EFFECT OF ARGININE-HEMOGLOBIN ON COLOR STABILITY OF GROUND LAMB DURING STORAGE

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Abstract – This study investigated the effect of arginine-hemoglobin on color stability of ground lamb during storage. Meat color, percentage of metmyoglobin (MetMb%) and thiobarbituric acid reactive substance (TBARS) were analyzed under different concentration (0, 0.15, 0.25, 0.5 g/kg) of arginine-hemoglobin during 7 days storage at 4±0.2 °C. The data showed that the arginine-hemoglobin treatments had lower TBARS and MetMb% compared with control. The redness (a* value) of treatments were higher than that in control during storage. In addition, the redness value increased as the arginine-hemoglobin concentration increased. The results suggested that the addition of arginine-hemoglobin could be an option in inhibiting the oxidation of myoglobin and fat in meat.

Key Words-arginine, hemoglobin, color, ground lamb

I. INTRODUCTION

Meat color is one of the most important indexes to evaluate the acceptability of meat product. The color of meat and meat products are affected by the oxidation of myoglobin (Mb) and lipid. In addition, the nutrition and sensory of meat and meat products are also affected by oxidation of Mb and lipid [1]. Various methods have been attempted to inhibit or reduce the oxidation reaction in meat and meat product, such as the use of food additives, salts and antioxidant [2].Animal blood is considered as a useful natural red colorant source due to the content of hemoglobin in meat industry, but the ferrous of hemoglobin is unstable. Arginine has been used to enhancing the stability of hemoglobin (Hb) because it can coordinate with ferrous which located in the central of Hb [3].

The objective of this study was to investigate the effect of arginine-hemoglobin on color stability of ground lamb during storage. The meat color (L*a*b*), metmyoglobin (MetMb%) and thibabituric acid reactive substance (TBARS) were analyzed.

II. MATERIALS AND METHODS

Six lambs were slaughtered in a local abattoir with the halal manner. The longissimus dorsi (LD) muscles from both sides of the carcass were collected after exsanguination immediately. After ridding the fat and connective tissue, the LD muscles were cut into pieces and these meat pieces were split into 4 groups to determine the effects of different treatments (50 g for each group) and each group included 3 repeats: (1) one group was used as control (C); (2) the other three groups were used as treatments with different concentrations (0.15, 0.25, 0.5 g/kg) of arginine-hemoglobin. The meats were mixed with salt (50:1, w/w), and smashed by meat grinder, immediately. The ground lamb meats were then stored at 4±0.2°C for 7 days. Ground meat samples were collected from all 4 groups at 0, 1, 2, 3, 4, 5, 6, 7 d and stored at -80°C before analysis. Color measurements were taken with DigiEye (Verivide, CO., Ltd, UK). The relative content of metmyoglobin （MetMb%） was evaluated with the method described by Krzywicki [4] with slight modifications. The extent of lipid oxidation is reflected by thiobarbituric acid reactive substances (TBARS) [5].

III. RESULTS AND DISCUSSION

3.1 Color of ground lamb

The a^* value increased as the arginine-hemoglobin concentration increased (Fig. 1). Based on these results, the addition of 0.5 g/kg arginine-hemoglobin was chosen to further studied. The changes in a^* value of different treatments during storage were shown in Fig. 2 (A). The a^* value of both of the control and treatment groups decreased significantly from 2 to 7d (P<0.05). In addition, the a^* values of treatment group was significantly higher than the control group during storage (P<0.05). In treatment group, the a^* value increased significantly (P<0.05) at 1 and 2 d, then, from 2 to 6 days, the a^* values was decreased significantly except the 4^{th} day.

3.2 TBARS value

The changes of TBARS value for the control and treatment groups are given in Fig. 2 (B). The TBARS value increased during storage, which was induced by the accumulation of lipid oxidation products. Some studies

indicated that arginine is able to enhancing the stability of hemoglobin and improving the color of hemoglobin during storage. Based on the present result, as one kind of colorant, the addition of arginine-hemoglobin plays an important role in enhancing the stability of ground lamb and reducing the oxidation of lipid of ground lamb.

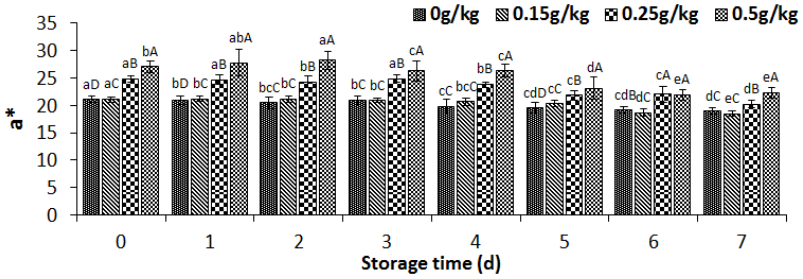

Fig.1. Effect of concentration of arginine-hemoglobin on the a* value of ground lamb

Different capital letters indicate significant differences among different treatment groups at the same storage time. Different lowercase letters indicate significant differences among different storage times in the same group.

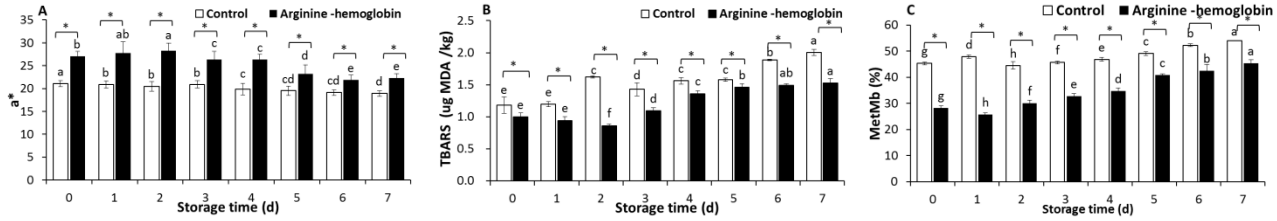

Fig.2. Effect of arginine-hemoglobin (0.5 g/kg) on the color stability of ground lamb a* (A), TBARS (B) and MetMb% (C) during storage at 4°C for 7 days.

Different letters indicate significant differences among different storage times in the same group. * shows significant difference between control group and treatment group at the same storage time.

3.3 MetMb content

The change of MetMb% was shown in Fig. 2 (C), the MetMb% of control group was higher than that of the 0.5 g/kg arginine-hemoglobin treatment during storage. The MetMb% of control and treatment groups increased significantly (P<0.05) from 3 to 7 days. Therefore, the increased of the MetMb% might lead to the discoloration of ground lamb. The MebMb content has a same trend as the value of TBARS. There was a significant correlation between a gradual accumulation of MetMb% and the development of lipid oxidation during refrigerated storage of meat and meat product in previous study.

IV. CONCLUSION

The results indicated that arginine-hemoglobin is effective in preventing the oxidation and delaying the discoloration of ground lamb during storage. Specifically, the addition of arginine-hemoglobin improved a* value and decreased the MetMb% of ground lamb, and the MetMb content has the similar trend as the lipid oxidation. On the basis of these results, the addition of arginine-hemoglobin could be an option in inhibiting the oxidation of myoglobin and fat in meat.

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