Egyptian J. Anim. Prod. (2025) 62(2):135-145

INFLUENCE OF SUPPLYING GINGER POWDER ON PRODUCTIVE PERFORMANCE AND CARCASS CHARACTERISTICS OF WEANED LAMBS

S. Abo Bakr

Animal and Poultry Production Division, Desert Research Center, Cairo, Egypt

Article History: Received:13/1/2025; Accepted: 4/5/2025; Published: 29/5/2025
DOI: 10.21608/ejap.2025.350788.1099

SUMMARY

Twenty-one weaned Barki lambs, aged between three to four months with an average weight of 27.26 kg ±0.72 kg, were used to study the effects of two different levels of ginger powder (Zingiber officinale) on lambs performance and carcass attributes. The lambs were divided into three groups (7lambs/group). The first group was used as a control (CR) was provided a basal diet consisted of a concentrate feed mixture (CFM) and alfalfa hay (AH) without any supplementation. The second and third groups received the same basal diet, but with ginger powder supplementation added at 3 g/h/d (LLGP) and 6 g/h/d (HLGP), respectively. Feed was offered as 70% CFM of the total nutrient requirements during experimental period (105 days), while AH was offered as 30% from total rations. The results showed that the lambs fed different levels of ginger showed an increase in average daily gain by 11.2% and 9.5%, respectively, in comparison to the control group. Supplemented groups showed higher feed efficiency by 13% and 6% for LLGP and HLGP, respectively than control. Moreover, carcass properties for LLGP lambs were significantly higher for some carcass traits *compared to CR. All of the ruminal and hematological parameters were within the normal range. It could be recommended that the use of 3 g/h/d ginger powder enhanced growth performance, nutrient utilization, and improve carcass characteristics, besides improving economic efficiency from Barki lambs.*

Keywords: Lambs, ginger powder, growth performance, rumen and blood parameters, carcass traits

INTRODUCTION

Livestock production is an essential income-generating activity for rural communities. It plays a major role in farmers' livelihoods and employment and contributes to the national economy (Ben Salem, 2012). Additionally, to fill the gap in animal protein, it's necessary to exploit the available natural resources under the arid and semi-arid conditions to make real sustainable development through livestock production (Khidr, 2022). Sheep play a significant role in Egypt's food security strategy, with a production of 72,296 tons of red meat in 2017, accounting for about 7.4% of the country's total red meat output (FAOSTAT, 2018). Barki sheep breed, known for its ability to withstand arid and harsh environmental conditions, produces high-quality meat and wool. This resilience makes it an ideal candidate for addressing the challenge of insufficient animal protein in desert regions (Fereig *et al*., 2023).

Feed additives are commonly used to enhance animal productivity and improve feed efficiency. These additives vary in nature, including chemical, natural, and herbal types. However, the European Union has prohibited the use of antibioticas feed additives due to concerns about cross-resistance and the potential for multiple drug resistance in human pathogenic bacteria (Demir *et al*., 2005). Furthermore, the World Health Organization supports the use of natural feed additives, emphasizing their safety and potential benefits in avoiding harmful side effects (Mohamed *et al*., 2003, and Abo Bakr, 2019). As a result, in recent years some researchers (Nassar *et al*., 2024, and Rabee *et al.,* 2025) have increasingly turned to herbal feed additives as a viable solution.

Ginger root (*Zingiber officinale* L.) is recognized as a valuable medicinal additive in animal nutrition. It offers several beneficial nutritional properties, including (i) containing active compounds like *zingerone, gingerdiol, zingibrene, gingerols*, and *shogaols*, which possess antioxidant properties (Zancan *et al*., 2002), (ii) exhibiting anti-inflammatory and antibacterial effects (Williams and Lamprecht, 2008), and (iii) being a rich source of essential micronutrients such as vitamins A, E, B, and C, which contribute to enhance disease resistance (Adel and Prakash, 2010). Additionally, some studies showed that ginger's root powder enhances the appetite of animals and improves the nutrients palatability (Tilgner, S. 1999) besides its favorable effects on digestion, absorption and animals productive (Nassar,2020, and Ali *et al*.,2024).

Moreover, herbal additives promote the health of gut microflora and stimulate pancreatic secretions, leading to enhance endogenous enzyme activity and immune function. These additives also exhibit a wide range of antimicrobial activity and possess strong antioxidant properties (Demir *et al*., 2005). The objective of the present study was to assess the impact of varying levels of ginger powder on the productive performance and carcass characteristics of weaned male Barki lambs.

MATERIALS AND METHODS

Experimental Location:

The study was conducted in the Siwa Research Station, Desert Research Center. Geographically, Siwa Oasis is located between longitudes 25º 16′ and 26º 12′ E and latitudes 29º 06′ and 29º 24′ N. The region is characterized by a desert climate (Zidane, 2010).

Experimental Animals and Diets:

The experiment involved twenty-one weaned Barki lambs, aged three to four months, with an average weight of 27.26 ± 0.72 kg. The lambs were randomly assigned to three groups, each one consisted of seven animals. The three groups were fed a concentrate feed mixture (CFM;40% corn, 18.8% wheat bran, 20% soybean meal, 18% discarded dates, 2% limestone, 1% salt, and 0.2% mineral and vitamin mixture) and alfalfa hay with ratio 70:30. The first group received zero supplementation as a control ration (CR), while the rations of the second and third group were supplemented with (3 g/h/d) ginger powder (LLGP) and (6 g/h/d) of ginger powder (HLGP), respectively. The supplementation was carried out by adding ginger powder to CFM. To ensure uniform distribution, the concentrated ingredients and ginger powder were thoroughly mixed.

The feeding trail was continued for 105 days; all animals were fed (at 8 am). The lambs were weighed at the beginning of the experiment then biweekly to calculate offered feed depending on the changes of live body weight according to Kearl (1982). Lambs were housed in shaded pens and water was offered twice a day.

Digestibility trial:

Following the group feeding trials, four lambs from each group were housed individually in metabolic cages (1.6 m x 0.53 m) for 15 days (seven days adaptation and seven days for sample collection). Water was provided twice daily, and water intake was recorded. Daily fecal samples were collected for each animal. The samples were weighed, and 10% of each sample were dried at 60°C. Urine was collected and measured daily.

Sampling of Rumen Liquor:

At the end of the digestibility trials, rumen liquor samples were collected using a stomach tube (according to Ramos-Morales *et al*., 2014) from all animals at three hr. post-feeding. The rumen samples were filtered through two layers of cheesecloth, and pH was immediately measured using a Beckman pH meter. The rumen liquor was stored in plastic bottles with a few drops of 0.1 N HCl and kept at -20°C for subsequent analysis.

Slaughtering Procedures and Carcass Traits:

Twelve lambs (four from each group) were slaughtered after being fasted for 12 hr. to evaluate carcass traits according to the standard protocol (Frild *et al*., 1961). Immediately after slaughter, the weight of abdominal and thoracic organs, the digestive tract, hot carcass weight, and dressing percentage were recorded. The 9th, 10th, and 11th rib cuts were separated, fat thickness was also measured using calipers, following the method outlined by USDA (1975).

Wholesale Cuts and Physical Components of 9-10-11 Rib Cuts:

After chilling, each carcass was divided into seven joints (neck, shoulder, rack, flank, loin, leg, and tail), according to Egyptian wholesale mutton cuts as described by Hamada (1976). The chilled carcasses and wholesale cuts were weighed to calculate their percentages relative to the chilled carcass weight. The 9th, 10th, and 11th rib cuts were further divided into their physical properties; lean meat, fat, and bone and the proportion of each component was calculated based on the total weight of the rib cuts. The cross-sectional area of the *Longissimus dorsi* muscle was measured between the 11th and 12th ribs using a polar plane meter.

Blood Sampling:

Blood samples (*withantico agulant*) were procured (at the end of the experiment) from the jugular vein of lambs. These blood samples underwent analytical evaluation to ascertain various hematological parameters, including the quantification of red and white blood cells (RBCs and WBCs). Furthermore, the hematocrit value (Ht) and hemoglobin (Hg) concentration within the whole blood were measured. Mean corpuscular hemoglobin concentration (MCHC%), mean corpuscular hemoglobin (MCH), and mean corpuscular volume (MCV) were subsequently calculated, as detailed by Patterson *et al*. (1960).

Chemical analysis:

Samples of feeds and feces were analyzed according AOAC (2000), dry matter (DM; method 930.15), ether extract (EE; method 954.02), crude protein (CP; method 955.04), and ash (method 942.05). The stored strained rumen liquor samples were thawed at room temperature and then analyzed for ammonia nitrogen (NH3-N) using Markham micro-distillation apparatus (Preston, 1995) and total volatile fatty acids (TVFA) were quantified by Kjeldahl distillation method according to AOAC (1997).

Statistical analysis:

Data obtained in this study were statistically analyzed as one-way ANOVA using SAS programmer for PC (2002), and the mathematical model was $Y_{ij} = \mu + T_i + e_{ij}$, Where$Y_{ij}$ = experimental observation, μ = overall mean, T_i = effect of treatment, e_{ij} = experimental error. Differences between means were compared by Duncan's multiple range test of Duncan (1955).

RESULTS AND DISCUSSION

The Chemical composition of concentrate feed mixture and alfalfa hay:

Chemical composition of alfalfa hay (AH) and concentrate feed mixture (CFM) are shown in (Table 1). The contents of CP and CF, nearly agreed with those obtained by El Shereef (2019). In general, AH in the current study contained acceptable values of most nutrients and was possible for sheep nutrition.

Chemical analysis of CFM showed 17.31 (MJ/kgDM), (Table 1). Generally, CFM provided an appropriate feed quality for sheep. These findings were similar to those reported by Kewan (2013).

Table 1. Chemical composition of the experimental concentrate feed mixture and alfalfa hay roughage

Items	D.M.	O.M.	C.P.	C.F.	E.E.	NFE	Ash	GE*
Alfalfa hay	92.54	88.29	14.78	28.11	1.09	44.31	11.71	16.71
CFM	94.46	89.32	17.8	6.24	2.15	63.13	10.68	17.31

*GE: Gross energy (MJ/kgDM) was estimated according to SCA(1990).

Intake and dry matter digestibility during digestibility trial:

The current findings (Table 2) showed no significant differences in total intake among the experimental groups (P > 0.05). This could be attributed to the adaptation period, which helped the experimental animals to consume the experimental rations without showing any variation in the feed intake.

Table 2. Average live body weight (ALBW), intakes, and dry matter digestibility (DMD) during the digestibility trial

Items	CR	LLGP	HLGP	±SE
ALBW (kg)	47.80	45.75	45.50	1.59
Roughage intake (g/h/d)	563	553	557	15.64
Roughage intake (g/kg BW)	11.8	12.1	12.2	0.36
CFM intake (g/h/d)	810	742	814	22.57
CFM intake (g/kg BW)	16.9	16.2	17.9	0.52
Total intake (g/h/d)	1373	1295	1371	36.14
Total intake (g/kg BW)	28.7	28.3	30.1	0.74
Total intake as a percentage of LBW	2.87	2.83	3.01	0.07
Dry matter digestibility	62.54[b]	70.20[a]	72.12[a]	1.37

[a,b] Means within a row that do not share a common superscript letter are significantly different at P<0.05.

These results are consistent with those of Fahim *et al*. (2022), and Ali *et al*. (2024), who found that the addition of ginger powder (5 or 7 g/kg BW) to the diets of Ossimi sheep improved dry matter (DM) digestibility by 11.4% and 17.8%, respectively, compared to the control groups. The enhancement in DM digestibility from ginger powder supplementation may be linked to its effect on rumen fermentation, reduction in ammonium synthesis, and control of intestinal worms, that may be due to the phytochemical compounds present in ginger (Barry and McNabb, 1999). Additionally, ginger supplementation has been shown to increase saliva secretion, which boosts the activity of digestive enzymes and ultimately improves nutrient digestion (Ernst and Pittler, 2000). Srinivasan (2005) also noted that many herbal plants stimulate digestive enzyme secretion. Equally, Nassar (2020) reported only a slight increase in dry matter digestibility in rams fed a low level of ginger powder. Furthermore, Al-Suwaiegh (2023) observed no significant differences in dry matter digestion coefficients in goats fed rations supplemented with varying levels of a garlic-ginger powder mixture.

Water utilization:

The obtained results of total water intake showed insignificant differences (P > 0.05) among treatments (Table 3). These findings are in line with earlier studies that reported similar results from adding the same level of ginger powder or ginger oil (Nassar, 2020).

On the other hand, water excretion as fecal and urinary showed significant differences among treatments. Control group was significantly higher for fecal water compared with other treatment groups which contained different levels of ginger powder (Table 3).

On the other hand, animals receiving the low level of ginger powder (LLGP) exhibited significantly (P <0.05) higher urinary and total water excretion compared to the other groups. This could be attributed to the potential increase in heat increment caused by diet fermentation, which in turn raised the water requirements for the body's cooling system. These findings align with those reported by Kewan *et al*. (2017).

Table 3. Water utilization (ml/h/d) for Barki lambs fed the experimental rations

Items	CR	LLGP	HLGP	±SE
Drinking water	3695	3718	3349	166.83
Combined water	277	272	274	7.65
Total water intake	3972	3990	3623	171.66
Fecal water	233[a]	202[b]	158[b]	13.60
Urinary water	439[b]	755[a]	531[b]	52.69
Total water exertion	672[b]	957[a]	689[b]	142.1
Water balance ml/h/d	3300	3033	2934	56.47

[a,b] Means within a row without a common superscript letter differ significantly at P < 0.05.

Rumen Liquor Parameters:

As shown in Table (4), there were no significant differences in ruminal pH. This result is consistent with previous reports by Nassar (2020), Abo Bakr (2019), and Zhang *et al*. (2011). Overall, the average pH values in this study ranged from 5.73 to 5.79, falling within the normal range suggested by Jasmin *et al*. (2011).

Table 4. Rumen fermentation parameters for rams fed experimental diets during digestibility trials

Items	CR	LLGP	HLGP	±SE
pH	5.79	5.75	5.73	0.05
NH_3-N (mg/dL)	12.04[a]	10.65[a]	6.65[b]	0.82
TVFAs (meq/dL)	22.3[a]	17.16[b]	18.13[b]	0.96

[a,b] Means within a row without a common superscript letter differ significantly at P < 0.05

Ammonia nitrogen concentration: The ruminal NH_3-N values (Table 4) revealed significant differences (P<0.05) among the experimental groups, with the groups receiving ginger powder showing the lowest values (Table 4). In this connection, Soroor and Moeini (2015), and El-Samarany (2015) reported lowered ammonia concentration as a result of addition of ginger powder in sheep diets.

The notable decrease in ammonia-N concentration might be due to the presence of ginger which probably led to decrease deamination of amino acids by ruminal bacteria (Soroor and Moeini, 2015), also, phenolic compounds contain high antimicrobial activity that led to definition of protozoa from the rumen, which prevents the recycling of N between bacteria and protozoa, this led to decrease of ammonia-N in rumen. In contrast to the findings of the present study, Zhang *et al*. (2011) reported no significant differences in rumen ammonia concentrations in sheep fed varying levels of ginger powder. In general, the mean values of NH_3-N differed insignificantly and ranged from 6.65 to 12.04. These values of NH_3-N were in the line with Paengkoum *et al*. (2006) who stated that the required concentration of rumen NH_3-N in the rumen is five to 20 mg/dl to support the activity of rumen microorganisms.

The TVFAs concentration:

Total VFA concentration was significantly lower (P < 0.05) in the ginger groups. This result is consistent with the findings of Zhang *et al*. (2011), who suggested that the antimicrobial properties of ginger powder may reduce rumen microbial activity and diet fermentation. Overall, the TVFA concentrations observed in the current study fell within the normal range reported by Phillip *et al*. (2014), Khir *et al*. (2015), and Mahrous *et al*. (2019), who found that TVFA concentrations in fattening lambs ranged from 9.8 to 17.81 meq/dL.

Blood parameters:

Hematological parameters:Hematological parameters of lambs were presented in Table 5. As shown, blood parameters, with the exception of MCHC, were not significantly affected by the experimental rations. However, hemoglobin levels in lambs fed different levels of ginger powder (GP) increased by 7.0% and 7.4% for LLGP and HLGP, respectively, compared to the control group. In general, improved hemoglobin values are associated with higher ability to resist disease infection and hence, this can be considered evidence of balanced nutrition and good health for animals (Cheesbrough, 2004). The RBC values in our study ranged from 9.26 to 9.90, with no significant differences observed among the groups. However, values in all the experimental groups were within the normal range which obtained for sheep in the semi-arid environmental zone Njidda *et al*. (2014).

Regarding the impact of ginger powder (GP) on MCHC, the current findings showed that animals supplemented with ginger powder had lower MCHC levels compared to the control group. In contrast, Zaki *et al*. (2021) observed a significant increase (P < 0.05) in both MCHC and MCH in sheep fed diets containing ginger powder, while Hendawy *et al*. (2019) reported no significant (P>0.05) differences in MCHC percentages.

Consistent with our findings, animals fed HLGP showed an increase in WBCs compared to those fed LLGP or the control group.

This result aligns with the study by Shams Al-dain and Jarjeis (2015). The higher level of ginger powder (HLGP group) resulted in a 20.67% increase in WBCs compared to the control. The increase in total WBC count in the HLGP group may be attributed to the active compounds in ginger, such as gingerdiol and gingerols, which possess antioxidant properties (Zancan *et al*., 2002). Ginger is also believed to enhance WBC production through its anti-inflammatory effects by stimulating immune cells (Lin *et al*., 2003). On the other hand, Kyume *et al*. (2020) found that most hematological parameters were not significantly affected (P > 0.05) by the inclusion of herbal additives (garlic or ginger).

Most hematological parameters in the current study were within the normal range for young sheep (under one year old) raised in the tropics and subtropics, as reported by Seixas *et al*. (2021). In general, the positive effects of medicinal plants on hematological parameters are attributed to their content of blood-forming factors like folic acid, iron, and vitamin C, which stimulate blood production in the bone marrow (Khattab *et al*., 2011). However, the observed variations in these parameters can be attributed to differences in preparation methods, species, and factors influencing their absorption and bioavailability (Hendawy *et al*., 2019).

Table 5. Some hematological parameters recorded for fattening lambs fed the different experimental rations

Items	CR	LLGP	HLGP	±SE
Hemoglobin (g/dl)	9.37	10.03	10.06	0.17
RBC (10^6 /mm^3)	9.26	9.66	9.90	0.24
Ht (%)	27.73	25.03	26.20	0.74
MCH (pg)	11.23	10.40	10.20	0.22
MCHC (%)	40.18^a	37.63^b	38.86^b	0.57
MCV (Fl)	26.90	27.70	29.33	0.97
MCV/RBC	2.93	2.90	2.96	0.11
WBC (10^{-3} /mm^3)	8.56	8.30	10.33	0.42

^{a,b} Means within a row without a common superscript letter differ significantly at P < 0.05.

Lamb Performance and Economic Efficiency Indicators:

The growth performance data for lambs are presented in Table (6). No significant differences (P > 0.05) were observed in initial and final weights among the experimental groups. However, the average daily gain (ADG) and total gain (TG) for lambs supplemented with ginger powder (LLGP and HLGP) were slightly higher than the control group, although the differences were not statistically significant. The ADG increased by 11.2% and 9.5% for LLGP and HLGP, respectively, compared to the control group. The increased ADG contributed to a higher total gain throughout the study, with LLGP and HLGP showing the greatest TG by 12.3% and 10.2%, respectively, compared to the control group. These results align with those of Shams Al-Dain *et al*. (2018), who reported significant (P ≤ 0.05) weight gain increases in sheep fed 15 and 30 g of ginger per kg of feed compared to the control group. The improved weight gain in experimental animals fed ginger-supplemented rations could be attributed to factors such as improved dry matter digestion (Fahim *et al*., 2022), as well as the presence of bioactive components like gingerol and shogaol, which are known to provide health benefits in animals (Ding *et al*., 2012). Moreover, ginger rhizomes possess several beneficial properties that enhance nutritional efficiency, such as being rich in protease, improving protein digestion, optimizing amino acid absorption, and promoting the growth of beneficial intestinal bacteria (Ali *et al*., 2008). The average intake across the different groups during the fattening period was nearly identical. This could be explained by the lack of significant differences in average gains. Feed offered was restricted as a percentage of body weight, and production requirements were calculated based on weight changes, as suggested by Kearl (1982). Similarly, these findings are in agreement with those reported by Noaman and Shujaa (2016). Feed conversion efficiency, expressed as kg DMI per kg of gain, was similar across all groups, ranging from 6.7 to 7.0 kg DM/kg gain. These values are consistent with those reported by Abo Bakr *et al*. (2020).

Economic efficiency indicators in the current study were influenced by the prevailing prices of feed ingredients and live body weight. The results showed that the daily cost of CFM for LLGP and HLGP increased by 5.8% and 13%, respectively, compared to the control group (CR). The addition of ginger powder (GP) affected the total daily feeding cost, with HLGP having an 18% higher cost, followed by LLGP at a 10% increase compared to the control group. Economic efficiency is influenced by several factors, including the price of feed ingredients, dry matter intake, total weight gain, feed conversion, and the price of live body weight. In this study, the highest economic efficiency was observed in the LLGP group, with a 13% improvement, followed by HLGP with a 6% improvement, while the control group showed the least efficiency. These findings are consistent with those of Abo Bakr (2019).

Additionally, El-Elaime and Sabbah-Allam (2020) reported that the inclusion of herbal plants in the diet improved economic efficiency in growing lambs.

Table 6. Lamb performance and economic efficiency indicators for experimental diets

Item	Experimental groups			±SE
	CR	LLGP	HLGP	
		Body Weight Variations in Lambs		
IBW	27.5	27.2	27.1	0.72
FBW	46.2	48.2	47.7	1.11
ADG	179	199	196	0.64
TG	18.7	21.0	20.6	6.16
RGR	68.00	77.21	76.01	2.90
		Average feed intake		
CFMI	863	913	975	
AH	391	413	385	
Total intake	1254	1325	1360	
		Feed conversion (kg/ kg)		
Kg Intake /kg gain	7.0	6.7	6.9	
		Indicators of Economic Efficiency		
Daily CFMI Cost	10.35	10.95	11.7	-
Daily BH I Cost	3.52	3.71	3.47	-
Cost of Ginger Powder Dose	0	0.6	1.2	
Total Daily Feeding Cost	13.87	15.26	16.37	-
Total Price of feeding in all period	1456	1603	1718	
Price of total gain	4301	4830	4738	-
Net revenue	2845	3227	3020	-
Relative profit, %	100	113	106	-
Improvement, %	0	13	6	-

* Relative Growth Rate (RGR), % = (final BW – initial BW) × 100/IBW. CFM= 12 LE/ kg, GP=200 LE/ KG, alfafa hay = 9 LE/kg, LBW= 230 LE/kg live body weight,

Carcass Characteristics:

The data on various carcass weights (kg) including fasting weight, after bleeding, and dressing percentage (%) showed no significant differences among the groups (Table 7).

The results indicate that different levels of ginger powder (GP) did not influence the previous carcass weights. Dressing percentage, based on fasting weight, ranged from 46.71% to 48.08%. These findings are consistent with those of El-Essawy *et al*. (2019), who reported no significant differences in the dressing percentage of Barki lambs fed diets supplemented with various herbal feed additives. Similarly, this study's results align with those of Mozhir and AL-Ali (2023), who found no significant effect of ginger powder (20 g/kg dry matter) on the dressing percentage of fattening Awassi lambs. Additionally, the current findings are in agreement with Ghanem *et al*. (2021), who reported dressing percentages ranging from 46.7% to 48.8% for Barki lambs. The *Longissimus dorsi* (LD) area (cm^2) in the LLGP group was significantly larger by 78.6% compared to the control group (CR) and by 54.9% compared to the HLGP group. These results are in line with those of Mozhir and AL-Ali (2023), who observed a 33.3% and 47.8% increase in eye muscle area with rations containing ginger or ginger plus vitamin E. The significant improvement in muscle area in the LLGP group, as shown in Table (7), can likely be attributed to the use of ginger powder, which may enhance nutrient metabolism due to its content of proteins, fatty acids, and various amino acids (Kemper, 1999). In contrast, the findings of Orzuna-Orzuna *et al*. (2021) did not align with this study, as they found no significant differences in rib eye muscle area or fat thickness between ginger and other feed additives for fattening lambs.

The best rib dissections from the experimental animals in Table (7) revealed significant differences ($P<0.05$) only in rib weight and lean meat percentage. LLGP resulted in a significantly higher rib weight, showing a 19.5% increase compared to HLGP and a 12.2% increase compared to the control group (CR). These results are consistent with those of Mozhir and AL-Ali (2023), who noted a 27% higher rib weight in the ginger-supplemented groups compared to the control group.

Table 7. Carcass traits of Barki lambs affected by supplementation with different levels of ginger powder

Items	GP0	LGP	HGP	±SE
Fasting wt. (Kg)	46.5	50.2	47.8	1.44
Body wt. after bleeding, (Kg)	45.04	48.91	45.98	1.39
Carcass wt. (Kg)	21.72	23.65	22.98	0.71
Dressing percentage (%)	46.71	47.11	48.08	0.31
L.D muscle area (cm^2)	14.8^b	26.43^a	17.06^b	1.61
Fat thickness (mm)	4.68^b	5.42^b	6.74^a	0.33
Characteristics of 9-10-11 rib cut:				
9-10-11 rib cut wt. (g)	1059^b	1188^a	994^b	36.45
Physical components (%)1 of 9-10-11 rib cut:				
Lean meat (%)	61.16^a	57.21^{ab}	54.31^b	1.18
Fat (%)	20.03	20.93	23.29	0.83
Bone (%)	16.96	18.92	19.05	0.86
Loss (%)	1.85	2.94	3.35	0.33
Lean: Fat ratio	3.08	2.76	2.35	0.14
Lean: Bone ratio	3.65	3.12	2.89	0.19

a,b Means within a row without a common superscript letter differ significantly at $P < 0.05$.

Carcass Data:

The data presented in Table (8) show no significant differences ($P > 0.05$) among groups for most external offal's (head, feet, skin). However, there was an increase in the percentage of external offal's for the LLGP and HLGP groups, which were 18.3% and 12.5% higher, respectively, compared to the control group. These results align with those of El-Essawy *et al.* (2019). This increase may be due to the higher slaughter weight of the treated groups, which was 7.96% and 2.79% higher than the control group, respectively. These findings are consistent with those of Abo Bakr *et al.* (2020), and Shehata (2013), who reported that increased slaughter weight in Barki lambs led to greater non-carcass component weights.

Table 8. Effect of ginger powder additive on some carcass traits of Barki lambs

Items	CR	LLGP	HLGP	±SE
External offal, kg:				
Head	2.74	3.14	3.02	0.11
Four feet	0.90	1.01	1.05	0.03
Peel	4.99	6.06	5.65	0.24
Total	8.64	10.22	9.72	0.35
As % of hot carcass	39.84	43.32	42.40	1.01
Internal offal, g:				
Liver	671.6	800	763.3	38.7
Heart	228.3	235	250	10.9
Kidneys	123.3	141.6	111.6	10.1
Spleen	96.6^b	83.3^b	130^a	8.3
Lunges	535.0	771.6	690	4.8
Testis	185.0^b	253.3^a	166.6^b	15.1
Total Internal offal	1840^b	2285^a	2111.7^b	22.4
Total Internal offal as % of hot carcass	8.54	9.70	9.18	0.29
Gut and rumen content(kg):				
G.I. full wt.	10.68	9.94	8.70	0.42
G.I. empty wt.	2.84	3.56	3.14	0.22
Rumen content wt.	7.83^a	6.38^{ab}	5.55^b	0.39
Full gut as % from hot carcass	49.49^a	42.22^{ab}	37.86^b	2.22

a,b Means within a row without a common superscript letter differ significantly at $P < 0.05$**.**

A similar trend was observed for internal offals, except for the spleen. Most internal offals were not significantly affected by the treatments. However, the LLGP group had higher weights for the testis and total offals compared to the other groups. On the other hand, the total internal offal percentage of hot carcass did not show significant differences among groups, ranging from 8.54% to 9.70%.

Gut Component Data:

The data on gut components, including full and empty weights, are presented in Table (8). No significant differences were observed in the full and empty weight of rumen contents. However, rumen content and full gut weight (as a percentage of hot carcass weight) were significantly ($P < 0.05$) higher than the control group (CR) compared to the other groups. These findings are consistent with those of Abo Bakr *et al*. (2020), who reported a significant increase in full gut weight for the control group of fattening Barki lambs compared to other groups supplemented with various feed additives.

Wholesale Cuts:

Wholesale cuts, expressed as a percentage of chilled carcass weight for the different experimental groups, are shown in Table (9). The results revealed significantly higher values for the rack in the LLGP group compared to the control (CR) and HLGP groups. This may be attributed to the higher slaughter and carcass weights observed in this group.

Table 9. Wholesale cuts (%) and Carcass fat distribution of Barki lambs fed different levels of ginger powder

Items	CR	LLGP	HLGP	±SE
Neck	6.36	5.65	5.97	0.15
Shoulders	16.51	18.53	19.60	0.78
Rack	25.12^{b}	27.18^{a}	24.32^{b}	0.51
Loin	13.65	15.23	13.73	0.47
Flank	6.92	6.50	6.36	0.21
Legs	23.06	22.20	22.99	0.20
Tail	4.48	5.76	6.23	0.40
Carcass fat distribution:				
Internal fat, g	653	485	616	49.70
Kidney fat, g	310	266	233	24.08
Tail wt, g	978	1373	1436	117.02
Total body fat	1941	2125	2286	100.25
Fat% of EW	8.97	8.95	9.28	0.35

^{a,b} Means within a row without a common superscript letter differ significantly at $P < 0.05$.

In general, the results from this study are in agreement with those of Shehata *et al*. (2012), who found similar percentages of wholesale cuts for fattening Barki lambs with comparable carcass weights under Siwa conditions.

Carcass Fat Distribution:

The distribution of fat in the carcass (Table 9) was not influenced by the experimental rations. This lack of effect may be attributed to the CFM component. Similar findings were reported by Keno *et al*. (2021), who suggested that carcass characteristics are influenced by factors such as feed intake, body weight changes, and digestibility. The increased body fat observed in this study aligns with the results of El-Essawy *et al*. (2019), who found an increase in abdominal and tail fat when using certain essential oils in the diets of fattening Barki lambs.

CONCLUSION

Based on the previous data, it can be concluded that supplementing sheep feed with ginger powder, particularly at a low level of 3g/h/d, enhanced nutrient utilization. It also positively impacted rumen and blood parameters, boosted animal immunity, and resulted in higher total and average daily gains. Furthermore, it improved feed efficiency and, as a result, increased net revenue. Additionally, the inclusion of three g/h/d of ginger powder in the diet contributed to better carcass traits.

REFERENECES

Abo Bakr, S., 2019. Effect of adding ginger powder or ginger oil on reproductive performance of ewes during lactation period. Egyptian J. Nutrition and Feeds, 22(1):63-78.

Abo Bakr, S., K.Z. Kewan, M.S. Nassar and A. El-Shereef Afaf, 2020. Utilization of trimming waste of mandarin trees as feed for small ruminants: 3. evaluation of growth performance and carcass traits for Barki lambs. J. of Animal and Poultry Production, Mansoura Univ., 11(12):555-564.

Adel, S.P.R., and J. Prakash, 2010. Chemical composition and antioxidant properties of ginger root (Zingiber officinale). Journal of Medicinal Plants Research, 4(24):2674-2679.

Ali, M.E, S.A. Alsalamah, S.A. Al-Thubyani, N. Baazaoui, A.E. Ahmed, M.A. Nasser and H.A. Nasr 2024. Impact of ginger powder (Zingiber officinale) supplementation on the performance, biochemical parameters, antioxidant status, and rumen fermentation in Ossimi rams, Veterinary World, 17(7):1619–1628.

Ali, B. H., G. Blunden, M.O. Tanira and A. Nemmar, 2008. Some phytochemical, pharmacological and toxicological properties of ginger (Zingiber officinale Roscoe): A review of recent research. Food Chem. Toxicol., 46(2):409–420.

Ali, M. E., S.A. Alsalamah, S.A. Al-Thubyani, N. Baazaoui, A.E. Ahmed, M.E. Nasser and Nasr Heba A. 2024. Impact of ginger powder (Zingiber officinale) supplementation on the performance, biochemical parameters, antioxidant status, and rumen fermentation in Ossimi rams. J. Veterinary World, 2231:1619-1628.

Al-Suwaiegh, S.B., 2023. Effect of dietary supplementation of ginger and garlic mixture on performance of arid goats under stressful conditions. Indian Journal of Animal Research, 57(7):889-894.

AOAC., Association of Official Analytical Chemists, 1997. Official Methods of Analysis, 16th ed. AOAC, Arlington, VA, USA.

AOAC., 2000. Official Methods of Analysis, 17th Ed. Association of Official Analytical Chemists., Arlington, VA, USA.

Barry T.N., and W.C. McNabb, 1999. The implications of considered tannins on the nutritive value and temperature forage fed to ruminants. British Journal of Nutrition, 81:263–272.

Ben Salem. H., 2012. Simple and effective options hold promises to improve productivity and sustainability of livestock-based production systems under the climate change context. International Workshop on Recent Strategies in Animal Production, November 5-7.

Calsamiglia, S., M.D. Stern and J.L. Firkins, 1995. Effects of protein source on nitrogen metabolism in continuous culture and intestinal digestion in Vitro. Journal of Animal Science, 73:1819-1827.

Cheesbrough, M., 2004. District Laboratory Practice in tropical Countries. Part 2 University Press Cambridge United Kingdom, 266-342.

Demir, E., S. Sarica, M.A. Ozcan and M. Suiçmez, 2005. The use of natural feed additives as alternative to an antibiotic growth promoter in broiler diets. Arch. Geflügelk., 69(3):110–116.

Ding, S.H., K.J., An, C.P. Zhao, Y. Li, Y.H. Guo, and Z.F. Wang, 2012. Effect of drying methods on volatiles of Chinese ginger (Zingiber officinale Roscoe). Food Bioprod. Process, 90(3):515–524.

Duncan, D.B., 1955. Multiple Ranges and Multiple F-Test. Biometris, 11:1-42. http://dx.doi.org/10.2307/3001478.

Ernst, E., and M.H. Pittler, 2000. Efficacy of ginger for nausea and vomiting: a systematic review of randomized clinical trials. Br. J. Anaesth., (84):67–371.

El samarany, W. H., 2015. Effect of crushed ginger root feeding on rumen fluid characters and digestion efficiency in Awasi sheep. Egyptian Journal of Nutrition and Feeds, 18:39-42.

El-Elaime, R.R., and A. Sabbah, 2020. Impact of garlic, lemongrass, peepermint and rosemary as feed additives on performance of growing barki lambs. Egyptian J. Nutrition and Feeds, 23(3):359-367.

El-Essawy, M. Abeer, Ahlam R. Abdou, Marwa.H. El-Gendy, 2019. Impact of anise, clove and thyme essential oils as feed supplements on the productive performance and digestion of Barki ewes. Australian J. of Basic and Applied Science, 13(1):1-13.

El-Shereef, Afaf A., 2019. Blood serum biochemical changes and milk fatty acids profile due to using garlic plant as feed additives for sheep. Asian Journal of Research in Anim. Vet. Sci., 4(4):1-8.

Fahim, N.H., A.E. Kholif, H.H. Azzaz, 2022. Fennel and ginger improved nutrient digestibility and milk yield and quality in early lactating Egyptian buffaloes. Ann. Anim. Sci., (22):255–270.

FAOSTAT., 2018. Live animals. http://www.fao.org/faostat/en/#data/QA.

Fereig, R.M., R.M. Ibrahim, A.M. Khalil, C.F. Frey and F.A. Khalifa, 2023. Evaluation of clinical and biochemical traits in Egyptian Barki sheep with different growth performances. J. of Animals, (13): 962.

Fox, D.G., L.O. Tedeschi, T.P. Tylutki, J.B. Russell, M.E. Van Amburgh, L.E. Chase and T.R. Overton, 2004. The cornell net carbohydrate and protein system model for evaluating herd nutrition and nutrient excretion. Animal Feed Science and Technology, 112(1-4):29-78.

Frild, R.A., J.D Kemp and W.Y. Varney, 1961. Indices for lamb carcass composition. Journal of Animal Science, (322):218.

Ghanem, N., M. Zayed, I. Mohamed, M. Mohammady and M.F. Shehata, 2021. Co-expression of candidate genes regulating growth performance and carcass traits of Barki lambs in Egypt. J. Trop. Anim. Health Production, (11):260.

Hamada, M.K.O., 1976. Mutton and wool production, Dar El-Maaref, Alexandria, Egypt (in Arabic). J. Anim. Sci., 9:389–396.

Hendawy, A.O., M.M. Mansour and A.N.M. Nour El-Din, 2019. Effects of medicinal plants on haematological indices, colostrum, and milk composition of ewes. Journal of Veterinary Medicine and Animal Sciences, 2:1-5.

Jasmin, B.H., R.C. Boston, R.B. Modesto and T.P. Schaer, 2011. perioperative ruminal ph changes in domestic sheep (ovisaries) housed in a biomedical research setting. J. American Association for Laboratory Animal Science, 50:27–32.

Kearl L.C., 1982. Nutrient requirements of ruminants in developing countries. 1st Edn. International Feedstuffs Institute. Utah State Univ. Logan, Utah USA.

Kemper J.K., 1999. Ginger (Zingiber officinale). The Longwood Herbal and Task Force and the Center for Holistic Pediatric Education and Research. 1-18.

Kewan, K.Z., 2013. impact of total replacement of corn grains with discarded dates in concentrate diets on performance of growing Barki lambs. Egyptian J. Nutrition and Feeds, 169-180.

Kewan, K.Z., Ahlam. R. Abdou, E.A. Zaki, F.A. Salem, H.M. El-Sayed and S.S. Eisa, 2017. Using of biological treatments to enhance nutrients of Moringa stalks before utilized in ruminant feeding as a sole diet. Res. J. Anim. Vet. Sci., 9(2):16-22.

Khattab H.M., A.Z. El-Basiony, S.M. Hamdy and A.A. Marwan, 2011. Immune response and productive performance of dairy buffaloes and their offspring supplemented with black seed oil. Iran J Appl. Anim. Sci, 1:227-234.

Khidr, R., 2022. Some applied programs for livestock development under desert conditions of Egypt. Egyptian J. Anim. Prod., 59:25-32.

Khir, A.A., A.A. Mahrous, A.A. Phillip, Y.L. AbdelAzeem, N. Safa, 2015. Production performance of small ruminants fed pruning fruits trees by products. 2. Effect of treated pruning peach trees by-products on growing sheep. J. Animal and Poultry Prod., Mansoura Univ., 6(3):181-200.

kyume, A.T., T.T. Allu, R.P. Aniche, O.S. Onuh and M.E. Agbo, 2020. Effects of garlic (Allium sativum) and ginger (Zingiber officinale) powder and their combination on antioxidant and hematological response in sheep. Mal. J. Anim. Sci., 23(2):29-39.

Lin N., G. Huo L. Zhang and X. Zhang, 2003. Effect of Zingiber officinale Rosc. on Lipid peroxidation in hyperlipidemia rats. Wei Sheng Yan Jiu, 32(1):22-23.

Mahrous A.A., A.S. Karkoutli, A.A.H. El-Tahan, Y.H. Hafez, M.A. El-Shora, S.K. Moussa, 2019. Using of biological and chemical treated olive trees byproducts treated for lactating Damascus goats feeding. Egyptian J. Nutrition and Feeds, 22(2):87-93.

Mohamed, A.H., B.E. El-Saidy and I.A. El-Seidy, 2003. Influence of some medicinal plants supplementation: 1- On digestibility, nutritive value, rumen fermentation and some blood biochemical parameters in sheep. Egypt. J. Nutr. and Feeds, 6(2):139-150.

Mozhir .A.K.K., and A.M. AL-Ali, 2023. Testing the synergistic effect of addition ginger powder and vitamin e in pelleted diet on growth and some carcass features of Iraqi lambs. J. ProEnvironment, 16(56):221–233.

Keno M.T., T. Tolemariam, S. Demeke, J. Wamatu, A. Alkhtib and J.P.G.J. Janssens, 2021. Effect of barley variety on feed intake, digestibility, body weight gain and carcass characteristics in fattening lambs. J. of Animals, (11):1773.

Nassar, M.S., El Shereef Afaf and S. Abo Bakr, 2024. Productive Performance of Weaned Male Sheep Fed Diets Supplemented with Garlic Additives. J. Bio. Innov, 13:(6):1012-1024.

Nassar, M.S., 2020. Adding ginger powder or oil and its effect on nutritional evaluation of rams rations. Inter. J. of Envi. Agric. and Biotech., 5(3):773-786.

Njidda, A.A., A.A. Shuai'bu and C.E. Isidahomen, 2014. Haematological and serum biochemical indices of sheep in semi-arid environment of northern Nigeria. Glob. J. Sci. Frontier Res. 14(2):48-56.

Noaman, A., and I.T.A. Shujaa, 2016. Effect of different levels of ginger (Zingiber Officinale) powder roots on the productive performance of Awassi lambs. The Third Scientific Conference of the Colleges of Veterinary Medicine / Tikrit University for the period 2 and 3 May 2102.

Orzuna-Orzuna, J.F., G. Dorantes-Iturbide, A. LaraBueno, G.D. Mendoza-Martí nez, L.A. Miranda-Romero, R. Lopez-Ordaz and A.P.A. Hernandez-Garcí, 2021. productive performance, carcass traits, and meat quality in finishing lambs supplemented with a polyherbal mixture. J. Agriculture, 11(10):942.

Paengkoum, P.J., B. Liang, Z.A. Jelan and M. Basery, 2006. Utilization of steam-treated oil palm fronds in growing saanen goats: ii. supplementation with energy and urea. Asian-Aust. J. Anim. Sci., 19 (11): 1623-1631.

Patterson, T.B., R.R. Shrode, H.O. Kunkel, R.E. Leighton and I.W. Rupel, 1960. Variations in certain blood components of Holstein and jersey cows and their relationship to daily change in rectal temperature and milk and butter fat production. J. of Diary Science, (43):1263-1274.

Phillip, Y.L., A.A., Mahrous, A.A., Khir, Safa, N. Abdel-Azeem, 2014. Productive performance of small ruminants fed pruning fruits trees by products. 1. Effect of treated pruning grape trees by-products on growing Ossimi lambs. Egyptian J. Nutrition and Feeds, 17(3):409-421.

Platel, K. and K. Srinivasan, 2004. Digestive stimulant action of spices: A myth or reality?. Indian J Med Res, (119):167-179.

Preston, T.R., 1995. Biological and chemical analytical methods. tropical animal feeding: a manual for research workers. Rome: FAO: 191-264.

Rabee, A.E. Afaf A. El Shereef, M.S. Nassar, M.A.H. El-Rayes, Rasha S. Mohammed and S. Abo Bakr, 2025. Effect of garlic powder supplementation on rumen microbiota and histology, and blood metabolites in Barki lambs. J. of BMC Veterinary Research, 21:216.

Ramos-Morales E, A. Arco-Perez, A.I. Martin-GarciaI, D.R. Yanez-Ruiz, P. Frutos and G. Hervas, 2014. Use of stomach tubing as an alternative to rumen cannulation to study ruminal fermentation and microbiota in sheep and goats. Anim Feed Sci Technol. (198),57-66.

SAS., 2002. Statistical Analysis Systems Institute Inc., Release 8.1, Cary, NC., USA.

Seixas, L. Peripolli., V. Façanha, D.A.E. Fischer, V. Poli, C.H.E.C. Melo, C.B.H. Louvandini and C.M. McManus, 2021. Physiological and hematological parameters of sheep reared in the tropics and subtropics. Arq. Bras. Med. Vet. Zootec., 73(3): 622-630.

Shams Al-dain Q.Z., and E. A.Jarjeis, 2015. Vital impact of using ginger roots powder as feed additive to the rations of local Friesian dairy cows and its effect on production & economic efficiency of milk and physiological of blood. Kufa J Vet. Med. Sci., 6:154- 165.

Shams Al-Dain, Q.Z., E.A., Jarjeis, H.A., Sulman, M.H.A. Shailai and Y.I.Hamad, 2018. Effect of adding ginger roots powder to the rations of Awassi lambs in some productive and physiological parameters under local condition of Nineveh province. Mesop. J. Agric., 46(3):77–90.

Shehata, M. F., 2013. Carcass Characteristics of Barki Lambs Slaughtered at Different Live Weights Journal of American Science, 9(6):656- 664.

Shehata, M. F., M. Mohammady, I.I.M. Khattab and A.M. Abdel-Wahed, 2012. meat quality and wholesale cuts of barki lambs carcass fed azzawi date. Egyptian J. Anim. Prod,49:89-95.

Soroor, M.E.N., and M.M. Moeini, 2015. The Influence of Ginger (Zingiber Officinale) on In vitro rumen fermentation patterns. Annual Research & Review in Biology, 5(1):54-63.

Srinivasan, K., 2005. Spices as influencers of body metabolism: An overview of three decades of research. Food Res. Int., 38(1):77–86.

SCA., 1990. Standing Committee on Agriculture. Ruminants Feeding Standards for Australian Livestock. CSIRO Publications, Australia.

Tilgner, S., 1999. Herbal Medicine from the herbal of the earth. Wise Acres Press Inc. Creswll. OR :66-67.

USDA., 1975. United states Department of Agriculture, Standards for Grades of Carcass beef. USDA food safety and quality service, Washington, D.C.

Wheeler B., 2003. Guidelines for feeding dairy animals. Ministry of Agriculture and Food, Calsamiglia, S *et al*. 1995. Effects of protein source on nitrogen metabolism in continuous culture and intestinal digestion in Vitro. Journal of Animal Science, 73:1819-1827.

Williams, C.A., and E.D. Lamprecht, 2008. Some commonly fed herbs and other functional foods in equine nutrition: A review. The Veterinary Journal, 178:21-31.

Zaki, M.G., T.A. Barka and F.A Tayeb, 2021. Effect of ginger powder (zingiber officinale) on acid-base balance, rumen and blood constituents in healthy Egyptian sheep. International Journal of Veterinary Science, 10(1):55-58.

Zancan, K.C., M.O. Marques, A.J. Petenate and M.A. Meireles, 2002. Extraction of ginger (Zingiber officinale Roscoe) oleoresin with CO2 and co-solvents: A study of the antioxidant of the extracts. J. Supercri . Fluids., 24(1):57-67.

Zhang T.T., Z.B. Yang, W.R. Yang, S.Z. Jiang and G.G. Zhang, 2011. Effects of dose and adaptation time of ginger root (Zingiber officinale) on rumen fermentation. Journal of Animal and Feed Sciences, 20:461-471.

Zidane, M.S., 2010. Physiological performance and immune competence of growing Barki sheep fed azzawi dates in siwa oasis. M. Sc. Thesis, Fac. of Agric., Ain Shams Univ.

تأثير إضافة مسحوق الزنجبيل على الأداء الإنتاجى وصفات الذبيحة للحملان المفطومة

صلاح أبوبكر

قسم تغذية الحيوان والدواجن، شعبة الإنتاج الحيوانى والدواجن، مركز بحوث الصحراء، المطرية، القاهرة، مصر.

تم إستخدام ٢١ حمل برقى مفطوم بعمر ٣-٤ أشهر ووزن ٢٧,٢٦ ± ٠,٧٢ كجم لدراسة تأثير إضافة مستويين مختلفين من مسحوق الزنجبيل (*Zingiber officinale*) على أداء الحملان وخصائص الذبيحة. تم تقسيم الحملان إلى ثلاث مجموعات متساوية (٧ حمل /مجموعة). غذيت المجموعة الأولى كعليقة كنترول على العليقة الأساسية المكونة من خليط العلف المركز (CFM) مع دريس البرسيم الحجازى بدون إضافة مسحوق الزنجبيل، أما المجموعتان الثانية والثالثة فقد غذيت على العليقة الأساسية مع تدعيمها بمسحوق الزنجبيل بمستويات ٣ أو ٦ جم /راس/يوم، على التوالي. تم تغذية جميع حيوانات التجارب على مخلوط العلف المركزبنسبة ٧٠٪ ودريس البرسيم الحجازي بنسبة ٣٠٪ طول فترة التجربة (١٠٥ يوم). أظهرت النتائج المتحصل عليها أن حملان مجموعتي مسحوق الزنجبيل سجلت زيادة وزنية يومية أعلى بمقدار ١١,٢ و٩,٥٪ مقارنة بحملان مجموعة الكنترول، وتزامنت هذه النتيجة مع تحسن كفاءة التغذية الإقتصادية لمجموعات مسحوق الزنجبيل، وبالتالي سجلت مجموعة المستوي المنخفض من مسحوق الزنجبيل (٣جم/راس/يوم) أفضل مؤشر إقتصادي (١٣٪ تحسن) يليها محموعة المستوي الأعلى (٦جم/راس/يوم) من مسحوق الزنجبيل (٦٪ تحسن). علاوة على ذلك، كانت خصائص الذبيحة لحملان مجموعة الزنجبيل ذات المستوي الأقل أعلى معنويا في بعض صفات الذبيحة مقارنة بالمجموعة الكنترول. جميع قياسات الكرش والدم المدروسة كانت ضمن المعدل الطبيعي. وقد تبين من خلال الدراسة أنه يمكن التوصية بإستخدام مسحوق الزنجبيل (٣جم/راس/يوم) ضمن علائق الأغنام النامية لتحسين أداء النمو والإستفادة من العناصر الغذائية وتحسين خصائص الذبيحة بجانب تحسين الكفاءة الإقتصادية للحملان البرقي.