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Evaluación sensorial de embutido tipo chorizo a base de carne de conejo

Sensorial assessment of “chorizo” as a type of sausage based on rabbit meat

Cruz-Bacab Luis* lecb82@gmail.com, **Baeza-Mendoza Lourdes** lulubaez75@hotmail.com, **Pérez-Robles Leonor** leoperezrobles@hotmail.com, **Martínez-Molina Itzel** itzelmtnez@gmail.com

División Académica de Ciencias Agropecuarias, Universidad Juárez Autónoma de Tabasco. México. *Author responsible and correspondence: Cruz-Bacab Luis. División Académica de Ciencias Agropecuarias, Universidad Juárez Autónoma de Tabasco, Carretera Villahermosa – Teapa, Km 25, R/a La Huasteca 2a Sección, Villahermosa, Tabasco, México C.P. 86040

RESUMEN

La carne de conejo es una opción viable para cubrir las demandas cualitativas y nutricionales de los consumidores actuales, debido a su fácil digestión, alto contenido proteico y de ácidos grasos insaturados, baja concentración de grasa. A pesar de sus características nutricionales, esta carne, no posee aceptación generalizada en México, por lo cual, es necesario desarrollar productos que favorezcan su aceptación. En el presente estudio, se realizaron dos experimentos mediante pruebas sensoriales para evaluar la aceptación de un embutido tipo chorizo elaborado a base de carne de conejo. El experimento uno consistió en una prueba sensorial del embutido con 24 horas de reposo posteriores a su elaboración, a través de una escala hedónica con valores del 1 al 10 donde 1 correspondió a la puntuación más baja y 10 a la más alta. El experimento dos fue desarrollado mediante una prueba sensorial para un embutido madurado a 48, 120, 216 y 312, con la escala hedónica establecida para el experimento uno. Los aspectos evaluados del producto fueron: color, olor, sabor, textura y global, los resultados obtenidos fueron analizados mediante estadística descriptiva y análisis de varianza. En conclusión, el embutido fue aceptado por los participantes en ambos experimentos. En el experimento dos, el mayor nivel de aceptación correspondió a 216 horas de maduración ($P<0.05$).

Palabras Clave: Evaluación sensorial, maduración, *Oryctolagus cuniculus*

ABSTRACT

Rabbit meat is a viable option to meet the qualitative and nutritional demands of the current consumers, due to its easy digestion, high protein content and unsaturated fatty acids, low-fat concentration. Despite its nutritional characteristics, this meat is not widely accepted in Mexico, so it is necessary to develop products that favor its acceptance. In the present study, two experiments were carried out using sensory tests to evaluate the acceptance of a sausage type made from rabbit meat. Experiment one consisted of a sensorial test of the sausage with 24 hours of rest after its elaboration, through a hedonic scale with values from 1 to 10 where 1 corresponded to the lowest score and 10 to the highest. Experiment two was developed by a sensorial test for a matured sausage at 48, 120, 216 and 312 hours, with the hedonic scale established for experiment one. The evaluated aspects of the product were: color, smell, flavor, texture and overall, the results were analyzed by means of descriptive statistics and analysis of variance. In conclusion, the sausage was accepted by the participants in both experiments. In experiment two, the highest level of acceptance corresponded to 216 hours of maturation ($P <0.05$).

Keywords: Maturation, *Oryctolagus cuniculus,* sensory evaluation.

INTRODUCTION

Currently, the aim is to develop a more dietetic and healthy meat production, to reduce the content of saturated fatty acids and to increase unsaturated fatty acids in meat (Dalle Zotte, 2002). The nutritional value of meat has increased its significance as a factor for acceptance among consumers (Weiss *et al*., 2010), leading the meat industry to experience an increase in the demand for reduced fat, cholesterol, sodium and nitrite products or enriched with fatty acids, and consequently the volume and variety of products with these characteristics, especially sausages have increased (Araya-Quesada *et al*., 2014).

The chorizo is a cured raw sausage of Spanish origin, whose elaboration has spread all over the world; its formulation and processing vary by country, and even in each region (Jiménez-Colmenero *et al*., 2013); making viable the use of meat of species other than the pig (Cobos *et al*., 2014). Rabbit meat is a lean meat of high protein value, in contrast to red meat; rabbit meat is of low caloric value because of its low fat content, representing a healthy alternative for human food (Dalle Zote and Szendro 2011, McNitt *et al*., 2011, Nistor *et al*., 2013).

The elaboration and diversification of products based on rabbit meat can favor their consumption and acceptance in the commercial market (Petracci and Cavani, 2013, Dalle-Zotte, 2014, Lenkgey and Lobo, 2016). The development of innovative products such as sausages is an option to improve the consumption of rabbit meat and preserve human health (Castillo et al., 2013).

The objective of the present work was to evaluate the acceptance of a sausage type "chorizo" based on rabbit meat through sensorial tests.

MATERIAL AND METHODS

Experiment 1

For the production of the product was used meat of rabbits of New Zealand breed of 90 days old, the grinding of the meat was carried out with an electric mill of the mark Torrey, model M-12-Fs 3/4HP. Subsequently, salt, nitrous salt, garlic, paprika, oregano, cumin all in powder, vinegar and colored chili were added according to the formulation presented

in Table 1. The ingredients were mixed manually to a homogeneous mass. The mixture was allowed to stand for 24 hours at 4 °C; later it was embedded in pork gut, making ties with thread to give the traditional form of the "chorizo". Once the sausage was made, it was subjected to 140 °C for 15 minutes in edible oil for frying. Once the fried sausage was obtained it was sectioned in samples of approximately 20-25 grams of weight, which were offered to 150 participants to carry out the sensorial test with a single time of maturation (Figure 1).

Experiment 2

For the elaboration of the product, the grinding of the meat was carried out with an electric mill, and then the ingredients were integrated: salt, paprika, garlic, nitro salt, oregano, cumin powder, vinegar, chili of color and chili guajillo scalded, according to the formulation presented in Table 1. After mixing the meat with the ingredients, it was allowed to mature for 24 hours, and then it was stuffed into pork gut previously prepared for the preparation of sausages. After drawing, sensory tests were performed at different maturation times. For the sensory tests, samples of "chorizo" were subjected to 140 ° C for 15 minutes in edible oil for frying. Once the fried "chorizo" was obtained, it was sectioned in samples of approximately 20 - 25 grams of weight, which were offered to 150 participants in each day of evaluation. The established maturation times for the sensory tests were 48, 120, 216 and 312 hours; between each sensory test the "chorizo" was stored in refrigeration at 4 ° C (Figure 2).

Table 1. Formulated sausage type "chorizo" made from rabbit meat

Ingredients	Experiment 1	Experiment 2
	%	%
Meat	89.84	88.30
Salt	0.89	0.88
Nitrous salt	0.45	0.44
Garlic powder	0.27	0.26
Paprika (Spanish pepper)	1.79	1.76
Oregano	0.17	0.17
Cumin powder	0.17	0.17
Vinegar	4.49	4.41
Color chili	1.88	1.85
Chili Guajillo	-	1.71

Sensory test

The sensorial test was carried out in the meat workshop of the Academic Division of Agricultural Sciences of the Autonomous Juárez University of Tabasco. To carry out the test a similar preparation was carried out as would be done by a common consumer. In both experiments the sensorial test was based on a structured hedonic scale of 10 points, considering the rating of 10 (I like it very much), until 1 (I dislike much). The minimum value to consider the product as accepted was 6 points overall. The evaluated attributes were: color, smell, taste and texture; additionally each participant issued a "global" rating on the product (Table 2).

Table 2. Chemical composition and energy value of rabbit meat (source Dalle Zotte and Szendro 2011)

	Forelegs		Loin		Thigh		Carcass	
	Average	D.E.	Average	D.E.	Average	D.E.	Average	D.E.
Water g/100g	69.5	± 1.3	74.6	± 1.4	73.8	± 0.8	69.7	± 2.6
Protein g/100g	18.6	± 0.4	22.4	± 1.3	21.7	± 0.7	20.3	± 1.6
Lipids g/100g	8.8	± 2.5	1.8	± 1.5	3.4	± 1.1	8.4	± 2.3
Ash g/100g	-	-	1.2	± 0.1	1.2	± 0.05	1.8	± 1.3
Energy kJ/100g	899	± 47	603	-	658	± 17	789	± 11

For both tests a panel of 150 untrained judges was used for a single maturation time in experiment 1; in Experiment 2, 150 untrained judges were used for each of the maturation times.

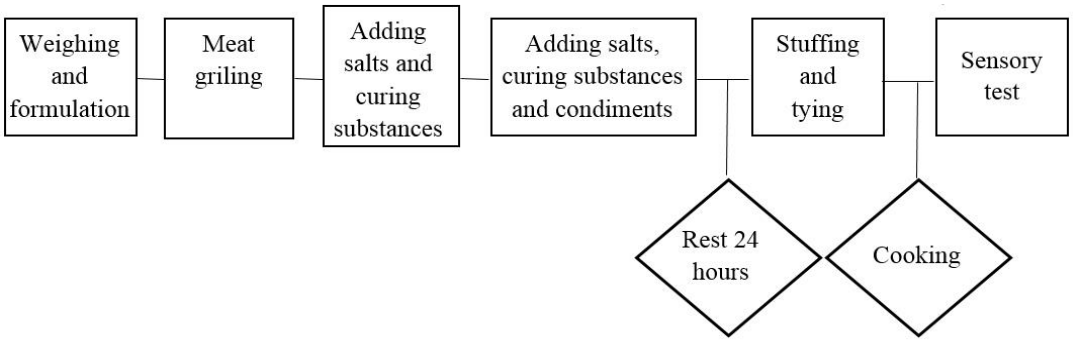

Figure 1. Flow diagram Experiment 1.

Statistical analysis

The experimental design for both experiments was completely randomized and the statistical analysis of the results obtained; descriptive statistics and analysis of variance were performed using statistical software Statgraphics 5.1.

RESULTS

In the present study it was observed that the sausage type "chorizo" based on rabbit meat in experiment 1, was accepted globally with a high score compared to the established in the study (Table 3); however, the "smell" aspect was rated below the acceptable score, and the "color" aspect had a low score with respect to the "taste" and "texture" aspects.

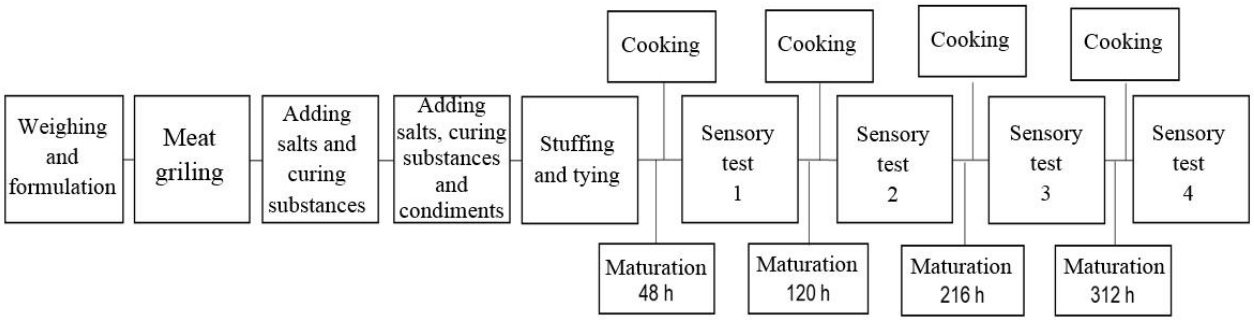

Figure 2. Experiment 2 Flowchart

Table 3. Evaluation of sensorial attributes of sausage type "chorizo" based on rabbit meat (experiment 1)

Attributes	Qualification	Standard deviation
Smell	5.4	2.17
Color	7.1	2.32
Taste	7.7c	1.86
Texture	7.6c	1.72
Global	8.3	1.50

In experiment 2, it was observed that a maturation of 216 hours significantly increased the acceptance of the sausage in all aspects evaluated (Table 3). The maturation time may play an important role in the acceptance of the sausage studied. As for the "smell" aspect, the score obtained in experiment 2 was higher in all maturation times with respect to experiment 1; with respect to "color" in experiment 2, the score was greater at 216 and 312 hours compared to experiment 1 (Table 4).

Table 4. Evaluation of sensorial attributes of sausage type "chorizo" based on rabbit meat with different maturation times (experiment 2)

	Maturation time (Hours)					
Attributes	48	120	216	312	Standard Deviation	P Value
Smell	6.9c	6.9c	7.7a	7.1b	1.93	0.0012
Color	6.8c	6.6c	7.4a	7.2b	1.94	0.0044
Taste	7.4c	7.1c	8.2a	7.7b	1.92	0.0000
Texture	7.2c	7.2c	8.1a	7.3b	1.83	0.0000
Global	7.8c	7.7c	8.6a	8.0b	1.48	0.0000

Different literals in the rows indicate statistically significant difference P <0.05.

DISCUSSION

Experiment 1

The current information about sausage based on rabbit meat and its acceptance are scarce. In the present study the results of experiment 1 show that the general acceptance of the product obtained an acceptable rating, (Wambui *et al*., 2016) mentions that in rabbit sausages there is a significant influence between the sensorial properties of the product and its chemical composition . In spite of having been accepted by the participants, the "color" aspect of the rabbit chorizo, obtained the lowest rating according to the established hedonic scale (Pérez and Andújar, 2000) and (Triki *et al*. 2013) mention that color is the factor that most influences the appearance of a product and acts as a selection factor by the consumer, however (Quintero - Salazar *et al*., 2011) states that the color assessment in sausages is mostly subjective. In the case of "chorizos" made in Mexico, (Guerrero *et al*., 2002) indicates that different varieties of *Capsicum spp*. in the formulations, being the guajillo chili the one that is used more frequently.

Authors such as (Gómez *et al.*, 2001), (Revilla and Vivar 2005) mention that variations in the color of sausages such as "chorizo" can be directly related to the majority composition of the sausage, amount of moisture or fat, as well such as the nature and quantity of dehydrated chili (pepper), or, if appropriate, paprika, used in the formulation; this is in agreement with what has been reported by Cobos *et al*. (2014) for rabbit "chorizo", in which color differences are directly related to the amount of fat and moisture, as well as the nature and quantity of chilli) dehydrated or ingredients such as paprika.

Additionally (Pérez-Dubé and Andujar-Robles, 2000) indicate that the addition of nitrates and nitrites is a factor that can exert an effect on the sausage color, since its addition favors the formation of nitrosomioglobin, which according to (Montes *et al*., 2013) is a pigment characteristic of curing. (González-Tenorio *et al*., 2013) reports that the appearance of extraneous colors not associated with product characteristics would result in their rejection; which coincides with the low score given to the chorizo "color" in experiment 1. Due to the above, in the present study, the proportion of paprika and guajillo chili used in the second experiment was modified to improve the "Color" ".

Experiment 2

In experiment 2, the sensory test showed that the overall acceptance of the sausage was higher with maturation during 216 hours, compared to the evaluated maturation times (48, 120 and 312) ($P < 0.05$). Currently the research on the maturation of rabbit-based meat products is scarce; (Koohmaraie *et al.,* 2002) points out that changes in tenderness of meat according to maturation time are related to the activity of the calpastatin/calpain enzyme complex in muscle fibers; said complex regulates the degradation rate of the protein, and consequently the quality of the meat.

Although the activity of the calpastatin/calpain enzyme complex was not evaluated in the present study and the information on its activity in rabbit meat is scarce, the results obtained by (Wang *et al*., 2016) indicate that the activity of calpastatin/calpain may be a potential indicator of the quality of rabbit meat, and consequently determine the characteristics of the products made with that meat. As for the evaluated aspects of the sausage: texture, color, smell and taste, the highest scores were obtained in sensory evaluation with a maturation of 216 hours ($P < 0.05$); these results are novel, because there are no bibliographical references for rabbit chorizo. (Acevedo *et al*., 2014) establishes that the "texture" aspect is directly influenced by the raw material; as well as the proportions of meat, fat, connective tissue in the product, the presence of starches or non-meat proteins in Catalan sausage (butifarra), which is a sausage elaboration and formulation similar to "chorizo".

In relation to the "color" aspect, in the experiment 2 the obtained score was higher with 216 h of maturation ($P < 0.05$), with respect to the maturation times evaluated, as well as the one obtained in experiment 1; this improvement in score can be related to the modification made to the formulation for experiment 2, in which chili guajillo was added. This agrees with (Cobos *et al*., 2014) who points out that, for rabbit "chorizo", the type and amount of chili used in the formulation directly affects the color of the sausage.

CONCLUSION

The sausage type "chorizo" based on rabbit meat was accepted by the panel of evaluators. Sensory perception of the product improved at 216 hours of maturation. It is necessary to evaluate the acceptance of "chorizo" made with rabbit meat vs sausages based on traditional meats, as well as the physico-chemical characterization of this sausage.

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