飯田女子短期大学紀要 第32集，179-183，2015

Time Course Changes in Freshness of Ostrich Meat in Cold Storage

Hiromi SEN

Abstract： Contents of adenosine 5'-triphosphate (ATP) and its related compounds were examined in ostrich meat stored at 4℃ for 16 days.

The amounts of ATP and adenosine 5'-monophosphate (AMP) were about 0.1 μmol/g meat at 4 hours in the storage, and the former disappeared on 2 days after and the latter tended to decrease in the experimental storage time. Adenosine 5'-diphosphate (ADP) level was maintained to be about 0.3 μmol/g meat throughout the experimental period. The amount of inosine 5'-monophosphate (IMP) which was a product analyzed from ATP was about 3.3 μmol/g meat constantly during the first 4 days, after that sharply decreased to 1.3 μmol/g meat during 16 days in the storage. That of inosine (HxR) which was the product from IMP tended to increase to 1.6 μmol/g meat during the first day and then unchanged until the 10 days in the storage, after that it decreased to 0.9 μmol/g meat on 16 days of the storage. On the contrary, hypoxanthine (Hx) and xanthine (X) concentrations increased gradually in the storage, to about 0.6 and 0.9 μmol/g meat on the 16 days, respectively.

The *K* value was calculated by the following：K (%) = (HxR + Hx) × 100/(ATP + ADP + AMP + IMP + HxR + Hx). The *K* value of 25% in fresh meat increased linearly up to 45% during 10 days of storage.

Key words： ostrich, meat, storage, freshness, ATP related compounds

Introduction

Ostrich farming is rapidly growing in the world and ostrich meat is noted because of the nutritive values. Ostrich meat has low concentrations of fat and cholesterol, and high concentrations of iron and protein. However, the information about the storage of ostrich meat is very few, which has made difficult for ostrich meat to come into the market.

The *K* value was introduced as an indicator of the freshness of fish meat[1], which is calculated by the following：K (%) = (HxR + Hx) × 100/(ATP + ADP + AMP + IMP + HxR + Hx). Since then this value has been used in the marine product industry and also in the other kinds of meat[2-6].

The aim of this study is to clarify the changes of quality of ostrich meat during storage in refrigerator after the slaughter. I calculated the *K* value in ostrich meat stored. This study would be helpful to gain the information about the freshness of ostrich meat during storage in refrigerator, and make it easy for many consumers to get ostrich meat in markets.

Materials and methods

Four-month-old female ostrich (*Struthio Camelus var. domesticus*) was obtained

2015年2月19日受付；2015年3月31日受理

from a farm in Okinawa prefecture for this experiment. The weight of the ostrich was 6.63kg. The ostrich was put to death by an exsanguinating via the carotid artery, and then the leg meat (*M. iliotibialis lateralis*) was quickly removed from the carcass, and the meat was stored at 4℃ in refrigerator. During storage, meat pieces were cut from the meat to examine the contents of ATP and its related compounds. The preparations for measuring the contents of ATP and its related compounds were used by the methods of Karasawa[5,7]. The methods were followings. After 2g piece of samples were picked up from the stored meat in each time, the piece of samples were homogenized by using a grinder with 10ml of 4% perchloric acid. And after the homogenates were centrifuged at 3,000 rpm in 20 minutes, the supernatants were neutralized by 2N KOH, and centrifuged at 3,000 rpm in 20 minutes again. The supernatants were filled up to 25 ml with distilled water, and stored in the freezer at −25℃ until the analysis. The samples were analyzed by using HPLC with Finepak Gel SA-121 Column.

Results and discussion

Changes of ATP concentration and of AMP concentration in ostrich leg meat during storage at 4℃ are shown in Fig.1. The concentration of ATP was about

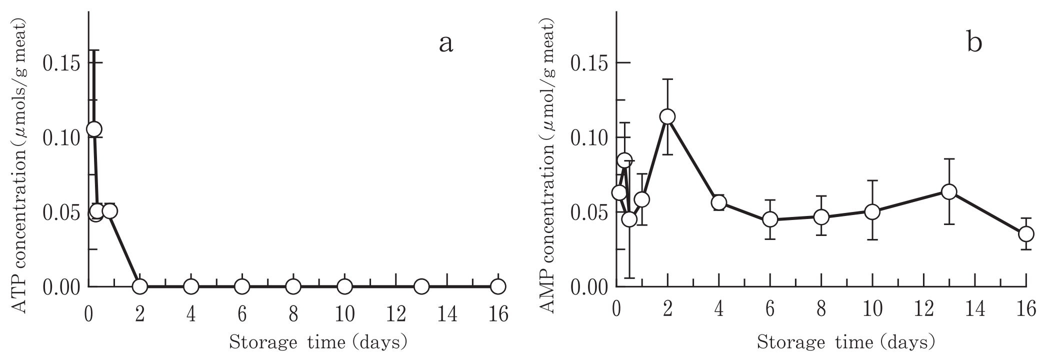

Fig.1. Changes of ATP concentration (a) and of AMP concentration (b) in ostrich leg meat during storage at 4℃.
Each point represents mean±SD of 3 samples.

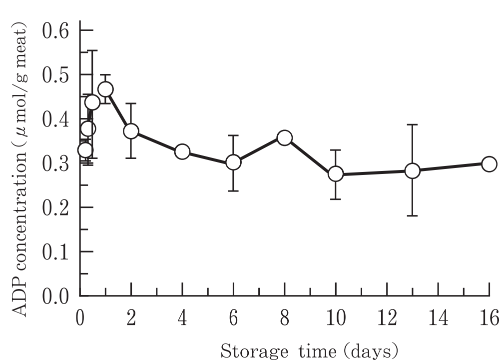

Fig.2. Change of ADP concentration in ostrich leg meat during storage at 4℃.
Each point represents mean±SD of 3 samples.

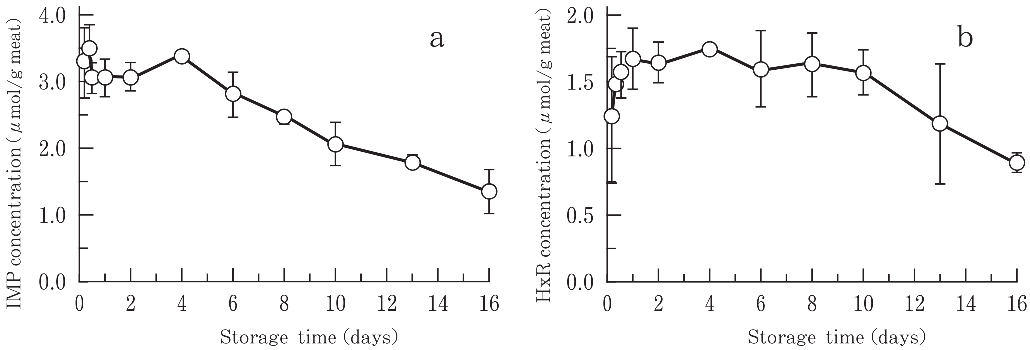

Fig.3. Changes of IMP concentration (a) and of HxR concentration (b) in ostrich leg meat during storage at 4℃.
Each point represents mean±SD of 3 samples.

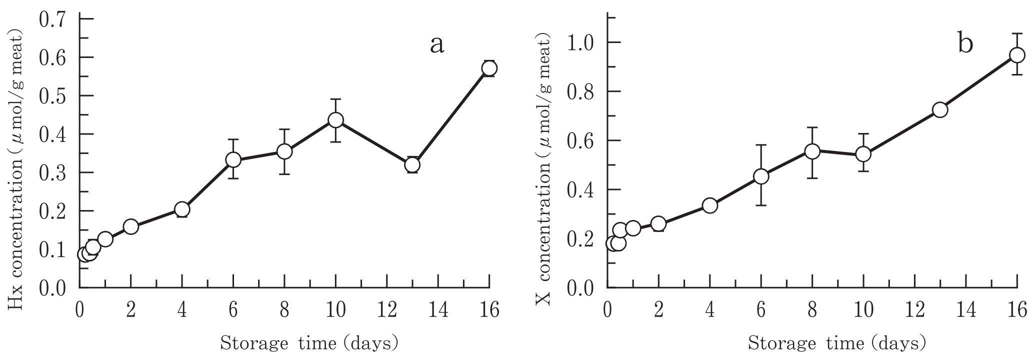

Fig.4. Changes of Hx concentration (a) and of X concentration (b) in ostrich leg meat during storage at 4℃.
Each point represents mean±SD of 3 samples.

0.1 μmol/g meat at 4 hours in storage, but it disappeared after 2 days storage. Similarly the concentration of AMP was about 0.1 μmol/g meat in early storage, and tended to decrease in the experimental storage time. On the other hand, ADP level was maintained to be about 0.3 μmol/g meat throughout the experimental period (Fig.2).

As shown in Fig.3a, the concentration of IMP was about 3.3 μmol/g meat during the first 4 days, which is similar to the value during early storage in breast meat such as beef[4], pork[8] and rabbit[4], however, is much smaller than the chicken's value[2,3,8,9]. Thereafter it sharply decreased to 1.3 μmol/g meat on the 16 days storage. The concentration of HxR tended to increase a little to 1.6 μmol/g meat during the first day then unchanged until 10 days storage. After that, HxR sharply decreased as well as IMP to 0.9 μmol/g meat on 16 days storage (Fig.3b).

On the contrary, Hx concentration increased gradually in 10 days storage as shown in Fig.4a. On the 13th day, it decreased suddenly, which is considered to occur since Hx resolved into another substance further. A remarkable unknown peak was observed on 13th day chromatogram which is supposed to be uric acid because of the degradation pathway.

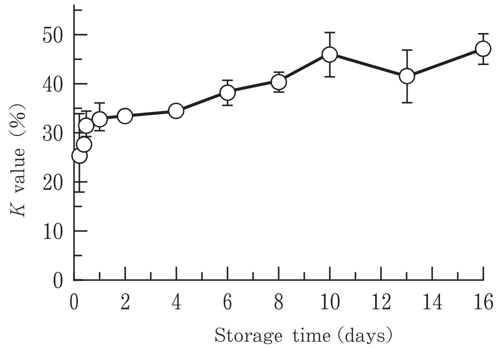

Fig.5. Change of *K* values in ostrich leg meat during storage at 4℃.
Each point represents mean±SD of 3 samples.

After that, Hx concentration increased again to about 0.6 μmol/g meat on the 16th day and the unknown substance was still observed. On the other hand, X increased throughout the storage time, and reached to 0.9 μmol/g meat on 16th day (Fig.4b).

The *K* value was calculated from the experimental data, whose change of the ostrich meat stored at 4℃ is shown in Fig.5. The *K* value of 25% in fresh meat was relatively high, which might be derived from that the methods for determining of ATP and its related compounds were not appropriate. Possibly I should have determined to concentrate it as soon as possible after the slaughter. The *K* value increased to 33% at one day of storage, after that, it increased gradually to 45% on 10 days of storage. On the 13th day, the *K* value was a little decreased, which is considered to be due to the appearance of an unknown substance as described previously. From these results, I could be allowed to judge the quality of the stored ostrich meat at 4℃ within 10 days by using the freshness index of *K* value. It is apparent that ostrich meat could keep freshness longer than broiler leg meat in a refrigerator, as considered from comparing this data with the case of broiler leg meat which we run previously[5]. In other cases, *K* value of beef becomes to 53% at 10 days storage in 5℃[4], harp seal meat's becomes to about 40% on 10 days storage in 0℃[6]. Although the temperatures are different in these cases from each experiment, the patterns of the freshness change of ostrich meat might be similar to those of beef and harp seal meat. The characteristics of ostrich meat concerning the change of the *K* value in refrigerator storage may show that it increases sharply in the initial time.

References

1) Saito, T., K. Arai and M. Matsuyoshi : A new method for estimating the freshness of fish. *Bull. Jap. Sci. Fish.,* **24**, 749-750, 1959.

2) Numata, K., H. Suzuki and K. Usui : Relations between freshness and behavior of ATP related substances in chicken muscle. *Nippon Shokuhin Kogyo Gakkaishi,* **28**, 542-547, 1981.

3) Kitada, Y., A. Hasuike, M. Sasaki, K. Tanigawa, R. Horiuchi and H. Yuba :

Analysis and behavior of ATP related substances in chicken muscle. *Nippon Shokuhin Kogyo Gakkaishi,* **30**, 151-154, 1983.

4）Nakatani, Y., T. Fujita, S. Sawa, T. Otani and I. Takagahara：Changes in ATP-related compounds of beef and rabbit muscles and a new index of freshness of muscle. *Agric. Biol. Chem.,* **50**, 1751-1756, 1986.

5）Karasawa, Y., H. Sen, M. Misonoh, N. Mori, K. Aoki and A. Hirasawa：Effect of storage on concentration of free amino acids and purine compounds in leg and breast muscles from Broiler, Satsuma Cross and Kukin Cross. *Jap. Poult. Sci.,* **27**, 298-308, 1990.

6）Shahidi, F., X. Chong and E. Dunajski：Freshness quality of harp seal（Phoca groenlandica）meat. *J. Agric. Food Chem.,* **42**, 868-872, 1994.

7）Karasawa, Y., K. Aoki and Hirakata, *Jap. Poult. Sci.,* **26**, 29-33, 1989.

8）Terasaki, M., M. Kajikawa, E. Fujita and K. Ishii：Studies on the flavor of meats. *Agric. Biol. Chem.,* **29**, 208-215, 1965.

9）Sen, H. and K. Endo：Changes of amino acids and ATP-related compounds in chicken muscle during storage and their relationship to the taste of chicken soup. *J. Home Econ. Jpn.,* **41**, 933-937, 1990.

冷蔵貯蔵したダチョウ肉の鮮度変化

千　　裕 美

要旨：新鮮ダチョウ肉の冷蔵中の鮮度変化について，いくつかの知見を得るために，ダチョウ腿肉（*M. iliotibialislateralis*）中のアデノシン5'-三リン酸（ATP）とその関連化合物濃度が，4℃で16日間肉を貯蔵した際にどのような変化するのかを経時的に追跡調査した.

ATPとアデニル酸（AMP）は，貯蔵4時間後の濃度が共に約0.1μmol/g肉であったが，前者は貯蔵2日目に消失し，後者は貯蔵期間中減少傾向にあった. アデノシン5'-二リン酸（ADP）濃度は，貯蔵期間を通して約0.3μmol/g肉であった. イノシン酸（IMP）濃度については，貯蔵初期の4日間は約3.3μmol/g肉であったが，その後急速に減少し，16日目には1.3μmol/g肉となった. イノシン（HxR）濃度は，死後24時間は増加傾向にあり，その後10日目まで1.6μmol/g肉の値が変化せず，さらに16日目には0.9μmol/g肉まで減少した. 一方，ヒポキサンチン（Hx）およびキサンチン（X）濃度は，貯蔵中に徐々に増加し，16日目にはそれぞれ約0.6および約0.9μmol/g肉となった.

得られた測定値を用いて，次式に示される鮮度判定恒数*K*値を算出した. *K*値（%）＝（HxR＋Hx）×100/（ATP＋ADP＋AMP＋IMP＋HxR＋Hx）. 新鮮肉の*K*値は25%であり，貯蔵1日目以降10日目までほぼ直線的に増加した.

Key words：ダチョウ，肉，貯蔵，鮮度，ATP関連化合物