Chicken viscera protein concentrate as a source of bioactive peptides: enzymatic hydrolysis as a strategy to enhance the angiotensin I-converting enzyme (ACE) inhibitory activities

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Abstract

In this study, protein hydrolysates from chicken viscera were obtained using different commercial proteases and a statistical mixture design. The protein hydrolysates obtained were used as a source of bioactive peptides with angiotensin I-converting enzyme (ACE) inhibitory activities (antihypertensive activity). The results from this research showed that the chicken viscera protein concentrate in its non-hydrolyzed form (control) was able to inhibit 73.9% of the activity of the angiotensin I-converting enzyme (ACE) at 1mg/mL. On the other hand, enzymatic hydrolysis enhanced the biological properties of the proteins, increasing their ACE inhibitory activities. The maximum values of inhibition detected were 82.1, 82.5 and 83.7% using the binary mixture of Flavourzyme® 500L (50%) and Alcalase® 2.4L (50%), the ternary mixture of Flavourzyme® 500L (33.33%), Alcalase® 2.4L (33.33%) and Neutrase® 0.8L (33.33%) and Neutrase® 0.8L (100%), respectively.

Key words:

Chicken viscera protein, enzymatic hydrolysis, antihypertensive activity.

Introduction

Chicken viscera flour is known for its high content of good quality protein that can be used as an interesting source of bioactive peptides. In this context, this work aimed to study the enzymatic hydrolysis of a protein concentrate obtained from chicken viscera flour using commercial proteases and an experimental mixture design. The antihypertensive activities of the protein hydrolysates were studied by inhibition of the angiotensin I-converting enzyme (ACE).

Results and Discussion

The results showed that the antihypertensive activity of the chicken viscera protein increased significantly after enzymatic hydrolysis. In general, the hydrolysis carried out with enzyme mixtures allowed one to obtain protein hydrolysates with higher ACE inhibitory activity. The protein hydrolysate obtained using the commercial Neutrase® 0.8L (run 3) resulted in the highest ACE inhibitory activity of 83.73 % (Table 1).

Table 1 – ACE inhibitory activities of the chicken viscera protein hydrolysates obtained using commercial proteases and a statistical mixture design.

Run	Enzymes			ACE Inhibition (%)
	Flavourzyme	Alcalase	Neutrase	
Control	0	0	0	73.9 ± 2.06
1	1	0	0	70.5 ± 1.22
2	0	1	0	73.4 ± 1.40
3	0	0	1	83.7 ± 5.17
4	1/2	1/2	0	82.0 ± 2.09
5	1/2	0	1/2	75.2 ± 6.00
6	0	1/2	1/2	80.9 ± 8.06
7	1/3	1/3	1/3	82.5 ± 3.65
8	2/3	1/6	1/6	79.2 ± 1.54
9	1/6	2/3	1/6	78.9 ± 2.45
10	1/6	1/6	2/3	80.2 ± 2.74

The interpretation of the contour plot considering the significant factors and interactions ($p \leq 0.10$) showed a synergistic effect for the combination of Flavourzyme® 500L and Alcalase® 2.4L, which resulted in higher ACE inhibitory activity. The contour plot also showed that the protein hydrolysate obtained using the commercial protease Neutrase® 0.8L individually, resulted in ACE inhibitory activity up to 82% (Figure 1).

Figure 1 - Mixture contour plots for the ACE inhibitory activities of chicken viscera protein hydrolysates as a function of the significant ($p \leq 0.10$) interaction effects of different commercial proteases.

Conclusions

The results from this research demonstrated that the enzymatic hydrolysis of the protein chicken viscera using commercial proteases enhanced its ability to inhibit the ACE activity, an indication of the antihypertensive potential of the protein hydrolysates.

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