

# PHYSICOCHEMICAL CHARACTERISTICS OF LOW-FAT, LOW-SALT FRESH SHEEP MEAT SAUSAGE

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**Abstract** – This study evaluated the centesimal composition of fresh sheep meat sausages prepared with passion fruit meal and potassium chloride (KCl). Seven formulations were prepared, six containing different percentages of passion fruit meal and KCl, and one control. Centesimal composition analysis showed that formulations F1, F2, and F3 had low fat contents, which were reduced by 59% with the addition of passion fruit meal, compared with the control. No significant difference was observed in sodium levels, probably due to the presence of sodium nitrite and sodium erythorbate in formulations. The formulations are in accordance with the quality standards defined for the fresh sausages. Formulations F1, F2 and F3 presented a reduction of approximately 40% in fat content, and F2 and F3 had a non-significant decrease in sodium levels. F3 showed the best results.

## I. INTRODUCTION

Fresh sausage is a raw meat product containing pork fat and other ingredients to improve properties like texture, conservation and flavor. However, these ingredients have high sodium and fat levels (1, 2, 3, 4).

Sodium, calorie and alcohol excess as well as deficiency in calcium and potassium are the main nutrition factors associated with systemic arterial hypertension (SAH), as well as the interaction between genetic and environmental variables (5, 6). SAH prevalence is high in the Brazilian population, and affects approximately 10% to 45% of the country's adult population (7, 8, 6) and between 1% and 2% of children and teenagers (9).

The excessive consumption of fat may cause health problems such as arteriosclerosis, colon cancer, obesity and others. Therefore, consumers today prefer low-fat foods that retain the sensory characteristics of more traditional products (10). The present study evaluated the influence of passion fruit meal and potassium chloride (KCl) in the

physicochemical characteristics of fresh sheep meat sausages.

## II. MATERIAL AND METHODS

Sheep shoulder blade cuts and pork fat were used in sausage formulations. All ingredients were purchased in local shops and appropriately inspected. Passion fruit meal was prepared in the Laboratory of Food Technology, (LTA, UENF).

Experiments were carried out in Federal Institute Espírito Santo (IFES), in Alegre, state of Espírito Santo (ES), and in LTA-UENF.

Seven formulations were prepared with fresh sheep meat, one of which was used as control. All formulations were defined after five pretests, which established acceptable levels of fat and sodium. Table 1 shows the decrease in fat and sodium in each formulation.

**Table 1.** Reduction of fat and NaCl levels in fresh sheep meat sausages (%).

Formulation	Fat	NaCl
Control	0	0
F1	59	0
F2	59	50
F3	59	25
F4	31	0
F5	31	50
F6	31	25

Fat was partially replaced by passion fruit meal, according to Oliveira (11), containing on average 26.4% pectin. Reduction of sodium levels was carried out replacing NaCl by KCl. Formulations are presented in Table 2.

**Table 2.** Composition of the seven fresh sheep meat sausage formulations (%).

Raw material	Control	F1	F2	F3	F4	F5	F6
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Sheep meat	76.66	82.36	82.36	82.36	80.30	80.30	80.30
Fat	20.00	8.20	8.20	8.20	13.80	13.80	13.80
Salt (NaCl)	2.20	2.20	1.10	1.60	2.20	1.10	1.60
KCl	0.00	0.00	1.10	0.50	0.00	1.10	0.50
Sugar	0.095	0.00	0.00	0.00	0.00	0.00	0.00
Water	1.00	4.70	4.70	4.70	2.30	2.30	2.30
Passion fruit meal	0.00	2.40	2.40	2.40	1.20	1.20	1.20
Sodium nitrite	0.015	0.00	0.00	0.00	0.00	0.00	0.00
Sodium erythorbate	0.025	0.00	0.00	0.00	0.00	0.00	0.00

The data obtained were submitted to Analysis of Variance (ANOVA) and the Student-Newman-Keuls (SNK) test in the software SAS version 9.3 (12).

### III. RESULTS AND DISCUSSION

Table 3 shows the results of the analyses fresh sheep meat sausage composition.

**Table 3.** Means (%) and standard deviations (SD) of centesimal compositions of sausage formulations and quality standards for fresh sheep meat sausage composition.

Raw material	Fat	Protein	Water	Na g/100g
Control	18.03 <sup>a</sup> ± 1.24	16.30 <sup>a</sup> ± 0.33	59.86 <sup>d</sup> ± 0.84	889.14 <sup>a</sup> ± 114.09
F1	10.12 <sup>d</sup> ± 0.65	17.04 <sup>a</sup> ± 0.71	66.19 <sup>a</sup> ± 0.43	908.43 <sup>a</sup> ± 48.00
F2	10.55 <sup>d</sup> ± 0.70	16.78 <sup>a</sup> ± 1.23	65.01 <sup>a</sup> ± 0.60	812.20 <sup>a</sup> ± 134.40
F3	10.33 <sup>d</sup> ± 0.29	17.01 <sup>a</sup> ± 0.90	65.47 <sup>a</sup> ± 0.34	797.54 <sup>a</sup> ± 80.00
F4	13.50 <sup>bc</sup> ± 0.77	16.07 <sup>a</sup> ± 1.86	63.24 <sup>b</sup> ± 0.75	831.86 <sup>a</sup> ± 107.62
F5	14.61 <sup>b</sup> ± 0.65	17.01 <sup>a</sup> ± 0.75	61.09 <sup>c</sup> ± 0.95	901.92 <sup>a</sup> ± 124.34
F6	12.92 <sup>c</sup> ± 0.56	16.10 <sup>a</sup> ± 1.30	62.27 <sup>b</sup> ± 0.61	886.02 <sup>a</sup> ± 115.57
Quality standard	≤ 30.00	≥ 12.00	≤ 70.00	

Centesimal composition of the seven formulations of raw sheep meat sausage was in accordance with the quality standards for the product, defined by the Ministry of Agriculture, Livestock and Food Supply (1).

The results for formulations F1, F2 e F3 did not differ in fat levels ( $p > 0.05$ ). The same was observed for F4 and F5, and F4 and F6. In the present study, mean fat level of formulations F1, F2

and F3 was approximately 40% lower, and the decrease in fat/100 g solids was greater than 3 g. These formulations are categorized as light products, that is, those that present low fat levels, compared with conventional products, as defined by Resolution 27, Health Ministry, from 13/1/1998 (13), replaced by Resolution 54, from 12/11/2012 (14). The formulations are according to the quality standards for fresh meat sausages, which establishes a maximum of 30% fat (1).

Tobin et al. (15) analyzed 20 samples of frankfurters produced in Ireland containing different salt and fat levels. Fat levels varied between 9.61% and 25.42% (mean: 17.52%), which differed from those reported in the present study. Tobin et al. (16) analyzed 28 samples of pork breakfast sausages also produced in Ireland, with variable contents of salt and fat. The values observed ranged between 22.27% and 37.98% (mean: 30.00%). These values also differed from those obtained in the present study. These differences may be due to the raw material used and fat levels, which were higher than those used here.

Regarding sodium levels no difference was detected ( $p > 0.05$ ) between formulations, due to the use of sodium nitrite and sodium erythorbate. The replacement of NaCl by KCl did not lead to a decrease in sodium levels. Carraro et al. (17) reported that sodium levels did not fall in mortadella, due to the presence of sodium erythorbate and sodium polyphosphate in formulations, confirming the values obtained in the present study. However, Corral et al. (18) observed a decrease in sodium levels in fermented encased meat products.

### IV. CONCLUSION

The formulations prepared in the present study met the quality standards defined for fresh sausages. Formulations F1, F2 and F3 met the requirements in Resolution 54/2012, Brazilian Health Ministry, which specifies low-fat products. Formulation F3 afforded the best results in the present study. However, further studies are necessary to assess the sensorial acceptance of this product.

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