

UTILIZATION OF INOBUTA (PIGS CROSSBRED WITH WILD BOAR) MEAT FOR FERMENTED SAUSAGE

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Keywords: inobuta (pigs crossbred with wild boar) , fermentation, sausage, starter cultures**Introduction.**

Inobuta, pigs crossbred with wild boar, has been fed in several parts of Japan, such as Ueno-mura in Gunma (This small village is located about 100 km northwest from Tokyo and has a population of 1,600). In Ueno-mura, the inobuta has been fed since 1970 and produced about 500 heads / year. Comparing with the characteristics of the pork meat, the inobuta meat is more red in color and harder in texture. Also, its "wild" flavor is a attractive property for some consumers. Since the inobuta meat requires high cost for its production, it is important to develop special products to extend the market.

In this study, We tried to produce a unique fermented sausage from inobuta meat for activating the local industry and community. Also, several properties of inobuta meat for fermented sausages were characterized.

Materials and Methods.

Fermented sausages were prepared from hand-deboned thigh meat (inobuta or pork) and back fat (in the ratio of 4 to 1) by using a procedure modified from that of Kato (1). The outline of the procedure and the ingredients of sausages are shown in Figure 1 and Table 1, respectively. Konjak (*Amorphophallus Konjac*), sage, oregano, caucas (*Allium victorialis* L.) were used as local and special products. Commercially available seven starter cultures (Table 2) were utilized for fermentation.

Viable counts of bacteria were determined according to the description of Kato *et al.* (2).

The pH was measured with a combination electrode and a pH meter.

The texture was examined with rheometer (Fudo kogyo NRM-2002J) according to the quality examination standard on frozen emulsified fish products (3).

Color was determined with color meter (Minolta CR-200) at the surface or the internal of the sausages. Total pigments were determined according to the method of Hornsey (4).

Moisture was determined at 135°C for 2hours. The total fat was analysed by Soxhlet's extraction method, and crude protein was determined by Kjeldahl method.

The free amino acids were extracted by 1.0% sulfosalicylic acid solution. Then they were identified and measured by amino acid analyzer (Hitachi, Ltd. L-8500) .

Water-soluble proteins were separated by SDS-polyacrylamide gel electrophoresis (SDS-PAGE) according to Laemmli method (5). the acrylamide concentration of gels was 10%.

Sensory characteristics were evaluated with 5 points scoring method about aspects, flavors, tastes, hardness, total evaluation by ten panelists.

Results and discussion

Of seven starter cultures tested for their ability to ferment sausages, four types of mixed cultures composing of I, II, III and VII (Table 2) demonstrated rapid growth and were suitable for fermentation of sausages (Figure 2). Since the starter culture VII (*Staphylococcus xylosus*, *Pediococcus pentosaseus*) is a freeze-dry type product, easy for handling, we employed this culture for further experiments.

The inobuta sausage was compared its properties with pork sausage. They showed the pH drop similarly during fermentation. From the results of color measurement at the surface of products, the sausage from inobuta meat was more red and darker in color (Table 3).

Concerning the textures, the former was harder and more elastic than the latter (Table 4). However, results of sensory evaluation indicated no significant differences between inobuta and pork sausages (Table 5). From these results, we can employ the same processing conditions for inobuta and pork sausages.

Addition of several ingredients, such as Konjak grain (Japanese traditional food, gel type and elastic. In this process, we employed the grain type, 2~3 mm in diameter.), was no influences on the pH drop during fermentation. However, the addition of Konjak increased elasticity and hardness of the products. Konjak is known as an effective material to increase binding capacity of foods. The results of this study indicated that it is also applicable to meat products.

From the results of SDS-PAGE analysis, water-soluble proteins were hydrolysed into peptides and amino acids during fermentation (date not shown).

Free amino acids, such as glycine and alanine, in fermented sausages increased comparing with those in raw meats (Table 6). It was noticeable that the amount of free amino acids in inobuta sausage was more than that in pork sausage. It was supposed that the hydrolysis of proteins was due to the activity of proteases from the starter culture and / or muscles.

Conclusions.
We prepared the semi-dry fermented sausages from inobuta (pigs crossbred with wild boar) meat in this study. Their chemical, physical, and sensory properties suggested that they would be acceptable for consumers. Also, the addition of several local and special products as ingredients showed the possibility for developing unique fermented products with inobuta meat. The amount of free amino acids in inobuta sausage is related to proteases, whose identification would be of particular interest.

Table 1. The ingredients of fermented sausages.

Ingredient	Standard	Test I	Test II
Inobuta meat	1,600g	1,600g	1,500g
Back fat of Inobuta	400	400	300
Konjak (small grain type)	0	0	200
Salt	44	44	44
Potassium nitrate	1.3	1.3	1.3
Sodium nitrite	0.14	0.14	0.14
Sodium ascorbate	2	2	2
Phosphates	2	2	2
Potassium solbate	4	4	4
Glucose	20	20	20
Sodium glutamate	6	6	6
Ground white pepper	6	6	6
Coarse ground black pepper	6	6	6
Ground nutmeg	2	2	0
Ginger powder	1	0	0
Garlic powder	1	0	0
Brandy	4	4	3
Rum	3	3	3
Sage powder	0	1	1
Oregano powder	0	1	1
Caucas powder	0	1	2

Table 2. The list of starter cultures used in fermented sausages.

- I. *Lactobacillus plantarum*-4
- II. *Pediococcus cerevisiae*-1
- III. *Lactobacillus casei*-12
- IV. *Staphylococcus carnosus*
- V. *Staphylococcus carnosus*, *Lactobacillus pentosus*
- VI. *Pediococcus acidilactici*
- VII. *Staphylococcus xylosus*, *Pediococcus pentosaceus*

I ~ III: San-Ei Surochemical Co. Ltd.
IV ~ VII: Chr.Hansen's Lab. Danmark

Table 3. Surface color of fermented sausages.

Ingredient	L *	a *	b *
Inobuta	32.7	22.2	13.5
Pork	35.9	20.6	17.6

Table 4. Textual values of fermented sausages.

Ingredient	breaking stress (g)	compressed range (mm)
Inobuta	792	5.1
Pork	707	4.9

Table 5. Sensory evaluation.

Ingredient	aspect	flavor	taste	hardness	total evaluation
Inobuta	3.20	2.90	3.50	3.00	3.20
Pork	3.20	3.30	3.70	3.00	3.40

Scored using a 5-point scale (1=extremely bad; 5=excellent).

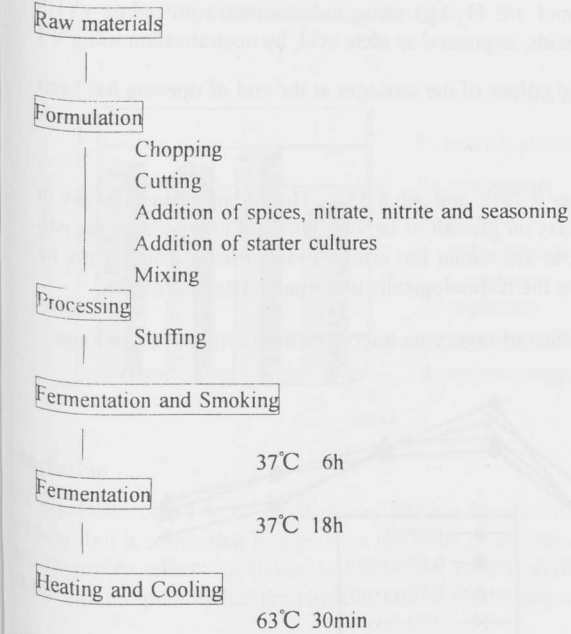


Fig. 1. Production method for inobuta fermented sausage.

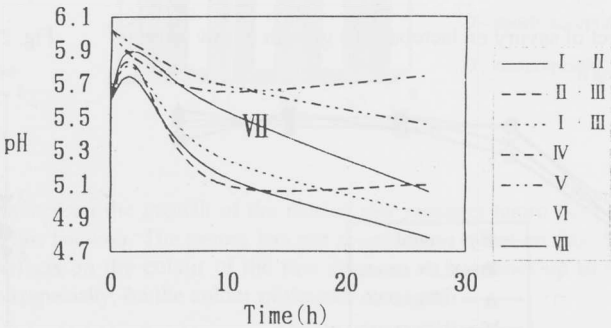


Fig.2. Changes in pH of sausages during fermentation by various starter cultures.

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