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Productive performance and meat quality of rabbits that consumed cookie waste

Comportamiento productivo y calidad de la carne de conejos que consumieron desperdicio de galleta

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ABSTRACT

Fattening commercial feed cost for rabbits in Mexico is high, the reduction of its cost without affecting the production parameters, the quality of the carcass and meat is of great interest for the agricultural industry. It has been proposed the use of supplements that provide the necessary energy requirements in the fattening of rabbits, among which we can mention the cookie waste, which can be a source of energy to replace conventional food and thus reduce costs. In this work, we intended to evaluate the effect of the inclusion of cookie waste over the productive parameters, the quality of the carcass and rabbit meat. 8 Nueva Zelanda rabbits were used distributed completely randomly in two treatments, the control and the experimental one (cookie waste). The results obtained showed that the use of biscuit waste on fattening feeding for rabbits did not affect the productive parameters, quality of the carcass and meat ($p > 0.05$), which suggests that it is a viable option for rabbit production, as well as a cheaper option.

Keywords: Supplements, Agroindustrial by-products, rabbit production.

RESUMEN

El costo de los alimentos comerciales para la engorda de conejos en México es alto, y disminuirlos sin afectar los parámetros productivos, la calidad de la canal y de la carne es de gran interés para la industria agropecuaria. Se ha propuesto el uso de suplementos que provean los requerimientos energéticos necesarios en la engorda de conejos, entre los que podemos mencionar el desperdicio de galleta, la cual puede ser una fuente de energía que sustituya a los alimentos convencionales y de esta manera aminorar los costos. En este trabajo, se pretende evaluar el efecto de la inclusión de desperdicio de galleta sobre los parámetros productivos, la calidad de la canal y de la carne de conejos. Se usaron 8 conejos de la raza Nueva Zelanda distribuidos completamente al azar en dos tratamientos, el control y el experimental (con desperdicio de galleta). Los resultados obtenidos demostraron que el uso del desperdicio de galleta en la alimentación de conejos en engorda, no afectó los parámetros productivos, calidad de la canal y de la carne ($p>0.05$), lo que sugiere que es una opción viable para la producción en conejos, debido a que no altera los parámetros productivos y la calidad de carne y la canal, además de ser una opción más económica.

Palabras clave: Suplementos, Subproductos agroindustriales, Producción cunícola.

INTRODUCTION

Food is one of the items with the highest incidence in costs in production units, supplementation is very important in this area, where the price of food and product, will define the level and supplement use period. From the production and processing of food for humans, numerous by-products and residues originate that can be used for animal feed (supplements); which have different nutritional characteristics according to their origin and the type of industrial processes to which they were subjected; in general they present the peculiarity of being very concentrated in one or more nutrients (proteins, lipids, carbohydrates, etc.); so they can be combined with other foods in balanced diets for animal feed (INTA, 2002).

The elaboration of balanced foods in the production of animals requires ingredients that cover their biochemical and energy needs; the most used raw material for energy-protein intake is corn and soybean meal; however, in our days, this can be a limitation, due to the costs generated by its use in the preparation of food (Al-Tulaihan *et al*., 2004); for this reason, non-traditional alternatives have been sought, which provide lower cost and greater flexibility in the formulation; among which we can mention energy raw materials, which at least partially replace cereals, since currently the demand for cereals for human and animal consumption has increased; reflected in an increase in the production costs of feed, (Catalá-Gregori *et al*., 2011).

Some researchers have been inclined towards these alternatives for the fattening of animals, as they are the waste of bakery in substitution of corn or sorghum in the fattening of pigs (Cárdenas, 2012), organic waste in the production and reproduction of dairy cows (Losada-Custardoy *et al*., 2016) and cookie flour to feed broilers (Catalá-Gregori *et al*., 2011). Biscuit flour is a by-product of the food industry, from the recycling of products for human consumption, which is increasingly used in the food industry of animals; its base component is wheat flour and can be considered a source of energy, given its high content of digestible carbohydrates and higher fat content than cereals; however, its composition and nutritional value may vary among suppliers (Waldroup *et al*., 1982), depending mainly on the quality of the initial product and processing conditions (Catalá-Gregori *et al*., 2011).

These alternatives can be used in various animal productions, among which we can mention rabbits. The production of rabbit in small and medium scale presents certain advantages over other species, due to its speed of reproduction and its digestive physiology, which allows them to adapt to diets rich in structural carbohydrates (Lara *et al*., 2012); In addition, rabbit meat has several advantages with respect to the meat of other species, has a better profile of fatty acids in conjunction with the amount of protein, vitamins and minerals; its low content of cholesterol and sodium, coupled with the lack of uric acid (Para, 2015); Despite

the qualities described above, its consumption and production is relatively low, the per capita consumption fluctuates between 30 and 134 g per person per year.

The rabbit production in the country is centralized in Hidalgo, Puebla, Mexico and Guanajuato states (Armada, 2016). It has also been recognized that various governmental and non-governmental institutions encourage the production and consumption of this meat, either fresh or through various meat products. However, one of the main problems of rabbits, as in other animal species, is the cost of feeding.

The objective of this research was to evaluate the effect that the inclusion of biscuit waste in the food has on the productive parameters, the quality of the carcass and the meat in the fattening of rabbits.

MATERIAL AND METHODS

Animals and diets

The animals of this study were housed in the Research and Production site of Complete Cycles of the Institute of Agricultural Sciences (Tulancingo de Bravo, Hidalgo, Mexico) of the Autonomous University of the State of Hidalgo. The care and handling of the rabbits was in accordance with the guidelines of the ethics committee of the Autonomous University of the State of Hidalgo. It was used 8 rabbits of 35 d of age of the Nueva Zelanda breed, with an average live weight of 571.25 g, assigned completely at random in two treatments (n = 4 per treatment): T1-control and T2-cookies waste; the diets used isoproteic (15% PC), isofibrous (13% FC) and isoenergetic (2.4 Mcal ED Kg MS^{-1}) were offered in pellet (Table 1). The rabbits were kept in cages (90 x 60 x 40 cm) equipped with manual feeders and automatic drinkers. The average temperature in the experimental ship was 20 °C and 65% relative humidity. The feed was pelleted in a model machine SKJ120 (Shandong, China).

Table 1. Experimental diets

Ingredient	Treaments	
	Control	DG
Cookie waste	0.0	11.2
Alfalfa hay	10.2	0.0
Cereal straw	10.1	10.0
Ground corn	20.0	18.2
Canola pasta	3.9	3.9
Soybean paste	17.0	18.0
Ground sorghum	17.9	17.9
Molasses	1.0	1.0
Soybean husk	10.8	10.8
Wheat bran	6.5	6.5
Premix	2.5	2.5

DG=cookie waste

Productive parameters

During the experiment the animals were weighed each week, while the daily food intake was determined, weighing the food offered and rejected. From these data, the daily weight gain during the four weeks of fattening, total gain and feed conversion during the fattening period was calculated. At the end of the fattening the rabbits were slaughtered with an average age of 63 d of age, for this they were transported to the Workshop of meat of the Institute of Agricultural Sciences, where they were slaughtered according to the NOM-033-SAG/ZOO 2014; the canal was dissected according to the recommendations of Blasco *et al*. (1993), and pH and water retention capacity were measured (SAGARPA, 2011).

Statistical analysis

All the data were analyzed under a completely randomized design, 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 inclusion of biscuit waste in rabbit feed did not show significant statistical difference (p> 0.05) over the productive parameters (Table 2); which coincides in research with other species, as found in Catalá-Gregori *et al*. (2011), who included biscuit flour in the fattening of broilers, without showing significant statistical difference over the productive parameters. Cárdenas (2012) substituted maize or soybean for bakery waste in diets for lambs without finding significant statistical differences in the productive parameters; however, they were able to reduce feeding costs. The values obtained for final weight were higher than that obtained by Khan *et al*. (2016), when using alfalfa hay and concentrated.

Regarding the quality of the meat and the carcass of rabbits that were fed with biscuit waste as an energy source, there were no significant differences (p> 0.05) (Table 3 and 4), as was found by Alagón *et al*. (2015) when feeding distillers dry grains to rabbits from 49 to 59 d of

Table 2. Productive parameters of rabbits that consumed in their diet waste of cookies, during fattening

Variable	Treatments			
	DG (mean ± DE)		Control (mean ± DE)	
Initial weight (g)	535	7.07	607.50	10.61
Final weight (g)	1615	183.15	1917.50	102.53
Total gained weight (g)	1080	190.2	1310.00	113.13
Food conversion	2.5	0.44	1.96	0.16
Daily weight gain (Week 1) (g)	40	2.02	45.35	7.57
Daily weight gain (Week 3) (g)	40.36	9.09	47.32	8.84
Daily weight gain (Week 4) (g)	33.57	11.12	47.14	6.06
Daily weight gain overall (g)	38.57	6.82	46.78	4.04

DG=cookie waste. DE=Estándar deviation. p>0.05

age, without having an effect on the carcass. Also, in chickens by Catalá-Gregori *et al*. (2011), that did not observe differences in the broiler carcass fed with cookies flour in the diet. It should be mentioned that the animals that consumed food that included cookies waste in their diet showed a tendency to present greater weight in viscera (Table 4). In regard to pH, including cookies waste, the pH of the meat was not modified, unlike what was found by Alagón *et al*. (2015), who when including dry distillery grains in the diet of fattening rabbits saw an increase in this measure.

Table 3. Quality of the carcass and meat of rabbits that consumed in their diet wasted biscuit during fattening

Variable	Treatments			
	DG (mean ± DE)		Control (mean ± DE)	
alive weight	1680.00	135.09	1738.75	250.15
Length of the animal	30.75	2.22	31.00	1.41
Hip circumference of the animal	26.00	1.63	25.13	2.72
Lumbar circumference of the animal	20.00	0.00	20.25	1.71
Hot carcass weight	850.00	97.55	815.00	100.29
Skin	238.75	47.23	274.25	43.85
Legs	42.25	4.79	44.25	7.41
Length of the carcass	30.75	0.50	31.00	0.82
Hip circumference of the carcass	22.25	2.06	22.38	1.38
Lumbar circumference of the carcass	14.75	0.50	15.13	1.03
Cold carcass weight	853.75	92.77	925.00	146.74
Renal fat	10.75	3.69	14.75	4.97
Scapular fat	5.25	2.06	3.5	0.58
Head	95.00	12.25	97.50	8.66
Previous part	211,25	35.21	228.75	44.60
Middle part	90	7.07	101.25	25.62
Back	145.00	14.14	158.75	33.26
Legs	293.75	30.92	326.25	48.37
Meat	208.75	27.80	223.75	33.01
Bone	115.00	17.86	95.00	18.71
Grease	2.75	1.40	1.50	0.73
pH	5.87	0.09	5.86	0.04
Water retention capacity	26.92	6.57	26.44	6.23

DG=cookies waste. DE=Standard deviation. p>0.05

Table 4. Weight of viscera of rabbits that consumed in their diet wasted biscuit, during fattening

Variable	Treatments			
	DG (mean ± DE)		Control (mean ± DE)	
Viscera	444.50	54.78	408.00	52.93
Full digestive tract	311.25	70.97	298.25	26.09
Empty digestive tract	149.50	16.42	156.00	12.14
Heart	5.00	1.41	5.50	0.58
Lungs	11.25	3.77	12.75	5.74
Spleen	1.00	0.0	1.00	0.00
Liver	71.5	22.78	71.50	28.57
Kidneys	11.75	1.26	10.75	0.96
Bladder	4	0.82	5	1.41

DG=cookies waste. DE=Standard deviation. p>0.05

CONCLUSION

The results obtained suggest that the inclusion of biscuit waste as an energy substitute for corn or soybean paste is a viable option for rabbit production, because it does not alter the productive parameters and the quality of meat and carcass; In addition to being a cheaper option, which would affect a substantial improvement in the production of rabbits.

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