Potential antihypertensive effect of protein by-products from whitefish filleting after simulated gastrointestinal digestion

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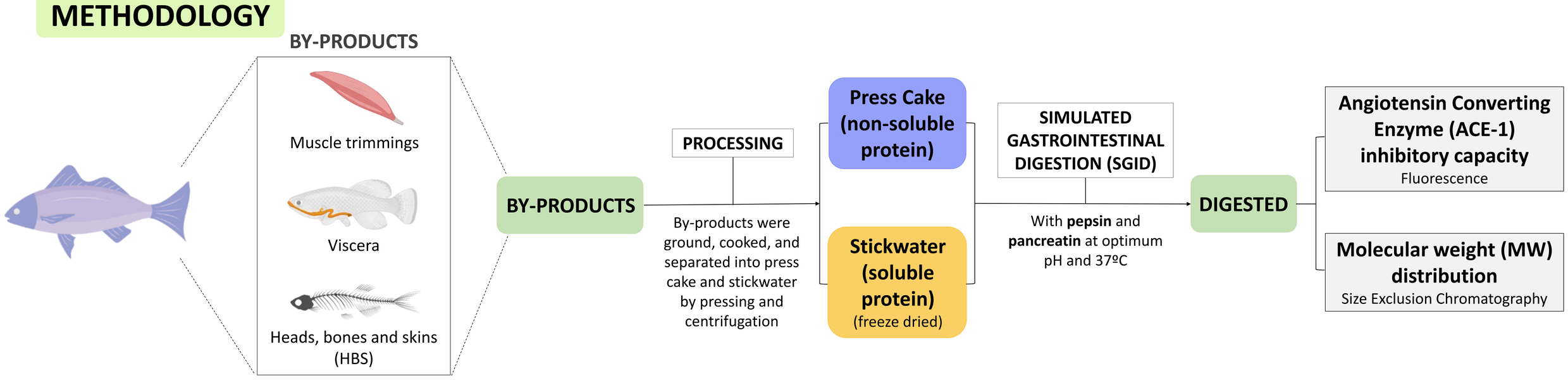
INTRODUCTION

Whitefish factory vessels generate thousands of tons of **raw material** (head, backbone, skin, viscera and trimmings) which, despite their high nutritional value, are hardly utilized due to the lack of economic incentives and viable technology on board. The development of a by-product processing technology on board fishing vessels would make it possible to obtain, from this raw material, different fractions such as **water-soluble proteins**, **non-soluble protein powder** and **lipids**, which could be used as food ingredients, contributing to improving the sustainable use of the world's fishery resources. In addition, gastrointestinal digestion of the protein fractions could release peptides with a bioactive potential that deserve to be studied. Within this context, the **aim of this work** is to investigate the ACE-inhibitory activity of protein concentrates derived from the filleting of four whitefish species (**haddock** *-Melanogrammus aeglefinus-*, **redfish** *-Sebastes norvegicus-*, **cod** *-Gadus morhua-* and **saithe** *-Pollachius virens-*) and subjected to simulated gastrointestinal digestion, to determine their potential as antihypertensive ingredients.

METHODOLOGY



RESULTS

Inhibition of ACE-1 activity

Molecular weight distribution

HADDOCK		*NON-SOLUBLE PROTEIN*		*SOLUBLE PROTEIN*	
Sample	*Dalton (Da)*	*Distribution (%)*	*Main molecular weight (Da)*	*Distribution (%)*	*Main molecular weight (Da)*
HBS	>1000	59	1300	-	-
	1000-500	16	535	11	762
	<500	26	313	89	208
Muscle trimmings	>1000	30	-	-	-
	1000-500	29	900	6	743
	<500	41	316	94	260
Viscera	>1000	13	1230	-	-
	1000-500	21	818	25	518
	<500	65	435	75	279

REDFISH		*NON-SOLUBLE PROTEIN*		*SOLUBLE PROTEIN*	
Sample	Dalton (Da)	Distribution (%)	Main molecular weight (Da)	Distribution (%)	Main molecular weight (Da)
HBS	>1000	51	1284	-	-
	1000-500	19	534	21	507
	<500	30	311	79	263
Muscle trimmings	>1000	38	1148	-	-
	1000-500	22	534	5	705
	<500	40	310	95	193
Viscera	>1000	42	1159	-	-
	1000-500	20	536	17	508
	<500	37	313	83	260

COD		*NON-SOLUBLE PROTEIN*		*SOLUBLE PROTEIN*	
Sample	Dalton (Da)	Distribution (%)	Main molecular weight (Da)	Distribution (%)	Main molecular weight (Da)
HBS	>1000	61	1316	-	-
	1000-500	15	537	11	501
	<500	24	313	89	209
Muscle trimmings	>1000	47	1217	-	-
	1000-500	20	545	5	791
	<500	32	300	95	261
Viscera	>1000	42	1019	-	-
	1000-500	22	537	23	514
	<500	37	314	77	206

SAITHE		*NON-SOLUBLE PROTEIN*		*SOLUBLE PROTEIN*	
Sample	Dalton (Da)	Distribution (%)	Main molecular weight (Da)	Distribution (%)	Main molecular weight (Da)
HBS	>1000	58	1282	-	-
	1000-500	16	538	14	796
	<500	26	314	86	206
Muscle trimmings	>1000	47	1282	-	-
	1000-500	20	544	4	774
	<500	33	306	96	202
Viscera	>1000	43	1069	-	-
	1000-500	20	533	24	523
	<500	37	309	76	271

RESULTS AND DISCUSSION

The non-soluble protein digests presented in almost all cases a predominant fraction of peptides with MW around 1-1.3 kDa, and to a lesser extent peptides with MW around 535 and 310 Da. The highest MW fraction was absent in the soluble protein digests, which were rich in small peptides, presumably dipeptides.

All digests showed ACE inhibitory capacity at very low concentrations (100 µg/ml). The highest ACE inhibitory capacity was observed in the viscera digests. Despite the differences observed in the molecular profile, the ACE-inhibitory capacity of soluble and non-soluble protein digests was very similar, suggesting that certain residues present at specific positions in the peptide chain would be responsible for the inhibition.

CONCLUSION

Viscera derived from the filleting of high-value fish species on board fishing vessels could be used as a source of soluble and non-soluble protein of interest as a food ingredient with antihypertensive potential. Protein fractions derived from other processing by-products such as muscle trimmings or heads, bones and skins are also of great interest for their bioactive potential, although their digests show a lower capacity to inhibit ACE.

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