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Aromatic plants in the feeding of rabbits and their effect on meat

Plantas aromáticas en la alimentación de conejos y su efecto en la carne

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ABSTRACT

The present work was carried out in order to determine the effect of chamomile and rue inclusion, in the feeding process of fattening rabbits on the quality of the carcass and meat. For that reason, 24 rabbits were used at weaning and fattened for four weeks until reaching an average of 63 d of age. The rabbits were sacrificed and the quality of the carcass and meat was evaluated, morphometric measurements were taken, in addition to carrying out the dissection of the carcass. The main results indicate significant differences ($P < 0.05$) in the length of the carcass, the weight of hot and cold carcass, middle part, meat and pH of the meat, having better results in the treatment with rue. That is why it is concluded that this plant has the potential to be used as an improvement of the quality of carcass in fattening rabbits.

Keywords: carcass quality, rabbits, chamomile, rue.

RESUMEN

El presente trabajo se realizó con la finalidad de determinar el efecto de la inclusión de manzanilla y ruda en el alimento de conejos de engorda sobre la calidad de la canal y de la carne. Para ello se emplearon 24 conejos al destete y se engordaron por cuatro semanas hasta alcanzar un promedio de 63 d de edad. Los conejos fueron sacrificados y se evaluó la calidad de la canal y de la carne, para ello se tomaron medidas morfométricas, además de realizar la disección de la canal. Los resultados indican diferencias significativas ($P < 0.05$) en largo de la canal, peso de la canal caliente y fría, parte media, carne y pH de la carne resultando con mejores promedios en el tratamiento que contiene ruda. Es por ello que se concluye que esta planta tiene potencial para ser utilizada para mejorar la calidad de la canal en conejos de engorda.

Palabras clave: calidad de la canal, conejos, manzanilla, ruda.

INTRODUCTION

Some of the outstanding characteristics in rabbit meat in relation to other animal species is its nutritional composition, highlighting the profile of fatty acids, the protein quality, the content of vitamins and minerals; in addition, low content of cholesterol and sodium (Para, 2015). The per capita consumption of rabbit meat in Mexico fluctuates between 30 and 134 g (Armada, 2016). Cunicultural production in the country is mainly developed in Hidalgo states, Puebla, Mexico and Guanajuato state. The production of rabbits is encouraged from various programs, both governmental and non-governmental institutions; with the main purpose of promoting the self-consumption of this meat, either fresh or through various meat products.

The use of various essential oils of spices and herbs to feed animals has the purpose of improving the oxidative stability of meat (Kone *et al.*, 2016), reduce their microbial loads (Soultos *et al.*, 2009) and improve their productivity (Cardinali *et al.*, 2015). In the case of rue essential oils, their volatile compounds have been characterized, Franca and Nascimento (2015), found that the main volatile compounds are 2-nonanone and 2-undecanone; report antimicrobial activity against Gram positive and negative bacteria. Karp *et al.*, (2016), suggest that homeopathic use of rue can combat breast cancer in women; while Ghosh *et al.*, (2015), used ethanol extracts of rue to prevent skin cancer.

On the other hand, chamomile is a medicinal plant that is used as an antispasmodic, it also has an anti-inflammatory and sedative effect; derived from its composition of sesquiterpenes (Tadrent *et al.*, 2017). Elmastas *et al.*, (2015), showed that chamomile contains phenolic compounds that have an antioxidant effect, which can help prevent lipid oxidation of foods. Due to these properties presented by these plants, the present study was carried out with the objective of evaluating the effect of the inclusion of chamomile, rue and its combination on the quality of the carcass and meat of rabbits.

MATERIAL AND METHODS

Animals and diets

The rabbits that were used for the study were housed in the experimental farm of the Institute of Agricultural Sciences (Tulancingo, Hidalgo, Mexico). The care and management was carried out in accordance with the guidelines of the ethics committee of the Autonomous University of Hidalgo State. Twenty-four weaned rabbits (35 d of age) were used New Zealand x California x Chinchilla, with an average weight of 824 g, which were randomized to four treatments (n = 6 per treatment): T1 - control, T2 - 2.5 g kg⁻¹ of chamomile, T3 - 2.5 g kg⁻¹ of rue, and T4 1.25 g kg⁻¹ of chamomile and 1.25 g kg⁻¹ of rue. The rabbits were kept in cages (90

cm x 60 cm) equipped with manual feeders and automatic drinkers. The average temperature in the experimental place was 20 °C and 65% relative humidity. The food was pelleted in a model machine SKJ120 (Shandong, China). The diets were balanced to be isoproteic (16% PC), isoenergetic (2.3 Mcal / kg digestible energy) and isofibrous (16% acid detergent fiber).

Slaughter of rabbits

Once finished the fattening period (28 d), the rabbits were transported to the meat workshop of the Institute of Agricultural Sciences in Tulancingo, Hidalgo, Mexico. The rabbits were slaughtered without prior fasting, weighed, stunned and slaughtered according to current regulations (NOM-033-SAG / ZOO-2014).

Determination of the quality of the carcass and meat

Before sacrificing the rabbits, the length of the animal was measured, circumference at the level of the hip and at the level of the lumbar vertebrae; Once the animal was exsanguinated, measurements were taken again. Subsequently, the various components of the animal were separated, for which the hot carcass, liver, kidneys, spleen, heart, lungs, gastrointestinal tract, bladder, skin and legs were weighed. The carcass was maintained under refrigeration conditions at 4 ° C for 24 h. After that time, the carcass was divided according to the indications of Blasco and Ouhayoun (1993) with some modifications, the head was cut at the level of the atlas, the anterior part was obtained by means of the dissection between the 6th and 7th ribs; the middle part was cut in the last rib and the posterior part was cut between the 6th and 7th lumbar vertebrae, to obtain the legs. The latter were dissected in order to obtain the proportion of meat, fat and bone.

The pH of the meat was measured with a meat potentiometer Hanna model HI99163 (Hanna instruments, Cluj-Napoca, Romania); while the capacity of water retention was carried out according to the indications of Honikel (1987).

Statistical analysis

For the statistical analysis of the data, a completely randomized design was used, to which an analysis of variance was performed by means of a GLM procedure (SAS, 2004). When there were differences, a comparison of Tukey's means was made, with a level of significance of $P < 0.05$.

RESULTS AND DISCUSSION

The morphometric measurements of the rabbits and their carcass are presented in Table 2; it was found that the length of the live rabbit and its channel, as well as the circumference at the level of the lumbar vertebrae, were different ($P < 0.05$). The rabbits fed with rue were longer and their carcass bigger, compared with the other

treatments. This suggests that rue contains compounds that promote the growth of animals. Molina *et al.*, (2018), used amaranth in the feeding of fattening rabbits until the age of 87 d, and found that the length of the carcass was greater in those animals in which they were fed with the highest proportion of amaranth; also they did not find differences in other morphometric measurements

Table 1. Experimental diet with inclusion of chamomile and rue.

Ingredient	Treatments			
	Control	Chamomile (% Dry base)	Rue	Chamomile -Rue
Experimental plant	0.0	11.2	11.2	11.3
Alfalfa hay	10.2	0.0	0.0	0.0
Cereal straw	10.1	10.0	9.2	10.7
Grinded corn	20.0	18.2	17.0	19.2
Canola paste	3.9	3.9	3.9	4.0
Soy paste	17.0	18.0	20.1	16.1
Grinded sorghum	17.9	17.9	17.9	17.9
Molasses	1.0	1.0	1.0	1.0
Soybean hull	10.8	10.8	10.8	10.8
Wheat bran	6.5	6.5	6.5	6.5
Premix	2.5	2.5	2.5	2.5

Table 2. Morphometric measurements of the rabbit and its carcass fed with chamomile and rue.

Variable	Treatments				S.E. ¹
	Control	Chamomile	Rue	Chamomile-Rue	
Length of the rabbit (cm)	30.33 ^b	29.53 ^b	33.33 ^a	28.25 ^b	1.0
Hip circumference (cm)	24.66	24.50	25.66	24.25	1.0
Lumbar circumference (cm)	22.00	21.00	21.66	20.62	1.0
Skin (g)Legs (g)	270.33	247.66	295.33	213.75	36.0
Long carcass (cm)	50.00	55.33	57.33	46.00	5.0
Circumference hip carcass (cm)	29.00 ^b	30.66 ^b	32.50 ^a	29.00 ^b	1.0
Lumbar carcass circumference (cm)	22.00	22.43	23.00	20.75	1.0
Length of the rabbit (cm)	15.16 ^a	15.00 ^a	16.33 ^a	14.25 ^b	0.8

^{a-c} Means with different literals have statistical difference (P<0.05).

¹SE: standard error.

Table 3 shows the variables that indicate the quality of the carcass of rabbits fed with chamomile and rue. Statistical differences were found (P <0.05) in the weight of the heart, lungs, hot and cold carcass, scapular fat, head, middle part, legs, meat, scapular fat and pH. The rabbits fed with ruda presented the best averages in terms of the variables measured for carcass and meat quality.

As mentioned above, these animals were heavier compared to the other treatments. It has been reported that plants such as oregano can improve carcass quality in rabbits (Cardinali *et al.*, 2015). Dalle *et al.*, (2016), summarizes the effect of various plants or plant extracts on the effect they have as a growth promoter,

where it indicates that the quality of the carcass is improved with the use of ginseng, oregano, rosemary, or well a mixture of extracts of several plants.

Table 3. Quality of the carcass of rabbits fed with chamomile and rue.

Variable	Treatments				S.E. ¹
	Control	Chamomile	Rue	Chamomile-Rue	
Viscera	484.33	437.33	502.33	453.50	34.0
TGI ² full	363.00	341.66	394.00	369.00	29.0
Heart	4.33 ^b	3.66 ^b	6.00 ^a	4.25 ^b	0.6
Lungs	15.66 ^b	15.00 ^b	17.00 ^a	10.75 ^b	1.0
Liver	84.33	61.66	75.66	59.50	11.0
Kidneys	12.66	9.66	11.66	9.50	1.0
TGI ² empty	190.00	184.00	196.00	181.50	12.0
Empty bladder	3.33	3.33	3.33	1.75	0.7
PCC ³	912.66 ^a	971.33 ^a	1098.00 ^a	791.00 ^b	114.0
PCF ⁴	911.33 ^a	962.00 ^a	1092.66 ^a	787.00 ^b	112.0
Kidney fat	16.00	12.66	14.33	8.75	5.0
Scapular fat	4.33 ^b	4.00 ^a	6.00 ^a	1.75 ^b	1.0
Head	92.66 ^b	100.66 ^b	118.66 ^a	98.50 ^b	8.0
Previous part	219.33	249.33	255.33	191.50	30.0
Middle part	80.66 ^b	73.33 ^b	108.66 ^a	98.00 ^b	13.0
Back	180.66	186.66	212.66	151.00	32.0
Legs	315.33 ^b	332.66 ^b	374.66 ^a	258.50 ^b	34.0
Meat	228.66 ^a	246.00 ^a	272.66 ^a	187.00 ^b	29.0
Bone	78.66	77.33	86.00	72.50	9.0
Fat	3.66 ^b	3.00 ^b	7.33 ^a	2.25 ^b	1.0
pH	5.96 ^c	6.10 ^b	6.00 ^c	6.16 ^a	0.05
CRA ⁵	21.21	21.31	19.81	24.13	2.0

^{a-c} Means with different literals have statistical difference (P<0.05).

¹S.E: standard error, ²TGI: gastrointestinal tract, ³PCC= Hot carcass weight, ⁴PCF= Cold carcass weight, ⁵CRA= Water retention capacity.

CONCLUSION

In the investigation it can be concluded that feeding rabbits with rue improves its morphometric measurements and parameters of the quality of its meat. More studies are required in order to identify the individual components that allow animals to improve their growth.

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