

Tenderness and physicochemical characteristics of meat treated by recombinant bromelain of MD2 pineapple from a codon-optimized synthetic gene

ABSTRACT

Bromelain is a complex of cysteine proteases from pineapple (*Ananas comosus*) which was widely used in meat tenderizers. Earlier, using a synthetic optimized gene approach, recombinant bromelain of MD2-pineapple (MD2-MBro) was successfully produced in a fully soluble form. Nevertheless, the use of MD2-MBro to tenderize the meat has never been examined. Indeed, no report on the meat tenderization activity using recombinant bromelain was found. The aim of the current study is to determine the effect of MD2-MBro on meat tenderness and its physicochemical properties. To address this, MD2-MBro was over-expressed in *Escherichia coli* BL21 Codon Plus(DE3), followed by purification using a single step of Ni-NTA affinity chromatography. Fresh lamb shoulder meat from a local market in Kota Kinabalu, Sabah, Malaysia, was then treated with MD2-MBro at the concentration of 0 (B0), 0.01 (B1), 0.05 (B2), and 0.1% (B3). The meat tenderness was measured using Warner-Bratzler shear forces, indicating that the addition of MD2-MBro had significantly ($P < 0.01$) reduced the shear force value from 8.80kg/cm² to the range of 6.01 to 6.92 kg/cm², which falls under the category of tender. The ability of MD2-MBro to tenderize meat might be related to its ability to degrade myofibril protein, as demonstrated by the formation of a clear zone under an agar plate system and scanning electron microscopy. Besides, the total protein or sarcoplasmic protein solubility was significantly enhanced by the MD2-MBro treatments, along with soluble peptides, free amino acids, collagen content, and collagen solubility, which indicated the improvement in meat protein digestibility. Other physicochemical properties (color, pH, water-holding capacity, and cooking loss) of the meat were affected by MD2-MBro treatments yet remained in the normal range. Altogether, while MD2-MBro consisted of only a single cysteine protease enzyme, this protein can tenderize meat and increase protein digestibility, with acceptable changes in the overall physicochemical properties.