Effect of the addition of collagen to Italian type salami on color and moisture parameters

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I. INTRODUCTION

Collagen is a structural protein that can be found in the dermis, bones, tendons, cartilage, ligaments, and other tissues, including the organs of animals [1]. It has several industrial applications, due to its characteristics, such as neutral odor, colorless, low viscosity in aqueous solution, acts as a stabilizer and emulsifier, as well as forming foam and films [2]. In meat products, the addition of collagen improves the gelling capacity, water retention, and protein content, as well as the sensory properties of the products [3]. The aim of this study was to evaluate the effects of the collagen fiber addition to Italian type salami with salt reduction on moisture and instrumental color.

II. MATERIALS AND METHODS

The salami was produced by mixing the ingredients in an automatic blender (Frigomaq, Chapecó, Brazil) for 10 minutes. Then, the samples were stuffed in collagen cases (diameter of 70 mm) of 20 cm and conducted to maturation for about 29 to 47 days at a temperature of 15-25 °C and relative humidity of 75-95 %, until a water activity of 0.90 has been reached. Therefore, the ripening time was different between the treatments. Six treatments were carried out, three with 2.5% sodium chloride (NaCl): without collagen - **CON**, 0.25% collagen - **T25**, 0.5% collagen - **T50**. And three with 1.25% NaCl: without collagen - **TR**, 0.25% collagen - **TR25**, 0.5% collagen **TR50**. The moisture content was determined according to the official method of the AOAC [4]. A Colorflex 45/0 spectrophotometer (HunterLab, Reston, USA) was used to determine the color parameters through the CIELAB system of color specifications. The results were analyzed for analysis of variance (ANOVA two ways) using the General Linear Model (GLM) and the means were compared using post-hoc Tukey test ($p < 0.05$) with STATISTICA 7.0 (StatSoft, Inc., 2004) software.

III. RESULTS AND DISCUSSION

The addition of collagen (0.50 %) contributed to an increase ($p < 0.05$) in the moisture in Italian type salami on day zero (Table 1), where TR50 presented the higher moisture value and it was similar to T50 and CON (67.07 %, 65.79 % and 62.54 %, respectively).

Table 1. Moisture of Italian type salami (%).

Treatments	Days							
	0	3	13	23	33	40	43	47
CON	62.54^{ab}	55.57	47.78^{a}	42.53	37.75^{b}	-	-	-
T25	61.15^{b}	56.20	47.93^{a}	44.84	38.97^{ab}	-	-	-
T50	65.79^{ab}	56.33	44.66^{b}	42.36	-	-	-	-
TR	60.98^{b}	55.85	49.01^{a}	43.44	39.04^{ab}	36.23	35.58^{b}	34.87
TR25	61.80^{b}	57.10	48.79^{a}	45.54	40.00^{a}	36.83	35.55^{b}	-
TR50	67.07^{a}	56.14	48.13^{a}	42.98	40.47^{a}	39.23	38.63^{a}	-
SEM	0.604	0.539	0.412	0.371	0.287	0.619	0.484	-
p-value	0.002	0.984	0.001	0.057	0.014	0.117	0.000	-

$^{a-b}$ Means followed by different letters in the same column differ by Tukey Test ($p \leq 0.05$); SEM – standard error of the mean. CON – without collagen and 2.5 % NaCl; T25 – 0.25 % collagen and 2.5 % NaCl; T50 – 0.5 % collagen and 2.5

% NaCl; TR – without collagen and 1.25 % NaCl; TR25 – 0.25 % collagen and 1.25 % NaCl; TR50 – 0.5 % collagen and 1.25 % NaCl.

The same concentration provided higher ($p < 0.05$) moisture for T50 at 13 days and for TR50 at 43 days when this treatment was ready for consumption with ideal water activity and higher moisture than TR ($p < 0.05$), which reached optimum water activity only at 47 days.

The L* values ranged from 54.40 to 56.09 and no difference was observed ($p > 0.05$) between the treatments of the Italian type salami (Table 2). The 50% reduction in NaCl and the addition of 0.5% collagen (TR50) provided the highest a* values with greater redness than the CON, T25 and T50 treatments ($p < 0.05$). In addition, TR50 showed the lowest whiteness value, different from the CON and TR treatments. The reduction of NaCl increased the b* value of Italian type salami, with the TR, TR25 and TR50 treatments being similar to each other but different from CON, T25 and T50 ($p < 0.05$) and collagen did not affect on this parameter.

Table 2. Color parameters of Italian type salami.

Treatments	L*	a*	b*	Whiteness
CON	55.87	8.95^{c}	9.15^{b}	54.03^{a}
T25	55.02	9.52^{bc}	9.56^{b}	53.01^{ab}
T50	54.55	9.55^{bc}	9.44^{b}	52.57^{ab}
TR	56.09	9.86^{ab}	11.11^{a}	54.09^{a}
TR25	55.54	9.80^{ab}	10.59^{a}	53.24^{ab}
TR50	54.40	10.32^{a}	10.80^{a}	52.01^{b}
SEM	0.194	0.068	0.078	0.199
p-value	0.056	0.000	0.000	0.014

$^{a-c}$ Means followed by different letters in the same column differ by Tukey Test ($p \leq 0.05$); *SEM* – standard error of the mean. CON – without collagen and 2.5 % NaCl; T25 – 0.25 % collagen and 2.5 % NaCl; T50 – 0.5 % collagen and 2.5 % NaCl; TR – without collagen and 1.25 % NaCl; TR25 – 0.25 % collagen and 1.25 % NaCl; TR50 – 0.5 % collagen and 1.25 % NaCl.

IV. CONCLUSION

The results show that the reduction of NaCl did not affect the moisture content but increased the ripening time of Italian salami. The addition of collagen, especially at a concentration of 0.5%, has the potential to contribute to the moisture and color parameters of Italian type salami, such as a* value and whiteness.

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