

INFLUENCE OF PROTEINS OF COLLAGENEOUS ORIGIN IN
SPREADABLE FERMENTED SAUSAGES (SALAMI-TYPES)

H. WEBER¹, R. FISCHER², K. MARGGRANDER² and F. KOCHINKE¹

¹ Technische Fachhochschule Berlin, Fachbereich
Lebensmitteltechnologie und Verpackungstechnik, 1000
Berlin 30, Germany

² Deutsche Gelatine-Fabriken STOESS AG, 6930
Eberbach/Baden, Germany

INTRODUCTION

Hydrolyzed collagenous proteins are obtained from connective tissue of the skin of pork and cattle, which have been slaughtered commercially. By a defined degradation process, which destroys the tripelhelical structure of the collagen molecule, fragments of different molecular weights are obtained. In contrast to gelatine those low molecular weight proteins are completely soluble in cold water. Also the gel forming ability is lost.

The typical character of collagen hydrolysates is their high content of the amino acids glycine and hydroxiprolin. Every third molecule in the primary structure of the polypeptide chain is occupied by glycine, which is also responsible for the faintly sweet taste of the powderous products. Hydroxiprolin is the chief amino acid of collagen, for its occurrence in other proteins is very rare and if at all hydroxiprolin is only contained to a minor extend (Table 1).

Collagen hydrolysates have a variety of properties which offer a wide range of applications:

Cold water solubility, Dispersibility, Stabilizing of emulsions, Stabilizing of foams, complex formation and adhesive properties.

Gelita-Sol-types are consisted by a large variety of polar amino acids, whose hydrophilic COOH, OH, imidazyl-, NH₂, guanidyl-groups enable salt formation. The liophilic amino acids form hydrophobic regions in the molecule. As well as the hydrophilic as the hydrophobic groups form separate regions. Gelita-Collagel shows a significantly higher viscosity and molecular weight than Gelita-Sol.

In liver based sausages (liver paté, liver pudding) in artificial casings and as canned food as well as terrines and patés the addition of collagen hydrolysates (2.0 to 2.5 % of Gelita-Sol or 2.0 to 3.0 % of Gelita-Collagel) resulted in significantly enhanced sensoric and technological properties (Marggrander and Hofmann, 1992). It was also noticed an enhancement of the softness (spreadability), the separation of less jelly and fat as well as a decrease of the a_w -value. This article describes the results in spreadable fermented sausages which were obtained adding collagen-hydrolysates. Of special interest was the influence of collagen hydrolysates on the spreadability of the products as well as the sensoric quality. In all experiments were determined the total protein content, the BEFFE-values and the a_w -values.

MATERIAL AND METHODS

Various types of spreadable fermented sausages were prepared according to the german "Leitsätze" as follows:
onion Mettwurst

Leitsatz-Nr. 2.212.

Braunschweig type Mettwurst
coarse Mettwurst

Leitsatz-Nr. 2.213.2
Leitsatz-Nr. 2.213.3

The following gelatine products were added:

- 2,0 % Gelita-Collagel article-No. 21601-
- 2,0 % Gelita-Sol article-No. 211010
- 2,0 % Gelatine 60 Bloom article-No. 111060

of which DGF STOEES is the supplier.

The chemical composition and other specifications of the above mentioned gelatine products are listed in Table 2. The preparation of the fermented sausages occurred as industrially common by the use of 26g nitrite curing salt, 1.2g starter cultures (Hagesüd Nitrostart G, Art.-No. 7320 0) and the normal use of spices. The curing salt was added at the end of the cutting process. Samples with and without the addition of GDL were prepared. The amount of GDL was always 3g per kg meat mass.

The following parameters were measured:

- a_w -value (Novasina Thermoconstanter TA2/RTD-33/BSK)
- pH-value (electronic measurement, Knick type 764 Multilabimatic)
- weight losses (gravimetric)
- total protein content (N x 5,55, Kjeldahl)
- sensoric evaluation (pair wise difference, number of testers: 20), judged were general taste, flavour, salt taste, colour, consistency and spreadability.

RESULTS AND DISCUSSION

a_w -values

By the addition of 2% Gelita-Collagel, Gelita-Sol and 60 Bloom gelatine, it was observed that the a_w -value was lowered in all types of sausages investigated. The types with the addition of GDL showed a decrease of the a_w -value of 0.03 to 0.16 units. The a_w -values of the samples without the addition of GDL were decreased by 0.02 to 0.04 units. The rapid reduction of the a_w -value at the beginning of the ripening process by the addition of collagenous proteins has a very positive influence on the final products.

pH-values

All investigated types of sausages with GDL showed after 24 hours pH-values lower than 5.3. In the case of no addition of GDL this effect was slower. The addition of 2% Gelita-Collagel, Gelita-Sol and gelatine 60 Bloom did not show any influence on the pH-values of the individual products.

Weight-loss

The control samples without the addition of gelatine products showed higher weight losses than the samples with gelatine products. In the case of coarse and fine Mettwurst the addition of gelatine products reduced the weight losses by 0.5 to 3 %. The longer the drying/ripening process, the better are the values in favour of the addition of collagenous proteins.

Total protein and BEFFE-content (Tables 3 and 4)

In the German regulatory for meat products (Leitsätze) defined BEFFE-values were exceeded in all cases. The BEFFE-values of all samples without the addition of gelatine products had an average value of 14.0%. The samples with the addition of gelatine products showed values between 14.4 and 14.8% BEFFE. The total protein content of the samples without the addition of gelatine products had an average value of 16.35%. All samples with the addition of 2% gelatine products resulted in values between 18.5 and 18.7%.

Sensoric evaluation

Table 5 gives a summary of the sensoric results of the individual products in relation to/without the addition of gelatine products.

Taste, salt taste

All control samples investigated without the addition of gelatine products were judged worse in general than the sausages with the addition of gelatine products, where significancies of values higher than 95% and even higher were obtained. The salt taste was also enhanced in comparison to the control samples.

Colour

The most intensive red colour with significance of 99% and higher was observed at the samples containing Gelita-Collagel. Samples with the addition of Gelita-Sol were nearly as red as those with Gelita-Collagel. The sausages with 60 Bloom gelatine were inferior in colour; some of the products showed few dark spots.

Consistency, spreadability

The sensoric evaluation showed, that the spreadability is increased by the addition of gelatine products. In addition the spreadability was assured over a longer period of time in comparison to the control samples. Significantly enhanced was the spreadability of fresh onion-Mettwurst by the addition of gelatine hydrolysates, whereas gelatine (60 Bloom) showed a reverse influence on the spreadability. It is assumed that gelatine, due to its gelforming properties links the various components of the meat mass better to each other, thus resulting in a firmer structure.

CONCLUSIONS

The use of additions of 2% collagenous proteins is advantageous for the production of spreadable fermented sausages of the salami-types with respect to the lower a_w -value and a significant increase of the sensoric qualities.

REFERENCES

- MARGRANDER, K. 1991. *Speisegelatine in Fleischerzeugnissen*. Deutscher Fachverlag, Frankfurt/M.
- MARGRANDER, K., and HOFMANN, K. 1992. Technologische Eigenschaften von Kollagenhydrolysaten beim Zusatz zu Fleischerzeugnissen und Fertiggerichten. *Fleischerei*. 43:1150-1153.

Table 1. Amino acid content of collagen hydrolysates.

	grams amino acid per 100g protein
Alanine	9.8
Arginine*	9.0
Asparatic acid	7.0
Cysteine**	0.2
Glutamic acid	11.5
Glycine	24.9
Hisidine**	2.1
Hydroxylysine	1.1
Hydroxyproline	12.0
Isoleucine**	1.8
Leucine**	3.3
Lysine**	3.7
Methopnine**	1.0
Phenylalanine	2.1
Proline	16.9
Serine	3.6
Threonine**	2.1
Tryptophan**	0.1
Tyrosine*	0.9
Valine**	2.8

* essential for growth

** essential for humans

Table 2. Chemical, physical and microbiological data of gelatine products.

property	Test method	Gelita-Collagel Gelita-Sol	Gelatine 60 Bloom
Protein	N x 5,5 (Kjeldahl)	87 - 90% ¹ 90 - 95% ²	84 - 90%
humidity	105°C, 24 h	4,5 - 8,5	8 - 12%
ash	USP XXI	<1%	<2,5%
pH-value		5,4 - 6,2	5,0 - 5,8
heavy metals	AAS	<50 mg/kg	<50 mg/kg
<i>microbiological data</i>			
total aerobic count	Caso Agar acc. USP XXII	<1000/g	<1000/g
Enterobacteriaceae	Mossel mod.acc.USP XXII	negative/g	negative/0,1g
Coliform bacteria	Mossel mod.acc.USP XXII	negative/g	negative/g
Escherichia coli	Mossel mod.acc.USP XXII	negative/g	negative/g
Salmonella	USP XXII	negative/25g	negative/25g

¹ Gelita-Collagel

² Gelita-Sol

Table 3. Total protein, connective tissue protein, BEFFE-values of spreadable fermented sausages with and without the addition of gelatine products (average values, n = 6)

	total protein (%)	BE & GE (%)	BEFFE (%)
Fermented sausage with 2% Gelita-Collagel	18.7	21.0	14.6
Fermented sausage with 2% Gelita-Sol	18.5	23.2	14.2
Fermented sausage with 2% Gelatin 60	18.6	21.3	14.8
Fermented sausage without Gelatin products	16.3	14.7	14.0

BEFFE = meat protein without connective tissue

BE = connective tissues protein

GE = total protein

Table 4. Total protein, protein of connective tissue and BEFFE-values of onion-Mettwurst, coarse Mettwurst and finely ground Mettwurst with and without addition of gelatine products.

	Total protein (%)	Connective tissue in total protein (%)	BEFFE (%)
Samples without GDL			
onion Mettwurst mit 2% Gelita-Collagel	22.63	14.49	19.35
onion Mettwurst mit 2% Gelita-Sol			
onion Mettwurst mit 2% Gelatine 60	21.75	13.24	18.87
onion Mettwurst (Control)	21.63	12.21	18.99
coarse Mettwurst mit 2% Gelita-Collagel			
coarse Mettwurst mit 2% Gelita-Sol	18.25	8.77	16.65
coarse Mettwurst mit 2% Gelatine 60			
coarse Mettwurst (Control)	18.19	21.55	14.27
fine Mettwurst mit 2% Gelita-Collagel			
fine Mettwurst mit 2% Gelita-Sol	18.25	26.30	13.45
fine Mettwurst mit 2% Gelatine 60			
fine Mettwurst (Control)	18.38	23.07	14.14
	17.19	16.29	14.39
	17.25	30.61	11.97
	17.31	27.73	12.51
	16.38	29.79	11.50
	15.88	16.63	13.24

Samples with GDL			
onion Mettwurst mit 2% Gelita-Collagel	22.19	18.03	18.19
onion Mettwurst mit 2% Gelita-Sol			
onion Mettwurst mit 2% Gelatine 60	21.57	14.47	18.45
onion Mettwurst (Control)			
	21.38	14.97	18.18
coarse Mettwurst mit 2% Gelita-Collagel			
coarse Mettwurst mit 2% Gelita-Sol	18.13	10.59	16.21
coarse Mettwurst mit 2% Gelatine 60			
coarse Mettwurst (Control)			
	18.60	17.20	15.40
fine Mettwurst mit 2% Gelita-Collagel			
fine Mettwurst mit 2% Gelita-Sol	18.03	20.41	14.35
fine Mettwurst mit 2% Gelatine 60			
fine Mettwurst (Control)	19.25	17.04	15.97
	16.75	15.76	14.11
	13.66	36.31	8.70
	14.16	37.29	8.88
	14.88	30.65	10.32
	11.88	20.20	9.48

Table 5. Summary of the enhancement of the sensoric properties by the addition of gelatine products to fermented sausages, number of testers = 20.

	Result	%	Sign.
Which product tastes more aromatic and stronger (especially salt taste)?			
onion Mettwurst ¹ (A:7,B:6,C:7,D:0)			
coarse Mettwurst ¹ (A:6,B:7,C:7,D:0)	A,B,C	100	***
fine Mettwurst ¹ (A:4,B:11,C:4,D:1)	A,B,C	100	***
onion Mettwurst ² (A:4,B:6,C:10,D:0)	A,B,C	95	***
coarse Mettwurst ² (A:0,B:0,C:20,D:0)	A,B,C	100	***
fine Mettwurst ² (A:5,B:8,C:7,D:0)	C	100	***
	A,B,C	100	***

Which product has the red colour? onion Mettwurst ¹ (A:0,B:20,C:0,D:0)	B	100	***
coarse Mettwurst ¹ (A:3,B:16,C:1,D:0)	B	80	**
fine Mettwurst ¹ (A:0,B:20,C:0,D:0)	B	100	***
onion Mettwurst ² (A:0,B:18,C:0,D:2)	B	90	***
coarse Mettwurst ² (A:0,B:17,C:3,D:0)	C	85	**
fine Mettwurst ² (A:0,B:19,C:0,D:1)	B	95	***
Which product has the softest consistency? onion Mettwurst ¹ (A:19,B:1,C:0,D:0)	A	95	***
coarse Mettwurst ¹ (A:0,B:1,C:19,D:0)	C	95	**
fine Mettwurst ¹ (A:1,B:1,C:16,D:2)	C	80	***
onion Mettwurst ² (A:0,B:7,C:0,D:3)	B	85	***
coarse Mettwurst ² (A:16,B:0,C:4,D:0)	A	80	**
fine Mettwurst ² (A:17,B:0,C:3,D:1)	A	85	***

A: Gelita-Collagel, B: Gelita-Sol, C: Gelatine 60 Bloom, D: Control
¹:with GDL, ²:without GDL