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Productive parameters of cattle fed with dry ruminal content

Parámetros productivos de vacunos alimentados con contenido ruminal seco

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ABSTRACT

The ruminal content is the product obtained from the benefit of bovine animals in slaughterhouses, represented by the food ingested by polygastric animals, which is discarded at the time of slaughter. In cattle the rumen volume is 48 L or 15 to 21% of body weight and 30 to 60 kg, which varies with the diet and with the rate of passage through the digestive tract. 12 calves with an average weight of 250 kg were used, distributed completely randomly in 4 treatments (T): T1, T2, T3 and T4, with 30%, 20%, 10% and 0.0% of ruminal content in the diet, respectively. Food consumption was evaluated every third day, body weight only at the beginning and end of the experiment, and feed conversion was calculated. The results were statistically analyzed by a completely randomized design by analysis of variance ($P > 0.05$). The average dry matter found in the cattle slaughtered was 4.05 kg. When exposed to the sun on a cement board, it dries in 10 days, being necessary to turn it three times, then it can be crushed. When performing the chemical analysis proximal to this product, it was found that it contained 12.6% crude protein. In the present study, no significant differences were found for any study variable. The weight gain was greater than 1.0 kg/day. The ruminal content obtained from the trail and dried in the sun contained 12.6% crude protein, which can be used in animal feed without affecting production parameters; it also reduces costs for food.

Keywords: recycled, food, weight gain, food consumption.

RESUMEN

El contenido ruminal es el producto obtenido del beneficio de bovinos en mataderos, representado por el alimento ingerido por los animales poligástricos, que es desechado al momento del sacrificio. En vacunos el volumen ruminal es de 48 L o 15 a 21% del peso corporal y 30 a 60 kg, lo cual varía con la dieta y con la tasa de pasaje a través del tubo digestivo. Se usaron 12 becerros con peso promedio de 250 kg, distribuidos completamente al azar en 4 tratamientos (T): T1, T2, T3 y T4, con 30%, 20%,10% y 0.0% de contenido ruminal en la dieta, respectivamente. Se evaluó el consumo de alimento cada tercer día, el peso corporal solo al inicio y final del experimento, y se calculó la conversión alimenticia. Los resultados se analizaron estadísticamente mediante un diseño completamente al azar por análisis de varianza ($P > 0.05$). El promedio de materia seca encontrada en los vacunos sacrificados fue de 4.05 kg. Al exponerlo al sol en una plancha de cemento se seca en 10 días, siendo necesario voltearlo en tres ocasiones, después se puede encostalar. Al realizar el análisis químico proximal a este producto se encontró que contenía 12.6 % de proteína cruda. En el presente estudio, no se encontraron diferencias significativas para ninguna variable de estudio. El aumento de peso fue superior de 1.0 kg/día. El contenido ruminal obtenido del rastro y secado al sol contenía 12.6 % de proteína cruda, el cual se puede usar en la alimentación animal sin afectar los parámetros productivos; además reduce costos por concepto de alimentación.

Palabras clave: reciclado, alimento, aumento de peso, consumo de alimento.

INTRODUCTION

The agricultural industry, bound by sanitary requirements, has been in need of finding a way out of solid wastes, produced in its normal operation, the so-called pig slurry, poultry manure trace wastes, which may be available food resources. The pollution generated affects the microenvironment and the environment in general. All these factors have been combined for the appearance of fattening projects in housing, initially as a way to dispose of farm waste and subsequently, as a productive activity with its own identity (Sosa, 2006). Another way out is the compost, which is increasingly booming, in the production of compost and biofertilizers (Uicab y Sandoval, 2003).

For a liter (1.1 kg) of orange juice 2.2 kg of orange are required, so 50% is waste, calculating that there is a daily availability of between 7 and 13 tons, which go to the landfill of the different municipalities of Nayarit and Puerto Vallarta, Jalisco, Mexico. For the Tepic and Xalisco area it is estimated that they are between 5 and 7 tons/day (Espinoza-Zamora *et al*., 2019).

On a farm, with 110 cattle with young in their bellies and fattening, a daily ton of pig slurry is produced (Hernández *et al*., 2019). In Mexico, more than 1,860 tons of pig manure per day are originated (Cervantes et al., 2007). Chicken poultry manure volumes 200 to 300 g of dry matter per kg of feed, or 700 to 800 g of dry matter per chicken are produced or, 550 g of dry matter per kg of chicken, and finally 9.6 ton of dry matter per 1000 kg of meat. This last data would represent an estimated 1.2 million tons produced annually by 1,461 million chickens (Munguía-Xóchihua *et al*., 2019).

The ruminal content or ruminaza is the product obtained from the benefit of cattle in slaughterhouses, represented by the food ingested by polygastric animals, which is discarded at the time of slaughter. It is a mixture of undigested material that has the consistency of a porridge, greenish yellow, very intense characteristic smell when it is fresh, it also has a large amount of microbiota, as well as products of ruminal fermentation (Trillos *et al*., 2007). The cattle are ruminants, which contain microorganisms that live in symbiosis with the food in the rumen. The fermentation process is carried out mainly in the first two parts of the stomach by the microorganisms (protozoa, fungi and bacteria) that inhabit the rumen (Lovett *et al*., 2006) and the physical and chemical environment that surrounds them. The great gastric capacity of ruminants is necessary to keep food long enough to be digested. Then, four compartments, rumen, reticulum, omasum and abomasum constitute the stomach of the ruminants; only the latter produces digestive enzymes capable of degrading food (Phillipson, 1981).

In cattle, the rumen volume is 48 L or 15 to 21% of body weight and 30 to 60 kg, which varies with the diet and with the rate of passage through the digestive tract. Dry matter in the rumen content is between 10 and 15%. Other authors estimate that it ranges from less than 7% to more than 14% of the fresh weight of the ruminal material of cattle. It is important to note that even with 24 hours prior to fasting, in bovines at the time of

slaughter, at least 30 kg of ruminal content can be obtained because the passage of food through the gastrointestinal tract of ruminants is slow.

In Colombia, most of the slaughter plants reach 85,000 tons of ruminal production annually; this is a high pollution index since there is a high organic load in the effluents, which by way of deposit reach septic tanks, municipal garbage dumps and sewage, promoting pollution. Currently, 40 tons of bovine ruminal content are being produced at the Colanta slaughter plant, which implies a serious environmental management problem for the company (Acevedo-Montoya *et al*., 2008). However, the ruminal content, instead of being seen as a contaminant, is a valuable source of nutrients when it is incorporated into animal diets, since it represents food not digested and ingested by polygastric substances, it also has a large microbial amount that it can be beneficial for the soil (Uicab y Sandoval, 2003).

The inclusion of excreta of pigs and chickens in the diet of ruminants helps solve the problem of environmental pollution and reduce production costs in cattle due to the replacement of traditional high-cost ingredients, by unconventional ingredients such as excreta (Castrillón *et al*., 2002). The pig slurry is the food not digested by the digestive system of the pig and enriched with the intestinal flora, which makes it an excellent quality food to be used in the preparation of diets for ruminants. The poultry manure is the excreta of broilers, which is always mixed with food residues, peeled intestinal mucosa, glandular secretions, microorganisms of the intestinal biota, mineral salts, feathers, insects, pigments, traces of medication and material used as a bed (Munguía-Xóchihua *et al*., 2019).

In Table 1, a comparison of protein and fat is made between pig slurry, ruminal content, corn and sorghum.

Table 1. Comparison of crude protein and crude fat content of ruminal content, pig slurry, corn and sorghum (% on dry basis).

	Pig slurry	Ruminal content	Corn	Sorghum
Crude protein	21.2	12.6	8	9
C	6.3	1.4	4	2

(Own elaboration).

Therefore, the objective of the present study is to study the productive parameters of cattle fed with dry ruminal content, obtained from cattle slaughtered on the municipal trail.

MATERIAL AND METHODS

Location of area of study

The study was conducted at the Las Barranquitas farm, Tepic, Nayarit, Mexico, which is located at the extreme geographic coordinates 21° 51' and 21° 24' north and 104° 34' and 105 ° 05' west. Two types of weather predominate in Tepic, the warm subhumid with rains in summer, which affects 66.06% of the municipal geography and the semi-warm subhumid with rains in summer, which benefits the remaining 33.94%. Rains are observed in 91.05% during July to October. The average annual rainfall is 1,121 mm and the average temperature is 21.1 °C. Las Barranquitas farm is circulated with galvanized mesh drowned in cement, it has several areas: food cellar, food preparation area, drying area for ruminal contents, office and pharmacy and parking (INEGI, 2001).

Experimental animals and treatments

The company has permanent 100 calves and cows crosses zebu in fattening. The recommended preventive program for the species is applied. Biosafety standards, recommended by SADER, apply. During the experimental phase, 12 calves with an average weight of 250 kg were used, which were randomly distributed to one of four treatments (T): T1, T2, T3 and T4, with 30%, 20%, 10% and 0.0%, of ruminal content in the diet, respectively. The animals of each treatment were assigned in a different 3 x 4 m pen, built with wood from the region, which were provided with water and food for free access. The experiment lasted 90 days, with 15 days of adaptation. The diets offered were isoproteic and isocaloric (NRC, 1980; Table 2).

Ruminal content

The ruminal content was obtained from the Tepic Municipal Trail, Nayarit; where 200 cattle were slaughtered daily, which came approximately: 50% of fattening pens, 25% of grazing and 25% of dairy stables. This ruminal content caused environmental contamination, so the present study was carried out. It was collected from the trail and exposed to the sun on a cement board, and then the proximal analysis was performed in the Nutrition Laboratory of the School of Veterinary Medicine of the University of Guadalajara, Mexico.

Study variables

Food consumption was assessed every third day, body weight only at the beginning and at the end of the experiment and feed conversion was calculated. The results were statistically analyzed with an analysis of variance through a complete design with randomized treatments ($P > 0.05$)

Table 2. Ingredients and nutritional contribution in diets for calves with different levels of rumen content.

Ingredient % and nutritional contribution	Treatment 1 30%	Treatment 2 20%	Treatment 3 10%	Treatment 4 0.0%
Sorghum (ground grain)	66.2	57.67	64.36	63.0
Peanut (ground straw)	4.85	2.02	10	9.6
Corn (ground whole plant)	2.32	13.95	9.30	18.60
Poultry manure	1.71	8.23	10.58	15.29
Sugarcane molasses	6.84	12.32	10.95	10.95
Dry ruminal content	33.33	22.22	11.11	0.00
Crude protein %	11.12	11.12	11.12	11.12
Metabolizable energy Mcal/kg	2.49	2.50	2.52	2.56
Dry matter %	87.20	86.10	86.10	85.60

(Elaboración propia).

RESULTS Y DISCUSSION

The average dry matter found in the cattle slaughtered in the Tepic Municipal Trail was 4.05 kg. When exposed to the sun on a cement board, it dries in 10 days, being necessary to turn it three times, then it can be crushed. Proximal chemical analysis reported 12.6% crude protein and other nutritional values (Table 3). However, fresh ruminal content may have been used, but the feed for cattle should then be prepared daily for moisture, or possibly, a silage process is necessary as indicated by Hernández *et al*. (2019) with the pig slurry.

In the samples of ruminal content evaluated in the present study, pieces of rope, belts, shirts, tennis, wood and small balls were found, which for some reason the animals consumed. Therefore, the pre-slaughter wait time and the consequent food deprivation are practices that have been evaluated in the processing plants, mainly on animal welfare and in the visual contamination of canals and their co-products (Vangaru *et al*., 2009).

Bracho (2017) found that the rumen content contained 17.11% of ashes, 8.72% of moisture, 21.29% of crude fiber and 6.78% of crude protein. The average dry matter content range is 13 to 30%, depending on whether the entire liquid is used or drained; the one of raw fiber goes from 21 to 34%; the crude protein is 9.6 to 15%; that of nitrogen-free extract ranges from 37 to 43%; and that of fat is from 2.23 to 3.0% (Domínguez and García, 2007).

Table 3. Proximal analysis of the sun-dried ruminal content (%).

Humidity	10.0
Crude protein	12.6
Ethereal Extract	1.4
Crude fiber	18.0
Ash	9.3
Nitrogen free extract	48.6

(Own elaboration).

In the present study, no differences (P> 0.05) were observed for any variable. The weight gain was greater than 1.0 kg / day (Table 4).

Table 4. Means of weight gain, feed consumption and feed conversion in calves with different levels of rumen content.

Variable	Treatment 1 30%	Treatment 2 20%	Treatment 3 10%	Treatment 4 0.0%
Weight gain (kg)	1.022	1.059	1.059	1.066
Food consumption, dry basis (kg)	7.3	7.3	7.6	7.8
Food conversion	7.6	6.8	7.1	7.3

($P > 0.05$).

By offering fresh ruminal content, it can be considered that it is usable for feeding cattle for fattening, with the disadvantage that, due to its consistency, humidity and characteristic smell, voluntary consumption decreases; however, it was observed that after 15 days, the animals consume it without the smell affecting them (Domínguez and García, 2007).

Ríos and Ramírez (2012) silage ruminaza for a period of thirty days, and offered it to rabbits as a nutritional alternative, to generate protein of animal origin, which allows to offer a slaughterhouse waste as a final non-polluting destination. Animal nutrition research has focused mostly on finding methods to reduce CH_4 emissions due to the energy inefficiency that occurs in the rumen, and not because of CH_4's role in global warming. However, more attention has recently been given to its potential contribution to climate change (Karnati *et al.*, 2009).

CONCLUSION

The ruminal content obtained from the trail, when exposed to the sun, dries in 10 days and contains 12.6% crude protein, which can be used in animal feed without affecting production parameters, reduces costs for feeding and prevents environmental pollution.

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