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THE EFFECT OF ADDING LICORICE EXTRACT ON PRODUCTIVE PERFORMANCE OF LACTATING ZARAIBI GOATS

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ABSTRACT

The purpose of this study was to determine how the use of licorice extracts (LE) as feed additives improved the production of dairy Zaraibi goats. Based on their milk production, animal weight, and age, twenty lactating Zaraibi goats were classified into four comparable groups, each consisting of five animals (Av. body weight, 39.1±2.5 kg). Each animal group received one of the following experimental ration at random treatments: T1 (control ration): consisted of 60% concentrate feed mixture (CFM) + 20% berseem hay (BH) + 20% Rice straw (RS) and without additives and all experimental treatments T2, T3 and T4 which, Animals were fed, the control ration plus 2, 4 and 6 g /head/day of the LE as fed supplement, respectively. The experimental rations included according to **NRC (2007)**. Numerically, the T1 group consumed feed more (P< 0.05) than the other groups. However, there were no significant (P>0.05) changes in TDN, DCP and water intakes among all treatments. No significant changes in values of digestibilities, TDN, and DCP among all experimental rations. All tested levels of LE resulted in insignificant increases in milk yield, but it caused significant (P< 0.05) amelioration in feed utilization efficiency values in comparison with the control. Goats supplemented with the 4 g LE/h/d in T3 had the greatest (P< 0.05) values of feed utilization efficiency, while those in T1 recorded the least values. Animals receiving 6g/head/day of LE (T4) had significantly higher levels of fat, protein, and galactose in milk compared to those in T3, while T1 had the lowest values. However, no significant difference was observed in milk total solids, ash, and lactose percentages. The LE did not significantly affect the measured blood parameters. The T4 ration recorded the highest relative economic efficiency at 217.19%, compared to the control ration 100%. It could be concluded that the LE led to beneficial effects on the productive performance of the lactating Zaraibi goats.

Key Words: licorice extract, lactating Zaraibi goats, feed Intake, digestibility, blood, economic efficiency.

INTRODUCTION

Due to worries about the development of antibiotic-resistant pathogenic bacteria and antibiotic residues in animal products, antibiotics have lately been banned as feed additives for ruminants **(Casewell *et al*., 2003 , Russell & Houlihan 2003 and Da Costa *et al*., 2010).** A number of studies have proven that feeding plants high in bioactive chemicals to animals can improve their health. Productivity and reproductive performance **(Durmic and Blache, 2012 ; Zhong *et al*., 2019)**. The licorice plant is one of the most widely used medicinal herbs in the world, with significant economic importance. Fresh licorice root has a high concentration of magnesium, calcium, potassium, sodium, zinc, manganese, iron, and copper as well as around 20% moisture, 6% ash, 30% starch, 8% protein, 1.35% fat, and 15 to 20% carbohydrates. 0.3 to 0.5 percent of phenols, 0.1 to 0.2 percent of flavonoids, triterpene saponins, coumarins, shale-cones, and isoflavones, as well as other compounds having antioxidant potential, are present in licorice root (tannins, ascorbic acid and carotenoids) In addition to glucose, asparagine, FA (C2–C16), fructose, sterols, lactones and polysaccharides **(Hayashi *et al*., 1998)**. Therefore, licorice (*Glycyrrhiza uralensis*) root extract's effects on the productive performance of sheep were studied as one of the plant food additives. As opposed to that, **Zhang *et al*., (2015)** demonstrated that supplementing the sheep diet with 0.4% of licorice root extract (16.4% of the total flavonoid content) improved the antioxidant content of the meat when compared to the non-supplemented group (control group). Additionally, **Xuefeng *et al*., (2019)** shown that sheep from Karakul fed Although there was no difference in the average daily weight gain, digestible energy intake, apparent nutrient digestibility, or feed conversion efficiency between the two treatments, there were 2.1 and 1.8 times more immunoglobulin A and G, total antioxidants, and superoxide dismutase in the serum. The augmented group consumed less DM than the control group. Also, **Kim *et al*., (2013) and Renata *et al*., (2016)** observed that adding 0.5% extract of licorice root to the feed of Hanwoo steers had no influence on their daily growth or dry matter intake (licorice chemical composition was not disclosed). According to **Sajjadi *et al*., (2014),** supplementing Holstein heifer calves' diets with 10 g per day of root licorice extract (equal to 0.56% of the food) boosted total immunoglobulin (Ig) level and thus enhanced their immune state. Licorice extract addition in the diet at a level of 4.5% of DM did not impact feed conversion efficiency or live weight gain, but it enhance the blood anti-oxidative status and immunoglobulin of Karakul sheep. **(Guo *et al*., 2012)**. While many factors, such as animal species, breed, genotype, period during lactation, and food intake, affect the chemical-nutritional composition and renneting characteristics of milk **(Morand-Fehr *et al.*, 2007)**. These factors greatly affect the quality of milk and the possibility of processing it in the manufacture of cheese and as a result of the biochemical processes that occur during the ripening of cheese the decomposition of milk protein and fat **(McSweeney and Sousa, 2000)**. Its effects on dairy farm animals and the dairy products are not well documented to date. It seems promising to use licorice root supplementation as a feeding approach for ruminants. Consuming modified dried licorice root chemical and technical aspects of milk formulations **(Bennato *et al.*, 2020)**. It seems promising to use licorice root supplementation as a feeding approach for ruminants. Numerous research suggest that supplementing with extract licorice may benefit animals' immunological and antioxidant systems. The maximum amount of licorice extract needed to enhance these possible advantages on DMI, ADG, and blood characteristics in addition to the composition and component of milk (g/kg) in ruminants remains unknown.

MATERIALS AND METHODS

From January 1 through March 31, 2022, this study was carried out in the animal production research station at El-Serw, Damietta governorate, Egypt. It is a part of the Animal Production Research Institute, Agricultural Research Center, and Egyptian Ministry of Agriculture.

Experimental animals and feeding

The goal of the current study was to assess the effect of licorice extract (LE) as a feed additive on dairy Zaraibi goats' ability to produce during the lactation season. Twenty lactating Zaraibi goats immediately postpartum were divided into four similar groups (five animals each based on their milk production, animal weight and age (Av. body weight, 39.1 ± 2.5 kg).

Each animal group received a different experimental treatment at random: T1 (control ration) consisted of 60% concentrate feed mixture (CFM) + 20% berseem hay (BH) + 20% rice straw (RS) and was additive-free. For the experimental treatments T2, T3, and T4, the animals were given the control ration along with 2, 4, and 6 g of licorice extract (LE) per head per day, respectively.

The experimental rations were created, according to **NRC (2007)** to cover the maintenance and production allowances. The CFM is made up of 40% yellow corn grain, 25% unprotected cottonseed meal, 22% wheat bran, 6% rice bran, 3.5% molasses, 2.5% limestone, and 1% common salt.

Daily calculations of the DMI for each animal group involved deducting the rejected feed from the given feed, and then correcting the result for DM content. Throughout the trial, every nursing goat in the Zaraibi group had unrestricted access to potable water, and they were all averaged out for each group. Prior to lactation, all Zaraibi goats were weighed. According to variations in weight, feeding needs were modified every two weeks. Before each meal, 100 g of feed was sampled twice daily. Weekly samples were bulked, and 10% of the feed subsamples were oven-dried and kept for analysis. Adhering to the rules of **AOAC (1995)**, the chemical composition of the ration components was estimated. Table 1 displays the chemical analyses of several feedstuffs and derived rations.

Table 1. The proximate Chemical composition of feed ingredients and the tested ration

Items	Chemical composition (% on dry matter basis)						
	DM	OM	CP	EE	CF	NFE	Ash
CFM	89.95	88.45	14.65	2.61	12.54	58.65	11.55
BH	88.60	87.40	11.20	2.25	26.31	47.64	12.60
RS	91.67	82.68	2.78	1.61	34.96	43.33	17.32
Ration (calculated)	90.02	87.09	11.59	2.34	19.77	53.39	12.91

Concentrate feed mixture (CFM), Brseem hey (Bh), Rice straw (RS), Dry matter (DM), Organic matter (OM), Curde protein (CP), Ether extract (EE), Crude fiber (CF), Nitrogen free extracts (NFE) and Ashes (ash).

Licorice extract

Licorice extract is a commercial extract purchased from Free Trade Egypt and added to the diet individually for each animal.

Digestibility coefficients and feeding values

Four digestibility experiments with sixteen mature bucks (average live body weight 37.41±3.23 Kg) were conducted to assess the digestibility and nutritional value of the experimental diets. The animals were divided into four groups, each with four animals. Bucks went through training to stand in metabolic cages for two weeks during the preliminary phase and one week during the collecting phase. The previously indicated experimental rations were served to each group. At 9 a.m. and 4 p.m. each day, the animals were fed, and freshwater was provided. Feed intake, leftovers, and representative samples were all collected during the collection times. Each 24-hour feces was quantified, and samples for chemical analysis were retained.

Milk production and milk composition

Early (5, 15 and 30 days), middle (60 days), and late (90 days) assessments of the quantities of suckling milk in the various treatments were made as described by **Khalifa *et al.*, (2013)**. The methodology proceeded to use the oxytocin technique, which included giving double dosages (2 IU/maternal goat) of oxytocin hormone directly after separating the kids from their mothers. The first oxytocin dosage was administered, and after two minutes, the udder milk was manually milked and discarded. After 4 hours of separation, the second oxytocin hormone dosage was given. Then, the udder milked by hands and this amount of milk was discarded also; this amount of milk was recorded. The amount of suckling milk was calculated using the following equation: the amount of milk that was suckled during 24 hours = suckling milk amount (g) obtained in 4 hours (as the isolation time of kids from their maternal) × 6 (as a factor). Using 50 ml of milk per goat, the composition of nursing milk from post-partum to weaning was examined during the nursing phase. Then, the composition of suckling milk included fat%, protein% and lactose% (using digital Lactoscans, Milk analyzer, Wide LCD 8900 Nova Zagora, Bulgaria) and suckling milk energy (kcal/kg) calculated as follows: 203.8 + (8.36×fat%) + (6.29×protein %) according to **Baldi *et al*., (1992).**

The 4% fat-corrected milk (FCM) for goats was estimated by **Mavrogenis and Papachristoforou (1988)**, Formula as follows:

FCM (4%) kg = M (0.411 + 0.147fat %), where, M: milk quantity in Kg.

Blood Parameters

At weaning, 20 nursing Zaraibi goats (N=5 / treatment) were randomly selected, and 10 ml of blood samples were taken from each animal's jugular vein into clean tubes.

The serum samples were then retrieved by centrifugation for 30 minutes at 3000 rpm, and they were kept at -18 ^{o}C until they were analyzed. Commercial test kits created by Bio-Merieux (Craponne, France) were used to estimate the total protein, albumin, glucose, urea, creatinine and the activities of aspartate aminotransferase (AST) and alanine aminotransferase (ALT) and Hemoglobin و Hematocrit %.

Statistical Analysis

Using the SAS computer software (SAS Statistics, version 2000 statistical assessment of the significant difference among means (mean SEM) were conducted by ANOVA followed by the Duncan's post hoc test to find the significant differences in all the parameters .The significant differences among the means were determined by using Duncan's Multiple Range test **(Duncan ,1955).**

RESULTS AND DISCUSSION

Feed intake and water consumption

Data of feed intake, DM, TDN, DCP and water consumption of dietary treatments are presented in Table 2. Daily dry matter intake (DMI) did not significantly differ between the T1 (control ration) and the T2 ration, while those fed T1 recorded significant higher (P < 0.05) than those fed in the rations T3 and T4. However, the relative difference in DMI between the best value in the T1 and the worst value was in the rations T4. There were no significant (P> 0.05) changes in TDN, DCP and water consumption among all treatments. It was minor variations in feed and water consumption parameters between the rations T2 and T3. The results revealed that all the tested doses of LE had a negligible effect on the ration palatability. These results are in line with those of **Xuefeng *et al.*, (2019)** who fed the Karakul sheep a cottonseed husk basal diet with supplementing 0 (control group) or 4.5% LE on a DM basis. They found that the consumed DM in the LE group was less than that in the control group. While, **Kim *et al*., (2013)** established that the Hanwoo calves who received diets supplemented with 0.5% LE showed no change in the DMI compared with that of un-supplemented calves. Also, **Sajjadi *et al.*, (2014)** discovered that when heifer calves were given 10 g of licorice per day as a supplement, there was no difference in DMI. On the other side, water intake showed no significant variations among the entire experimental group.

Table 2. Feed intake and water consumption of lactating Zaraibi goats fed different experimental rations.

Item	Experimental treatments			
	T1	T2	T3	T4
licorice extract g	-	2.0	4.0	6.0
Feed intake as DM basis (Kg / h / d)				
CFM	1.020	0.977	0.972	0.960
BH	0.340	0.325	0.324	0.320
RS	0.340	0.325	0.324	0.320
Total feed intake Kg / h / d				
DM	1.700[a]	1.627ab	1.620b	1.600c
Relative DMI %	100	95.71	95.29	94.12
TDN	1.09	1.05	1.051	1.035
DCP	0.124	0.118	0.121	0.118
Water consumption				
mL/h/d	4175	4140	4050	3980
mL/ g DMI	2.45	2.54	2.50	2.49

a,b and c, The mean within certain rows with different superscripts varies significantly ($P< 0.05$).

Relative DMI %= [DMI in T2,T3 or T4 / DMI in T1 (control)]×100. T1 (control group), T2 (control ration plus 2g licorice extract), T3(control ration plus 4g licorice extract), T4 (control ration plus 6g licorice extract), Concentrate feed mixer(CMF), Brseem hey(BH), Rice strow(RS), Dry matter (DM),Total digestibility Nutrient(TDN),Digestion crud protein (DCP) and Dry matter intake (DMI).

Digestibility and feeding values

Data presented in Table 3 showed no significant changes in values of digestibilities, TDN, and DCP among all tested rations. Animals that received either 2 or 4 g/head/day of the LE (T2 or T3) had slight improvements in digestibilities and feeding values when compared to other treatments (T1 or T4).

These results are in agreement with **Xuefeng *et al.*, (2019)** who found no differences in digestibilities and feeding values when they incorporated the LE in the basal ration of Karakul sheep. Additionally, these outcomes concur with those of other plant extracts rich in saponin added to ruminants' diets **Lovett *et al*., (2006), Pen *et al*., (2006), Santoso *et al*., (2007) and Guo *et al*., (2019).**

Table 3. Digestibility coefficients and feeding values of experimental rations

Item	Experimental treatments			
	T1	T2	T3	T4
Digestibility coefficients %				
DM	72.14±3.65	72.37±2.12	72.56±1.87	71.84±2.69
CP	62.53±2.89	64.15±3.24	64.82±2.75	63.54±3.36
CF	54.07±3.11	55.63±2.25	55.81±2.64	55.10±1.97
EE	82.32±2.89	82.77±3.21	84.69±2.86	83.76±3.16
NFE	78.87±4.43	79.99±3.78	80.17±2.89	78.70±2.66
feeding values %				
TDN	64.19±2.64	64.42±2.67	64.90±2.73	64.69±3.01
DCP	7.29±0.32	7.27±0.61	7.48±0.73	7.37±0.49

a, b and c, the mean within certain rows with different superscripts varies significantly (P< 0.05). **T1 (control group), T2 (control ration plus 2g licorice extract), T3(control ration plus 4g licorice extract), T4 (control ration plus 6g licorice extract), Concentrate feed mixer(CMF), Brseem hey(BH), Rice strow(RS), Dry matter (DM),Organic mater (OM),Curd protein (CP),Either exract (EE),Crud fiber (CF),Non fiber exrract(NFE),Ashes(ash),** Total digestibility Nutrient(TDN) and Digestion crud protein (DCP).

While, **Ramos-Morales *et al*., (2018) and Darat *et al*., (2021)** found that 24 h in vitro incubations were used in to assess the short-term LE (0, 0.5, 1, or 2 g L^{-1}) impact on fermentation parameters. They illustrated that although there was a trend toward decreasing the OM disappearance (P=0.069), the ammonia generation reduced (51%; P 0.001) and there were no detrimental effects on fermentation when LE was added at a rate of 1 2 g L^{-1}. However, the addition of 2 g L−1 led to a significant lessen in the overall VFA concentration (P= 0.014). These results are also in line with those of **Ameneh *et al*., (2023),** who discovered that adding LE to the diet enhanced rumen metabolism and animal performance.

Milk production and composition:

Table 4 represents the milk yield, composition, and feed utilization efficiency with the experimental rations. All tested levels of LE resulted were insignificant increased in milk yield and significant enhancements in feed utilization efficiency values in comparison with the control. Goats supplemented with the 4 g LE/h/d LE in T3 had the greatest (P< 0.05) values of feed utilization efficiency, while those in T1 recorded the lowest values. These findings might be due to the improved nutrient digestibility and feeding values by including the LE in the diet. These results matched **Kim *et al*., (2013)** who concluded that the Hanwoo calves supplemented with 0.5% licorice had better feed utilization efficiency than that with the un-supplemented calves. In the same trend, **Xuefeng *et al*., (2019)** found that the group supplemented with LE recorded higher feed utilization efficiency value than that with the control group.

Table 4. Milk yield, composition and feed utilization efficiency with the experimental rations

Item	Experimental treatments			
	T1	T2	T3	T4
N0. of does	5	5	5	5
Av. LBW, kg	38.80±1.23	39.20±1.34	39.10±2.23	39.20±2.12
Metabolic bod y size, $W^{0.75}$	15.54±0.18	15.66±0.45	15.64±0.66	15.66±1.08
Av. milk yield, kg / h / d	0.990±0.09	1.015±0.11	1.10±0.17	1.018±0.21
Feeding utilization efficiency				
DM kg / kg milk	1.717^{c}±0.01	1.603^{b}±0.09	1.473^{a}±0.12	1.572^{ab}±0.19
TDN kg / kg milk	1.101^{c}±0.05	1.034^{b}±0.08	0.955^{a}±0.08	1.017^{ab}±0.09
DCP kg / kg milk	0.125^{c}±0.005	0.116^{b}±0.003	0.111^{a}±0.002	0.116^{b}±0.002
Fat (%)	3.84^{c}±0.09	3.89^{b}±0.11	3.95^{ab}±0.17	4.03^{a}±0.12
Fat yield (g/kg)	3.80^{c}±0.26	3.95^{b}±0.12	4.35^{a}±0.87	4.10^{b}±0.14
Protein (%)	3.77^{c}±0.14	3.79^{c}±0.15	3.85^{b}±0.18	3.9^{a}±0.09
Protein yield (g/kg)	3.73^{b}±0.13	3.85^{ab}±0.18	4.24^{a}±0.03	3.97^{ab}±0.16
Total solids (%)	12.28±0.68	12.42±0.21	12.46±0.75	12.53±0.64
Total solids yield (g/kg)	12.16^{c}±0.11	12.61^{b}±0.11	13.71^{a}±0.19	12.76^{ab}±0.14
Ash (%)	0.77±0.08	0.81±0.008	0.84±0.01	0.87±0.002
Ash yield (g/kg)	0.76^{c}±0.1	0.82^{b}±0.09	0.92^{a}±0.036	0.89^{a}±0.009
Lactose (%)	4.31±1.16	4.32±2.78	4.33±2.36	4.34±1.34
Lactose yield (g/kg)	4.27^{b}±2.08	4.38^{b}±1.33	4.76^{a}±1.91	4.42^{b}±1.89
Galactose (%)	0.046^{b}±0.001	0.048^{ab}±0.002	0.05^{a}±0.001	0.05^{a}±0.002
Galactose yield (g/kg)	0.046^{c}±0.001	0.049^{b}±0.002	0.055^{a}±0.002	0.051^{b}±0.001

a, b and c, the mean within certain rows with different superscripts varies significantly (P< 0.05). T1 (control group), T2 (control ration plus 2g licorice extract), T3 (control ration plus 4g licorice extract), T4 (control ration plus 6g licorice extract), Dry matter intake (DM), Total digestibility Nutrient (TDN) and Digestion crud protein (DCP).

The study investigated the effect of different levels of LE on milk composition, expressed as daily yields, and showed that the animals receiving 6g/head/day of LE (T4) had significantly higher (P< 0.05) levels of fat, protein, and galactose compared with other treatments, while T1 had the lowest values. However, no significant difference was observed in total solids, ash, and lactose percentages, while the corresponding values expressed daily yields of the animals fed control rations had the lowest (P< 0.05) values compared with other treatments. **Francesca *et al*., (2019)** stated that there were significant increases in milk yield and fat, protein, and casein contents when the Saanen goats received standard diets supplemented with licorice compared with the control diet. Also, **Reynolds *et al*., (1994)** reported that the quantity and compositions of proteins in milk are substantially regulated by the diet's energy content.

Blood parameters

Results in Table 5 indicated that the values of hematocrit, hemoglobin, total protein, albumin, globulin, urea, creatinine, glucose, AST, and ALT did not significantly alter by different dietary treatments. The experimental diets for these animals were balanced, which had an impact on their state of health and the typical behavior of all animal groups.

These results are consistent with those from **Kim *et al*., (2013)** who found that adding a licorice root extract (0.5%) to Hanwoo calves diets had no effect on total protein concentration or AST and ALT activities.

Table 5. Blood profile of lactating Zaraibi goats as affected by different experimental rations

Item	Experimental treatments			
	T1	T2	T3	T4
Hemoglobin g/d	10.55±0.76	10.60±0.89	10.65±0.43	10.53±0.32
Hematocrit (Het) %	32.28±1.12	32.30±1.43	32.35±2.31	32.22±2.34
Total protein g/d	6.50±0.77	6.67±0.53	6.57±0.29	6.43±0.36
Albumin g/d	3.33±0.09	3.37±0.13	3.38±0.14	3.30±0.28
Globulin g/d	3.17±0.08	3.30±0.07	3.19±0.06	3.13±0.07
Urea mg/d	49.63±4.42	49.66±4.87	49.67±3.21	49.60±5.11
Creatinine mg/d	0.74±0.01	0.81±0.008	0.78±0.02	0.73±0.01
Glucose mg/d	65.32±3.43	65.34±3.18	65.38±3.01	65.31±2.98
AST U/L	83.70±5.21	83.68±4.66	83.52±4.87	83.69±6.12
ALT U/L	20.65±1.02	20.42±1.15	20.35±1.17	20.53±1.21

T1 (control group), T2 (control ration plus 2g licorice extract), T3 (control ration plus 4g licorice extract), T4 (control ration plus 6g licorice extract), the activities of aspartate aminotransferase (AST) and alanine aminotransferase (ALT)

The mean in several rows with various superscripts varies significantly (P 0.05) in the cases of a, b, and c.

Economic feed efficiency

The results of the economic study are shown in Table 6. The daily feed cost was highest for the T1 ration (6.97 E£) and the lowest was with T4 (6.60 E£). The T3 ration recorded the highest relative economic efficiency at 164.34 compared to the control ration 100%. In this study, supplementing with LE relatively reduced daily feed intake and improved dairy goat productivity, ultimately increasing economic efficiency.

Table 6. Economic effectiveness of the experimental rations

Item	Experimental rations			
	T1	T2	T3	T4
Av. daily intake as fed, kg/h/d				
Concentrate feed mixture	1.02	0.97	0.97	0.96
Berseem hay	0.34	0.32	0.32	0.32
Rice straw	0.34	0.32	0.32	0.32
licorice extract g/h/d	0	2	4	6
Average daily milk yield kg/h				
Actual milk yield	0.99±0.09	1.015±0.11	1.1±0.17	1.018±0.21
4% Fat corrected milk yield	0.96±0.09	0.99±0.1	1.09±0.18	1.01±0.20
Economic efficiency				
Total feed cost E£ /h/d	6.97	6.69	6.67	6.61
Average revenue of 4% FCM E£ /h/d	9.66	9.99	10.90	10.10
Net feed revenue cost E£ /h/d	2.69	3.30	4.23	3.49
Economic efficiency %	38.59	49.33	63.42	52.8
Relative economic efficiency	100	127.83	164.34	136.82

At the time of the experiment, the market prices for Concentrate feed mixture was 5500 Egyptian pound (E£)/ton, Berseem hay was 3000 E£/ton, Rice straw was 1000 E£/ton, licorice extract was 0.8 E£/g, and 1kg goats' milk 4% FCM was 10 E£/kg.

CONCLUSION

Conclusively, the LE acted as a vital feed additive and its contents of bioactive compound could be potentially led to beneficial effects on digestion and feeding values of rations as well as blood constituents, milk production, composition which consequently improved the productive performance of goats. Further study is needed to validate this speculation.

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تأثير إضافة مستخلص عرق السوس على الأداء الإنتاجي للماعز الزرايبي الحلابة

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هدفت هذه الدراسة تحديد كيفية استخدام مستخلص عرق السوس كإضافة علفية في تحسين إنتاج الماعز الزرايبي الحلابة. تم تقسيم عشرين ماعز زرايبي حلابة بعد الولادة مباشرةً إلى أربع مجموعات متجانسة (خمسة حيوانات لكل مجموعة) حسب إنتاجية اللبن ووزن الحيوانات والعمر (متوسط وزن الجسم ، 39,1 ± 2,5 كجم). تم توزيع مجموعات الماعز على المعاملات التجريبية بشكل عشوائي كالتالي: المجموعة الأولى (العليقة الضابطة): تتكون من 60٪ مخلوط مركزات + 20٪ دريس البرسيم + 20 ٪ قش الأرز وبدون أية إضافة، وتغذت الثلاث مجموعات الأخرى علي العليقة الضابطة مضافا إليها 2 أو 4 أو 6 جم / حيوان / اليوم من مستخلص عرق السوس على الترتيب،غذيت الحيوانات وفقا لمقررات الماعز بمنشور المجلس القومى الأمريكى للبحوث (2007). استهلكت حيوانات المجموعة الأولى علف أكثر معنويًا من المعاملات الأخرى. ومع ذلك، لم تكن هناك تغييرات معنوية بين جميع المعاملات في تناول المركبات الكلية المهضومة والبروتين المهضوم والماء. لا توجد تغيرات معنوية في قيم قابلية الهضم والمركبات الكلية المهضومة والبروتين المهضوم بين جميع العلائق المختبرة. أدت جميع المستويات المختبرة من مستخلص عرق السوس إلى زيادة غير معنوية في إنتاج اللبن ولكنها سببت تحسنًا معنويًا في قيم كفاءة استخدام العلف بالمقارنة مع المجموعة الضابطة. كانت كفاءة الاستفادة من العلف الافضل معنويَا للماعز المضاف لعليقتها 4جم مستخلص عرق

السوس/رأس/يوميًا (المجموعة الثالثة) بينما سجلت الماعز مع عليقة المجموعة الضابطة أقل القيم. كانت لدى الحيوانات التي تلقت 6 جم مستخلص عرق السوس/ رأس/ يوم (المجموعة الرابعة) مستويات أعلى بكثير من دهن وبروتين وجلاكتوز اللبن مقارنة بتلك الموجودة في المجموعة الثالثة ، في حين كان لدى المجموعة الضابطة أقل القيم. ومع ذلك، لم يلاحظ أي اختلاف كبير في نسب المواد الصلبة الكلية والرماد واللاكتوز باللبن. لم يؤثر مستخلص عرق السوس على معايير الدم المقاسة. سجلت عليقة المجموعة الرابعة أعلى كفاءة اقتصادية نسبية بنسبة 217,19٪ مقارنة بالعليقة الضابطة 100٪. ويمكن الاستنتاج أن مستخلص عرق السوس أدى إلى تأثيرات مفيدة على الأداء الإنتاجي للماعز الزرايبي الحلابة.