Use of casein as a meat extender

S. DALE[1], K. STEINSHOLT[1], S. Aa. GUMPEN[2] and T. HØYEM[2]

[1]Dairy Research Institute, Agricultural University of Norway, 1432 Aas-NLH, Norway
[2]Norwegian Food Research Institute, 1432 Aas-NLH, Norway

Rennet casein is regarded as a by-product in the production of brown cheese commodities in Norway. The total production of dried rennet casein from cow's and goat's milk was 1290 tons in 1980. The rennet casein is traditionally used for technical purposes or as fodder. Even though there has been a significant export to the US in recent years at favourable prices, a stable domestic utilization in food commodities is to be preferred.

The interest in using rennet casein for food purposes seems to be limited internationally, and the literature on the subject is scarce. Goldman (1973) points out that casein, due to its low solubility, is unfit for use in small goods manufacture. She also found that casein has a low water absorption in bread, and concluded that rennet casein had to be turned into caseinate for practical use. Southward (1974) found that the biological value for rennet casein equalled that for acid casein.

The purpose of this study was to explore the possibilities of utilizing rennet casein in sausages (frankfurters) and in fermented, dry sausage (salami type).

Materials and methods

Frozen or dry rennet casein from cow's and goat's milk was obtained from Norwegian Dairy Sales Association. Meat and fat were kept frozen and transferred to a cold room (4°C) 20-24 hours before use.

Dry or frozen casein from both cow's and goat's milk was used in cooked sausages at levels of 3, 6 and 9%, resp. 6, 12 and 18%, calculated from the cooked product, and with an assumed cooking loss of 5%.

For the salami type sausage only dry casein from goat's milk was used, at levels of 3, 6 and 9%.

The differences in water content between dry and frozen casein were compensated with water in the batter. The experiment with cooked sausages was performed in triplicate, while the salami sausage experiments were done in duplicate.

Duplofermente 66 (Rudolf Müller & Co., Giesen, BRD) was used as starter culture in the fermented sausage production. Sensoric analyses were performed with 12 experienced panelists giving points on a 1-9 scale. The products were evaluated with respect to colour intensity, total impression of colour, meat taste, off-flavour, total impression of taste, hardness, juiciness, graininess, and total impression of texture.

Fat and water losses for cooked sausages were determined on sausage samples drawn with a 18 mm cork bore and heated for 60 sec in a Sharp R 6460 E microwave oven. The analyses were performed on freshly cooked sausages, and after 8-10 weeks storage in the freezer.

For the salami type sausages, fat analyses were performed with the Foss-let 15 300 equipment following standard procedure, while protein was determined after Kjeldahl. In both cases large samples were homogenized, and smaller samples with drawn for analyses. Dry matter was determined in a sand bath at 105°C to constant weight.

Consistency was determined with an Instron Universal Testing Instrument TM-SM by forcing a probe of 6 mm diameter into sausage samples (27 mm) at a speed of 10 cm/min (cooked sausages), and 20 mm probe, penetration length 18 mm at 2,5 cm/min (salami type sausages).

An analysis of variance was performed where the hypothesis of no effect was rejected at the 5% level of significance.

Results and discussion

Cooked sausage.

The effects of addition of types and levels of casein to cooked sausages are compiled in Table 1. The results show that casein has an impact on all product characteristics studied.

Sensoric property	Significant effects of parameters studied						
	Casein level of addition			Casein, origin		Type	
	3(6)%	6(12)%	9(18)%	Cow	Goat	Dry	Frozen
Colour intensity	5.11	4.67	4.42			4.86	4.60
Total impression of colour	5.45	4.95	4.70			5.17	4.90
Meat taste	5.20	4.86	4.25	5.05	4.49		
Off-flavour	2.51	3.24	4.07	2.58	3.96		
Total impression of taste	4.92	4.43	3.73	4.78	3.94		
Hardness	4.95	4.77	4.69	5.01	4.59		
Juiciness	5.14	4.60	4.24	4.77	4.55	4.47	4.85
Graininess	3.17	4.15	4.89			4.37	3.77
Total impression of texture	4.93	4.34	3.66	4.48	4.14	4.15	4.47

Table 1. Significant effect of various casein types at different levels on sensoric properties in cooked sausages. The scoring ranged from 1-9 (9 highest).

Generally, the properties became poorer with increasing levels of casein added. Taste and consistency obtained lower points with addition of casein obtained from goat's milk compared to casein from cow's milk. Colour and texture properties were better by using frozen casein than with dry casein.

Analyses on fat and water binding showed that the loss of fat of freshly cooked sausages and after frozen storage was significantly greater for sausages with frozen casein than with sauages with dry casein. Frozen storage also influenced the fat loss in a negative direction.

The water loss was greater after frozen storage and for addition of frozen casein.

The Instron measurements revealed an increasing hardness as a function of increasing additions of dry casein, while no significant correlations could be found between hardness and the addition of frozen casein. Dry casein gave in our experiments a significantly higher hardness than frozen casein.

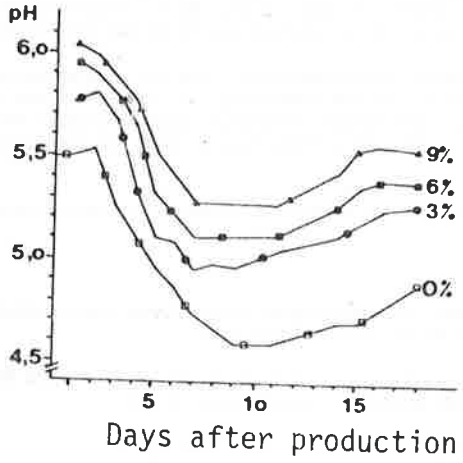

Fig. 1. pH during fermentation of salami type sausage with different levels of rennet casein from goat's milk added.

Dry, fermented sausage

Weight loss and pH measurements were monitored during the fermentation process. Addition of dry casein (goat) caused somewhat less weight loss than the control (no casein), but the differences between the different levels of addition (3, 6 and 9%) were insignificant. On the other hand, the pH development during fermentation was dependent on casein addition level as seen from fig. 1.

Sensoric analyses were performed as for cooked sausages except for total impression of colour, meat taste, and graininess. Increased levels of casein gave better performance for colour intensity and general appearance, and the hardness increased.

Results from the chemical analysis and texture measurements are given in Table 2.

As far as cooked sausage production is concerned, the addition of rennet casein has a negative effect on the overall quality. Casein from goat's milk adds pronounced taste of goat which is not anticipated to be accepted by the majority of consumers.

This study indicates, however, that rennet casein from goat's milk has a favourable effect in the production of dry, fermented sausage. Important properties are significantly improved without interfering with the taste. Weight loss is also lowered, while the pH during fermentation is higher. This may impair the microbiological safety during fermentation and storage. On the other hand, it should be possible to lower the pH by changing the fermentation procedure, changing the starter culture, or by the addition of glucono-δ-lactone.

Rennet casein from goat's milk, %	Hardness, kg	Protein, %	Fat, %	Dry matter, %
0	5.46	17.3	30.9	63.3
3	7.76	19.4	29.8	62.4
6	8.72	22.2	28.4	63.4
9	9.45	24.4	27.0	64.5

Table 2. Chemical/physical properties measured for dry, fermented sausage, significantly affected by casein addition. The measurements were performed as described under Materials and Methods.

In conclusion, it seems possible to utilize rennet casein in certain meat products, and thereby use this nutritionally valuable protein for human foods.

Literature

Goldman, A. (1973): Applications for dairy products in smallgoods manufacture. F. Technol. in New Zealand, 9(7):25-27.

Southward, C.R. (1974): Rennet casein - Industrial chemical or food ingredient? F. Technol. in New Zealand, 9(8):11-15.