FORMULATION OF SAUSAGE WITH ADDED PORK TESTICLES AS AN OFFAL INGREDIENT

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Abstract – The immunocastration is a reality in swine production which currently aims to animal welfare, improve carcass characteristics and meat quality. However this management provides the testicle as a new raw material in the process, this viscera has an important physical characteristics in their chemical composition, such as the quantity of protein (12%) and collagen (10%). The protein and collagen help to improve technological characteristics and sensory attributes in processed meat products. Therefore, it has the potential to be incorporated in formulations of products such as sausage, once the meat-processing industry strives to optimize the use of all tissues provides of the animals. The sensory analysis conducted with consumers has shown that the addition of porcine testicle in sausage is feasible, since there are no significant difference (p >0.05) between the sausage containing testicle and control (without testicle).

Key Words – Acceptance, Immunocastration, Texture profile analysis

I. INTRODUCTION

Immunocastration has become a increasingly and widely used option in worldwide pork production, replacing traditional castration, avoiding boar taint, improving carcass and meat characteristics [1], and also decreasing aggressive behavior [2], and keeping the animal welfare principles. This technology requires adaptation and innovation by industry, since immunocastrated animals are slaughtered with testicles. Testicles has become a new raw material to be worked and utilized aiming a sustainable development and a total utilization of animal tissues once industry is looking constantly for new strategies in order to reach a feasible and profitable production. This material may be considered an offal to be applied in meat products, as in its composition there are a good protein (12%) and collagen (10%) content in its concentration and it is well known that protein and collagen contribute to improving some quality attributes, as water binding, purge, processing yield, juiciness or even blend cost in processed meats [3].

The aim of this experiment was to analyze the effects of adding testicles in a sausage and the physicochemical, texture and sensory analysis.

II. MATERIALS AND METHODS

The experimental sausages were manufactured in a pilot plant. Table 1 shows the formulations of treatment S1 and S2. Each treatment was characterized by 10kg batch and used 21mm diameter casings, weighing 50g/each unit, summing around 100 sample units.

Table 1. Cooked sausage formulations.

	Formulations Percentage	
Ingredients	S1	S2
Testicle	0.00	20.00
Pork meat	59.92	47.32
Pork fat	20.00	19.00
Water	15.27	5.87
Maltodextrin	1.8	1.8
Salt (NaCl)	1.60	1.60
Antioxidant	0.30	0.30
Phosphate	0.40	0.40
Curing Salt	0.20	0.20
Spices	0.40	0.40
Carmine	0.03	0.03
Corn Starch	0.00	2.00
Isolated soy protein	0.00	1.00
Liquid smoke	0.08	0.08

Sausages were cooked in a through all the regular steps using industrial oven until the inside temperature of the product reached 72-75 °C.

The physicochemical composition of each treatment was performed according Horwitz [4].

The texture analysis was carried out through texture profile analysis (TPA) [5] under the following conditions: sausage samples from two treatments cut into 2.0cm length at 22ºC, model – TA-XT 2i (Stable Micro Systems Ltda.) and compressed axially in two consecutive cycles of 50% compression with a 35mm diameter probe (P/36R), at a constant 0.8mm/s speed, 25kg cell charge (force per area).

Acceptance testing was conducted in individual cabins illuminated by white fluorescent light and the data was computerized using the Compusense software system. Consumers were invited to voluntarily participate.

Samples were provided to panelists according to a balanced complete blocks [6] in monadic form, in disposable plastic pots with the lids coded with three-digit numbers.

Two samples were evaluated by 51 sausage consumers. Acceptance of appearance, odor, texture, flavor and overall acceptability were investigated. Consumers recorded their acceptance grades in a 9-point structured hedonic scale [7].

Experiment data was submitted to the following statistical analysis:

(1) Variance Analysis;

(2) Means comparison test of Tukey (HSD) at 5% significance ($p<0.05$) using SAS software.

III. RESULTS AND DISCUSSION

Table 2 shows the physical-chemical composition of testicle, pork meat and pork fat used in the formulation of sausages. Testicles has more moisture, because of this the amounts of water in the formulation of treatment S2 (added of testicle) were lower. The analysis of treatments S1 and S2 is shown in Table 3.

Table 2. Physical-chemical composition of testicle, pork meat and pork fat.

	Testicle	Pork meat	Pork fat
Ashes(g/100g)	1.07±0.02	1.12±0.02	0.24±0.01
Fat (g/100g)	2.31±0.04	2.90±0.14	83.92±0.94
Protein (g/100g)	12.06±0.25	21.79±0.35	4.20±0.08
Moisture (g/100g)	85.67±0.07	75.90±0.18	16.84±0.84

Texture properties of treatments S1 and S2 were analyzed through Texture Profile Analysis (TPA), where it was analyzed the hardness, springiness, cohesiveness and chewiness parameters. Results are presented in Table 4.

As it can be seen that the parameters of texture profile presented values with no significant difference ($p>0.05$) between treatments S1 and S2.

Table 3. Physical-chemical composition of two sausage formulations.

	S1	S2
Aw	0.972	0.971
Ashes(g/100g)	2.80	2.91
pH	5.79	5.89
Fat (g/100g)	20.65	18.66
Protein (g/100g)	15.59	15.91
Moisture (g/100g)	59.49	59.06

Table 4. Texture profile evaluation of the sausage samples.

	S1	S2
Hardness (g)	4277.2 [a] ± 796.1	4011.7 [a] ± 819.9
Springiness	0.886 [a] ± 0.016	0.881 [a] ± 0.016
Cohesiveness	0.669 [a] ± 0.018	0.669 [a] ± 0.045
Chewiness	2524.0 [a] ± 418.0	2369.1 [a] ± 494.2

Means ± standard error.

Means with same lowercase superscript letters in the same row do not differ significantly ($p<0.05$) according Tukey test.

Andrade [8], working with aspects of quality characterization for commercial sausages, found the following results: hardness mean value 2296.8g; springiness mean value 0.939; cohesiveness mean value 0.555 and chewiness mean value 1195.1. Springiness and cohesiveness values of the present experiment were close to this presented by Andrade [8], otherwise the values for hardness and chewiness were higher than that found by the author.

López-López *et al*. [9] found that parameters of springiness, cohesiveness, chewiness and hardness of sausages were affected ($p<0.01$) by formulation and time of cold storage. Sausages prepared with olive oil (5% olive oil and 4% pork fat) presented higher values of hardness and chewiness, and lower springiness and cohesiveness than control (9.5% pork fat).

Results for sensory evaluation may be noted at Table 5, which shows the consumers answers distribution in three zones: rejection values between 1 and 4, indifference value equal to 5 and acceptance values between 6 and 9.

Data from Table 5 shows that both evaluated sausages obtained a high acceptance percentage, up to 70.0%, and a low rejection percentage, below 24.0%. Odor obtained the higher acceptance (90.2% for S1 and 88.2% for S2) and a rejection of 3.9% and 7.9%, respectively. Flavor appeared with an acceptance of about 80.0% for both products.

Table 5. Consumers percentage in range scale.

	S1	S2
Odor		
Acceptance	90.2	88.2
Indiference	5.9	3.9
Rejection	3.9	7.9
Appearance		
Acceptance	74.6	84.4
Indiference	3.9	3.9
Rejection	21.6	11.8
Flavor		
Acceptance	84.3	80.5
Indifference	5.9	7.8
Rejection	9.8	11.8
Texture		
Acceptance	70.6	84.3
Indiference	5.9	2.0
Rejection	23.5	13.7
Overall Acceptability		
Acceptance	80.4	80.5
Indiference	7.8	5.9
Rejection	11.8	13.7

Hedonic scale range– Acceptance: 9 to 6; Indifference: 5; Rejection: 4 to 1.

Table 6. Results of acceptance test for evaluated samples.

	S1	**S2**	LSD
Odor	$7.0^{a} \pm 1.2$	$7.0^{a} \pm 1.3$	0.38
Appearance	$6.2^{a} \pm 1.8$	$6.4^{a} \pm 1.4$	0.39
Flavor	$6.8^{a} \pm 1.4$	$6.5^{a} \pm 1.5$	0.41
Texture	$6.2^{a} \pm 2.0$	$6.6^{a} \pm 1.6$	0.53
Overall acceptability	$6.6^{a} \pm 1.6$	$6.4^{a} \pm 1.6$	0.40

Means ± standard error.
Means with same lowerscript letters in the same row do not differ significantly ($p>0.05$) according Tukey test.
LSD: least significant difference.

Texture from S1 was the attribute with the lower acceptance, 70.6% and higher rejection, 23.5%, followed by appearance attribute, with 74.6% of acceptance and 21.6% of rejection. For overall acceptability both treatments obtained an acceptance index of 80.0%.

Comparing these two products (Table 6) according odor, appearance, texture and overall acceptability, it appears that there was no statistical difference (at 5% of significance) between sausage samples. Products obtained average notes between 6 (liked slightly) and 7 (liked moderately) for evaluated characteristics.

IV. CONCLUSION

Both treatments (S1 and S2) obtained good acceptance among the consumers.

It was advantageous the use of testicles into sausage (emulsified meat products) and the product with testicle did not present difference from control treatment.

The use of testicles in sausage may be considered a profitable alternative to applying this offal as so this practice also would bear more utility and value to this product as being aggregated into meat products.

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