EFFECT OF DRY GUAVA LEAVES (*PSIDIUMGUAJAVA*) ON DAMASCUS GOAT´S MILK PRODUCTION, IMMUNE RESPONSE AND ECONOMIC EFFICIENCY UNDER GRAZING OR CONFINEMENT MANAGEMENT SYSTEM

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SUMMARY

This study was conducted on 30 Damascus female dairy goats to investigate the effect of dry guava leaf supplementation on milk yield, milk composition, immune response, and economic efficiency under a grazing or confinement management system. Experimental goats were divided into two groups (15 goats/group). The first group was allowed to graze Egyptian clover while the second group was kept in clean and hygienic pens. Each management group was further divided into three sub-groups (5 goats/sub-group). The first sub-group was fed on the basal diets of the farm according to NRC (2007), the second sub-group received the basal diet supplemented with 1% dry guava leaves, and the third sub-group received the basal diets supplemented with 2% dry guava leaves. Daily and overall milk yield were recorded throughout the 12 week experimental period. Milk samples were collected weekly in the morning from each goat and stored at 5º C *until analysis. Blood Samples were collected individually from each goat at the end of the experimental period for analysis. Results showed that grazing goats supplemented with 2% dry guava leaves had significantly higher (P<0.05) milk yield, immune response, and economic efficiency compared to the other groups. Additionally, grazing goats supplemented with 2% dry guava leaves had blood metabolite levels within the normal range compared to the other groups. It was concluded that supplementing grazing goats with 2% dry guava leaves improved milk yield, immune response, and economic efficiency without negative effects on blood metabolites.*

Keywords: Guava leaves; management system; milk; immune response; Damascus goats.

INTRODUCTION

Psidium guajava is a small medicinal tree native to Mexico City and northern South America. It is popularly known as the guava tree and belongs to the *Myrtaceae* family (Barbalho*et al.*, 2012). Antioxidant contents in guava leaves (*Psidium guajava*) enhance immune responses and has positive effects on the production performance of animals (Kuo *et al.*, 2023 and Hossain*et al*., 2024). Guava leaves are rich in flavonoids particularly quercetin, saponins, tannins, alkaloids anthraquinones, phlobatannins, and cardiac glycosides. Moreover, these flavonoids had antibacterial activity (Pandey and Shweta, 2011). Quercetin acts as a calcium antagonist, influencing intestinal smooth muscle fibers, and is responsible for the antispasmodic and anti-motility effect of guava leaves (Galvez *et al.*, 1996). Additionally, 3, 4-dihydroxybenzoic acid produced by peroxidase-dependent oxidation of quercetin, enhances their antibacterial and antioxidant properties. High amounts of phenolic compounds in the guava leaves (*Psidiumguajava*) have been shown to exhibit antioxidant activity (Haida *et al.*,2011). The effectiveness of antibacterial compounds found in the leaves of guava trees is affected by the tannin concentrations, with higher tannin concentrations increasing antibacterial activity (Mailoa *et al.*, 2014). guava leaves contain approximately 9% tannins, which can act as antibacterial agents, either inhibiting the growth of bacterial or fungal cells (bacteriostatic or fungistatic) or killing bacterial or fungal cells (bactericidal or fungicidal).

Goat milk accounts for approximately 2.3% of global milk production (Claeys *et al.*, 2014). Goat milk yield and its products have gained popularity for the past two to three decades among certain ethnic groups, goat producers, and especially those who have allergies to cow milk. Various products are derived from goat milk, including cheese, yogurt, butter, ice cream, powdered milk, infant formula, as well as cosmetic products (Park *et al.*, 2007). Several factors have been identified to influence the milk composition in ruminants, including age, breed, parity number, nutrition, lactation stage, and management systems (Al-Saiady, 2006 and El-Tarabany and El-Bayoumi, 2015). Generally, the quality of milk produced by ruminants is usually determined by the constituents that make up the milk,including lactose, fat, protein, non-solid fat, and minerals (Yangilar, 2013 and Claeys *et al.*, 2014). Most researchers stated that optimizing grazing or confinement management systems is crucial for achieving the best production performance in animals (Brito *et al.*, 2022 and Imrose *et al.*, 2023). Therefore, the main objective of this experiment was

to investigate the effects of supplementing the diet with dry guava leaves on milk yield and composition, blood metabolites, and immune response in Damascus dairy goats under grazing or confinement management systems.

MATERIALS AND METHODS

This experiment was conducted at the Experimental Goats Farm, Faculty of Agriculture, Benha University, Egypt, on 30 Damascus dairy goats, from February 2023 to April 2023.

Guava leaves collection and preparation:

The fresh guava leaves of the species *Psidium Guajava* were collected from the garden trees of Benha University Farm. Leaves of guava trees were carefully separated and cut into small pieces and dried at room temperature under 60°C for two days, then crushed for supplementation in the goats' diet. Samples of the dried guava leaves were stored in closed bottles for subsequent chemical analysis.

Management of experimental animals:

The 30 Damascus goats were divided into two groups, each consisting of 15 goats. The first group was allowed to graze on Egyptian clover (*Trifolium alexandriunm*) around the field of the Faculty of Agriculture at Moshtohor, Benha University daily from 8 amto 4 pm. Thesecond group was housed in clean and hygienic pens. Each group was divided into three subgroups (5 goats/subgroup). The first subgroup was fed the basal diet of the farm, while, the second and third subgroups were Fed the basal diet supplemented with 1 or 2% dried guava leaf powder, respectively. Experimental goats were fed rations formulated according to the NRC (2007) recommendations. Clean and renewed water was provided *ad libitum* to all goats. The ingredients and chemical composition of the goat's diet are presented in Table 1. Diet samples were analyzed according to AOAC (1995). Neutral detergent Fiber (NDF) and Acid Detergent Fiber (ADF) were determined according to Van Soest *et al.* (1991).

Table1. Composition and calculated chemical analysis of diet fed to experimental goats

Item	Treatments		
	Control	**1% GL**	**2% GL**
Ingredients (g/kg DM)			
Dried guava leaves (GL)[1]	0.0	10.0	20.0
Concentrate mixture[2]	600.0	600.0	600.0
Egyptian clover hay	275.0	270.0	262.0
Wheat straw	122.0	117.0	115.0
Mineral & vitamin mixture[3]	3.0	3.0	3.0
Total	**1000.0**	**1000.0**	**1000.0**
Chemical composition (% of DM)[4]			
ME (Mcal/kg DM)	2.48	2.48	2.49
CP	14.44	14.45	14.46
CF	16.06	15.88	15.74
NDF	41.99	41.74	41.60
ADF	29.20	29.13	29.12
Ca	1.07	1.07	1.06
P	0.44	0.44	0.44

[1]Dried guava leaves contain 91.03% dry matter, 93.31% organic matter, 13.15% crude protein, 2.66% ether extract, 16.47% crude fiber, 61.04% nitrogen-free extract, 6.68% ash, 56.08% neutral detergent fiber and 38.70% Acid detergent fiber.
[2]Concentrate mixture consisted of 46% yellow corn, 15 % soybean meal (44% CP), 30 % wheat bran, 5 % molasses, 2.6 % calcium carbonate, 1 % sodium chloride, 1% salt, 0.2% yeast, 0.15% vitamins and minerals mixture and 0.05% antitoxins.
[3]Purchased from the Misr feed additives for animal nutrition, Egypt. Each 3 kg contain**:** Vitamin A = 12,000,000 IU, D_3 = 2,500,000 IU, E =15,000 mg, Zinc = 60,000 mg, Manganese =70,000 mg, Iron =60,000 mg, Copper =30,000 mg, Iodine =5,000 mg, Selenium = 300 mg, Cobalt = 1000 mg, Cobalt = 1000 mg, and Calcium carbonate up to 3 kg.
[4]The rations were calculated according to the feed composition table of NRC for goats, (2007).

Goats milk yield:

The goats were in their first and second parity and kidded in February 2023. Milk yield was determined at weekly intervals starting from kindling till weaning at 12 weeks of age. During the suckling period, kids were kept all the time with their dams in clean and dry pens. To measure milk yield, kids were separated from their dams at 10 pm on the day before measurements. On the following day, milk yield was measured through two milking times at 8 am and 6 pm of the day of measuring. The kid suckling technique involves weighing the kids, to the nearest 10 grams, just before and after suckling, The sum of differences between the two weights of kids was considered as the daily milk intake. After suckling, the goats were milked and the collected milk was weighed to the nearest five grams. This weight was added to the kids' daily milk intake to calculate the daily milk yield. This daily milk yield was multiplied by seven to get the preceding weekly milk yield. The total milk yield of the 12-week period was calculated by summing up of weekly milk yield (Coombe *et al.*, 1960).

Milk sampling and analysis:

Milk samples were collected weekly in the morning from each goat in all experimental groups throughout the study. Milk Samples were stored at 5ºC for subsequent analysis of milk composition. Samples were analyzed for their chemical

composition using Milk-Scan Kit (Lactostar™ manufactured by Funk Gerber Company, Germany) which is an advanced analytical system that gives reliable results with high accuracy covering the most important milk chemical constituents and properties. At least 20 mL of fresh milk was pre-wormed to 40°C in a water bath and thoroughly mixed before measuring. Each sample was then placed in a clean beaker and placed to be close to the sucking tube of the device. The measuring button was pressed to allow the suction tube to draw the sample into the device. After two minutes, the measurement was completed and the connected thermal printer provided a full report of the measured values.

Blood samples and biochemical analysis:

Blood samples were collected individually from all experimental goats at the end of the experiment period to estimate the effects of the management system and dietary supplementation with dry guava leaves on some blood plasma metabolites. Blood samples were collected in dry, clean tubes containing EDTA. Blood plasma was separated by centrifuging the blood samples immediately after collection at 3000 rpm for 15 minutes. Blood plasma was transferred into vials and stored at -20 ◦C for subsequent specific biochemical analysis. The total protein concentration in blood plasma was determined according to Henry (1964). Plasma albumin Concentration was estimated colorimetrically according to Doumas *et al*. (1971). Plasma globulin concentration was calculated by subtracting albumin concentration from total protein concentration. Blood plasma triglyceride and cholesterol concentrations were determined according to Frings *et al*. (1972). High-density lipoprotein (HDL) and low-density lipoprotein (LDL) concentrations were determined according to Natio and Kaplan (1984) andFriedewald *et al*. (1972), respectively. Alanine aminotransferase (ALT) and aspartate aminotransferase (AST) were determined as described by Wahlefeld (1974) and Reitmans and Frankels (1957), respectively.

Anti-oxidant parameters and immune response:

The activities of superoxide dismutase (SOD) and glutathione peroxidase (GSH-PX) were measured according to Aebi (1984). Oxidized glutathione (GSSG) levels were measured by HPLC according to Jayatilleke and Shaw (1993).

Economic efficiency:

A financial analysis was conducted to evaluate the production profitability of supplementing experimental goats with guava leaves at levels 0, 1, and 2%). The net return (NR) was calculated according to Sankhyan (1983) from the difference between total income (TI) and total costs (TC). Total income and total costs were individually calculated for each goat. The total costs include: the feed, labor, building rent value, electricity, and water costs. The total income included: income value from marketable milk for all experimental goat. All these parameters were estimated in L.E. over the course of the experiment.

Statistical analysis:

Statistical analysis was carried out using the least squares procedure for analyzing the data with unequal subclass numbers using SAS (2004). The statistical model is as follows:

$$Y_{ijk} = \mu + M_i + GL_j + (M*GLT)_{ij} + e_{ijk}$$

Where: Y_{ijk} = the observation of k goat milk yield, composition, and blood metabolites; μ = the overall mean; Mi=the fixed effect of i^{th} management system (i= 1, 2 while, 1= grazing and 2= confinement); GLj = the fixed effect of j^{th} supplement with dry guava leaves (j= 1, 2, 3 while, 1= 0% GL and 2= 1% GL and 3= 2% GL); $(MT)_{ij}$ = the fixed effect of the interaction between the management system and supplement with dry guava leaves; e_{ijk} = random error associated with the individual observation and assumed $(NI\ D) \cong (0, \delta_e^2)$.Significance differences between means were carried out according to Duncan (1955).

RESULTS AND DISCUSSION

Goat's milk yield:

Grazing goats had a higher milk yield compared to goats managed under the confinement system, with the differences in milk yield due to the management system being highly significant (P<0.01) as shown in Table 2. The amount of milk produced and its composition are depending on several factors, among which the key role is played by the animal nutrition. The obtained results agreed with the finding of Hadaya *et al.* (2017) who concluded that grazing Damascus goats and their crosses with Alpine goats yielded 0.6 kg more milk production (*P*<0.001) than goats under confinement management. They concluded that the management system had an interactive effect on milk yield. Similarly, Charpentier *et al.* (2019) demonstrated that increasing pasture allowance (low, medium, and high grazing time) significantly (P< 0.001) improved the milk yield of Alpine dairy goats (2.79, 3.12, and 3.15kg/day, respectively). Also, Granados-Rivera *et al.* (2022) revealed that grazing Creole goats produced significantly more milk compared to zero-grazing goats (1.22 vs. 0.71 kg/day, respectively). Moreover, Lemoine and Delagarde (2023) found that the grazing system had a positive influence on the milk yield of Alpine dairy goats. On other species, Carabaand Caraba (2023) concluded that grazing Turcana sheep freely for about 10 hours daily significantly (P < 0.05) increased total milk yield. Goats supplemented with higher level of dry guava leaves (2%) produced a higher level of milk yield compared with the other groups and the differences between means of goats' milk yield, due to the effect of supplement with dry guava leaves was significant (P<0.05) as presented in Table2. Similar results showed by, El-Sayed *et al.* (2013), Kuo *et al.* (2023) and Hossain *et al.* (2024) who reported that the high amount of phenolic compounds in the dried leaves of

the guava tree (*Psidiumguajava*) exhibited antioxidant activity, enhanced immune response and positively impacted productive performance. Also, Gbaguidi and Saricicek (2020) stated that supplementing the diet with 25% guava leaves did not negatively affect ruminal degradability of nutrients and may be an alternative contribution in increasing production. In a similar study, Akinbode *et al.* (2024) recorded that supplements with guava leaves affected the diet composition as crude protein, tannins and flavonoid content of the diets increased with an increase in guava leaves. Therefore, dietary manipulations that reduce the protozoa population as observed in the current study will positively affect animals' energy efficiency. On other species, Nobre *et al.* (2020) and Raju *et al.* (2024) noticed that incorporating guava leaves at 20% in concentrate mixtures for sheep significantly (P< 0.01) improved crude protein digestibility, resulting in enhanced productive performance. There were significant (P<0.05) differences in goat milk yield due to the interaction between the management system and the level of dry guava leaves supplementation.

Table 2. Least-squares means (±SEM) of milk yield (kg) and its composition (%) of Damascus goats

Items	Management systems (M)								Significant		
	Grazing system				Confinement system						
	0% GL	1% GL	2% GL	SEM	0% GL	1% GL	2% GL	SEM	M	GL	M×GL
Milk yield (kg)											
Daily yield	1.86^{c}	1.94^{b}	2.00^{a}	0.01	1.73^{c}	1.81^{b}	1.88^{a}	0.01	**	*	*
Total yield	156.72^{c}	163.52^{b}	168.87^{a}	9.08	146.06^{c}	152.85^{b}	158.20^{a}	8.55	**	*	*
Milk composition (%)											
Total solids	11.24	11.61	11.65	0.26	11.12	11.49	11.54	0.32	NS	NS	NS
Fat	3.85	3.95	4.00	0.11	3.78	3.88	3.93	0.13	NS	NS	NS
Protein	3.37	3.55	3.48	0.06	3.34	3.51	3.45	0.07	NS	NS	NS
Lactose	3.48	3.48	3.61	0.12	3.40	3.40	3.54	0.15	NS	NS	NS
Not fat solids	7.45	7.71	7.71	0.18	7.39	7.65	7.66	0.22	NS	NS	NS
Minerals	0.57	0.59	0.66	0.07	0.55	0.59	0.73	0.08	NS	NS	NS

$^{a, b, c}$ Means within a row with different letters different (P<0.05). SEM = Standard Error of Mean, NS= not significant, * = P<0.05 and ** = P<0.01

Goat's milk composition:

Milk quality depends on its chemical composition (Fat, protein, total solids, non-fat solids, minerals, and lactose) as presented in Table (2). The averages of fat, protein, lactose, non-fat solids, and total solids were higher in grazing goats compared with goats in the confinement system. These results showed that management system has no significant effects on milk composition. Similar observations by Inglingstad *et al.* (2014) revealed that Norwegian dairy goat's milk composition (Protein, lactose, total solids, and minerals %) was not influenced by grazing season, and Lemoine and Delagarde (2023) concluded that the grazing system did not influence milk composition of Alpine dairy goats. On other species, Carabaand Caraba (2023) found that grazing freely on the pasture area for about 10 hours daily had no significant effect on Turcana sheep milk composition (fat, lactose, casein, and solids not fat%). Such findings may support the obtained results. On the contrary, Charpentier *et al.* (2019) reported that increasing pasture allowance (low, medium, and high grazing time) had a significant effect on the milk fat and protein of Alpine dairy goats. Also, Surner *et al.* (2021) noticed that the grazing system increased the fat percentage in milk which is a primary demand by milk consumers. Hence, a grazing management system should be promoted for increased milk yield and quality. Additionally, Granados-Rivera *et al.* (2022) observed that the milk composition (fat, protein, and lactose %) of creole grazing goats had a high significant (P<0.05) effect compared to zero grazing goats .Paskaš *et al.* (2023) reported that French Alpine goats milk composition (Fat, protein, lactose, SNF and ash %) was strongly influenced by the different husbandry methods (grazing or indoor system). Finally, Smistad *et al.* (2024) stated that Norwegian dairy goat's milk composition (Fat, protein, and lactose %) was significantly affected (P<0.01) by management systems (pasture or indoor system). Such differences between the previous author's results and our results may reflect the effect of the different breeds used in each study.

Goats with the high supplement of dry guava leaves (2%) produced a higher level of milk chemical composition compared with goats fed on 0% dry guava leaves and goats fed on 1% dry guava leaves. Differences between means of goat's milk composition, due to supplement with dry guava leaves effect was not significant (P>0.05) as observed in Table 2. The composition of goat's milk varies with the breed and nutrition. The most significant fluctuations are shown in protein percentage, whereas the lactose levels and fat remain more or less stable. Goats' milk contains more whey proteins, like globulins and albumins (25–39%), compared with cows' milk (15–17%). Also, the protein of goat's milk contains small amounts of alphas1-casein, which makes it more suitable for children with cows' milk protein allergy (Mohammed *et al.*, 2020). There were no significant differences between the means of

milk of goat's composition, due to the effect of interaction between the management system and supplement with dry guava leaves.

Blood parameters:

The differences between means of blood metabolites, due to the effect of the management system (grazing or confinement) were not significant except for cholesterol, triglyceride, LDL, and AST (P<0.05) as presented in Table 3. Grazing goats' blood metabolites and immune response were almost the same without any differences with those in confinement management system. The present results imply the absence of any negative effects of the management system (grazing or confinement) on blood metabolites and immune response. The same results were obtained by several authors; Caroprese *et al.* (2016) showed that the immune profile of goats was not affected by grazing management also, Charpentier *et al.* (2019) confirmed that increasing pasture allowance (low, medium, and high) grazing time had no significant effect on blood metabolites of Alpine dairy goats. Moreover on other species, Wang *et al.* (2020) reported that grazing and confinement management systems showed no differences in blood metabolites and immune response of Small-tailed Han sheep. Also, Matos *et al.* (2024) concluded that there were no changes in the blood parameters of Dorper sheep in relation to the grazing and confinement management systems.

Goats supplemented with dry guava leaves had the best level of blood metabolites and immune response without significant differences except for cholesterol, triglyceride, LDL, and AST (P<0.05) as shown in Table 3. In accordance with previous results of El-Sayed *et al.* (2013) which affirmed that supplementation with 0, 0.5, and 1% dry guava leaves by improved blood AST, ALT, cholesterol, triglyceride, and superoxide dismutase (P<0.05). Also, Abdelghani *et al.* (2024) stated that supplements with guava leaves significantly reduced blood cholesterol, triglyceride, and oxidative stress, while enhancing antioxidant activity and immune ability. These positive effects were also recorded in the intestinal and hepatic architectures of animals fed diets containing guava leaves. Finally, Ghoneem*et al.* (2015), Morsy *et al.* (2019) and Hossain *et al.* (2024) found that supplement with dry guava leaves enhanced and acquired immune responses due to antioxidant contents activity. There were no significant differences between means of goat's blood metabolites, due to the effect of interaction between the management system and supplement with dry guava leaves except for cholesterol, triglyceride, LDL, and AST (P<0.05).

Economic efficiency:

Grazing goats had a higher value of economic efficiency than the confinement group. The differences between means of economic efficiency, due to the effect of the management system (grazing or confinement) were significant (P<0.05) as shown in Table 4. The same results were obtained by Akinbode *et al.* (2024).

Goats supplemented with 2% GL had a higher value of economic efficiency (P<0.05) as observed in Table 4. These results aligned with El-Sayed *et al.* (2013), Kuo *et al.* (2023) and Hossain *et al.* (2024).

There were significant (P<0.05) differences between means of economic efficiency, due to the effect of interaction between the management system and supplement with dry guava leaves.

Table 3. Least-squares means (±SEM) of blood metabolites of Damascus goats

Items	Management systems (M)								Significant		
	Grazing system				Confinement system						
	0% GL	1% GL	2% GL	SEM	0% GL	1% GL	2% GL	SEM	M	GL	M×GL
Total protein, g/dl	9.71	10.30	10.05	0.04	9.70	10.29	10.05	0.03	NS	NS	NS
Albumin, g/dl	5.86	6.03	5.95	0.02	5.97	6.13	6.05	0.08	NS	NS	NS
Globulin, g/dl	4.55	4.12	4.39	0.06	4.53	4.10	4.36	0.01	NS	NS	NS
Cholesterol, mg/dl	214.75^{a}	214.95^{a}	208.90^{b}	5.14	210.09^{a}	210.29^{a}	204.24^{b}	6.85	*	*	*
Triglyceride, mg/dl	181.34^{a}	178.99^{b}	179.39^{b}	1.83	180.60^{a}	178.25^{b}	178.65^{b}	2.58	*	*	*
HDL, mg/dl	76.84	75.49	75.94	0.33	78.07	76.72	77.17	0.65	NS	NS	NS
LDL, mg/dl	106.50^{a}	98.01^{b}	95.75^{b}	0.75	104.36^{a}	95.88^{b}	93.61^{b}	1.25	*	*	*
AST, U/L	55.29	56.79	54.44	0.61	54.95	56.45	54.10	0.55	NS	NS	NS
ALT, U/L	141.94^{a}	129.24^{c}	137.39^{b}	2.94	142.57^{a}	129.87^{c}	138.02^{b}	2.30	*	*	*
SOD, U/mL	50.53	50.14	50.28	0.54	51.42	51.03	51.17	0.60	NS	NS	NS
GSH, µmol/mL	3.60	3.55	3.63	0.16	3.59	3.55	3.63	0.20	NS	NS	NS
GSSG, µmol/mL	0.38	0.39	0.41	0.01	0.39	0.40	0.41	0.02	NS	NS	NS

$^{a, b, c}$ Means within a row with different letters different (P<0.05). SEM, Standard Error Mean; NS= not significant, * = P<0.05

HDL, High denisty lipoprotein; LDL, Low denisty lipoprotein; AST, aspartate transaminase; ALT, alanine transaminase; SOD, superoxide dismutase; GSH, reduced glutathione; GSSG, oxidized glutathione.

Table 4. The effects of the management system and supplementation with dry guava leaves on the economic efficiency of Damascus goats

Item	Grazing system				Confinement system			
	0% GL	1% GL	2% GL	SEM	0% GL	1% GL	2% GL	SEM
Marketable milk yield (kg/goat)	156.725	163.52	168.87	9.08	146.06	152.855	158.205	8.815
Income from marketable milk (L.E./goat)	3768.125	4088	4221.75	62.90	3501.5	3821.375	3955.125	58.875
Total feed intake (kg/goat)	136.5	141.75	147	2.14	126	131.25	136.5	2.695
Feed cost (L.E. /goat)	2047.5	2126.25	2205	6.73	1890	1968.75	2047.5	7.665
Labor cost (L.E. /goat)	100	100	100		100	100	100	
Building rent value (L.E. /goat)	50	50	50		50	50	50	
Electricity and water cost (L.E. /goat)	20	20	20		20	20	20	
Total costs (L.E. /goat)	2217.5	2296.25	2375	15.52	2060	2138.75	2217.5	17.035
Total income (L.E. /goat)	3768.125	4088	4221.75	76.06	3501.5	3821.375	3955.125	65.455
Profit net return (L.E. /goat)	1550.625^{c}	1791.75^{b}	1846.75^{a}	23.79	1441.5^{c}	1682.625^{b}	1737.625^{a}	21.97

Price of goat milk: 25 (L.E./kg); Price of dry guava leaves: 10 (L.E./kg); Price of goats ration: 15(L.E./kg); SEM, Standard Error of Mean. Price of Egyptian clover: 10 (LE/kg).

$^{a, b, c}$ Means within a row with different letters different ($P<0.05$).

CONCLUSION

The present study concluded that grazing Damascus dairy goats supplemented with 2% dry guava leaves achieved higher milk yield, improved immune response, and enhanced economic efficiency without negative effects on blood metabolites. Thus, it is recommended that goat breeders use a grazing management system supplemented with 2% dry guava leaves in the diet to gain high milk yield, enhanced immune response, and greater economic profitability.

REFERENCES

A.O.A.C., 1995. Official Methods of Analysis, 16th ed. Association of Official Analytical Chemists (A.O.A.C), Arlington, VA, USA.

Abdelghani, I.G., A.M. Sheiha, S.A. Abdelnour, M.F. Abo El-Maati, A.A. El-Darawany and K.M. Al-Marakby, 2024. Dietary supplement guava leaf extract regulates growth, feed utilization, immune function, nutrient digestibility and redox regulation in growing rabbits. Tropical Animal Health and Production (2024) 56:325.

Aebi, H., 1984. Catalase in vitro. Methods Enzy-mol. 105:121-126.

Akinbode, R.M., K.O. Adebayo, O.A. Isah, I.K. Oyewusi, A.R. Oloyede and F.D. Adebayo, 2024. Effects of guava leaf (*Psidium Guajava*) supplementation in the diet of ruminant on in vitro methane production, degradability and protozoa population. Proc. 49th Conf., Nig. Soc. for Anim. Prod.24-27 March, Univ. of Ibadan, Nigeria.

Al-Saiady, M.Y., 2006. Effect of restricted feeding, breed and diet on sheep milk yield. Journal of Applied Animal Research. 30:85–88.

American Association for Clinical Chemistry, 1977. Pediatric Clinical Chemistry (S. Meites, Ed) Washington, D. C., P.240.

Barbalho, S.M., M.V. Flávia, Farinazzi-Machado, Ricardo de Alvares Goulart, Anna Cláudia Saad Brunnati, Alda Maria Machado Bueno Ottoboni and Cláudia Cristina Teixeira Nicolau, 2012. *Psidium Guajava* (Guava): A Plant of multipurpose medicinal applications. Medicinal & Aromatic Plants, Vol. 1(4):1-6.

Brito, A.F., V. Kleves, Almeid and A.S. Oliveira, 2022. Production performance, nutrient use efficiency, and predicted enteric methane emissions in dairy cows under confinement or grazing management system. Translational Animal Science, 6:1–8.

Caraba, I.V., and M.N. Caraba, 2023. Effects of feeding management System on milk production and milk quality from sheep of the Turcana breed. Animals, 13: 2977.

Caroprese, M., M.G. Ciliberti, A. Santillo, R. Marino, A. Sevi and M. Albenzio, 2016.Immune response, productivity and quality of milk from grazing goats as affected by dietary polyunsaturated fatty acid supplementation. Research of Veterinary Science, 105: 229-235.

Charpentier, A., H. Caillat, F. Gastal and R. Delagarde, 2019.Intake, milk yield and grazing behaviour of strip-grazing Alpine dairy goats in response to daily pasture allowance. Animal, 13 (11): 2492–2500.

Claeys, L.W., C. Varraes, S. Cardoen, J. De Block, A. Huyghebaert, K. Raes, K. Dewettinck, L. Herman, 2014. Consumption of raw or heated milk from different species: An evaluation of the nutritional and potential health benefits. Food Control, 42:188–201.

Coombe, J.B., I.D. Wardrop and D.E. Tribe, 1960. A study of milk production of the grazing ewe, with emphasis on the experimental technique employed. J. Agric. Sci. 54:353–359.

Doumas, B. T., W. A. Watson, and H. G. Biggs, 1971. Colorimetric determination of albumin. Clin. Chem. Acta, 31:87.

Duncan, D. B., 1955. Multiple range and multiple F tests. Biometrics, 11:1-42.

El-Sayed, M.R., D.I. Badawi and M. El-Sayed, 2013. Effect of supplementation of broiler diets with

guava leaves and/or olive oil on growth, meat composition, blood metabolites and immune response. Benha Veterinary Medical Journal, 25 (2):23-32.

El-Tarabany, M.S., and K.M. El-Bayoumi, 2015. Reproductive performance of backcross Holstein × Brown Swiss and their Holstein contemporaries under subtropical environmental conditions. Theriogenology 83: 444–448.

Friedewald, W.T., R.I. Levy and D.S. Friedrickson, 1972. Determination of LDL-cholesterol in plasma.ClinChem J, 18:499.

Frings, C.S., T.W. Fendly, R.T. Dunn and C.A. Queen, 1972. Improved determination of total serum lipids by the sulfophosphoalanine reaction. Clinical Chemistry, 18:673-679.

Galvez, J., J. Duarte and F. Sanchez, 1996. Inhibitory effects of quercetin on guinea pig ileum contractions. Phytother Res, 10: 66-69.

Gbaguidi, G. T. and B. Z. Saricicek, 2020. Availability of some tropical plants as alternative roughage source in ruminant feeding. Black Sea Journal of Agriculture, 4 (3): 107-111.

Granados-Rivera, L.D., J.A. Maldonado-Jáquez, P.A. Domínguez-Martínez, J. Salinas-Chavira and Y. Bautista-Martínez, 2022. Effect of the feeding system (grazing vs. zero grazing) on the production, composition, and fatty acid profile in milk of creole goats in northern Mexico. Emirates Journal of Food and Agriculture, 34(6): 502-508.

Gutiérrez, R.M.P., S. Mitchell and R.V. Solis, 2008. *Psidiumguajava*: A review of its traditional uses, phytochemistry and pharmacology. J. Ethnopharmacol, 117: 1–27.

Hadaya,O., S.Y. Landau, T. Glasser, H. Muklada, L.Dv, R. Mesilati-Stahy and N. Argov-Argaman, 2017. Milk composition in Damascus, Mamber and F1 Alpine crossbred goats under grazing or confinement management. Small Ruminant Research, 153: 31-40.

Haida, K.S., A. Baron and K.S. Haida, 2011. Phenolic compounds and antioxidant activity of two varieties of guava and rue. Rev Bras Ciênc Saúde, 28: 11-19.

Henry, R.J., 1964. Colorimetric determination of total protein.Clinical Chemistry. Harper and Row Publ., New York, USA.

Hossain, M.M., S. Akter, B.K. Dey, T.A. Alahmadi, M.J. Ansari, N. Rahman, S.A. Rojoni, U. Rubayea, S.A. Bristy, B. Hossain, M. Alam, B.K. Sen, R.R. Ghosh and M. Rahman, 2024. Dietary *Psidiumguajava*, guava leaf extract protects *Oreochromisniloticus*, Nile tilapia from Pseudomonas aeruginosa infection and enhances growth. Comparative Immunology Reports 7: 200164.

Imrose, S., S.S. Islam, S. Islam and M.A. Sun, 2023.Optimization of grazing hour for indigenous sheep of southwestern coastal region of Bangladesh. Research Square, 1: 1-10.

Inglingstad, R. A., H. Steinshamn, B. S. Dagnachew, B. Valenti, A. Criscione, E. O. Rukke, T. G. Devold, S. B. Skeie and G. E. Vegarud, 2014. Grazing season and forage type influence goat milk composition and rennet coagulation properties. J. Dairy Sci., 97:3800–3814.

Jayatilleke, E and S. Shaw, 1993.A high-performance liquid chromatographic assay for reduced and oxidized glutathione in biological samples. Analytical Biochemistry 214: 452–457.

Kuo, P., C.S. Liu, S.D. Yang, Y.F. Hu, Y.T. Chu and F.H. Nan, 2023.Anti-discoloration effect of phytochemicals mixture extracted from mango leaf (*Mangiferaindica*), guava leaf (*Psidiumguajava*), and green tea residue (Camellia sinensis var. sinensis cv. Chin-shin Dah-pang) on stored Nile tilapia (*Oreochromisniloticus*) fillets. Aquaculture Reports 33: 101818.

Lemoine, M. and R. Delagarde, 2023. Drinking water intake, milk production, and grazing behaviour of alpine dairy goats in response to daytime water restriction on temperate pastures. Journal of Thermal Biology 117: 103720.

Mailoa, M. N., Meta Mahendradatta, AmranLaga and NatsirDjide, 2014. Antimicrobial activities of tannins extract from guava leaves (*Psidium Guajava L*) on pathogens microbial. International Journal of Scientific &Technology Research, 3(1): 236-241.

Matos, J.C., A.R.F. de-Lucena, E.M.S. Castro, E.A.R. de-Souza, E.J.N. Ramos, G.C. Gois, M.C. Horta, D.R. Men ezes, E.A. Moraes and M.A.Á. Queiro, 2024. Changes in the physiological, hematological and parasitological parameters of Dorper sheep in relation to residual feed intake and confinement environment.Journal of Thermal Biology, 119: 103753.

Mohammed, A.S., G. Animut, M. Urge and G. Assefa, 2020. Grazing behavior, dietary value and performance of sheep, goats, cattle and camels co-grazing range with mixed species of grazing and browsing plants. Veterinary and Animal Science 10: 100154.

Morsy, W.A., G.E. Younan, and Hoda E. El-Gabry, 2019. Effects of dietary guava (*Psidium Guajava L*) leaf extract supplementation on productive performance, blood parameters and carcass traits of growing rabbits. Egyptian J. Nutrition and Feeds, 22 (2) Special Issue: 183-192.

N.R.C., 2007.Nutrient Requirements of Small Ruminant.National Academy Press, Washington, DC.

Natio, H.K. and A. Kaplan, 1984.High Density Lipoprotein (HDL) Cholesterol. J. Clinical Chemistry. Toronto. Princeton. pp. 1207-1213.

Nobre,P.T., P.E.S. Munekata , R.G. Costa , F.R. Carvalho, N.L. Ribeiro, R.C.R.E. Queiroga, S. Sousa, A.C.R. da Silva and J.M. Lorenzo, 2020. The impact of dietary supplementation with guava (*Psidium guajava* L.) agroindustrial waste on growth performance and meat quality of lambs. Meat Science, 164: 108105.

Pandey, A. and M. Shweta, 2011. Antifungal properties of *Psidium guajava* leaves and fruits against various pathogens. Pharmaceut Biomed Sci J, 13:16.

Park, Y.W., M. Juárez, M. Ramos, and G.F.W. Haenlein, 2007.Physico-chemical characteristics of goat and sheep milk. Small Ruminant Res 68: 88-113.

Paskaš, S., J. Miočinović, I. Pihler, K. Čobanović, M. Savić and Z. Becskei, 2023.The influence of grazing and indoor systems on goat milk, brined cheese and whey quality.Mljekarstvo 73 (3): 143-154.

Raju, S., D. Nagalakshmi, N. NaliniKumari, N. Rajanna, B. Swathi and G. Roupesh, 2024. Effect of moringa, subabul and guava leaves either sole or in combination on nutrient utilization, nitrogen balance of ram lambs. Indian Journal of Animal Research, B-5388, 1-7.

Reitmans, S. and S. Frankels, 1957. A colorimetric method for determination of serum glutamic oxalacetic transaminase and serum glutamic pyruvic transaminase.Am Clin Path J, 25: 26.

S.A.S., 2004.SAS Procedure Guide" version 9 Ed".SAS Institute Inc., Cary, NS, USA.

Sankhyan, L.P., 1983.Introduction to farm management. Tata MC-Grow Hill Publishing Company Limited, New Delhi.

Smistad, M., R.A. Inglingstad and S. Skeie, 2024. Seasonal dynamics of bulk milk somatic cell count in grazing Norwegian dairy goats. Health, Welfare, and Behavior, 5:205–209.

Surner, PB, Vijay D Kele, SN Landage, Vijay Upadhye and Preeti Nair, 2021. Relative Impact and Analysis of Composition of Goat Milk by Stall-Feeding System and Rearing with Grazing System of Goats. International Journal of Pharmaceutical and Bio-Medical Science, 1 (8): 165-174.

Van Soest, P.J., J.B. Robertson and B.A. Lewis, 1991.Methods for dietary fiber, neutral detergent fiber and non-starch polysaccharides in relation to animal nutrition. J. Dairy Sci. 74: 3583-3597.

Ghoneem, W.M.A. and A.E.M. Mahmoud, 2015. Effect of rations including guava by-product with or without probiotic on growth performance of growing goat kids. Egyptian J. Nutrition and Feeds, 18 (1): 77-86.

Wahlefeld, A.W., 1974. In methods of enzymatic analysis.vol. 5, HUB Bergmyer, ED).Academic press, New York, pp. 1831-1835.

Wang, J., Xiao-Jie Yu, Yuan-Yuan Bai Peng-Zhen Wang and Chu-Yuan Liu, 2020.Effects of grazing and confinement on the morphology and microflora of the gastrointestinal tract of Small-tailed Han sheep. Livestock Science, 241:104208.

Yangilar, F., 2013. As a potentially Functional Food: Goats' Milk and Products. J. Food Nutr. Res. 1:68–81.

تأثير أوراق الجوافة الجافة على إنتاج اللبن والإستجابة المناعية والكفاءة الإقتصادية فى الماعز الدمشقى تحت نظام الرعى أوالأحتجاز

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أجريت هذه الدراسة على ٣٠ أنثى من الماعز الدمشقى الحلابة لبحث تأثير أستخدام أوراق الجوافة الجافة على أنتاج اللبن ومكوناته ومكونات الدم والأستجابة المناعية والكفاءة الأقتصادية تحت نظامى الرعى أو الأحتجاز. قسمت الماعز بالتجربة الى مجموعتين (كل مجموعة ١٥ من الماعز الدمشقى) المجموعة الأولى سمح لها بالرعى على البرسيم المصرى والثانية بقيت فى حظائر صحية ونظيفة. كل مجموعة رعائية قسمت الى ثلاثة مجموعات (كل مجموعة خمسة من الماعز الدمشقى) المجموعة الأولى غذيت على العليقة الأساسية فى المزرعة والمجموعة الثانية غذيت على عليقة مضاف لها ١٪ أوراق جوافة جافة والثالثة غذيت على عليقة مضاف لها ٢٪ أوراق جوافة جافة. تم تسجيل انتاج اللبن اليومى والكلى خلال فترة التجربة (١٢ أسبوع) تبدأ من الأسبوع الثانى وحتى الأسبوع الثالث عشر من بداية أنتاج اللبن. تم تجميع عينات اللبن صباحا أسبوعيا من كل ماعز وحفظت للتحليل. تم تجميع عينات الدم فى نهاية التجربة من كل ماعز للتحليل. أظهرت النتائج أن الماعز فى نظام الرعى والمغذاه على عليقة مضاف لها ٢٪ أوراق جوافة جافة أعطت أعلى محصول لبن وأستجابة مناعية وكفاءة أقتصاديةعن باقى الماعز بالمجموعات الأخرى كذلك أظهرت مستويات طبيعية من مكونات الدم مقارنة بالماعز الأخرى. لذلك نستخلص من النتائج الحالية أن الماعز التى ترعى وتتغذى على عليقة مضاف لها ٢٪ أوراق جوافة جافة تعطى أعلى محصول لبن وأستجابة مناعية وكفاءة أقتصادية بدون تأثيرات سلبية على مكونات الدم.