Meat Science 86 (2010) 243–248

Contents lists available at ScienceDirect

Meat Science

journal homepage: www.elsevier.com/locate/meatsci

Review

Prospects for new technology of meat processing in Japan

Ryoichi Sakata *

Laboratory of Food Science, School of Veterinary Medicine, Azabu University, Sagamihara, Kanagawa 252–5201, Japan

ARTICLE INFO

Article history:
Received 1 February 2010
Received in revised form 1 May 2010
Accepted 6 May 2010

Keywords:
Meat processing
Meat color
Freezing
Warming treatment
Soft sausage
Natural casing

ABSTRACT

This review starts by introducing the history and underlying culture of meat production and consumption in Japan since early times, and the effects of social change on these parameters. Meat processing in Japan is described, and certain other related papers are also introduced. Automatic machines for meat cutting have been developed by the Japanese food industry and are currently being used throughout the world, particularly in Europe. Soft meat products specially produced for the elderly, along with diet meat products low in salt and calorie content for middle aged persons have recently gone into production. The intensification of color formation of meat using naturally occurring materials, and tenderization of sausage casing are discussed.

Contents

1. Introduction

The meat consumption culture of Japan differs from that of other countries. Up until the middle of the 19th century, the kinds of meat which are now commonly available had not been consumed in Japan for the previous 1000 years. However, with the passage of time and in sharp contrast to the traditional agricultural methods and dietary habits, Japanese farmers have developed the special Japanese black cattle, called “Wagyu”. Gloss and fine meat color combine with meat marbling, a prominent feature of Wagyu. In these cattle, intra-muscle fibers are characterized by numerous fat cells and fatty tissue and the outstanding marbling quality of this meat is referred to as “Sashi” (fat lining) or “Shimofuri” (frostiness) in Japanese. Thus, marbling and color are priority features for carcass meat evaluation and meat grading in Japan, and possibly other counties as well. Kobe beef is a very well known type of Wagyu, but brands of this meat may differ according to location, and all are of excellent quality throughout the country.

Recently, the yield of pork has been improved through use of the deboning machine developed by the Japanese meat industry. This machine was presented at the 45th International Congress of Meat Science and Technology, held in Yokohama, Japan (Toyoshima, 1999). For greater tenderness of chicken breast, electrical stimulation in combination with deboning is also being conducted as an innovation in Japan (Sakata et al., 2006). At meat processing plants, many automatic systems have been developed by the plants themselves, such as brine injection for uniform dispersion of brine or seasoning liquid in meat processing (Tanaka & Takahashi, 2001), although the protection of commercial interests imposes limitations on the availability of information and photographs of such systems.

* Corresponding author.
E-mail address: sakata@azabu-u.ac.jp.

0309-1740/$ – see front matter
doi:10.1016/j.meatsci.2010.05.039

Fig. 1. Kitchen at the Holland residence for pork meat preparation in the Edo period. Meat was prepared by foreigners during that period at a few designated places in Japan. This picture is presently on exhibit at the Nagasaki Museum of History and Culture.

The highlights of meat processing in Japan are presented in this paper, with reference to previous reports on this subject.

2. History of meat processing in Japan

The roots of modern animal meat consumption are generally traced to the end of the Edo period, the so-called Samurai era, approximately 150 years ago. It was at this time that Japan opened its doors to foreign trade. The national religion, Buddhism, was considered by the imperial court to forbid the eating of any four-legged animal such as cows or pigs, although the consumption of deer, wild boar and game birds were allowed as exceptions. However, even with the introduction of foreign trade, ordinary livestock meat consumption continued to be placed under strict limitation. Indeed, meat consumption was a luxury most common people could not afford.

Fig. 2. Karl Jahn and Yoshifusa Iida (at right), and the textbook on meat processing belonging to Karl Jahn published in 1902, Berlin (adapted from Sakata, 2005).

During the Meiji period (1868–1912), the livestock industry was promoted to ensure that meat, milk and egg production would become sufficiently available for the sound health and physical development of the Japanese. At that time, Japan looked to European countries, such as England, for methods in meat processing but information materials and product importing were limited to only a few ports such as Yokohama and Nagasaki (Fig. 1). Modern technology was obtained from German prisoners taken in World War I from Qingdao, China for transfer to concentration camps in Japan. Among them were Metzger, or butchers, who taught the Japanese about meat processing techniques. One such person, Karl Jahn, demonstrated the preparation method of traditional German sausage to a Japanese livestock manager under appointment to the Japanese agricultural ministry. The name of this Japanese was Yoshifusa Iida (Fig. 2). The textbook used by the German was given to Iida who entrusted it to the care of the Japanese Meat Product Association (Tokyo). The book was eventually sent to the Federal Centre for Meat Research in Kulmbach (Now, the Max-Rubner-Institute), Germany (Sakata, 2005). Thereafter, German products started to be produced in Japan, such as the frankfurter, wiener and numerous kinds of smoked and cooked sausages and ham (Sakata, 2005). Thus, even today, the machinery for meat processing is primarily imported from Germany and German-type products continue to be produced. However, the taste of meat products has been modified somewhat to suit Japanese consumers by reducing salt content and enhancing food sweetness with umami. At the international ham and sausage quality contest organized by Deutsche Landwirtschafts-Gesellschaft (DLG) or German Agricultural Society, approximately 10% of all meat products on exhibit are presently from Japan and nearly all of which won medals, thus demonstrating their high quality (Müller & Lautenschläger, 2008).

3. Meat color study

In the study of meat product safety, nitrite and nitrate color forming agents to accelerate color formation were used in lesser amounts, and a lot of efforts were made to find agents to enhance reddening.

Whey protein hydrolysates were examined as color formation accelerators in meat products such as hams and sausages and to establish to what extent they stabilize heme pigments (Sakata, 2008). These hydrolysates may be obtained by enzymatic degradation. Residues still present following removal of casein were examined for potential application in color acceleration. Peptides in muscle have been shown to promote color formation (Sakata & Nagata, 1988a,b). The same has been noted for peptides from milk and other dairy products. Fig. 3 shows the redness of a ham preparation using whey protein (WPC 80) hydrolysates. WPC 80 promoted color formation and with increase in degradation time with protease, greater redness was achieved.

In our previous study on red pigment in Parma ham, pigment separation and purification were performed (Morita, Niu, Sakata, & Nagata, 1996). Parma ham produced in northern Italy is famous worldwide. Though this product is prepared from pig thigh using only marine salt with controlled aging, a unique red color is produced. China produces a raw ham in a manner similar to that for preparing Parma ham. This ham, Jin-Hua ham, a traditional specialty of the Jin-Hua province, is made using only pig thigh and marine salt over a long aging period to achieve red color. In the salting stage, these hams are prepared in essentially the same manner. Nitrite and nitrate as color forming agents may possibly have given rise to carcinogenic