Poster exhibition parallel session 10: Meals

PE10.01 Development of soft sausage for the elderly 49.00

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***Abstract*— Soft sausage prepared by steam heating was examined for rheological properties and microbial characteristics. Maximum force, breaking strain and other parameters were found to be less in fresh soft sausage and to increase with refrigeration and freezing. This sausage manifested flat wave, while the waves for refrigerated and frozen samples rose and fell with consequent hardening of structure. Rheological properties of the sausage were essentially the same as for tsumire. No *Escherichia coli, Staphylococcus aureus* or *Salmonella* could be detected. Aerobic bacterial count was considerably less than the standard, this likely being due to steam heating in the present study.**

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***Index Terms*—soft sausage, the elderly, texture, microbiology**

I. INTRODUCTION

Recently, consumer trends in food selection, based on health considerations, have come to be noted. This is especially the case for the steadily increasing elderly segment of the population, which requires special care in food choice. For such persons, soft foods which can be easily chewed should thus be made readily available for wide distribution. Three years ago in this country (Japan), Tanabe and Yano (2006) published a research paper, "Meat Hanpen" which is concerned with meat products especially suited for the elderly. Hanpen is basically a Japanese traditional fish meatball with soft texture to facilitate chewing. This research has provided basis for preparing delicious meals easily consumable by the elderly. There are also available meals containing pork and egg white but no other meat (Tanabe, 2003; Tanabe and Nakamura, 2005). These meals are prepared by steam-cooking to ensure soft pork texture. In their research, Tanabe and Imai (2006) used a steam convection oven to prepare pork meal which they designated "Soft Sausage" whose fat content is quite low, but with its sensory characteristic juiciness and smoothness was still retained.

The present study examines soft sausage prepared by steam heating with respect to the following: 1) Features of the sausage prepared with a steamer (stainless container) instead of a steam convection oven and 2) the rheological and microbiological properties of the sausage.

II. MATERIALS AND METHODS

Sample preparation Soft sausage was prepared using pork thigh with chicken leg meat, white egg powder *etc* in a steamer at 80°C for 30 min as follows: (1) 3.5 g NaCl were rubbed into 175 g of pork which was then vacuum-packed and maintained overnight at 4°C.→ (2) Following the procedure for salted pork (1), 75 g of chicken treated with 1.5 g NaCl were mixed by a processor with 10 g water for 10 min. → (3) 20 g dogtooth violet starch swelled with 20g water, 20 g crumbs, 20 g suger and 1.5g baking soda which had been added to the meat mixture followed by stirring for 30 sec to yield a meat paste. → (4) 20g dried powder of egg white were added to 140 g water. The system was allowed to swell and then stirred with a mechanical mixture to produce a meringue. → (5) The meringue and meat paste were mixed and stirred for 10 sec to obtain a paste which was then introduced into a small stainless container (Fig.1), followed by steam heating at 80°C for 30 min.

Rheological measurement The soft sausage samples (Fig.2) obtained above were grouped as follows: 1) the control (fresh) group just after cooking, 2) the refrigerated group (vacuum-packed and kept at 4°C for 1 week) and 3) the frozen group

(vacuum-packed and frozen at -20°C for 1 week). Each groups, $15\times15mm^3$, was examined for rheological properties using a Creep Meter (RE2-33005s, YAMADEN, Japan) (Fig.3) at room temperature, under the following conditions: load cell, 20N; press rate, 1 mm/sec; plunger, wedge type (No.49, YAMADEN) (Fig.4); moving, 1 time press cut and clearance, 0.75 mm (strain 95%). Auto analysis software (RAS-3305, YAMADEN) was used to determine maximum force (g) and braking strain (%). For comparison with commercial products, pork sausage and steamed fish paste products, such as hanpen, tsumire and kamaboko, all traditional Japanese foods, were examined in the same manner as above.

Microbiological measurement Aerobic bacteria count of the soft sausage was determined using plate agar and that of *E. coli,* with a BGLB fermentation tube. *Staphylococcus aureus* was detected by mannitol salt agar with egg yolk. *Salmonella* determination was conducted by BPW in a pre-enrichment culture, using Hajna tetrathionate medium for selective enrichment and MLCB agar for isolation.

III. RESULTS AND DISCUSSION

Rheological properties Maximum force, breaking force, breaking stress, breaking strain and breaking energy of the soft sausage were noted to decrease in the order, control (fresh), refrigerated and frozen groups (data not shown). The control group exhibited a flat-wave form with no clearly defined breaking point. The refrigerated and frozen groups manifested rising and falling wave patterns subsequent to mechanical breaking up of the sausage (Fig.5). In contrast to the control, the other two groups displayed various values for breaking strength, possibly owing to the tightly knit internal structure created by vacuum packing or ice crystal formation subsequent to swelling caused by baking soda and steaming of the meat paste. The sausage, hanpen, tsumire and kamaboko were all examined for the same properties specified above (Table 1). Breaking stress, lowest for hanpen, increased in the order, tsumire, soft sausage, pork sausage and kamaboko. Breaking strain was lowest for tsumire, followed by soft sausage, pork sausage, kamaboko and hanpen. Hanpen showed the lowest maximum force. This parameter increased in the order, tsumire, soft sausage and kamaboko. The highest value was noted for pork sausage (data not shown). Soft sausage was seen to show essentially the same parameter values as tsumire. Breaking wave patterns were basically the same in both cases.

Microbiological properties

[Aerobic bacterial count] Aerobic bacterial count for the three groups was found less than that specified by the standard guideline in Japan. For two samples of soft sausage the same experiment was repeated 3 times to ensure value reliability. The incubated plate agar showed only one colony for a 10-times diluted sample. No other plates exhibited a colony. The average count was computed to be 0.5×10 CFU/g, a value quite considerably less than 10^4 CFU/g, the limit of the standard for meat products of the packed type after heating. Heating at 80°C for 30 min is thus shown to effectively destroy microbes.

[*E. coli*] In this study, the possibility of detecting *E. coli* was considered small and consequently, MPN using a BGLB fermentation tube was conducted with incubation at 35 ± 1°C for a maximum of 48 hr. For no sample was any gas formation noted in the tube and thus all the samples were concluded to be *E. coli* negative.

[*S. aureus*] Some colonies could be seen on mannitol salt agar with egg yolk but no *S. aureus* colony was found. These bacteria are always present on the surface of human skin and within the nostrils and may possibly come in contact with and contaminate food. But, in this study, no .*S. aureus* was detected in any sample.

[*Salmonella*] In no case could *Salmonella* be found and this possibly would be due to proper and thorough heating and packing of sausage.

The present results for sausage preparation by stainless steamer were found quite satisfactory, thus clearly demonstrating the steam convection oven need not always be used to produce soft sausage. The soft sausage prepared was found, by actual eating, to be considerably more tender than commercial pork sausage. Rheological and sensory data were virtually the same for tsumire. Vacuum-packing would have essentially the same effect on hardening as refrigeration. Frozen samples were hard and sensory texture was not satisfactory, this possibly being due to ice crystal formation and dripping with thawing to bring about low binding capacity with subsequently brittle texture. Better means for the storage of soft sausage may possibly be found through histological study using electron microscopy. Microbiological examination confirmed the absence of *E. coli*, *S. aureus* and *Salmonella* and aerobic bacterial count was

considerably below the Japanese standard. This would appear possible indication of microbe sterilization by steam heating at 80°C for 30min. Soft sausage was prepared in this study using pork and chicken whose amounts constituted 45% of the total ingredients. But general sausage contains meat at more than 50%. Further research should direct careful attention to meat volume in sausage production. Plant oil and egg shell calcium are to be used in the future production of soft sausage and this should lead better taste, texture and nutritional value.

IV. CONCLUSION

The soft sausage prepared by steam heating was much more tender than commercial pork sausage. Rheological and sensory data were virtually the same for tsumire, a traditional Japanese fish paste product. Aerobic bacterial count was considerably less than the standard. No *E. coli, S. aureus* or *Salmonella* could be detected in the sausage. Under the conditions of the present study, heating at 80°C for 30 min is thus shown to effectively destroy microbes.

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Fig. 1 Stainless container filled with meat paste.

Fig. 2 Soft sausage sample.

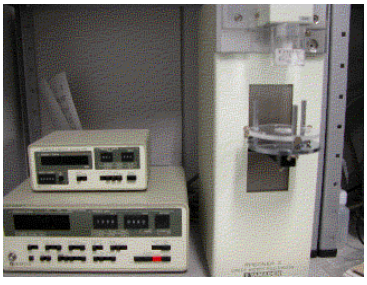

Fig. 3 Creep Meter used to measure rheological property examination.

ACKNOWLEDGEMENT

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REFERENCES

[1] Tanabe, H. and Sachio Yano (2006). Newly developed and nutritional food, Meat-Hanpen, Meeting of Japanese Society for Meat Research, Tokyo.

[2] Tanabe, H. (2003) Development of a new sausage-type product with pork and egg white. Final Reports for Research Grants for Meat and Meat Products 21, 211-215.

[3] Tanabe, H. and Nakamura, T. (2005). A novel type low fat pork sausage. *Animal Science Journal* 76, 415-422.

[4] Tanabe, H. and Imai, E. (2006). Physical and sensory scores for the evaluation of new type pork sausage for elders. Final Reports for Research Grants for Meat and Meat Products 24, 348-353.

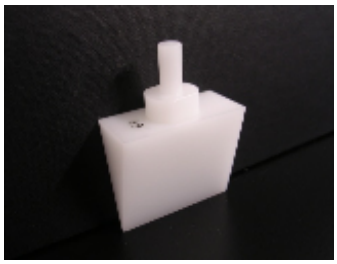

Fig. 4 Wedge type plunger for sausage sample study.

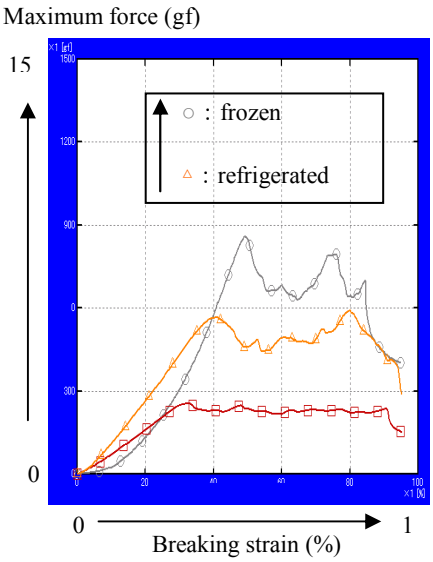

Fig.5 Strength wave patterns for soft sausage.

Table 1 Rheological features of sausage type products as determined with the rheometer

Sample	Breaking stress (Pa)	Breaking strain (%)
Soft sausage	3.844×10^5	34.40
Pork sausage	1.059×10^6	43.75
Hanpen	3.531×10^5	73.23
Tsumire	3.547×10^5	28.02
Kamaboko	1.256×10^6	69.03