

Effects of Hawthorn (*Crataegus monogyna*) Polyphenols on Oxymyoglobin and Myofibrillar Proteins Stability in Meat

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Abstract : The oxidation of the fresh muscle oxymyoglobin (bright red colour) to metmyoglobin (brown colour) leads to discoloration of red meats. After slaughter, enzymatic systems involved in metmyoglobin reduction are continually depleted as time post-mortem progresses, thus the meat colour is affected. Phenolic compounds are able to scavenge reactive species involved in oxymyoglobin oxidation and to reduce metmyoglobin to oxymyoglobin. The aim of this study was to investigate the effect of polyphenols extracted from hawthorn fruits on the stability of oxymyoglobin and myofibrillar proteins in ground pork subject to refrigeration for 6 days. Hawthorn polyphenols (HP) were added in ground pork in 100, 200 and 300 ppm concentrations. Oxymyoglobin and metmyoglobin were evaluated spectrophotometrically at every 2 days and electrophoretic pattern of myofibrillar proteins was investigated at days 0 and 6 by Sodium Dodecyl Sulfate Polyacrylamide Gel Electrophoresis (SDS-PAGE). For all meat samples, oxymyoglobin concentration significantly decreased during the first 4 days of refrigeration. After 6 days, the significant decrease of oxymyoglobin concentration continued only in the negative control samples. In samples treated with HP and butylated hydroxyanisole (BHA - positive control), oxymyoglobin concentration increased after 6 days of refrigeration, the highest levels complying with the following order: 100 ppm HP > 200 ppm HP > 300 ppm HP > 100 ppm BHA. The increase in metmyoglobin was coincidental with the decrease in oxymyoglobin; metmyoglobin concentration progressively increased during the first 4 days of refrigeration in all meat samples. After 6 days, in meat samples treated with HP and BHA, lower metmyoglobin concentrations were found (compared to day 4), respecting the following order: 100 ppm HP < 200 ppm HP < 300 ppm HP < 100 ppm BHA. These results showed that hawthorn polyphenols and BHA reduced metmyoglobin (MbFe³⁺) to oxymyoglobin (MbFe²⁺), and the strongest reducing character was recorded for 100 ppm HP. After 6 days of refrigeration, electrophoretic pattern of myofibrillar proteins showed minor changes compared to day 0, indicating that HP prevent protein degradation as well as synthetic antioxidant BHA. Also, HP did not induce cross-links in the myofibrillar proteins, to form protein aggregates, and no risk of reducing their ability to retain water was identified. The pattern of oxymyoglobin and metmyoglobin concentrations determined in this study showed that hawthorn polyphenols are able to reduce metmyoglobin to oxymyoglobin and to delay oxymyoglobin oxidation, especially when they are added to ground meat in concentration of 100 ppm. This work was carried out through Partnerships in priority areas Program - PN II, implemented with the support of MEN - UEFISCDI (Romania), project nr. 149/2014.

Keywords : Hawthorn polyphenols, metmyoglobin, oxymyoglobin, proteins stability

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