STABILITY OF ENDOGENOUS ANTIOXIDANT ENZYMES IN CHINESE SEMI-DRY SAUSAGE AS AFFECTED BY DRY-TEMPERATURE AND STORED TIME

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Introduction

The muscle tissue contains various endogenous antioxidant compounds, which includes enzymic antioxidants, superoxide dismutase, glutathione peroxidase, catalase, which function as free radical scavenging to reach the oxidative stability of meat. The purpose of this study was to evaluate the stability of endogenous antioxidant enzymes in Chinese semi-dry sausage as affected by various drying temperatures (55, 50, 45 and 10°C) and when stored for 8 wks at 0-5°C.

Materials and Methods

(1) Raw materials: The chilled shoulder picnic (85/15) 85% and backfat (0/100) 15%, was purchased from Shang-Li Food Industry Company Ltd., Nantou, Taiwan, R.O.C., in a 100 kg meat block.
(2) Formula ingredients: The ingredients used are based on a 100 kg meat block, sugar 8%, sorbitol 3%, salt 1.5%, phosphate 0.25%, sodium nitrite 0.015%, Na-erythorbate 0.05%, glucono-lactone 0.1%, ethyl maltol 0.1%, nucleotide 0.05%, white pepper 0.2%, cinnamon 0.05%, garlic 0.05%, allspice 0.05%.
(3) Manufacturing procedures: The chilled shoulder picnic was ground through a 9mm plate, and the backfat cut into size 0.3 cm3. All the ingredients were mixed in a mixer for 5 min, stored at 0-5°C and cured for 3 days. The cured mixes were stuffed into size 30-32 mm hog casing, linked at 10 cm intervals, then dried by 4 various drying temperatures until the moisture content of the lean meat of sausage reached 45~48%; treatment 1 55°C hot-air drying for 3 hours; treatment 2 50°C hot-air drying 4 for hours; treatment 3 45°C hot-air drying for 5 hours; treatment 4 10°C, 80-85% relative humidity cold-air drying for 2 days. After cooling, the sausage was vacuum-packaged (vacuum degree -0.92bar), stored at 0-5°C cold storage, and sampled for determination at 0, 1, 2, 3, 4, 5, 6, 7, 8 weeks.
(4)Antioxidant enzymes activity determination: The endogenous antioxidant enzyme assay for all samples were performed as described by De Vore and Greene (1982); Günzler and Flohé (1985).
a. Superoxide dismutase (SOD) activity was performed by the riboflavin/nitro blue tetrazolium (NBT) photochemistry analysis method as described by Beauchamp and Fridovich (1971).
b. Glutathione peroxidase (GSH-Px) activity analysis was performed as described by De Vore and Greene (1982).
c. Catalase (CAT) activity analysis was performed as described by Aebi (1983) and Mei *et al.*, (1994).

Results and Discussion

Figure 1 shows the changes in absorbance variation of SOD of Chinese semi-dry sausage using various temperatures and stored for 8 wks at 0-5°C. The result showed that SOD activity of products dried using 10°C cold air were significantly higher than the others ($P<0.05$), and SOD activity of various drying temperature were significantly ($P<0.05$) decreased with the increased stored time. Figure 2 shows the changes in absorbance variation of GSH-Px of Chinese semi-dry sausage dried by various temperatures and stored for 8 wks at 0-5°C. The results show that GSH-Px activity of products by the cold air drying group at 0 wk being significantly ($P<0.05$) higher than the other hot air drying groups, and the GSH-Px activity of all treatments samples were significantly ($P<0.05$) decreased with the increased storage time, and GSH-Px activity by hot air drying groups was completely inactivated at 5 wks. Figure 3 shows the changes in absorbance variation of CAT of Chinese semi-dry sausage dried by various temperatures and stored for 8 wks at 0-5°C. The result showed that the CAT activity of all treatments samples had the same tendency, CAT activity of products dried by 10°C cold air was significantly ($P<0.05$) higher than the others, and CAT activity of all samples was significantly ($P<0.05$) decreased with the increased storage time. These results partly confirm previous observations by Mei *et al.*, (1994) who found that cooking ground pork and beef to an internal temperature of 70°C resulted in total inactivation of CAT and partial inactivation of GSH-Px , as GSH-Px ,which differed from CAT, was capable of reacting with both lipid and H_2O_2. On the other hand, during the later storage periods, Chinese semi-dry sausage may have started an auto-oxidative reaction which could produce more H_2O_2 than the Fenton reaction to cause the activity of GSH-Px of all tested samples to be completely inactivated at 5 wks.

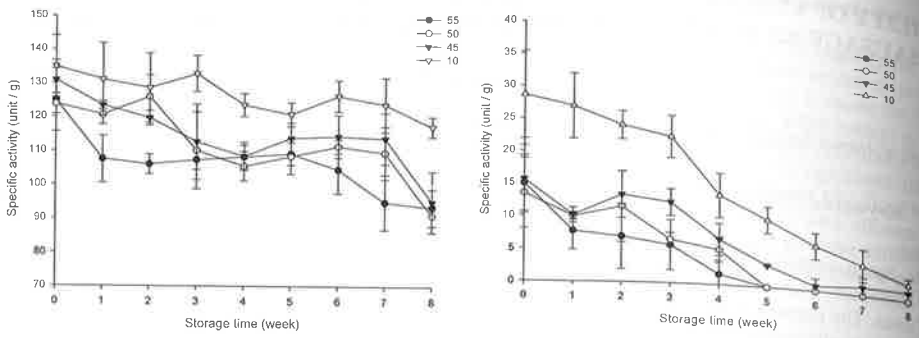

Figure 1 (Left): Changes in absorbance variation of superoxide dismutase from Chinese style semi-dry sausage dried by different temperatures and stored for 8 wks at 0-5°C.

Figure 2 (Right): Changes in absorbance variation of glutathione peroxidase from Chinese style semi-dry sausage dried by different temperatures and stored for 8 wks at 0-5°C.

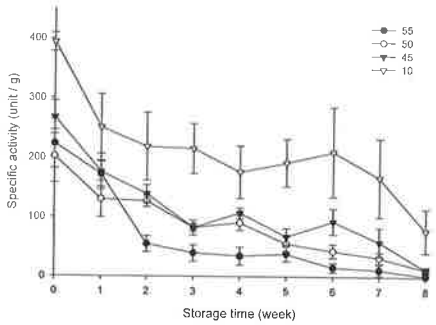

Figure 3: Changes in absorbance variation of catalase (CAT) from Chinese style semi-dry sausage dried by different temperatures and stored for 8 wks at 0-5°C.

Conclusions

The results show that the endogenous antioxidant enzyme activity in Chinese semi-dry sausages dried by 10°C cold air and 80-85% relative humidity were significantly ($P<0.05$) higher than the others, and GSH-Px of each group was completely inactivated following 5 weeks storage time. Although the antioxidant enzyme activity of all samples were significantly ($P<0.05$) decreased with the increased stored time, the stability of SOD is the highest among all tested samples.

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