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Angiotensin I-converting enzyme inhibitory peptide from yellowfin sole (*Limanda aspera*) frame protein and its antihypertensive effect in spontaneously hypertensive rats

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Abstract

In order to utilize yellowfin sole (*Limanda aspera*) frame protein, which is normally discarded as industrial waste in the process of fish manufacture, yellowfin sole frame protein was hydrolysed by α-chymotrypsin. Yellowfin sole frame protein hydrolysates (YFPHs) were fractionated into three ranges of molecular weight (YFPH-I, 30–10 kDa; YFPH-II, 10–5 kDa; YFPH-III, below 5 kDa) using an ultrafiltration (UF) membrane bioreactor system. Angiotensin I-converting enzyme (ACE) inhibitory activity was detected on YFPH-III, and the ACE inhibitory peptide (YFP) was purified from YFPH-III using consecutive chromatographic techniques. The YFP with a molecular mass of 1.3 kDa consisted of 11 amino acids, Met-Ile-Phe-Pro-Gly-Ala-Gly-Gly-Pro-Glu-Leu, and its IC_{50} value was 28.7 μg/ml. Lineweaver–Burk plots suggest that YFP acts as a non-competitive inhibitor to inhibit ACE. Antihypertensive effects of YFP on spontaneously hypertensive rats (SHR) following oral administration was determined as the blood pressure significantly decreased after peptide ingestion.

Keywords: Yellowfin sole frame protein; Hydrolysates; ACE inhibitory peptide; Antihypertensive effect

1. Introduction

Angiotensin I converting enzyme (EC 3.4.15.1; ACE) plays an important physiological role in regulating blood pressure (Skeggs, Kahn, Kahn, & Shumway, 1957). ACE belongs to the class of zinc proteases and is located in the vascular endothelial lining of the lungs. ACE acts as an exopeptidase that cleaves dipeptides from the C-terminus of various oligopeptides (Curtiss, Chon, Vrobel, & Francious, 1978; Yang, Erdös, & Levin, 1971). ACE converts an inactive form of the decapeptide, angiotensin I, to the octapeptide angiotensin II, a potent vasoconstrictor, and inactivates bradykinin, which has a depressor action. Since the discovery of ACE inhibitors in snake venom, many studies have been attempted in the synthesis of ACE inhibitors, such as captopril, enalapril, alacepril and lisinopril, which are currently used extensively in the treatment of essential hypertension and heart failure in humans (Ondetti, 1977; Patchett et al., 1980).

For many years, food researchers have extensively studied peptides derived from food proteins as potential nutraceuticals in relation to the development of functional foods (Ariyoshi, 1993; Yamamoto, 1997; Meisel, 1997). Recently, a new relationship between food and health has drawn considerable attention, that being

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