PRODUCTION OF A COOKED "ITALIAN SALAMI" TYPE SAUSAGE USING CHICKEN LEG MEAT

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Background

The production of chicken meat in Brazil surpassed last year that of bovine meat and is more than three times larger than that of pork meat (AVES & OVOS, 2003). It is expected that in the future the chicken industry might have an over supply of leg meat Many products that in the past were manufactured with pork and beef are now produced with chicken meat. The use of chicken leg meat in a cooked salami type could be an additional diversification to increase its consumption.

In this the hurdles principle of LEISTNER (1986) were applied with respect of water activity and pH to devise an stable product and cooking was introduced to prevent any presumption of *Salmonella* presence due to the use of chicken meat.

Objectives

Development of a cooked "Italian salami " type sausage using chicken leg meat with good acceptability.

Materials & Methods

The chicken leg meat was bought from a local chicken slaughter house. The pork fat was bought from a local butcher. All non meat ingredients were donated by Dicarne Rio Claro-SP. Casings were bought from Viscofan do Brazil – Cruz das Almas –SP. The vacuum packaging film were donated by Cry-o-Vac do Brazil S.A. The starters cultures were a mixture of *Staphylococcus carnosus and Lactobacillus pentosus* (1) of and *Staphylococcus xylosus* and *Pediococcus pentosaceus* (2) donated by Christian Hansen Ind. Com. Ltda – Valinhos – SP.

Experimental design: The complete factorial design is shown in Table 1. Seasonings, salt and other ingredients were added in quantities normally recommended to Italian salami (TERRA, 1993).

Determinations – pH: measured in triplicate by insertion of the electrode in the samples during fermentation and drying. **Water activity**: measured in triplicate during fermentation and each day during drying by means of an CxT2 instrument. **Acidity** (as lactic acid): according to the methodology of INSTITUTO ADOLFO LUTZ (1990). **Proximate composition**: *water* and *protein content* according to AOAC (1995); *total lipid content* according to HORWIRTZ (1990); *ash content* according to INSTITUTO ADOLFO LUTZ (1990). **Microbiological Evaluations:** total and faecal coliforms, *Salmonella* and sulphite reducing clostridia according to the American Public Health Association (1992). **Sensory evaluation:** consumer acceptance test based on the methodology of MEILGAARD *et al* (1999), using 30 panelists, frequent consumers of salami, that evaluated *overall acceptance*, *taste*, *firmness* and purchase *intent*.

Processing: The stuffed sausages (4.5 cm diameter) were kept in the fermenting chamber at 23 – 25^{O}C and R.H. 85-90% until pH readings were below 5.3. Next, they were cooked in dry air at 85°C until its internal temperature reached 63°C. After cooking, sausages were dried at 17-19°C and 75-70% RH for the period of time necessary to reach the desired water activities

Results and Discussion

According to AMI (1982) the recommended time to lower the sausages pH to 5.3 at 24°C would be 60 hours. All treatments studied complied with this recommendation as the time to lower pH to 5.3 was in the range 20-40h (Figure 1). Fermentation times were larger and final pH higher for sausages in the treatment with lower sugar content combined with culture 1 (T1, T2 - Table 1). The sausages of all treatments could be considered stable according to LEISTNER & RÖDEL (1975) definition of stable meat products, as water activities of products from all treatments were below 0.91.

Water, fat and protein contents (Table 1) respectively 40% (maximum), 35% (maximum) and 25% (minimum) complied with brazilian legislation (BRAZIL, 2000) for fermented sausages. Microbiological evaluation of the cooked and dried sausages showed that they also complied with brazilian legislation (ANVISA, 2001): no *Salmonella* on 25g; MPN of coliforms equal to 10^3/g; *Staphylococcus aureus* <5x10^3/g. Sugar content was the main factor in lowerring pH however there is evidence that the starter culture 2 also contributed to that. The targeted water activities were reached being significantly different ($p<0.05$) for treatments with the same sugar content and starter culture as aimed. From the acidity measurements was not possible to have a clear picture of the effects of the different treatments as differences observed between treatments were not statisticatly significant ($p>0.05$). Moisture as expected followed the same pattern of water activities. Shear force values were lower for sausages with higher water activity being not affected by either sugar or starter culture. Regarding the sensory attributes the mean scores were higher for different treatments with no clear trends emerging. So it was not possible to link consumer purchase intent lowest for T3 (46.7%) and highest for T7 (70.0%) to sensory characteristics.

Conclusions

All treatments resulted in products with good acceptance by consumers.

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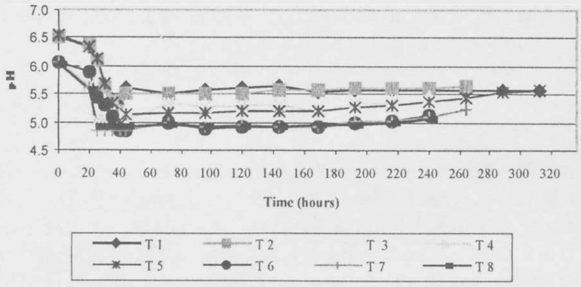

Figure 1. pH variation of the chicken cooked fermented sausage during fermentation and drying.

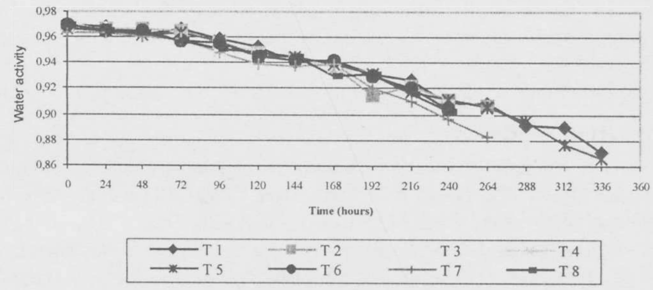

Figure 2. Water activity of the chicken cooked fermented sausage during fermentation and drying.

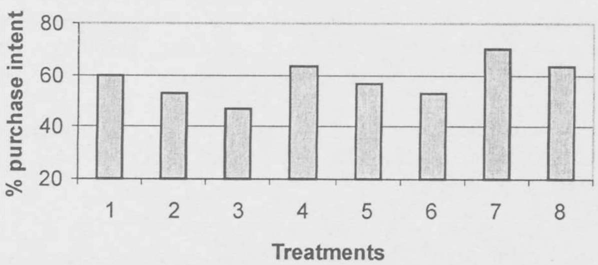

Figure 3. Consumer's purchase intent of the chicken cooked fermented sausage

Table 1. The 2^3 complete factorial design

Treatments	Sugar (%)	Starter culture	Water activity
T1	0.4	1	0.87-0.88
T2	0.4	1	0.90-0.91
T3	0.4	2	0.87-0.88
T4	0.4	2	0.90-0.91
T5	0.75	1	0.87-0.88
T6	0.75	1	0.90-0.91
T7	0.75	2	0.87-0.88
T8	0.75	2	0.90-0.91

Table 2. Physical, chemical and sensorys caracteristics of the chicken cooked fermented sausages

	Treatments							
	T1	T2	T3	T4	T5	T6	T7	T8
pH	$5.7^{a,b} \pm 0.1$	$5.9^{a} \pm 0.1$	$5.6^{b,c} \pm 0.1$	$5.6^{b,c} \pm 0.3$	$5.5^{b,c,d} \pm 0.1$	$5.3^{c,d} \pm 0.3$	$5.3^{c,d} \pm 0.3$	$5.2^{d} \pm 0.2$
Water activity	$0.87^{c} \pm 0.0$	$0.90^{a,b} \pm 0.0$	$0.88^{b,c} \pm 0.0$	$0.91^{a} \pm 0.0$	$0.87^{c} \pm 0.1$	$0.91^{a} \pm 0.0$	$0.88^{c} \pm 0.0$	$0.90^{a,b} \pm 0.0$
Acidity as lactic acid (%)	$0.4^{b,c} \pm 0.2$	$0.4^{b,c} \pm 0.1$	$0.3^{c} \pm 0.2$	$0.4^{b,c} \pm 0.1$	$0.5^{a,b} \pm 0.2$	$0.6^{a} \pm 0.3$	$0.4^{b,c} \pm 0.3$	$0.5^{a,b,c} \pm 0.2$
Moisture (%)	$33.8^{a,b} \pm 1.1$	$36.5^{a} \pm 1.5$	$34.7^{a,b} \pm 1.2$	$36.5^{a} \pm 2.2$	$31.8^{b} \pm 1.4$	$34.1^{a,b} \pm 2.1$	$33.4^{a,b} \pm 2.4$	$36.1^{a} \pm 1.9$
Protein (%)	$28.4^{a,b,c} \pm 0.4$	$26.5^{c,d} \pm 0.4$	$29.7^{a,b} \pm 0.6$	$27.0^{a,b,c} \pm 2.5$	$30.0^{a,b} \pm 0.2$	$24.7^{d} \pm 2.9$	$30.4^{a} \pm 1.3$	$27.2^{b,c,d} \pm 0.4$
Fat (%)	28.5 ± 0.5	29.1 ± 0.8	29.1 ± 2.0	28.8 ± 1.0	31.5 ± 0.4	31.3 ± 2.2	30.8 ± 1.2	29.5 ± 4.1
Ash (%)	$6.3^{a,b} \pm 0.4$	$6.0^{a,b} \pm 0.0$	$6.1^{a,b} \pm 0.0$	$5.6^{b} \pm 0.1$	$7,1^{a} \pm 0.4$	$5.8^{b} \pm 0.5$	$6.2^{a,b} \pm 0.3$	$5.7^{b} \pm 0.3$
Shear force (kgf)	$4.0^{a,b,c} \pm 0.4$	$2.9^{c} \pm 0.4$	$4.2^{a,b} \pm 1.5$	$3.1^{c} \pm 0.4$	$4.2^{a,b} \pm 0.7$	$3.2^{b,c} \pm 0.6$	$4.9^{a} \pm 0.1$	$3.5^{b,c} \pm 0.6$
Overall acceptance	$5.5^{a,b} \pm 1.2$	$5.4^{a,b} \pm 1.1$	$5.3^{a,b} \pm 0.8$	$5.7^{a} \pm 0.9$	$5.7^{a} \pm 0.9$	$5.0^{b} \pm 1.0$	$5.2^{a,b} \pm 0.9$	$5.3^{a,b} \pm 0.8$
Taste	$5.2^{a,b} \pm 1.5$	$5.6^{a} \pm 1.2$	$4.7^{b} \pm 1.4$	$5.5^{a,b} \pm 0.8$	$5.8^{a} \pm 1.0$	$5.1^{a,b} \pm 1.3$	$5.5^{a,b} \pm 0.8$	$5.5^{a,b} \pm 0.8$
Firmness	$5.6^{a} \pm 1.2$	$5.8^{a} \pm 0.8$	$4.7^{a,b} \pm 1.2$	$5.3^{a,b} \pm 1.2$	$5.3^{a,b} \pm 1.6$	$5.4^{a,b} \pm 1.0$	$5.3^{a,b} \pm 1.1$	$5.6^{a,b} \pm 1.0$
Slice color	$5.9^{a} \pm 1.2$	$5.6^{a,b} \pm 1.3$	$5.6^{a,b} \pm 0.9$	$5.7^{a} \pm 0.7$	$5.7^{a} \pm 1.4$	$4.9^{b} \pm 1.2$	$5.5^{a,b} \pm 0.7$	$5.3^{a,b} \pm 0.7$

Means folowed by different superscrits in the same line are different at $p < 0.05$.