CHANGES IN NUCLEOTIDE COMPOUNDS OF DUCK MEAT DURING AGING DEPENDED ON TEMPERATURE

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■ **ABSTRACT - The objective of this study was to find appropriate aging condition, and it was carried to changes in nucleotide compounds of duck meat during aging. Forty-five days old Peckin ducks were storaged for 7 days in stable temperature at 0℃ and 4℃. ATP and AMP contents were wasted in breast and leg meat immediately. ADP and AMP did not show any tendency between breast and leg meat. Regardless of parts and temperature, the amount of IMP showed the highest at 0 day and then it rapidly decreased until 7 day. After 7 days at 0℃ and 5 days at 4℃, IMP and hypoxanthine contents of breast meat showed similar results respectively between 0℃ and 4℃. In breast meat, IMP contents of was lower and hypoxanthine was higher at 4℃ than that of 0℃ . IMP contents did not difference between breast and leg meat. Inosine contents of breast meat showed about 2 times contents higher tendency but showed not differences between 0℃ and 4℃ of aging temperature.**

Index Terms— **Aging, Duck, Temperature, Nucleotide**

I. INTRODUCTION

After slaughter, muscles get post-mortem and then begin to relax during aging. Generally, the aging time of meat depends on its condition. Dransfield (1992) reported that degree of meat aging is related to a storage temperature. The higher the temperature is, the shorter time it takes for aging. Aging of meat affects the taste of meat, flavor and acceptability concerned to eating quality; therefore, appropriate aging is very important (Liu, Xu and Zhou, 2007).

Taste are senses: sweety, salty, bitter and sour. A further basic sense is called 'umami'(Mateo, Dominguez, Aguirrezabal and Zumalacarregui, 1996). Umami is an important tool for balancing the five basic tastes, aromas, and textures (Marcus, 2009). Moreover it is concerned in nucleotide related compounds and free amino acid (Cho *et al*., 2007). Nucleotide related compounds result from the decomposition of adenosine triphosphate (ATP) and it is quite variable depending on the aging (Flores, Armero, Aristoy and Toldra, 1999). Before slaughter, ATP is major compound and adenosine monophosphate (AMP) and adenosin diphosphate (ADP) are in the muscle. However, after slaughter, a great quantity of inosine monophosphate (IMP) and a small quantity of ATP, AMP, ADP, inosine and hypoxanthine(Hx.) exist(Choi, Rhee, Joo and Lee, 1995; Lee and Lee, 2001). ATP become AMP by dephosphorylation and it is converted to IMP which gives good taste in meat flavor (Tikk *et al*., 2006). Also, aging is the most important factor related to the contents of IMP (Meinert *et al*., 2009). IMP changes to inosine and to hypoxanthine which tastes bitter during aging . Therefore, excess aging can make the meat tender, but at the same time, result in poor taste (Cho *et al.* 2008).

Many studies reported on the nucleotide related compounds concern to taste of fishes (Cho, Shim, Kim, Ju, Yook and Cho, 2003; Lee and Lee, 2001; Ozogul, Taylor, Quantick and Ozogul, 2000; Sung and Shim, 1981; Valle and Malle, 1998; Valls, Bello and Kodaira, 2001). Also, there have been reports on nucleotide compounds concentrations in beef (Cho *et al*., 2007; Cho *et al*., 2008), pork (Choi *et al.,* 1995; Flores *et al*., 1999; Meinert *et al*., 2009; Tikk *et al*., 2006), chicken (Ahn and Park, 2002; Fujimura *et al*., 1996) and duck during processing (Liu *et al*., 2007).

The purpose of this study is finding the appropriate aging condition that was carried to the relation between temperature and concentration of nucleotide related compounds of duck meat during aging . .

Ⅱ. MATERIALS AND METHODS

Sample preparation

Duck meat samples were used 45 days old Peckin white ducks. After slaughter, carcasses were refrigerated at

0±1℃ for 7 days and 4±1℃ for 5days after vacuum packaging . Breast and leg lean meat was separated from carcass for analysis in ultrastructural changes.

Nucleotide related compounds analysis

The nucleotide related compounds were extracted according to the method of Valle and Malle (1998). Briefly, Homogenize 10g duck meat sample with 20 mL 0.6M perchloric acid ($HCLO_4$). Homogenizate was centrifuged that the centrifugation condition was 15,000×g for 15min at 2℃. Adjust pH of supernatant to 6.5-6.8 with 5M KOH and leave at 4℃ for 10min before injecting 20 uL into HPLC (Jasco PU-2089, Korea). The condition of HPLC showed Table 1. for nucleotide related compounds analysis. The identity and quantity of the nucleotide related compounds were assessed by comparison with the retention time and peak area of each standard (Sigma, USA).

Table 1. Condition of nucleotide related compounds analysis

Item	Condition
Instrument	Jasco PU-2089
Column	Kromasil 100Å, 5 um, C18
Temperature	25℃
Detector	Jasco UV-2075
Eluents	Eluent A, ACN and eluent B, phosphate buffer (pH 7.00, 60mM K_2HPO_4 + 40mM KH_2PO_4)
Gradient	0min. 100% B, 4min. 98% B, 5min. 97% B, 8min. 96% B, 15min. 96% B, 15.01min. 100% B
Detection	UV 254 nm
Flow rate	1 ml/min

Ⅲ. RESULTS AND DISCUSSION

Figure 1 shows peaks of standard substances ATP, ADP, AMP, IMP, inosine and Hx. to analyze nucleotide related compounds of duck breast meat by aging temperature. Nucleotide related compounds changes ATP → AMP and ADP → IMP, inosine and Hx.(Lee and Lee, 2001, Terasaki, 1965, Valle and Malle, 1998). AMP is converted to IMP which gives good taste in meat flavor (Tikk *et al*., 2006). Retention time(RT) of standard substances were ATP(5.3min), ADP(6.2min), AMP(7.8min), IMP(4.0min), inosine(12.5min) and Hx.(8.9min).

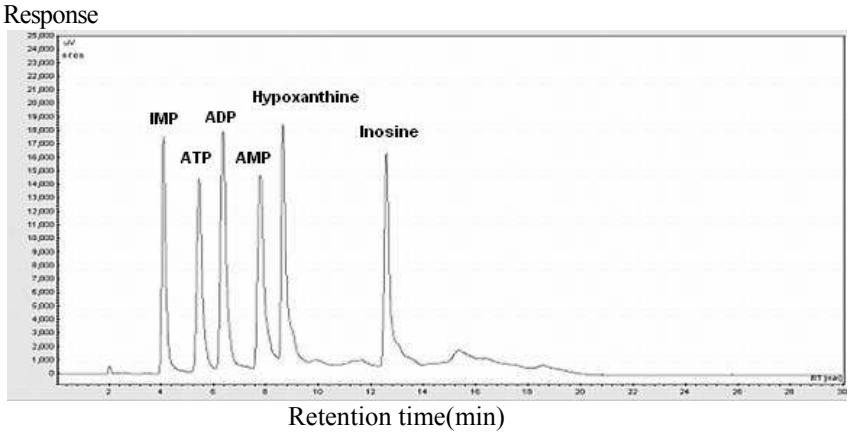
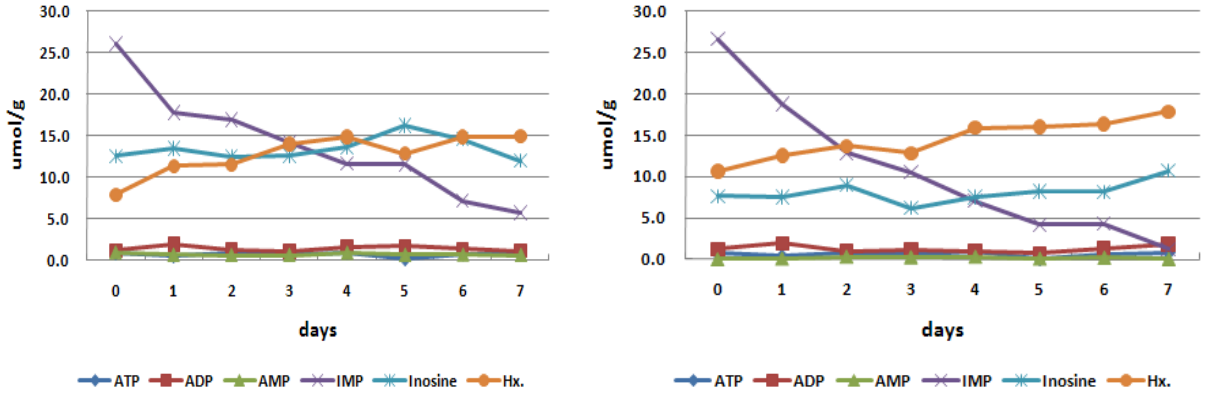


Figure 1. Chromatogram of nucleotide related compounds standard solution by HPLC
ATP : adenosine triphosphate, AMP : adenosine monophosphate, ADP : adenosin diphosphate, IMP : inosine monophosphate

Figure 2 shows duck breast meat(A) and leg meat(B) changes in nucleotide related compounds during aging at 0℃. In breast meat, ATP contents was 0.06-0.89 μmol/g without difference during aging period. In leg meat, ATP was not detected almost for whole aging period. It was used after slaughter immediately. Ahn and Park (2002) reported similar result that ATP was not detected in chicken after 48 hours after slaughter. Depending on aging period, with breast meat, ADP was 1.02-1.90 μmol/g and AMP was 0.56-0.88 μmol/g. and ADP was 0.71~1.94 μmol/g

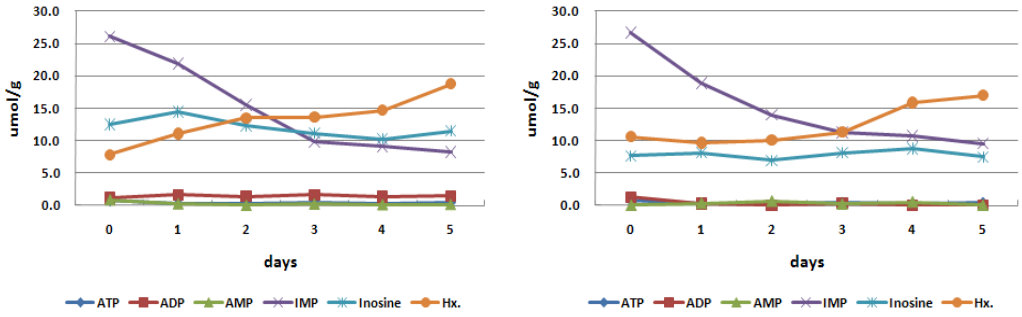
and AMP was 0.00~0.36 μmol/g, which were respectively less than contents of breast meat. IMP which affects umami taste (Cho *et al.*, 2007) reached the highest at 0 day (26.69 μmol/g) and then it decreased rapidly until 7.11 μmol/g. IMP contents from leg meat were 4.28 μmol/g and hypoxanthine were 16.41 μmol/g on day 7. Meinert *et al.* (2009) reported the concentration of IMP in pork loin decreased significantly during aging. Inosine contents were breast meat(12.52 – 16.24 μmol/g) and leg meat(6.24 – 8.99 μmol/g) at 0, and breast meat(11.14 – 18.45 μmol/g) and leg meat(6.97 – 8.77 μmol/g) at 4℃. Inosine contents of breast meat showed about 2 times higher tendency, but showed no difference between 0℃ and 4℃ of aging temperature. Tikk *et al.* (2006) reported during aging, the contents of IMP of pork decreased with a simultaneous increase in the contents of inosine and hypoxanthine. This results, nucleotide related compounds in leg meat seems to be more decomposed than that of breast meat. Ahn and Park (2002) reported similar results in chicken meat.

Figure 3 shows duck breast meat(C) and leg meat(D) changes in nucleotide related compounds during aging at 4℃. ATP contents of breast meat was 0.18-0.49 μmol/g, the contents of leg meat was 0.00-0.30 μmol/g. This result can be supposed that leg meat ATP was more degraded than breast meat that. ADP and AMP contents did not show any tendency between breast and leg meat. In leg meat, amount of IMP also rapidly decreased from 0 day (26.06 μmol/g) to 1 day (12.90 μmol/g). After 7 days, IMP contents of breast meat showed similar results between 0℃ (7.11 μmol/g) and 4℃ (6.94 μmol/g) and hypoxanthine contents was 0℃ (14.88 μmol/g) and 4℃ (17.71 μmol/g). Similarly, IMP contents of leg meat at 7 day was 0℃ (4.28 μmol/g) and 4℃ (5.56 μmol/g) and hypoxanthine contents was 0℃ (16.41 μmol/g) and 4℃ (20.34 μmol/g). Thus, this results that IMP was lower and hypoxanthine was higher at 4℃ than that of 0℃ was thought that IMP was degraded faster at 4℃ than at 0℃.



(A) (B)

Figure 2. Nucleotide related compounds changes in breast(A) and leg(B) meat at 0℃
ATP : adenosine triphosphate, AMP : adenosine monophosphate, ADP : adenosin diphosphate, IMP : inosine monophosphate, Hx. :Hypoxantine



(C) (D)

Figure 3. Nucleotide related compounds changes in breast(C) and leg(D) meat at 4℃
ATP : adenosine triphosphate, AMP : adenosine monophosphate, ADP : adenosin diphosphate, IMP : inosine monophosphate, Hx. :Hypoxantine

Ⅳ. CONCLUSION

On the day slaughtered, ATP and AMP contents were hardly detected in breast and leg parts of fresh duck meat. ADP and AMP contents did not show any tendency in breast and leg meat. Regardless of parts and temperature, the amount of IMP was the highest at 0 day (26.69 μmol/g) and then, rapidly decreased until 7 day(7.11 μmol/g). After 7 days at 0℃ and 5 days at 4℃, IMP contents of breast meat were seen with 7.11 μmol/g at 0℃ and 8.24 μmol/g at 4℃. Hypoxanthine contents was 14.88 μmol/g at 0℃ and 18.80 μmol/g at 4℃. Similarly, IMP contents of leg meat was 4.28 μmol/g at 0℃ and 9.58 μmol/g at 4℃, while hypoxanthine contents was 16.41 μmol/g at 0℃ and 17.03 μmol/g at 4℃ respectively. IMP contents was lower and hypoxanthine one was higher at 4℃ than those of 0℃. Inosine contents of breast meat showed about 2 times higher tendency than those of leg meat, but showed no difference by aging temperature between 0℃ and 4℃. According to these results, nucleotide related compounds in leg meat seem to be more decomposed than those of breast meat.

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