PHYSICAL-CHEMICAL CHARACTERIZATION OF UNIQUE TEXTURE OF DRIED HORSE MACKEREL MEAT

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Ⅰ. INTRODUCTION

Dried horse mackerel was originally salted and dried to extend its shelf life. However, in recent years, due to health consciousness, the salt content has been lowered and the dried mackerel is distributed in the cold chain, but its preference remains popular with Japanese consumers. One reasons for consumer preference is its unique texture, along with its moderate saltiness and umami, which are enhanced by salt-drying. An appropriate texture for this product is described as “firm and elastic”. The texture of dried fish meat is thought to be affected by changes in the properties of the major muscle proteins, myosin and actin, as well as by water content [1]. However, the details of the mechanism behind the formation of the unique texture of recent low-salt dried fish have not been clarified.

Therefore, in this study, we dried salted horse mackerel meat and investigated changes in physical properties and muscle proteins.

Ⅱ. MATERIALS AND METHODS

Raw horse mackerel (*Trachurus japonicas*, body size 15-20 cm) from the sea near Japan was purchased, and the muscle was cut into small pieces, approximately 1 cm x 3 cm x 1 cm, and immersed in 1 L of 1.5 M NaCl/20 mM Tris-acetate (pH 7.0) to be salted at 4°C for 20 min. This was dried for 0-4 h in an air circulation incubator at 30°C. The salt content and moisture content of the sample after drying were measured. In addition, the breaking strength of each sample was measured using a creep meter (YAMADEN, RE-33005s) equipped with a cylindrical plunger with a diameter of 2 mm. The Mg^{2+}- and Ca^{2+}-ATPase activities of the sample homogenate were measured to estimate the degree of denaturation of actin and myosin [2]. Furthermore, myofibrils prepared from the sample were subjected to SDS-PAGE using a 6 M urea-2% gel [3] to examine the generation of myosin polymer.

Ⅲ. RESULTS AND DISCUSSION

As a result of salting the horse mackerel meat sample for 20 minutes, the salt concentration was around 0.3 M. This is approximately the same concentration as the recent dried horse mackerel described in Japanese government database [4]. As a result of drying it, the moisture content reached 68% after 2 h of drying, being almost the same as commercial dried mackerel products. The breaking strength increased with drying for 0-4 h. As shown in

Figure 1, the Mg^{2+}- and Ca^{2+}-ATPase activities of the homogenate prepared from dried

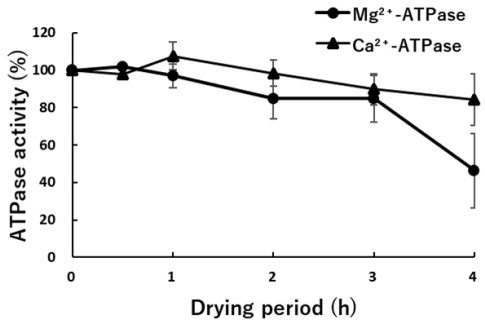

Figure 1. Changes of Mg^{2+} and Ca^{2+} -ATPase activities during drying process

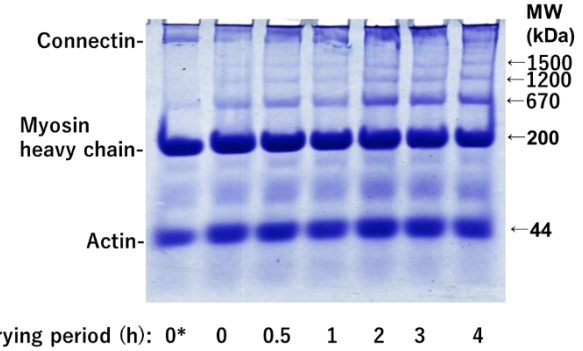

Figure 2. Urea-SDS-PAGE pattern of myofibrils prepared from dried horse mackerel meat.
*** control (untreated meat)**

horse mackerel meat decreased during 4 h-drying, but the Mg^{2+}-ATPase activity decreased faster than the Ca^{2+}-ATPase activity. Therefore, it was suggested that actin was denatured earlier than myosin. Being similar with a heating gel of a mixture of actin and myosin [5], the increase of myosin/actin ratio induced by faster denaturation of actin than myosin might increase breaking strength during drying. Furthermore, three new bands (MW 1500, 1200, 670 kDa) presumable to be polymer of myosin heavy chain were detected by urea-SDS-PAGE of the myofibrils, which increased with drying (Figure 2), similarly with dried walleye pollack meat [6]. Therefore, the newly formed bonds between myosin molecules indicated by the appearance of such polymers could cause an increase in breaking strength due to drying.

Ⅳ. CONCLUSION

During drying of salted horse mackerel meat, the breaking strength increased. The binding between denatured actin and myosin presumably promoted by the faster denaturation of actin than myosin, and the formation of polymers of myosin heavy chain would strengthen the meat structures. These are probably responsible for the unique texture of dried horse mackerel meat.

REFERENCES

1. Iseya, Z. et al. (1998) Fisheries Science, 64: 969-972.
2. Masanori, M. et al. (2018) Animal Science Journal, 89: 597-605.
3. Maruyama, K. et al. (1981) Journal of Biochemistry, 89: 701-709.
4. Ministry of Education, Culture, Sports, Science and Technology Japan (2023) Standard Tables of Food Composition in Japan. https://www.mext.go.jp/a_menu/syokuhinseibun/mext_00001.html (cited April, 17, 2024).
5. Yasui, T. et al. (1982) Agricultural and Biological Chemistry, 46, 1049-1059.
6. Ito, T. et al. (1990) Nippon Suisan Gakkaishi (in Japanese), 56, 999-1006.

Conflicts of Interest: M. Matsuishi is a board member of Starzen Co., Ltd.