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EVALUATION OF WATER HOLDING CAPACITY OF PORK FROM F1 HYBRID PIG CROSSED BETWEEN VIETNAMESE NATIVE WILD BOAR AND MONG CAI PIGS

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ABSTRACT

This study aimed to assess the water holding capacity of F1 hybrid pigs produced by crossing between Vietnamese native wild boar and Mong Cai pigs. The water holding capacity was evaluated by using parameters of thawing loss, cooking loss, and evaporator loss for 24 hours, 48 hours, and 7 days of preservation. The results showed that thawing loss and evaporator loss values were increased during preservation. The thawing loss value after 24 hours, 48 hours, and 7 days were 4.08 ± 0.32, 6.49 ± 0.45, 14.62 ± 1.15, respectively. The evaporator loss values were increased from 14.18 ± 1.00 to 27.18 ± 1.10 after 24 hours and 7 days of preservation. On the other hand, a decrease of cooking loss value was observed from 24 hours to 7 days after preservation. The cooking loss value was reduced from 25.09 ± 0.69 to 16.31 ± 1.18 after 24 hours and 7 days of preservation, respectively. These results revealed that F1 hybrid pigs have well water holding capacity.

KEYWORDS: Cooking loss, Evaporation loss, Pork, Thawing loss, Water holding capacity.

INTRODUCTION

Nowadays, meat quality has become a top concern for both producers and consumers. Pork is a red meat with high protein content and contains many essential vitamins, minerals and amino acids that are good for health. Lean meat is a good source of protein with a lower fat content and therefore, a lower calorie content. According to the assessment criteria of experts, five basic attributes affecting the decision of the consumer when choosing meat are flavor, softness, safety, color, appearance and sweetness [1]. The pH factor can significantly affect meat quality parameters, including color, water retention and shelf life. As a consequence, pH has been widely used as an indicator of potential meat quality [2].

In addition, softness of meat is also associated with pH. High-pH meat will quickly become stiffer than low-pH meat in the process of aging. The highest quality meat products tend to decrease in pH from 5.5 to 6.2. PH changes affect the water's ability to retain water. Low pH values make meat reduced water retention and lighter color. Conversely, higher pH will give darker color and less dehydration [3,4]. Water retention is defined as the ability to conserve water in muscle after animal death under the influence of external pressure (eg, gravity, heat). One of the most common meat production problems is the loss of moisture in fresh and processed meat. The loss of moisture from fresh products or drip loss has been estimated to occur in about 50% of the meat [1]. Moreover, proteins and water-soluble vitamins are also lost along with moisture. Water retention capacity may also affect processing characteristics [1]. Low water retention capacity meats tend to become poor quality products [1]. In this study, we evaluated the water holding capacity of pork from F1 hybrid pigs. The results of this study are contributed to estimate meat quality of F1 hybrid pigs.

MATERIALS AND METHODS

Site description

The study was conducted at Institute of Tropical Biology, Vietnam Academy of Science and Technology, Ho Chi Minh City. The F1 hybrid pig was produced by crossing Vietnamese native wild boar (located in Vietnam Central Highland) and Mong Cai pigs (located in Northern Vietnam).

Pork preservation

Thigh muscle pork samples were prepared with 2 × 2 × 1 cm (width × depth × height) in size for evaluation. Then pork samples were placed in a chiller box set at 2-4°C for 24 hours, 48 hours, and 7 days for preservation. The water holding capacity was assessed by evaluating parameters of thawing loss, cooking loss, and evaporator loss. The pork samples were heated for 50 minutes at 80^{o}C.

Thawing loss

Thawing loss of pork (%) was assessed at 24 hours, 48 hours and 7 days. The formula for calculating thawing loss following [5]:

$$\text{Thawing loss} = \frac{(\text{weight before thaw}) - (\text{weight after thaw})}{(\text{weight before thaw})} \times 100$$

Cooking loss

Cooking loss of pork (%) was assessed at 24 hours, 48 hours and 7 days. The formula for calculating thawing loss following [5]:

$$\text{Cooking loss} = \frac{(\text{weight of raw pork after thawing}) - (\text{weight of cooked pork})}{(\text{weight of raw pork after thawing})} \times 100$$

Evaporation loss

Evaporation loss of pork (%) was assessed at 24 hours, 48 hours and 7 days. The formula for calculating thawing loss following [5]:

$$\text{Evaporation loss} = 100 - \frac{(\text{weight after cooking})}{(\text{raw weight})} \times 100$$

Statistical analyses

The experiments were triplicated. Data was analyzed for statistical significance by one-way ANOVA where $P < 0.05$ was considered statistically significant.

RESULTS AND DISCUSSION

Thawing loss

In this study, the thawing loss of thigh muscle pork was assessed at 24 hour, 48 hours, and 7 day. The results showed that the thawing loss of pork after 24 hours of cold preservation was 4.08 ± 0.32. This parameter was increased to 6.49 ± 0.45 after 48 hours of cold preservation. After 7 days of preservation, the thawing loss was dramatically increased to 14.62 ± 1.15 which was about 3.6-fold higher than 24 hours of preservation.

Cooking loss

The cooking loss is one the most important parameter for pork quality evaluation. After 24 hours of preservation, the cooking loss was 25.09 ± 0.69. A reduction of cooking loss was observed after 48 hours of preservation. This parameter was decreased to 16.31 ± 1.18 which was the lowest during preservation (Table 1).

Table 1. The thawing loss and cooking loss of pork during preservation

	24h	**48h**	**7 days**
Thawing loss	4.08 ± 0.32a	6.49 ± 0.45b	14.62 ± 1.15c
Cooking loss	25.09 ± 0.69a	18.17 ± 1.21b	16.31 ± 1.18c

Evaporation loss

The Table 2 showed that an increase of the evaporation loss was observed in pork preservation. After 24 hours, the cooking loss was 14.18 ± 1.00. This was significantly increased to 21.24 ± 0.73 after 48 hours of preservation. After 7 days of preservation, the evaporation loss was 27.18 ± 1.10 which was 1.9-fold higher than 24 hours.

Table 2. The evaporator loss of pork during preservation

	24h	**48h**	**7 days**
Evaporator loss	14.18 ± 1.00^{a}	21.24 ± 0.73^{b}	27.18 ± 1.10^{c}

DISCUSSION

The Vietnamese native wild boar and Mong Cai domestic pig were genetically characterized by cytochrome b gene [6]. They are indigenous pigs which have different distributions in

Vietnam. The F1 hybrid generations which was produced by crossing Vietnamese native wild boar and Mong Cai pigs showed some dominant characteristics of pork quality. The present study demonstrated the changes of some pork quality parameters during cold preservation.

The thawing loss and evaporator loss were increase during preservation. Otherwise, the cooking loss was dramatically reduced after seven days of preservation. The previous study showed that the cooking loss of Berkshire pork is 25.21 ± 3.77 after 24 hours of preservation [2]. Our result of pork cooking loss from 24 hours of preservation (25.09 ± 0.69) was consistent to this study. In long-term preservation of pork, the cooking loss from other study 16.61 ± 2.20 [7] was equivalent to our result (16.31 ± 1.18). A reduction of cooking loss and an increase of thawing loss after 48 hours and 7 days of preservation suggested that pork exposed a strong dehydration during preservation. The cooking temperature has been described as a cause change in meat including shrinkage of protein network and protein coagulation [8, 9]. The decrease was observed in cooking loss caused by endogenous enzymes, such as collagenase which are produced by bacteria within meat or by ionic solubilisation, progresses at faster rates as ageing increases [5]. The collagenase disperses my ofibrillar proteins and connective tissue, thus improving water holding capacity by proteins [10, 11]. In this study, the cooking temperature applied for pork treatment in one hour was 80^{o}C which was higher than above study, suggesting that the pork of F1 hybrid pigs have a well water holding capacity. The present study also found that a positive correlation between thawing loss and evaporation loss exposed in the F1 hybrid pork during preservation. After the beef has been frozen, ice sublimation during thawing from the beef surface occurs, and if it is excessive during thawing, a dry and spongy beef product may occur [12].

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REFERENCES

1. R.G. Kauffman, R.G. Cassens, A. Scherer, and D.L. Meeker, Variations in pork quality; history, definition, extent, resolution, *A National Pork Producers Council Publication*, NPPC. Washington, D.C. USA, 1992.

2. T.W. Kim, C.W. Kim, M.R. Yang, G.R. No, S.W. Kim, and I.S. Kim, Pork Quality Traits According to Postmortem pH and Temperature in Berkshire, *Korean Society for Food Science of Animal Resources, 36(1)*, 2016, 29-36.
3. T.R. Dutson, The relationship of pH and temperature to disruption of specific muscle proteins and activity of lysosomal proteases, *Journal of Food Biochemistry, 7(4)*, 1983, 223-245.
4. J.A. Silva, L. Patarata, and C. Martins, Influence of ultimate pH on bovine meat tenderness during ageing, *Meat Science, 52(4)*, 1999, 453-459.
5. N. Jama, V. Muchenje, M. Chimonyo, P. E. Strydom, K. Dzama and J. G. Raats, Cooking loss components of beef from Nguni, Bonsmara and Angus steers, *African Journal of Agricultural Research, 3(6)*, 2008, 416-420.
6. T.L. Le, T.P.M. Nguyen, C.C. Doan, M.S. Do, N.Q.C. Ho, N.S. Hoang, The Genetic Relationship of Vietnamese Pigs in Central Highlands Assessed by Cytochrome b, *Open Journal of Genetics, 4(5)*, 2014.
7. F.G.B. Los, R.C. Prestes, D. Granato, D.R.S. Simões, S.S. Roman, I.M. Demiate, Assessing the use of frozen pork meat in the manufacture of cooked ham, *Food Science and Technololy (Campinas), 36(1)*, 2016, 124-131.
8. C.H. Bertram, D.M. Aaslyng, J.H. Andersen, Elucidation of the relationship between cooking temperature, water distribution, and sensory attributes of pork–a combined NMR and sensory study, *Meat Science, 70(1)*, 2004, 75-81.
9. S. Barbera, S. Tassone, Meat cooking shrinkage: Measurement of a new meat quality parameter, *Meat Science, 73(3)*, 2006, 467-474.
10. M.J. den Hertog-Meischke , F.J.M. Smulders , J.G. van Logtestijn, The effect of storage temperature on drip loss from fresh beef, *Journal of the Science of Food and Agriculture, 78(4)*, 1998, 522-526.
11. H.L. Bruce, J.L. Stark, S.L. Beilken, The effect of finishing diet and post mortem ageing on the quality of M. longissimus thoracis of the electrically stimulated Brahman steer carcasses, *Meat Science, 67(2)*, 2003, 261-268.
12. S. James, J.C. James, Meat Refrigeration, *Woodhead Publishing Ltd.*, Abington, England, 2002, 33-92.