Electric Stimulation of Rabbit Carcass Toward Meat Pshysical Characteristic on Various Aging Time

Suradi K, Yurmiati H, Mikusuma T

Faculty of Animal Husbandry, Padjadjaran University, Bandung, Indonesia
Corresponding e-mail: kusmajadi@gmail.com

ABSTRACT

Rabbit which was slaughtered at old age would produce less tender meat. Aging is one of the ways to increase meat tenderness and one of them is through electric stimulation The aim of this research is to know the effect of long aging of rabbit carcass which stimulated by electric on meat physical characteristics. The measured variables were pH, water holding capacity, cooking loss and tenderness. This research was done using 30 male Flemish Giant rabbits with the age of 1.5 years. Rabbit was slaughtered and the carcass was stimulated by electric. Then the carcass was kept at refrigeration temperature of aging for 0 hour (without aging as control), 2, 4, 6, 8, 10 hours as treatment in a Completely Randomized Design experiment with 4 replicates. The result of this research showed that the best physical characteristic (pH, water holding capacity, cooking loss and tenderness) was obtained in 10 hours aging.

Key Words: Stimulation, Aging, Physical Characteristics, Rabbit Meat

INTRODUCTION

Meat from older rabbit has lower tenderness than meat of younger rabbit. There are many ways to increase meat tenderness and one of them is through electric stimulation. It has been proved by Savell et al. (1977), that electric stimulation can increase tenderness of beef and lamb.

Tenderness is one of important physical characters of meat to determine meat quality. Tenderness has closely related with other physical characteristics of meat, such as pH, cooking loss and water holding capacity. Decrease speed of pH until the ultimate pH will affect rigor speed and release protease enzyme. This enzyme will break down meat protein which cause meat become tender and in the end will affect cooking loss and meat ability to hold water.

Physicochemical changing would on meat appear after slaughter, *e.g.* pre rigor, rigor mortis, and post rigor (Lawrie 1995). Pre rigor phase is the best meat condition to be consumed, because in this phase, meat still tender, but this phase was short as it is for several hours only. Meat would become tender again in post rigor phase. To reach this phase, and meat does not rot, it would be better to keep in low temperature which is called aging.

Meat aging right after slaughter will cause cold shortening, it is muscle shortening which cause meat become hard. This is happening because muscle is in pre rigor condition (Soeparno 2005). This situation can be avoided by fast meat refrigeration until 15°C, and maintained until it is in rigor mortis condition (Soeparno 2005).

Electric stimulation will speed up the process of glycolysis postmortem, which is happening during muscle conversion to meat, and it is accelerate pH decline. The best giving of electric stimulation was done on impulse 50 postmortem, indicated by significant decreasing of rabbit meat pH but if the given of impulse was increased to 75, it did not give a significant effect to decrease of rabbit meat pH (Yurmiati et al. 2010). It was the same with sheep carcass which was stimulated by electric, it will enter rigor mortis phase earlier and reached pH 5.7 in 3 hours (Pearson & Dutson 1985). Accelerate pH decline means broken troponin T and myosin component faster, so that neutral proteinase enzyme will inactive and cathepsin enzyme would be released by muscle lysozome, that tenderness will increase (Yates et al. 1983; Soeparno 2005).

Process of meat storage in long time at low temperature will cause more lactic acid, so that meat pH will be low and will increase the activity of proteolytic acidofilic enzyme from

lysozome (Lawrie 1995). Therefore, long meat storage in low temperature must be noted in order that no damage by microbes occurred. Therefore, this aim of this research is to know the effect of aging time of rabbit carcass which was stimulated by electric on meat physical characteristics.

MATERIAL AND METHODS

The research was done in the laboratory using a completely randomized design with treatment of aging time 2, 4, 6, 8 and 10 hours and one without aging with 4 replications. Variables of physical characteristic that observed were pH, tenderness, water holding capacity, and cooking loss of rabbit meat.

Carcasses were produced by slaughtering rabbits using the Kosher method, followed by removal head, skin, internal organs, and lower legs. Carcasses were hung by the two back legs in a gallow. Electrical stimulation was applied by placing the positive electrode in the two thigh muscles, and the negative electrode at the end of the collar bone. After stimulation, carcasses were kept at the temperature of 15-18°C for 2 hours, 4 hours, 6 hours, 8 hours, 10 hours, and without storage.

Measurement protocols:

The pH of muscle was measured using a handheld pH-meter calibrated with pH 4 and 7 buffer solution. Tenderness of the meat was measured using a penetrometer (Muchtadi & Sugiyono 1992). Thigh meat was cut 5 × 2,5 × 1,5 cm^3, then steamed for 30 minutes and for about 80-82°C. After the sample reached the room temperatue, it was placed under penetrometer needle with horizontal fiber direction. The chuck of the penetrometer was released for 10 second, each time at different locations. Tenderness of the samples was read on the scale (gram/10 second).

Water holding capacity was measured using the filter Paper Press Method according to the procedure described by Honikel & Hamm (1994). Initially, the free water content of the meat was determined. A sample of 300 mg was placed on a Whatman 41 filter paper and pressed between two glass plates for 5 minutes under 35 kg weight. Then, the wet meat and area on the filter paper was drawn on a transparent plastic. The size of wet area was determined by a millimeter block paper, and free water content (mg H_2O) was calculated as wet area divided by 0.0948 minus 8.0. Secondly, the water content of meat sample was determined using oven. A porcelain cup was dried in an oven at 100°C for 30 minutes, cooled in a desiccator and weighed. Meat from thigh part (5 g) was placed in the cup and weighed. The cup with sample was dried under temperature of 100-102°C for 16-18 hours. The cup and sample was weighed after cooled in the desiccator. The water content of the meat was the loss of weight after drying and expressed in percent. Finally, water holding capacity was calculated using the following formula:

$$\text{Water holding capacity} = \% \text{ water content} - \frac{\text{Mg } H_2O}{300} \times 100\%$$

Cooking losses of the meat was determined using the procedures described by Soeparno (1994). Meat sample was weighed, then placed in pot for one hour. Cooling was done by placing the plastic bag with sample ethylene plastic bag. Then, the plastic and sample was placed in a waterbath at 80°C for one hour. Cooling was done by placing the platic bag with sample in a glass cup filled with cold water (10°C) for 15 minutes. Meat sample was removed from the bag, drained and dried using tissue papers. Meat sample was reweighed. Cooking losses (in percent) were calculated as the loss of weight after cooking divided by sample weight multiplied by 100.

RESULTS AND DISCUSSION

Result of the effect of the experiment aging time on the physical characteristics of rabbit meat is on Table 1.

Table 1. The effect of treatment on rabbit meat physical characteristic

Variables	Aging time (hours)					
	0	2	4	6	8	10
Meat pH	6.96[a]	6.49[b]	6.10[c]	5.81[d]	5.71[de]	5.59[e]
Tenderness (gram/10 seconds)	96.20[a]	124.15[b]	127.03[b]	127.95[b]	134.63[c]	154.81[d]
Water holding capacity (%)	67.34[a]	25.63[b]	23.90[b]	18.44[c]	17.43[cd]	14.70[d]
Cooking losses (%)	18.50[a]	16.76[a]	19.75[bc]	23.50[c]	26.72[cd]	29.75[d]

Values bearing different superscript at the same row differ significantly (P<0.05)

Data in table 1 shows that the highest pH meat was on meat pH without aging, next there is a significant decrease in meat pH (P<0.05) after 2 hours aging, and the longer the aging time, more decrease the pH meat. After rabbit was dead, a glycogen renovation process occurred and it became lactic acid through anaerobic glycolysis, which caused pH meat decrease (Swatland 1984). According to Buckle et al. (2009) amount of pH changes depended on amount of glycogen reserves before the cattle was slaughtered and will be changed become lactic acid. Change of muscle glycogen into lactic acid would stop if muscle glycogen run out or after glycolytic enzyme become inactive.

The lowest meat tenderness in meat before aging, and is not significantly different compared with 2 hours aging time. The tenderness will increase with longer aging time, and the best tenderness is in 10 hours aging time significantly different with other treatments (P<0.05). This is because pH in 8 hours aging treatment is not significantly different with 10 hours aging time, it is suspected that lysosome enzyme activity increase, so that the tenderness is increased. Bouton et al. (1971) said that relation between pH and meat tenderness is in the same direction. Meat with high pH has high tenderness, and on the other side meat with low pH will have low tenderness. This pH decrease will be followed with protease enzyme released. This protease enzyme will degrade muscle protein, so that meat more tender (Pearson & Dutson 1985).

Meat cooking loss on 2 hours thawing is not significantly different compared with without thawing, but both is significantly (P<0.05) lower compared with other treatments. Cooking loss will be more increase with more longer aging time, and different significant (P<0.05) occurs after meat is in storage for 8 hours is not significantly different with 10 hours aging time. This is because 8 and 10 hours aging produce lowest pH and not significantly different between both treatment. According to Soeparno (2009), that pH value is connected with meat cooking loss, more lower value pH of meat , more increase meat cooking loss. Meat cooking loss is also connected with meat water holding capacity, more lower meat water holding capacity, more bigger it cooking loss, and vice versa. High meat water holding capacity will cause the water that came a little so that meat cooking loss become low (Bouton et al. 1971).

CONCLUSION

Long aging time of rabbit carcass which was stimulated by electric in refrigeration temperature affect pH, tenderness, water holding capacity and meat cooking loss. To produce rabbit meat with optimum physical characteristic, the use of aging with 10 hour is recommended.

REFERENCES

Bouton PE, Harris PV, Shorthose WR. 1971. Effect of ultimate pH upon the water-holding-capacity and tenderness of mutton. J Food Sci. 36:435.

Buckle KA, Edward RA, Fleet GH, Wootton W. 2009. Ilmu Pangan. Diterjemahkan oleh Hari Purnomo dan Adiono. Jakarta (Indonesia): UI Press. hlm. 227-267.

Honikel KO, Hamm R. 1994. Measurement of water holding capacity and juiceness. In: Quality attributes and their measurement in meat, poultry and their measurement in meat, poultry and fish products. In: Pearson AM, Dutson TR, editors Advances in meat research. Glasgow (UK): Blackie Academic & Professional.

Muchtadi TR, Sugiyono. 1992. Ilmu Pengetahuan Bahan Pangan. Depdikbud. Dirjen DIKTI. Pusat Antar Universitas Pangan dan Gizi. Bogor (Indonesia): Institut Pertanian Bogor. hlm. 19-35; 46-49.

Pearson AM, Dutson TR. 1985. Scientific Basis for Electrical Stimulation. In: Pearson AM, Dutson TR, editors. Advance in Meat Research, Vol 1, Electrical Stimulation. Connecticut (USA): The Avi Publishing Company Inc. p. 45-72.

Savell JW, Smith GC, Dutson TR, Carpenter ZL, Sutter DA. 1977. Effect of Electrical Stimulation on Palatability of Beef, Lamb and Goat Meat. J Food Sci. 42:702-706.

Soeparno. 1994. Ilmu dan Teknologi Daging Cetakan ke-2. (Indonesia): Gadjah Mada University Press.

Soeparno. 2005. Ilmu dan Teknologi Daging Cetakan III. Yogyakarta (Indonesia): Gadjah Mada University Press.

Soeparno. 2009. Ilmu dan Teknologi Daging. Yogyakarta (Indonesia): Gadjah Mada University Press. p. 6; 152-156; 289-290; 297-299.

Swatland HJ. 1984. Structure and Development of Meat Animals. Englewood Cliffs (USA): Prentice-Hall Inc. p. 3-5.

Yurmiati H, Wiedy G, Kusmajadi S. 2010. Effects of electrical stimulation with different impulses on physical characteristics of rabbit meat. J Product. 12:1411-2017.