

STUDY OF A TRADITIONAL PORTUGUESE BLOOD SAUSAGE "MOURA"

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SUMMARY

The chemical and microbiological composition of a traditional blood sausage "Moura" was studied at different times of processing. Four batches were done following the traditional recipe. The sampling was made on the paste before stuffing, five days after smoking and ten days after stuffing. Parameters of stability like a_w , pH and microbiological analysis were monitored at different stages of processing. A study of the chemical composition was made on the final product which showed the following mean values: a_w - 0.87 ± 0.03 ; pH - 4.89 ± 0.26 ; moisture - $27.19 \pm 3.45\%$; protein - $22.15 \pm 1.43\%$; fat - $28.20 \pm 0.82\%$; nitrogen free extract - $17.87 \pm 3.26\%$; NaCl - $3.79 \pm 0.36\%$; ash - $4.60 \pm 0.37\%$.

On the final products no *Staphylococcus aureus*, *Salmonella* and sulfite-reducing *Clostridium* spores were detected (except two samples on *Staphylococcus aureus*). Along the processing and the drying caused by smoking, the pH and a_w decreased, so the "Moura" became a stable product that can be classified as an Intermediate Moisture Meat Product.

The blood sausage had a good taste and firmness after boiling, which is similar to the traditional ones.

The study has shown the possibility of making safety products, similar to those of the traditional type if raw material and critical points during the processing were controlled.

INTRODUCTION

Portugal has a large variety of traditional blood sausages, "Moura" is one of them. It is produced in a small area at the North east of the country.

Its composition differs according to the producers, but it is basically made with pork meat and fat, chicken and beef meat, bread, blood, salt, garlic, paprika and red wine. This sausage is eaten boiled or grilled and it is highly appreciated by the portuguese consumer. It is a cheap product and in the last few years its demand increased considerably.

The aim of this work was to study the chemical and microbiological composition of this type of blood sausage, produced experimentally at a commercial meat plant, following the traditional recipe, furthermore some parameters of stability at different stages of processing were controlled.

The variables studied, a_w , pH and microbiological content were made at different times of processing. In addition moisture, protein, fat, nitrogen free extract, salt (NaCl) and ash were determined on the final product.

MATERIAL AND METHODS

The recipe and the technological process of the traditional blood sausages "Moura", was discovered by direct inquiry near the traditional producers of Trás-os-Montes region*.

The experiments were conducted at a commercial meat plant in four batches weighing 100 Kg each. The technological process of "Moura" consisted in boiling chicken meat, bones, pork meat and fat in water with salt, garlic and parsley. Some of the water was previously poured over on bread slices to make a consistent paste. Boneless meat, in rather small pieces, after cooking, was added. Pork meat and fat minced (± 20 mm) were matured previously for 5 days at 5°C with salt (4.5%) garlic (0.2%) and red wine (7%) and added at the paste. Finally paprika,

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pepper and blood was mixed with the paste, to give a typical colour. The stuffing is filled into a thin pork gut, subject to the drying effect of smoke for three days in a traditional smokery, and kept at environmental temperature until ten days after stuffing.

The study was based in forty eight samples randomly drawn from four batches at three different times of processing: 1) On the paste before stuffing; 2) 5 days after smoking; 3) 10 days after stuffing.

The moisture, fat, protein, ash and salt content (NaCl) were determined on the final product (10 days after stuffing) according to the A.O.A.C. procedures (1990). Nitrogen free extract was calculated by difference. The pH was measured directly on the paste with a Crison pH meter model microph 2002. The aw was determined in a Rotronic Higrroskop DT at 25°C. The control of this two parameters and the microbiological analysis were made at different times of processing.

Counting and search of microorganisms, aiming at the sanitary aspects included: Total count of mesophilic (PCA - Difco - 0479-3 days at 30°C); Total count of Mould and Yeast (CRBA - Difco 0703 with chlorotetracycline - 5 days at 25°C); Search of Coliforms bacteria (BGB - Difco 0007 - 2 days at 30°C); *Escherichia coli* (BGB - Difco 0007; Peptone water for indol production - 2 days at 44.5°C - Portuguese standard methods - 2308/86); *Staphylococcus aureus* - pré enrichment-Chapman broth - 1 day at 37°C; isolation and confirmation on Baird Parker Agar with EY tellurite - Difco 0779 - 1 day at 37°C; the coagulase activity was determined with bacto coagulase plasma - Difco 0286 - Portuguese standard 2260/86); sulfite reducing *Clostridium* spores (VL with natrium sulfite and iron alum - 5 days at 37°C - Portuguese standard 2262/86); Salmonella - pré enrichment on buffered peptone water - 1 day at 37°C; enrichment on Rapaport broth - Biomérieux - 41214 and selenite cistine broth - Difco 0684 - 1 day at 37°C; isolation and identification - BGA-Difco 0285 and DCL 1 or 2 days at 37°C; confirmation Kligler Iron agar - Difco 0086 - 1 day at 37°C; rapidec Z - Biomérieux 03400 - Sorology - Difco 2264.(Portuguese standard 870/88)

The Student Newman Keuls test was used to evaluate the significance of the differences among the batches.

RESULTS AND DISCUSSION

On table 1 the results of chemical composition of " Moura" on the final product (ten days after stuffings) are presented.

Table 1 - Approximate composition of "Moura" *

Batches	aw	pH	Moisture %	Protein %	Fat %	NFE %	NaCL %	Ash %
1	0.88 ^a	4.65 ^a	27.08 ^a	22.20 ^a	28.00 ^a	18.06 ^a	3.77 ^a	4.67 ^{ab}
2	0.82 ^b	4.96 ^b	22.73 ^b	26.67 ^a	27.19 ^a	22.40 ^b	4.15 ^b	5.01 ^b
3	0.90 ^a	4.73 ^a	31.12 ^a	20.18 ^a	28.48 ^a	15.74 ^a	3.94 ^{ab}	4.49 ^{ab}
4	0.89 ^a	5.23 ^c	27.82 ^a	23.56 ^a	29.14 ^a	15.36 ^a	3.30 ^c	4.12 ^b
\bar{X}	0.87	4.89	27.19	22.15	28.20	17.87	3.79	4.60
s	0.03	0.26	3.45	1.43	0.82	3.26	0.36	0.37

*each value is the mean from four repetition

abc - means followed by similar letters do not differ significantly (P > 0.05)

NFE - Nitrogen free extract

The pH value (4.89±0.26) was low compared with most traditional Portuguese sausages and this is explained by the inclusion of bread in the paste and also because of the level of lactic acid bacteria (8.5 log c.f.u./g - for publication).

This traditional sausage is considered stable because of pH and aw (0.87 ± 0.03) parameters and do not require refrigeration according to the E.E.C. decision 77/79 (Cantoni *et al.* 1977). No significant differences were observed on protein and fat among the batches.

Nitrogen free extract, aw and moisture were similar batches 1, 3 and 4, but batch 2 was significantly different from the others. The salt content among the batches was significantly different, reflecting a different seasoning or drying effect during the smoking.

The Table 2 show the aw and pH values at different time of processing.

Table 2 - Evolution of aw and pH values of "Moura" during different times of processing

Batches	aw			pH		
	T1	T2	T3	T1	T2	T3
1	0.97 ^a	0.93 ^a	0.88 ^a	6.18 ^a	4.69 ^a	4.65 ^a
2	0.97 ^a	0.89 ^b	0.82 ^b	6.05 ^b	4.87 ^b	4.96 ^b
3	0.98 ^a	0.96 ^c	0.90 ^a	6.17 ^a	4.72 ^a	4.73 ^a
4	0.98 ^a	0.94 ^a	0.89	5.74 ^c	5.13 ^c	5.23 ^c
\bar{X}	0.97	0.93	0.87	6.04	4.85	4.89
s	0.01	0.03	0.03	0.19	0.18	0.26

* each value is the mean from four repetition
 abc - means followed by similar letters do not differ significantly (P>0.05)
 T - different time of processing (T1 - on the paste before stuffing;
 T2 - 5 days after smoking; T3 - 10 days after stuffing)

during the processing but the aw value was not enough low in the final product to inhibit these microorganisms (LEISTNER & RODEL, 1976). The number of mesophilic bacteria (table 3) except for batch four increased during the processing, probably by the presence of lactic acid bacteria.

Table 3 - Counting of microorganisms on "Moura" at different time of processing (log c.f.u/g)

Batches	Moulds			Yeasts			Mesophilic bacteria		
	T1	T2	T3	T1	T2	T3	T1	T2	T3
1	3.4	<2.0	<2.0	4.8	5.2	3.9	6.9	8.5	8.5
2	3.2	<2.0	<2.0	5.1	4.2	4.6	7.5	>8.5	>8.5
3	3.2	2.8	<2.0	5.6	6.2	4.7	>8.5	>8.5	>8.5
4	3.1	<2.0	<2.0	5.3	<2.0	3.5	>8.5	6.6	6.2

Table 4 - Number of samples of "Moura" containing Coliforms, *Escherichia coli* and *Staphylococcus aureus*.

Batches	Coliforms 0.001g			<i>E. coli</i> 0.001g			<i>S. aureus</i> 0.01		
	T1	T2	T3	T1	T2	T3	T1	T2	T3
1	4	4	4	3	3	1	4	2	0
2	4	2	3	0	0	0	4	1	0
3	4	4	4	4	3	4	4	2	2
4	4	0	0	3	0	0	1	0	0

T - different time of processing (T1 - before stuffing; T2 - 5 days after smoking; T3 - 10 days after stuffing)

all the batches before stuffing but their number reduced by the processing. Only two samples of the final product, were not in accordance to the bacteriological standard for portuguese food (RIBEIRO, 1974). No sulfite reducing *Clostridium* spores or *Salmonella* species, could be detected.

The organoleptic characteristics evaluated on "Moura" after boiling, were similar to the traditional ones, which exhibited a good taste and firmness.

CONCLUSION

Considering chemical and microbiological determinations as an indicator of the quality of the raw material and the technological process, this study demonstrated the possibility of making safety products close to the traditional type, if the critical points during the processing can be controlled.

The aw value on the paste before stuffing (0.98±0.01) was reduced after five days of smoking (0.93±0.03), which is caused by the drying effect. On the final product the aw value (0.87±0.03) makes "Moura" an intermediate moisture meat product (LEISTNER, 1990).

The pH value was 6.04 (±0.1) on the paste, and it was reduced to 4.84 (±0.18) during the smoking time, probably by the effect of lactic acid bacteria, present on the meat and fat seasoned with salt, garlic and red wine added to the paste before stuffing. A subsequent work have shown that lactic acid bacteria were present on the final product at 8.5 log c.f.u/g. The population of mould and yeasts (Table 3) decreased

The presence of Coliforms and *Escherichia coli* (Table 4) in the final product (0.001g of sample), can be explained by the handling of the paste and stuffing into fresh pork gut and constitutes a critical point of the technological procedure. Strains of *Staphylococcus aureus* were observed on

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