mon Salt Replacement by Modified Potassium Chloride in Italian Salami and Mortadella Sausages: ence on Composition and Sensory Properties

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MMARY: The effect on the final composition and sensory properties of reducing the sodium content by substituting e of the common salt with modified potassium chloride (Takeda Chemical Industries, Tokyo, Japan) was investigated ypical Italian sausage products; the product used as the substitute, called RIBO-KCl, is prepared in a proprietary way Takeda. The salt replacement levels were 0%, 50% and 75% of the amount used in the typical recipes; the products stigated were a) one-month matured fermented sausages (salami) and b) cooked sausages (mortadelle, piece weight 1 The sodium content (expressed as mg/kg meat product) in the final products at the three substitution levels resulted lami and mortadelle to be respectively 15200, 6900, 3200 and 11100, 4000, 2200.The preparation and processing of products proved to be unaffected by the substitution level. The flavour proved to be the one sensory attribute enced by the substitution: the sensory evaluation carried out by following the triangular test procedure showed the mented sausages (salami) at the higher level (75%) of salt substitution to be the most susceptible to flavour variation in products tested.

RODUCTION: Sodium chloride is the second most used additive in the food preparation industry; after the meat it is most important ingredient in the meat product field. The direct relationship between the sodium intake and an se of high blood pressure, which can also depend on a hereditary disposition or the effects of obesity (ABERNETHY SEBRANEK et al. 1983) , has led to an increasing consumer demand for low-sodium content foods. The problem of cing the sodium content in processed meats (ANJAN REDDY et al. 1991, BARBUT et al. 1988, TERREL 1983, TH 1989,) involves many technological, practical and economic aspects and its solution has to be found in a sort of mpromise between actual need of reduction, technological effect on the preparation of the products and consumer-driven ceptic acceptability. In a recent work (G.PASIN et al., 1989) the effects of substitution of common salt with modified on the sensory attributes were evaluated in fresh pork sausages; the modified KCl used in the study, prepared by keda Chemical Industries, Tokyo, Japan, was a potassium chloride-based salt substitute in which the characteristic ter taste of potassium chloride is suppressed by processing it in a proprietary way by Takeda. The aim of the present rk was to evaluate the effects on the sensory properties of typical Italian sausage products caused by the substitution of with the modified KCl.

ATERIALS AND METHODS: The modified KCl used in this study was supplied by Takeda Chemical Industries. kyo, Japan through the Italian representative Mitsui & Co. S.p.A., Milan, Italy; the product, called RIBO-KCl, is a tassium chloride-based salt substitute (typical analysis, from Takeda technical information: potassium chloride 95%, ter 0.4%, disodium 5'-inosinate and disodium 5' guanylate 0.9%) which is similar in taste and appearance to sodium oride; it is coated with RIBOTIDE ® (a 50:50 co-crystallized mixture of disodium 5'-inosinate and disodium 5'- anylate, Takeda product data) by a proprietary process; the sodium content of RIBO-KCl is reduced to 0.5% compared to % for sodium chloride. The feasibility of the substitution of salt was investigated in two well-diffuse Italian sausage oducts: fermented salami and cooked mortadella; the original formulations of the products as well as the salt bstitution levels of the six batches and the processing outlines are shown in Tables 1 and 2. The substitution ratios of RIBO-KCl were chosen so as to keep the water activity values of the original formulations unchanged; it is beyond the ope of the present contribution to illustrate the experimental procedures followed to obtain the salt substitution values, ch and other topics of technological interest will be the subject of a separate paper. About 100 kg. of the product in each ich were processed under industrial conditions; in order to establish if a proper process had been applied chemical terminations were performed on the products by the official AOAC methods (AOAC, 1990); the sodium and potassium ments were evaluated by atomic absorption spectrometry (wavelengths Na = 589 nm, K = 766.5 nm), after the propriate sample preparation. The sensory evaluation of the end products was performed by the triangular test

Table 1 - Salami original recipe. formulation of the salt replacements and processing outline.

meat recipe (w/w%)		seasoning (g/100 kg meat)	
fresh ham	45	ground pepper	150
pork shoulder	30	sodium ascorbate	100
bacon	25	potassium nitrate	10
		potassium nitrite	5
		powdered milk	1000
		sugar	300
		wine	500

salt substitution level	0%	50%	75%
sodium chloride (kg/100 kg meat)	2.5	1.25	0.625
RIBO-KCl	0	2.50	3.750

Processing outline:
meat cut through 5 mm plate (grinder)
60 mm diameter artificial casing

climate conditions: 1st week, T°C 20 to 14, R.H.% 75-85
2nd to 4th week, T°C 12-14 and R.H.% 85-90

Table 2 - Mortadella original recipe. formulation of the salt replacements and processing outline.

meat recipe (w/w%)		seasoning (g/100 kg meat)	
pork shoulder	45	powdered milk	1250
pork fat	30	sodium ascorbate	150
pork trimmings	25	potassium nitrite	10
pork tripes	12	potassium nitrate	4
lean trimmings	8	spieces	90
pigskin emulsion	5		

salt substitution level	0%	50%	75%
sodium chloride (kg/100 kg meat)	2.500	1.250	0.625
RIBO-KCl	0	2.500	3.750

Processing outline:

artificial casing (piece weight 1 kg)

cooking to internal temperature of 70-71°C (about 12 hours) ambient temperature 80-90°C

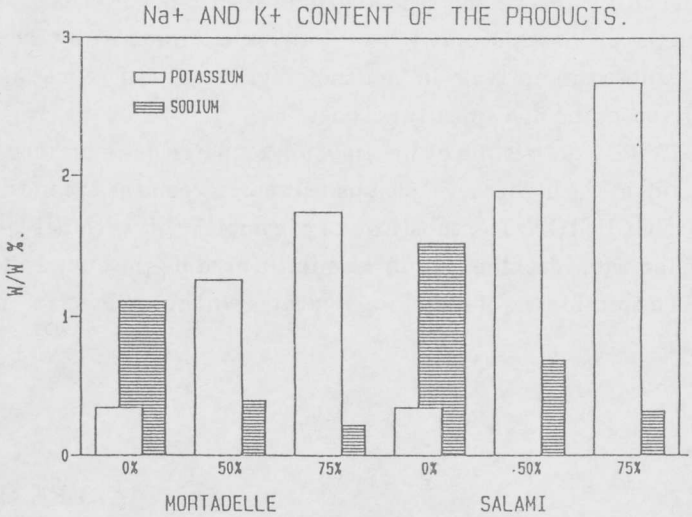
cooling and storage below 10°C

ble 3 - Analytical data of the meat products (each value is the mean of three determinations).

t repl. level	Salami, fresh mixtures			Salami, ripened		
ter (w/w%)	0%	50%	75%	0%	50%	75%
tein "	59.96	59.26	58.21	38.40	37.10	38.50
"	17.00	16.70	17.20	26.08	26.04	25.50
oride "	19.04	19.28	19.10	30.60	30.30	30.40
ium "	1.52	1.81	1.93	2.36	2.95	3.12
assium "	0.98	0.49	0.20	1.52	0.69	0.32
	n.d.	1.18	1.60	n.d.	1.89	2.67
	5.70	5.70	5.70	5.25	5.48	5.60
	0.97	0.97	0.96	0.91	0.88	0.88

t repl. level	Mortadella, cooled		
ter (w/w%)	0%	50%	75%
tein "	52.50	53.50	52.10
"	15.00	15.10	14.90
oride "	27.03	25.21	27.54
ium "	1.71	2.25	2.41
assium "	1.11	0.40	0.22
	n.d.	1.26	1.74
	6.24	6.23	6.23
	0.97	0.97	0.96

Na+ AND K+ CONTENT OF THE PRODUCTS.



ble 4 - Results of the product taste comparisons by the triangular test procedure: 4a and 4b salami, salt replacement levels 0% vs. 50% and 0% vs. 75%, respectively; 4c and 4d mortadelle, salt replacement levels 0% vs. 50% and 0% vs. 75%, respectively.

Salami

4a) 0% vs. 50%

Run No.	significance level		
	n.s.	5%	1%
1	+		
2	+		
3	+		
4	+		
5	+		
6	+		

4b) 0% vs. 75%

Run No.	significance level		
	n.s.	5%	1%
1		+	
2			+
3			+
4	+		
5	+		
6		+	

Mortadelle

4c) 0% vs. 50%

Run No.	significance level		
	n.s.	5%	1%
1		+	
2	+		
3	+		
4	+		
5			+
6	+		

4d) 0% vs. 75%

Run No.	significance level		
	n.s.	5%	1%
1	+		
2	+		
3	+		
4	+		
5	+		
			+

procedure (CAULCUTT, 1983) by a six member panel of food technologists with wide experience in meat product sens evaluation and with a deep knowledge of meat processing problems; the low number of panel members was balanced their experience and by the number of replicates (six) for each comparison.

RESULTS AND DISCUSSION: The substitution of salt did not affect the preparation and the processing of products, no particular drawbacks were encountered during the various processing stages.

Table 3 summarizes the analytical data of the products: as expected, no significant differences in the values of water and protein content exist among the various samples. The variation in the water activity values of the matured saiami respect to the fresh ones can be explained by the different slopes of the sorption curves of sodium chloride and RIBO-K which were experimentally determined in the preliminary part of this work; the variation of the pH-value in the cou of maturing, leading to distinct final values for the three salt substitution levels, can be interpreted as a consequence the aforementioned path of water activity values. The relevant reduction of sodium content, as well as the consequ increase in potassium, are graphically emphasized in the inserted figure, where the potassium content values at the salt substitute level correspond to published data (LAWRIE, 1985).

The flavour was the only sensory attribute influenced by the substitution of salt with RIBO-KCl: the products at the salt substitution levels did not show significant differences as regards odour, colour and texture when compared with th corresponding non-substituted ones.

In Table 4 the results of the flavour comparisons performed by the triangular test procedure are presented; ferment salami at the higher level of substitution proved to be the most prone to flavour changes.

CONCLUSION: The substitution of common salt with RIBO-KCl did not affect the preparation and processing of typic Italian sausages; the flavour was influenced by the substitute to varying degrees depending on the product;, we believ that a suitable use of seasoning mixtures will be sufficient to minimize the changes in flavour.

REFERENCES

ABERNETHY J.D., 1979. Sodium and potassium in high blood pressure. Food Technol. 12, 57-59.

ANJAN REDDY K. and MARTH E.H., 1991. Reducing the Sodium Content of Foods: A Review. J. of Food Prot. 54, 1 150.

AOAC, Association of Official Analytical Chemistry, 1990. Official Methods of Analysis. Washington, D.C.

BARBUT S., MAURER A.J. and LINDSAY R.C., 1988. Effects of Reduced Sodium Chloride and Added Phosphates Physical and Sensory Properties of Turkey Frankfurters. J. Food Sci. 53, 62-66.

CAULCUTT R., 1983."Statistics in Research and Development". Chapman and Hall, New York, 72-89 pp.

LAWRIE R.A., 1985."Meat Science". Pergamon Press, Oxford-New York-Toronto-Sidney-Paris-Frankfurt, 43-73 pp.

PASIN G., O'MAHONY M., YORK G., WEITZEL B., GABRIEL L. and ZEIDLER G., 1989. Replacement of Sodiu Chloride by Modified Potassium Chloride (Cocrystalized Disodium-5'-Inosinate and Disodium-5'-Guanylate wi Potassium Chloride) in Fresh Pork Sausages: Acceptability Testing using Signal Detection Measures. J. Food Sci. 54, 55 555.

SEBRANEK J.G., OLSON D.G., WHITING R.C., BENEDICT R.C., RUST R.E., KRAFT A.A. and WOYCHIK J.H., 198 Physiological Role of Dietary Sodium in Human Health and Implications of Sodium Reduction in Muscle Foods. Fo Technol. 7, 51-59.

TERRELL R.N., 1983. Reducing the Sodium Content of Processed Meats. Food Technol. 7, 66-71.

WIRTH F., 1989. Reducing the common salt content of meat products. Possible methods and their limitation Fleischwirtsch. 69, 589-593.