Protease-assisted fermentation of heat-denatured goat and cow whey proteins as a process to yield a functional ingredient

C. Alvarado-Carrasco¹, J.A. Gómez-Ruiz², M. Guerra³. ¹Department of Animal Production and Industry, Faculty of Veterinary Science, Universidad Central de Venezuela, Campus Maracay, Venezuela. ²Instituto de Investigación en Ciencias de Alimentación (CIAL), Campus de Cantoblanco, Madrid, Spain. ³Department of Biological and Chemical Processes, Universidad Simón Bolívar, Sartenejas, Venezuela.

Whey derived from cheese making operations has been recognized as a source of bioactive peptides, such as antihypertensive and antioxidant peptides. This has promoted its use as a functional ingredient by the food industry. In order to release them from the original structure of the whey proteins, the proteins have to undergo enzymatic treatments, usually after a concentration step either by ultrafiltration or by thermo-coagulation. The latest has a lower operational cost. In this study, heat-denatured goat and cow whey protein concentrates were hydrolyzed using Flavourzyme™, an Aspergillus oryzae protease/peptidase complex, along with a lactic-acid bacterial fermentation, to yield functional ingredients with a strong in vitro Angiotensin Converting Enzyme (ACE) inhibitory activity. Sweet whey, either from goat or cow cheese production, with a pH >6.3, was heated at 92°C during 30 minutes. Later, after cooling to 42°C, 75% of the liquid whey was removed, and the coagulated protein solution was hydrolyzed with the protease at a 3% enzyme/protein (w/w) ratio and 0.02% (w/v) lactic acid bacteria, during 150 minutes at this temperature. A 10-20% hydrolysis was reached, measured by formol titration. The antioxidant capacity was also measured by the Oxygen Radical Absorbance Capacity (ORAC) method. IC₅₀ of bovine and goat hydrolysates were 4.27 and 10.54 µg/mL, respectively. ORAC activity was 0.601 µMoles Trolox/mg soluble solids and 0.265 µMoles Trolox/mg soluble solids for the bovine and the goat hydrolysates, respectively. Both hydrolysates showed strong ACE inhibitory activity indicating, therefore, their potential to be used as ingredients in functional foods formulation.

Keywords: Aspergillus oryzae, bioactive peptide, whey, protein hydrolysates