Utilization of Mechanically Separated Chicken Meat in Salami Type Product

R.Z.M. da SILVA, N.J. BERAQUET, M.T.E.L. GALVÃO, E.A. YAMADA and **N.F.A. SILVEIRA**

Meat Technology Centre - ITAL, Caixa Postal 139, Campinas, Brazil

SUMMARY: Raw fermented sausages were formulated with mechanically separated chicken meat (MSCM) from backs and necks at 20 and 50% levels using a mixture of **L.plantarum** and **Micrococcus violagabriella** as a starter. The sausages were ripened at 20 - 22°C at appropriate relative humidities for 13 days. Final weight losses ranged from 32 to 36%. Water/protein ratios ranged betwee 1.7 and 2.3. Products containing 20% and 50% MSCM had pH in range 4.7 - 4.8 and 4.9 - 5.0 respectively. Water activities were around 0.91. Firmness (shear compression), significantly decreased with the increase of MSCM levels. Subjective evaluation by descriptive analysis revealed 20% MSCM products significantly firmer than 50% ones. Overall quality showed control and 20% MSCM sausages as moderately desirable products and those with 50% MSCM slightly undesirable. **Salmonella** and **S.aureus** were not detected in all final products. Lactic acid bacteria counts reached 10^8 CFU/g representing the total of mesophiles.

INTRODUCTION: Cerca of 50% of the 2,355 thousand ton produced in Brazil (APA, 19919) is being used as cut up parts, generating large amounts of backs and necks that are utilized to produce low cost mechanically separated chicken meat (MSCM). Salami products made from beef and pork are expensive and out of reach of the majority of the brazilian population. Using MSCM in a salami type product would lower its cost making it available to more people while helping to expand the use of MSCM. The use of MSCM in raw fermented products has some drawbacks. MSCM has higher pH (6.5 - 7.0), fat content (9 - 21%) and water/protein ratio (5.0 5.6) than hand deboned meat, and a paste like texture (BERAQUET, 1990). All these physical characteristcs are **a priori** detrimental to salami manufacture. In spite of these considerations. McMAHON & DAWSON (1976) obtained acceptable fermented/cooked sausages white levels of turkey MSM up to 50%. HOLLEY et al (1988) prepared acceptable raw fermented sausages with up to 15% MSCM, concluding that it did not influence the pH change during ripening. Other authors (BARANY & STEVENSON, 1975; RACCAH & BAKER, 1979; DHILLON & MAURER, 1975; KELLER & ACTON, 1974) also reported successful use of mechanically separated poultry meat at high levels in summer sausages type products. There are also concerns with the contamination of MSCM with the pathogens that are associated with chicken meat, like **Salmonella**. The contamination of MSCM is the same as the carcasses from which the parts for mechanical separation were used (OSTOVAR et al, 1971, FIELD, 1988). In relation to staphylococcal food poisoning BABER and DEIBEL (1972) reported that most staphylococcal strains they tested failed to produce detectable enterotoxin under anaerobycal conditions at pH below 5.7.

The purpose of this work was to evaluate the influence of the use of two types of MSCM at two levels on physical, chemical and microbiological characteristics of a salami type product.

MATERIALS AND METHODS: Two trials were conducted on the processing of a raw fermented salami type sausage aiming pH around 5.0 and Aw below 0.91 using MSCM from backs and from necks. Frozen skinless chicken backs and necks, obtained in a nearby slaughtering plant, were mechanically separated in a Poss deboning machine yielding two types of MSCM. The MSCM was frozen to - 20°C and used on the next day. The beef and pork meat from shoulder was trimmed from excess fat and tendon, ground with pork back fat through 10mm plates, frozen and kept at - 20°C till use. Raw fermented products were formulated to contain 20 and 50% MSCM in relation to the meat block, for both types of MSCM. The control contained only pork and beef meat and pork back fat in equal weights. The meats

salt, nitrite, dextrose, GDL and seasonings were chopped for 13 s. Fat and the starter cultures, **L.plantarum** and **M.violagabriella** (3:1), were then added and the mixture was chpped under vacuum for additional 20s, followed by stuffing in 40mm cellulosic casings. Fermentation and maturation were carried out in the temperature range of 20 - 22°C. Relative humidity (R.H) was in the range of 90 - 95% until a pH around 5.0 was reached. During drying the R.H was reduced from 95 to 75%. The processing ended when products reached water activity (Aw) equal to 0.91 or less.

Chemical and Physical Analysis - For each treatament one sausage was collected at each sampling time. Three slices were cut from the middle portion, for direct water activity measurement. The remaining portion was homogenized and triplicate samples collected for each determination carried out. A 10g sample was homogenized with 50ml distiled water and the **pH** read in a potentiometer with 0.001pH units resolution. One cm thick slice had its **water activity (Aw)** measured in a NOVASINA EEJA-3 water activity measuring apparatus. **Salt** contents was determined by $AgNo_3$ titration of a a clarified homogenate of 2.5g meat and 250ml distilled water. The **moisture** content was determined by drying a 5g sample at 105°C for 24h, as described by HORWITZ (1980). The total nitrogen was determined using the macrokjedahl method as described by Torry Research Station (1973) for **protein** determination. **Weight losses** ware determined by measuring weight differences in a semi analytical balance.

Sensory analysis was conducted using a panel of trained members (19 members in trial and 10 in trial 2) evaluated **flavor, juiceness** and **overall quality** of 3mm slices from salime slices from all treatments in two judging sessions. For firmness $1cm^3$ cubes were used.The sausages were cooled at 4°C before being evaluated. Descriptive analysis was used with a 10 point scale. The sample were codifield with an aleatory distribution using a computerized sensory evaluation system (Compusense version 4.1). The evaluated parameters mean values were statistically analysed using the Tukey test. For **objective texture measurement,** cylinders of 1cm of height and 0.8cm diameter were taken from 1cm thick sausages slices with a cork borer and compressed to 30% of its height in an Instron model TM-2318. For each sausage the compression peaks of 13 samples were averaged.

For **microbiological analysis** samples from the raw mixtures and final products were analysed. Total plate count, lactic acid bacteria, **S.aureus** and presence of **Salmonella** in 25g samples were determined according to the methodology of SPECK (1984).

RESULTS and **DISCUSSION: pH** values during processing are presented in **Figure 1**. Initial values for meat mixtures were in the range of 5.5 - 5.8 and 5.8 - 6.0, in trials 1 and 2 respectively. In trial 1 pH values dropped to 4.8 - 5.0 after only one day of fermentation whereas in trial 2 it took 3 days. In trial 1 the temperature at the beginning of the process was 2 - 3°C higher than in trial 2. Final products containing 20% and 50% MSCM had pH in the range of 4.7 - 4.8 and 4.9 - 5.0, respectively, in trial 1. The control final pH was 4.9. Similarly, trial 2 the pH of MSCM products were in the range of 4.9 - 5.1 end control had a pH of 4.8. These values are similar to the 4.6 - 5.1 range reported by DHILON & MAURER (1974) for summer sausages.

Aw values during processing are in **Figure 2.** There were no noticeable influence of the MSCM on the pattern of water activity decline during the processing time. In trial 1, final water activities were 0.91 or less for all sausages. In trial 2 the sausages containing 50% MSCM from necks had final Aw around 0.92. There was no difference between treatments regarding **weight losses (Figure 3).** In trial 1 final weight losses ranged from 32 - 34%, whereas in trial 2 they ranged between 34 - 36%. **Moisture** values were similar in both trials **(Table 1).** Products with 50% MSCM had higher moisture contents, around 45%, refleeting the influence of MSCM higher moisture. With the exception of the 20% back treatment in trial 2, all sausages had final moisture contents

around 39%. It can be concluded that the addition of MSCM up to 20% does not affect the rate and amount of water loss during processing. **Protein** contents were similar for all treatments in trial 1 but in trial 2 sausages with MSCM from backs had lower contents, refleting variation in raw material composition. This resulted in larger variation in moisture/protein ratios in trial 2. These results indicate that with the addition of MSCM up to 20% it is possible to obtain moisture/protein ratios close to those obtained with red meats. The sausages had a salt content between 4.6 - 4.8 fitting brazilian taste. The increase of MSCM levels in the products decreased the objective **firmness** as determined by shear compression **(Table 2).** The firmness evaluated by sensory analysis showed the some trend. Sausages containing 20% MSCM were significantly softer from control in trial 2 but not in trial 1. At the 50% level of MSCM sausages were significantly softer than the control and 20% MSCM sausages in both trials except for MSCM from backs in trial 1. The control sausage received the ideal score of 5.0 in both trials. **Juiceness** was considered ideal at score 5.0 as shown by the control. As the level of MSCM increased the sausages became too juicy. Sausages with 20% MSCM were significantly juicer than the control in trial 2, but not in trial 1. Sausages with 50% MSCM were significantly juicer than the control and the 20% MSCM in both trials. No differences were found in **flavor** in trial 1, except for sausages containing 50% MSCM from backs, in relation to the control, but all sausages containing MSCM were significantly different from the control in trial 2. The increase of the MSCM levels decreased the flavor score. **Overall quality evaluation** showed control and 20% MSCM as moderately desiroble products and 50% MSCM as slightly undesirable in trial1. In trial 2 control and 20% neck sausages were considered slightly desirable. The other sausages were considered slightly undesirable but the product containing 50% MSCM from backs was rated extremely undesirable. A general appraisal of the **Table 2** indicates that all treatments in trial 2 had lower scores than in trial1, and that all 20% MSCM treatments were not statistically different from the control. Only the objective firmness criterium showed all treatments containing MSCM to be significantly softer than the control.

Salmonella and **S.aureus** were not found neither in the raw products nor in the final products for both trials **(Table 3).** Lactic acid bacteria counts reached 10^7 CFU/g in the raw products and 10^8 CFU/g in the final products in trial 1, representing the total of mesophiles. The same results were found for all sausages in trial 2.

CONCLUSIONS: Mechanically separated chicken meat can be incorporated into raw fermented sausages up to 50% levels with little effect on weight losses, water activity and pH drop during processing. Sensorially acceptable fermented sausages could incorporate up to 20% MSCM from backs or necks. Under the conditions studied there was no growth of pathogens neither in the control nor in the MSCM sausages. The source of MSCM showed no clear influence on any of the parameters studied.

REFERENCES:

APA, Associação dos produtores de aves. Aves e ovos - Tabela da Agricultura, fev., 1991.

BARAN, W.L. and STEVENSON, K.E. (1975). Survivel of selected pathogens during processing of a fermented turkey sausage. **J.Food Sci. 40**:618-620.

BABER, L.E. and DEIBEL, R.H. (1972). Effect of pH and oxygen tension on staphylococcal growth and enterotoxin formation in fermented sausage. **Applied Microbiology**, vol.24, nº **6**:891-898.

BERAQUET, N.J. (1990). CMS: caminho para o aproveitamento integral da carne de aves. In: **Anais** do Congresso de Ciência e TEcnologia Avícolas. Associação dos Produtores de Pinto de Corte (APINCO), 6-8 julho, Campinas, 187pp.

DHILLON, A.S. and MAURER, A.J. (1975). Utilization of mechanically deboned chicken meat in the formulation of summer sausages. **Poultry Sci. 54**:1164-1174.

FIELD, R.A. (1988). Mechanically separated meat, Poultry and Fish. In: Edible Meat By-Products. **Advances in Meat Research**. vol.**5**. Ed. A.M. Pearson and T.R. Dutson, Elsevier Applied Science, London and New York, 439pp.

HOLLEY, R.A.; JUI, P.A.; WITTMANN, M. and KWAN, P. (1988). Survival of **S.aureus** and **S.typhimurium** in raw ripened dry sausages formulated with mechanically separated chicken meat. **Fleischwirtschaft, 68**:194-201.

HORWITZ, W. (1980) ed. **Official Methods of Analysis of the Association of Official Analytical Chemists**. 3ª ed. Washington, D.C., A.O.A.C., 1018pp.

KELLER, J.E. and ACTON, J.C. (1975). Properties of a fermented, semidry turkey sausage during production with lyophilized and frozen concetrates of Periodiccus Cerevisae. **J.Food Sci. 39**:836-840.

McMAHON, E.F. & DAWSON; L.E. (1976). Influence of mechanically deboned meat and phosphate salts on functional and sensory atributes of fermented turkey sausage. **Poultry Science, 55**:103-112.

OSTOVAR, K.; McNEIL, J.H. & O'DONNELL, (1971). Poultry product quality. 5. Microbiological Evaluation of Mechanically Deboned Poultry Meat. **J.Food Sci. 36**:1005-1007.

RACCAH, M. and BAKER, R.C. (1979). Fermented mechanically deboned poultry meat and survival of **Staphylococcus aureus**. **J.Food Prot. 42**:214-217.

SPECK, M.L. (Ed.). (1984). **Compendium of the methods for the microbiological examination of foods**. American Public Health Association 2nd Edition. 914p.

TORRY RESEARCH STATION (1973). **Recommended analytical methods for fish and fish products**. Aberdeen (T.D.123).

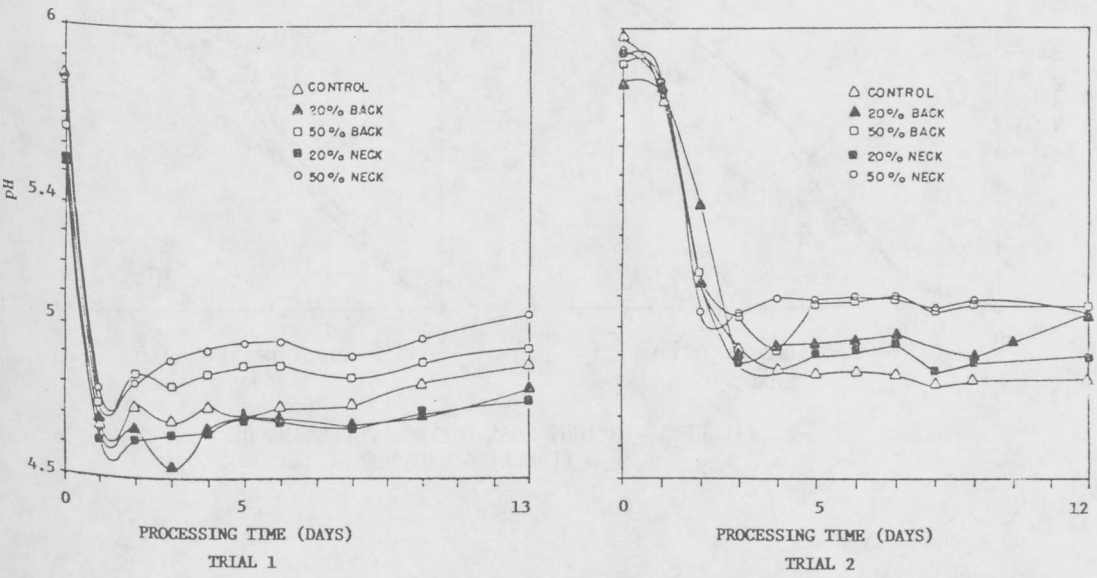

FIGURE 1 - pH DROP ALONG THE FERMENTATION OF RAW FERMENTED SAUSAGES

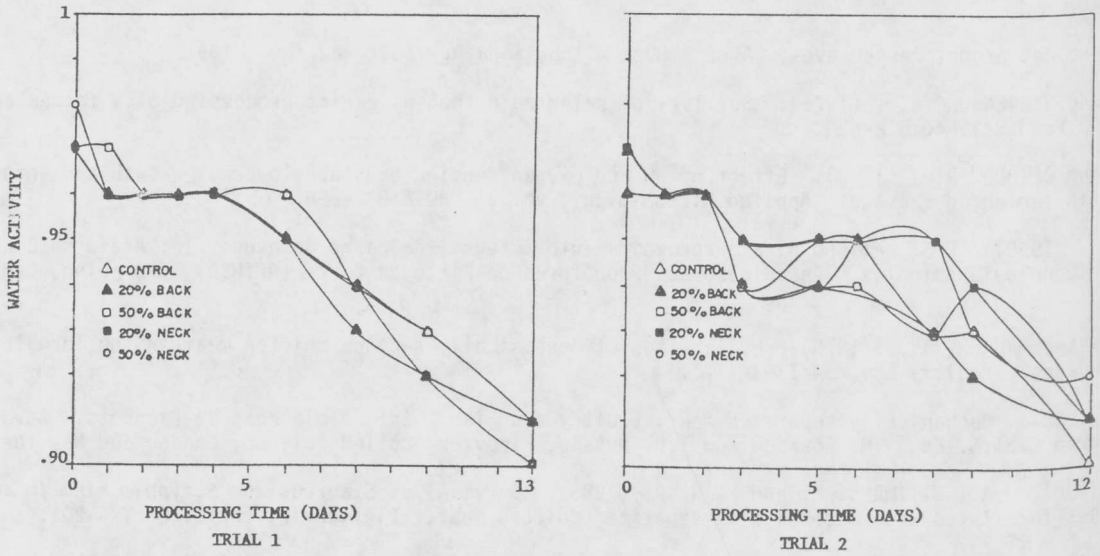

FIGURE 2 - CHANGES IN Aw OF RAW FERMENTED SAUSAGES DURING PROCESSING

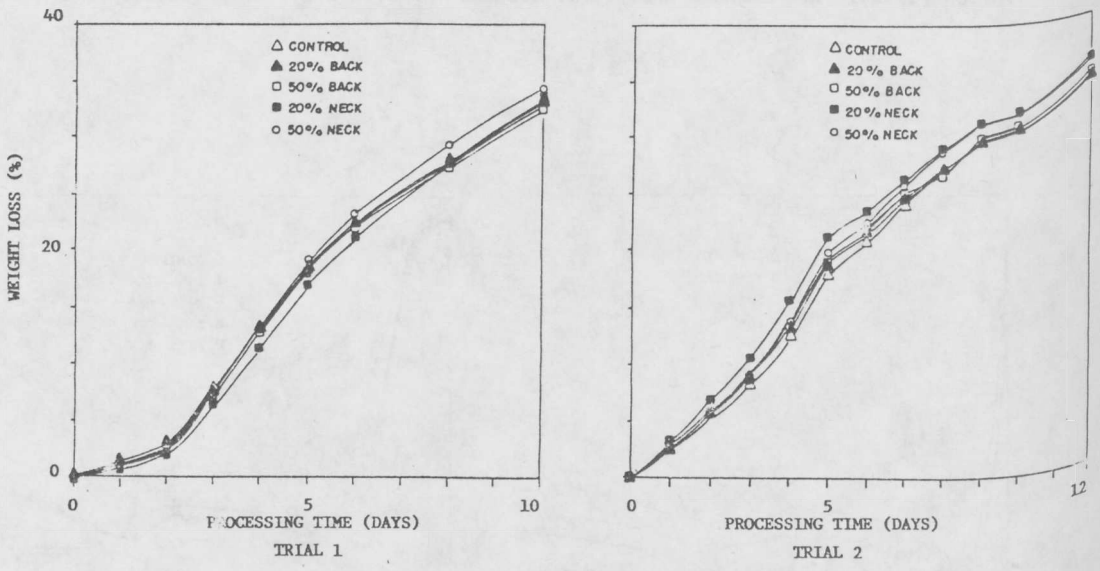

FIGURE 3 - WEIGHT LOSS DURING PROCESSING OF RAW FERMENTED SAUSAGES

TABLE 1 — MOISTURE AND PROTEIN CONTENT OF THE FINAL RAW FERMENTED SAUSAGES

	MOISTURE		PROTEIN		MOISTURE/PROTEIN	
	TRIAL		TRIAL		TRIAL	
	1	2	1	2	1	2
CONTROL	39,3	40,5	22,8	24,3	1,7	1,7
20% BACK	39,5	42,3	21,8	18,7	,8	2,3
50% BACK	45,6	44,5	21,5	18,4	2,1	2,4
20% NECK	38,9	40,5	20,1	21,2	1,9	1,9
50% NECK	45,4	44,3	20,6	19,6	2,2	2,3

TABLE 3 — LOG_{10} OF SELECTED MICROORGANISMS IN THE RAW AND FINAL PRODUCTS

	TOTAL PLATE COUNT (CFU/g)* MESOPHILE		LACTIC BACTERIA		S. AUREUS (CFU/g)		SALMONELLA (IN 25g)	
	TRIAL		TRIAL		TRIAL		TRIAL	
	1	2	1	2	1	2	1	2
RAW PRODUCT								
CONTROL	7,7	-	7,5	-	<2	-	none	-
20% BACK	7,9	-	7,8	-	<2	-	none	-
50% BACK	7,9	-	7,7	-	<2	-	none	-
20% NECK	8,0	-	7,7	-	<2	-	none	-
50% NECK	8,0	-	7,6	-	<2	-	none	-
FINAL PRODUCT								
CONTROL	7,6	8,0	7,6	7,9	<2	<2	none	none
20% BACK	8,1	7,8	8,2	7,8	<2	<2	none	none
50% BACK	8,1	8,1	8,2	8,1	<2	<2	none	none
20% NECK	8,0	7,5	8,0	7,3	<2	<2	none	none
50% NECK	8,1	7,8	8,1	7,6	<2	<2	none	none

* Colony Forming Units per gram

TABLE 2 — SENSORY EVALUATION OF THE FINAL RAW FERMENTED SAUSAGES

	PRODUCTS WITH MSCM*									
	CONTROL		20% BACK		50% BACK		20% NECK		50% NECK	
SENSORY PARAMETER	TRIAL		TRIAL		TRIAL		TRIAL		TRIAL	
	1	2	1	2	1	2	1	2	1	2
FIRMNESS	$5,0^{a}$	$5,1^{a}$	$4,0^{ab}$	$2,5^{b}$	$2,6^{bc}$	$0,8^{d}$	$4,6^{a}$	$3,0^{b}$	$2,2^{c}$	$2,0^{c}$
JUICENESS	$4,8^{a}$	$4,5^{a}$	$3,9^{ac}$	$3,2^{b}$	$1,9^{b}$	$1,3^{d}$	$3,8^{ad}$	$3,4^{b}$	$2,6^{bcd}$	$2,8^{c}$
FLAVOR	$8,2^{a}$	$7,0^{a}$	$7,1^{ab}$	$6,0^{b}$	$5,9^{b}$	$5,0^{c}$	$7,6^{ab}$	$6,1^{b}$	$6,8^{ab}$	$5,1^{c}$
OVERALL QUALITY	$7,4^{a}$	$6,4^{a}$	$6,4^{a}$	$4,8^{c}$	$4,2^{b}$	$2,2^{d}$	$7,3^{a}$	$5,3^{b}$	$4,6^{b}$	$4,1^{d}$
FIRMNESS (OBJECTIVE)	$6,4^{a}$	$3,8^{a}$	$3,1^{b}$	$0,4^{c}$	$1,0^{cd}$	$0,2^{d}$	$1,7^{c}$	$1,2^{b}$	$0,4^{d}$	$0,4^{c}$

* same letter means no difference between two mean values, significant at 5% level