Comparison of bioactive properties of cod and chicken protein hydrolysates

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INTRODUCTION

- During processing of cod (Fig. 1) considerable amounts of protein rich byproducts are left over. This material is used for production of lower value products like mince and fish meal.
- The same problem concerns the poultry (Fig. 1) industry due to increasing quantities of chicken waste causing growing disposal costs and possible environmental pollution.
- Worldwide demand of proteins is increasing, and proteins from a variety of sources are growing in popularity in functional foods and neutraceuticals. Animal derived proteins have yet to enter this market sucessfully.
- Protein hydrolysates have been found to possess certain bioactive properties potentially beneficial to human health. Studies on peptides, mainly from *in vitro* studied, have recorded potential effects on hypertension, insulin regulation and oxidative stress
- The properties of the hydrolysates may however be dependent on what type of protein source is used in processing. So far there has been no published comparison between chickn and fish protein hydrolysates so comparative studies on different protein sources are lacking

OBJECTIVE

- The objective was to compare the bioactivities of protein hydrolysates produced under the same conditions from two different muscle protein sources (chicken v.s. cod).

METHODS

Materials

- Mince was made from fresh cod fillets and chicken breasts.
- Isolates were made by solubilizing the myofibrillar proteins at pH 11.0, separating them from lipids and connective tissue, and recovering the myofibrillar proteins by precipitation at pH 5.5.

Hydrolysis

- Isolate solutions (3% protein) were prepared and Protamex (Novozymes) used to hydrolyze the proteins for 5 hours at 45 C and pH 8.
- Soluble fractions after centrifugation were collected and freeze dried.

Measurements

- Antioxidant properties of the different fractions were measured
  - ✓ 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging
  - ✓ Reducing power
  - ✓ Oxygen radical absorbance capacity (ORAC)
  - ✓ Metal chelation
- Angiotensin Converting Enzyme (ACE) inhibitory activity
- SDS-PAGE Electrophoresis

Table 1. Properties of cod and chicken hydrolysates.

Measurement	Cod	Chicken
Protein [%]	84.1	84.0
Salt [%]	11.2	10.7
DPPH [%]	60.2 ± 0.6	87.0 ± 0.7
Metal ion chelating[%]	81.5 ± 2.2	83.3 ± 1.2
Reducing power*	17.7 ± 1.9	14.6 ± 2.9
ORAC value**	94.3 ± 6.0	108.6 ± 7.6
IC_{50} [mg/ml]	0.7 ± 0.3	1.0 ± 0.2

*Ascorbic acid equivalent mg/g protein

**µmol Trolox equivalent/g protein

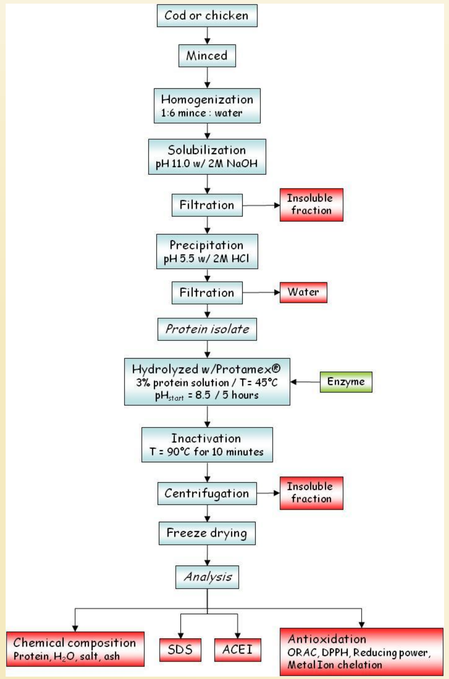

Figure 2. View over production and analysis of cod and chicken hydrolysates

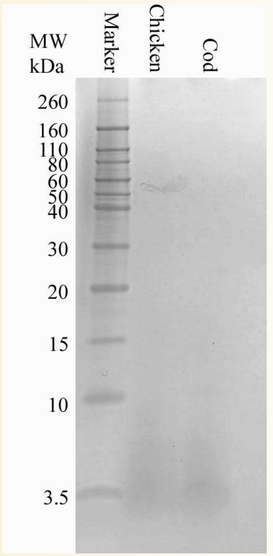

Figure 3. SDS-PAGE analysis of cod and chicken hydrolysates. Lane 1, wide range Mw standards; lane 2, chicken hydrolysates; lane 3, cod hydrolysates.

Figure 1. Atlantic Cod (*Gadus morhua*) and Icelandic hen and cock with chickens © Jón Baldur Hlíðberg; www.fauna.is. The raw materials for the study are also shown.

RESULTS

- Protein source had little impact on the bioactive properties of the hydrolysates (Table 1). SDS-PAGE showed both samples had small peptides with MW < ~ 10 kDa (Fig. 3).
- Cod protein hydrolysates (CPH) had slightly higher DPPH and reducing power activity while chicken protein hydrolysates (CHPH) had slightly higher metal ion chelating activity and ORAC values (Table 1).
- CPH had a higher ACE inhibition activity with an IC_{50} value of 0.7 0.3 mg/ml compared to 1.0 0.3 mg/ml for CHPH (Table 1).

CONCLUSION

- This study demonstrated that two different muscle sources, cod and chicken, had very comparable bioactivities measured *in vitro*.
- The bioactivity is therefore largely determined by the processing conditions and not the muscle protein source, which can be very useful information for processors of hydrolysates and users of these products.
- *In vivo* studies are necessary to investigate if same results are found in living systems.

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