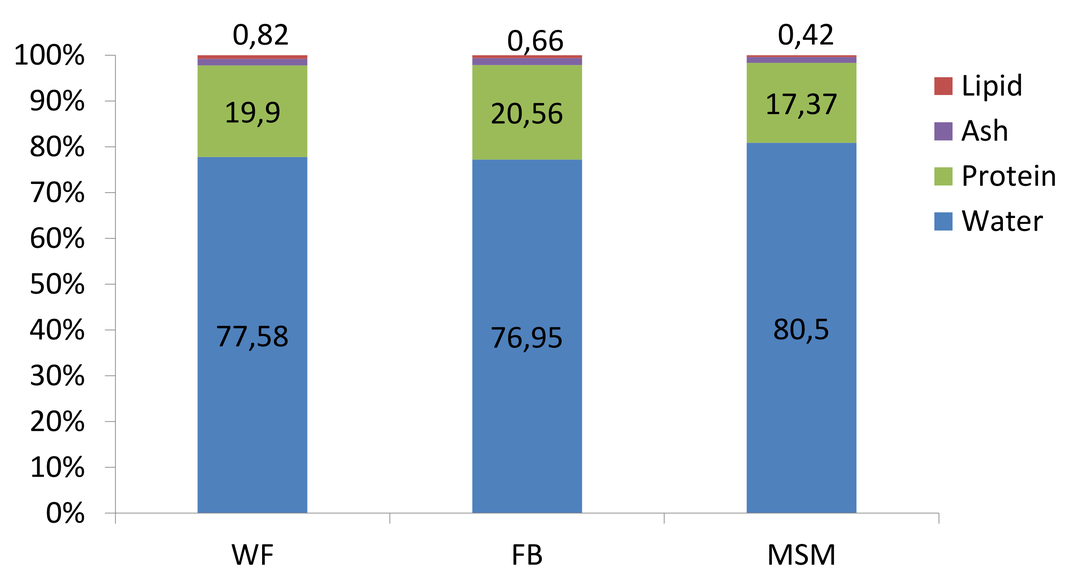


Table 1 - Fatty acid composition (g fatty acid/g total fatty acids) of whole fillets (WF), and MSM burgers (MSM) stored for 90 days at – 20 °C.

	Treatment (T)		Storage (S)		T x S	SEM
	WF	MSM	T0	T90		
C16:0	12.26	11.95	***11.08b***	***13.13a***	NS	0.31
C18:0	***6.24a***	***5.75b***	***5.58b***	***6.41a***	NS	0.13
C18:1ω9	10.24	8.41	9.02	9.63	NS	0.83
C20:5ω3 (EPA)	5.57	6.41	6.24	5.74	NS	0.32
C22:5ω3	4.28	4.32	***4.75a***	***3.84b***	NS	0.12
C22:6ω3 (DHA)	46.68	48.49	48.80	46.37	NS	1.21
ΣSFA	20.82	19.83	***18.95b***	***21.70a***	NS	0.49
ΣMUFA	15.37	13.44	13.97	14.83	NS	1.10
ΣPUFAω6	5.91	6.00	5.90	6.01	NS	0.20
ΣPUFAω3	57.46	60.31	60.80	56.98	NS	1.39
ΣPUFA	63.81	66.73	67.07	63.46	NS	1.56

Table 2 - Lipid oxidation (CD, mmolHp/100g fat; TBARS, mg MDA-eq/100 g muscle) and antioxidant capacity (ABTS•, and DPPH mmol Trolox/kg muscle; FRAP, mmol Fe^{2+}/kg sample) of whole fillets (WF), minced burgers (FB), and MSM burgers (MSM) stored for 90 days at – 20 °C.

	Treatment (T)			Storage (S)		T x S	SEM
	WF	FB	MSM	T0	T90		
CD	***0.15ab***	***0.20a***	***0.14b***	0.17	0.15	NS	0.01
TBARS	8.14	11.59	8.07	7.70	10.84	NS	1.49
ABTS	***0.73a***	***0.46b***	***0.36c***	***0.67a***	***0.36b***	0.00	0.02
DPPH	***0.18a***	***0.16b***	***0.13c***	***0.19a***	***0.13b***	0.02	0.00
FRAP	***0.32a***	***0.26a***	***0.16b***	***0.33a***	***0.16b***	NS	0.01

Mechanical separation process seemed not to reduce lipid stability, indeed no significant differences between MSM and WF were found for CDs nor for TBARS values (**Table 2**). Nevertheless, horse mackerel oxidative status was deeply compromised from the beginning (>8 mg MDA-eq/100 g product). Globally, MSM antioxidant capacity resulted significantly damaged by the mechanical separation treatment in comparison both to WF and FB. As well, storage significantly reduced antioxidant content but the oxidative status was unaffected by it.

CONCLUSION

Some advantages and disadvantages emerged by the use of mechanical separation process. Horse mackerel showed a low fat content (<1 g/100 g muscle), a high PUFAω3 content, especially EPA and DHA (around 52 g/100 g total FAs), regardless the treatment. However, PUFA fraction increases products susceptibility to oxidation, as revealed by the high TBARS content at T0 for WF, FB, and MSM. Nevertheless, horse mackerel had a high antioxidant power which may protect muscle against oxidative damages both during treatment and storage. Indeed no significant increase in TBARS content was found at T90 whilst at the same time the antioxidant capacity significantly decreased. In conclusion, the mechanical separation process can be applied on horse mackerel without many detrimental effects.

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