

## THE EFFECT OF LENGTH OF SOAKING IN PAPAIN ON MEAT WATER CONTENT, pH AND TENDERNESS OF CULLED LAYER HENS

HENDRONOTO ARNOLDUS W. LENGKEY,  
DANI GARNIDA, LILIES SURYANINGSIH  
Animal Husbandry, Universitas Padjadjaran, Bandung, Indonesia

The increased number of population growth needs enough food stock to fulfill the food necessity. Protein-sources food stuffs resulted by the farmers, such as meat, egg, or milk, are between the food stock which must be increased. Furthermore, it is known that meat is the primary source of animal protein. Demand rate of chicken meat is four per cent more than its production rate. Chicken meat can be supplied from the poultry farm, either from the broiler hens or from the layer hens. Layer hens have double benefits, beside producing eggs, they can also produce meat after their production period over. Unproductive layer hens also can be used to produce meat, and then to be sold as culled layer meat, since they have tough meat (Lengkey, 1991). The broiler industry is gaining rapid momentum and consumer usually do not prefer old culled birds for table use because of the poor quality due to lack of tenderness. The quality of meat for commercial purpose and acceptability depend on the amount and nature of biochemical constituent (Sinku, et al., 2002). Papain is in the dried latex obtained from the papaya fruit (*Carica papaya* L). It is the protease which is most commonly used for the food processing. Tenderness is considered to be the most important organoleptic characteristic of meat.

According to Archile-Contreras et al. (2011), the toughness associated with spent chicken meat is primarily due to the increased cross-linking in the connective tissue of older animals. Culled hens which were being used for meat purpose are going to be discarded by the quality conscious consumers due to inherent quality differences especially tenderness of spent hen meat. Therefore, the farmers are facing a problem in disposing their old-unproductive layers. The treatment of proteolytic enzymes is one of the popular methods for meat tenderization. The latex of the papaya plant and its green fruits contains two proteolytic enzymes, papain and chymopapain. The latter is most abundant

but papain is twice as potent (Virdi, 2009). The usage of tenderizer can be done by injection (Lengkey, 1991), by dipping the meat cut in a solution containing proteolytic enzymes (Gerelt, et al., 2000) or wrapping the meat with fresh papaya leaves (Abdalla, et al., 2013). Papain is in the dried latex obtained from the papaya fruit (*Carica papaya* L). It is the protease which is most commonly used for the food processing. Using for papain is in the meat industry for the tenderisation of meat. *Carica papaya* is a native to tropical countries. The latex is a complex mixture of chemical compounds with diverse chemical activities (El Mousaoui et al., 2001) and serves as an excellent meat tenderizer (Huet, et al., 2006).

### MATERIAL AND METHODS

#### Culled Laying Hens

The experimentals culled laying hens were 63 weeks of Hyline strain, and the weight was between 1.1 – 1.6 kg. These birds were randomly divided into four groups, and each group containing 5 birds. The breast were chosen randomly for dipped in papain solution.

#### Papain

The papain is a commercial papain. The papain used in this study at 3% level (w/w) to improve the tenderness and functional properties such as water content and pH of culled layer hens meat. The papain, was divided in four groups, where the meat was dipped for 15', 30', 45' and 60'.

#### *Preparation and cooking of the meat :*

The breast were chosen from the carcass to test the effect of papain on meat pH, water content and tenderness. The meat was divided randomly, into four groups and then dipped in papain solution, for 15', 30', 45' and 60'. Meat pH was measured immediately after

Table 1. pH, Water Contents and Tenderness of Culled Laying Hens in Papain treated groups

| Treatments | pH                | Water contents (%)  | Tenderness (mm/g/10 sec) |
|------------|-------------------|---------------------|--------------------------|
| R-1        | 5.50 <sup>a</sup> | 50.25 <sup>a</sup>  | 8.16 <sup>a</sup>        |
| R-2        | 5.55 <sup>a</sup> | 54.10 <sup>ab</sup> | 9.25 <sup>b</sup>        |
| R-3        | 5.58 <sup>a</sup> | 56.80 <sup>b</sup>  | 9.65 <sup>c</sup>        |
| R-4        | 5.60 <sup>a</sup> | 58.59 <sup>b</sup>  | 10.00 <sup>d</sup>       |

Notes: R-1 : dipping for 15'

R-2 : dipping for 30'

R-3 : dipping for 45'

R-4: dipping for 60'

a,b,c,d means bearing same superscript did not differ significantly.

slaughter and then dipped in papain solution, using pH meter. The water content is using oven method, and the tenderness using Universal penetrometer 1/10 TH MM DV. The breast was cooked after putting in plastic bag until boiled for 10 minutes. This experimental was done at Laboratorium Bahan Makanan and Laboratorium Teknologi Pengolahan Produk Peternakan, Fakultas Peternakan Universitas Padjadjaran, Bandung, Indonesia.

#### *The experimental method and statistical analysis :*

The experimental method is Completely Randomized Design 4 x 5. Data collected in these experiment were subjected to analysis of variance (ANOVA) test under Completely Randomized Design (CRD) 4 x 5. Duncan's multiple range tests was used to determine the differences among the treatments means.

## RESULTS AND DISCUSSION

Data pertaining to the effect of papain on pH, water content and tenderness of culled laying hens is presented in Table 1.

### **The effect of treatment on meat pH**

The means on pH of culled layer hens, has no significance, even the longest it was dipped in the papain gave more pH and this results indicated that there is no significance because the carcass has the same treatments and the pH was measured after the birds was slaughtered and then the meat was soaked in papain solution. The pH of meat plays important role in maintaining the meat quality. The toughness of the meat, occurs at low pH. In this treatment, the pH of the meat are between 5.50 – 5.60. The meat pH level rise as the dipping time is longer. It means that the dipping time has effect on pH level. So there is an activity of papain

towards the meat pH, even there is no significance on this treatment. According to **Sinku et. al** (2002), the pH of culled layers are 5.63, and **Khan and Natamura** (1970) reported an ultimate pH near 5.7 as desirable for maintaining quality of poultry breast meat. But when the carcass was injected with papain, and then slaughtered after 1 – 3 minutes, the pH were between 5.967 – 6.233 (**Lengkey**, 1991).

### **The effect of treatment on Meat Water Content**

In Table 1, the water content are between 50.25 till 58.59%. The water content was rise as the dipping time is longer. The means from R-1 treatment was significantly effect to R-3 and to R-4; but between R-1 and R-2 has no significantly effect, and between R-2 vs R-3, and also between R-3 vs R-4. The water content will effected the tenderness of the meat. It means that the papain has effect on the meat water content. There is an increasing on meat water content when the dipping time more longer. The meat ability to bind the water will increase because of the papain. According to **Sinku et al.** (2003) there is significantly increased of water content in breast muscle after treatment with proteolytic enzyme.

### **The effect of papain on Meat Tenderness**

From Table 1, it is showed that the meat tenderness is increase, when the dipping time more longer, and there are significance between the treatments (R-1; R-2; R-3 and R-4). The longer the meat was dipped in papain, the tenderness will rised. When dipped for 15 minutes (R-1) is 8.16 mm/g/10 sec vs 10.00 mm/g/10 sec, after 60 minutes dipping (R-4). It means that the using of papain was affected the tenderness of the meat. According to **Lengkey** (1991), papain injected in culled layer hens will increased the tenderness; and **Abdalla et al.**, (2013); there is improvement in tenderness using leaves papain, about 30% on breast.

## CONCLUSIONS

It can be concluded that soaking the carcass in the papain solution, had a positive effect on water content, pH and tenderness of culled layer hens meat. The longer the soaking time, will increase the water content, pH and tenderness; even there is no significance in the meat pH, but there is significance in the water content and the tenderness of culled layer hens meat.

## REFERENCES

1. Abdalla, H. O., N. N. A. Ali, F. S. Siddiq and S. A. M. Ali, 2013. Improving Tenderness of Spent Layer Hens Meat Using Papaya Leaves (*Carica papaya*). Pakistan Veterinary Journal. 33(1) : 73-76. www.pvj.com.pk.
2. Archile-Contreras, A. C., M. C. Cha, I. B. Mandell, S.P. Miller and P.P. Purslow, 2011. Vitamin E and C may increase collagen turnover by intramuscular fibroblasts. Potential for improved meat quality. J. Agric Food Chem. 59: 608-614.
3. El Moussaoui, A., M. Nijs, C. Paul, R. Winljens, J. Vincentelli, M. Azarkan and Y. Looze, 2001. Revisiting the enzymes stored in the laticifers of

*Carica papaya* in the context of their possible participation in the plant defence mechanism. Cell Mol Life Sci. 85: 556-570.

4. Gerelt, B., Y. Ikeuchi, A. Suzuki, 2000. Meat tenderization by proteolytic enzymes after osmotic dehydration. Meat Science. Vol. 56, Issue 3. November 2000, pages 311 – 318.
5. Huet, J., Y. Looze, K. Bartik, V. Raussens, R. Wintjens and P. Boussard, 2006. Structural characterization of the papaya cysteine proteinases at low pH. Biochem Biophys Res Commun, 341:620-626.
6. Khan, A.W. and R. Nakamura, 1970. Effect of pH and postmortem glycolysis on poultry tenderness. J. Food Sci. 35: 266.
7. Lengkey, H A. W., 1991. Pengaruh Penyuntikan Papain Terhadap Keempukan Karkas Ayam Petelur Afkir. Majalah Ilmiah Universitas Padjadjaran No. 2 Vol 9, hal. 57 – 6.
8. Sinku, R. P., R. L. Prasad, A. K. Pal, S. B. Jadhav, 2003. Effect of Plant Proteolytic Enzyme on the Physico-chemical Properties and Lipid Profile of Meat from Culled, Desi and Broiler Chicken. Asian-Aust. J. Anim. Sci. 2003. Vol. 16, No. 6: 884-888.
9. Viridi, M. S., 2009. Papain from Papaya. Science Tech Entrepreneur, Nov. 2009. p. 1 – 5.

**THE EFFECT OF LENGTH OF SOAKING IN PAPAIN  
ON MEAT WATER CONTENT, pH AND TENDERNESS  
OF CULLED LAYER HENS**

*H. A. W. Lengkey, D. Garnida, L. Suryaningsih  
Animal Husbandry, Universitas Padjadjaran - Bandung, Indonesia*

## SUMMARY

Twenty culled layer hens was test on the effect of length of soaking in papain on meat water content, pH and tenderness. The length of soaking are 15, 30, 45 and 60 minutes; and the experiment used Completely Randomized Design (CRD), and each treatment was repeated five times. Results indicated that 60 minutes soaking has the best on water content (58.59%), pH (5.60) and tenderness (10 mm/g/10 sec).

**Key words :** *papain, water content, pH, tenderness, culled layer hens*

Corresponding e-mail : lengkeyhendronoto@unpad.ac.id; lengkeyhendronoto@gmail.com