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Replacement of concentrate mixture with *Sesbania sesban* hay in the feeding of lactating Egyptian Zaraibi goats

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ABSTRACT

For a 90-day feeding trial, 45 Zaraibi does with an average body weight of 34.97 kg were divided into three similar groups (15 in each) and fed three rations composed of concentrate mixture (CM) and *Sesbania Sesban* hay (SH) as follows: 60% CM + 40% SH (G1), 40% CM + 60% SH (G2), and 30% CM + 70% SH (G3). In addition of this, three digestion trials were conducted using 12 male Zaraibi goats to evaluate the tested rations. SH has higher levels of CF, CP, and ash, but lower levels of OM, EE, and NFE than CM. Nutrient digestibility, feeding values, and CF content all decreased when SH levels were increased. The quantities of ammonia-N and total volatile fatty acids (VFAs) in ruminal fermentation were significantly ($P<0.05$) affected by the tested meals, although most blood parameters were not significantly affected. The percentages of fat, protein, solids not fat, total solids, and unsaturated fatty acid (USFA) level were higher in G2 and G3, while the concentration of saturated fatty acids (SFA) tended to decline in G3 as compared to G1. Higher yields of actual milk and 4% fat-corrected milk (FCM) were found in G2 and G3. Color, flavor, acidity, and pH of milk were rather similar, but there was a negative relationship between milk yield and somatic cell counts (SCC). High SH rations increased economic efficiency, although feeding high concentrates combination diets enhanced feed conversion. In conclusion, high concentrates improved digestion, feeding value, milk yield, and feed conversion, while high concentrations of *Sesbania sesban* hay improve milk composition and economic efficiency.

Keywords: Digestibility, Economics of milk production, Egypt, Metabolism, Milk, Zaibari Goats

Among the local Egyptian breeds, Zaraibi goats (Egyptian NUBIAN) are the most promising dairy goats due to their strong genetic potential for milk production (Dowider et al. 2018). Farm animals' physiological and metabolic status, and thus their productivity and health, are greatly influenced by their diet. The available feed resources in Egypt are insufficient to meet the nutritional requirements of the livestock population. Additionally, animals experience malnutrition, particularly in the summer season when green forages with appropriate protein levels are insufficient (Ahmed *et al*. 2020). Numerous experiments were conducted to introduce new green fodder and silage with greater protein content, such as *Sesbania sesban* (El-Kholany 2004, Ahmed *et al*. 2009 and 2017, and Ibrahim *et al.* 2012) and kochia plant (Shehata *et al.* 2001 and Hanafy *et al*. 2013). According to Madi (2018), the CP of *S. sesban* varied between 14.0 and 21.0% on a DM basis. When compared to teosinte or entire maize plants, *S. sesban* (forage or silage) significantly increased both CP digestibility and DCP% (Soliman *et al*. 1997 and El-Kholany *et al.* 2004). According to Ahmed *et al.* (2009), El-Kholany *et al.* (2016), and El-Maghazy *et al.* (2017), employing *S. sesban* in various forms as feed, silage, seeds, and hay generally improved the productive performance of small ruminants. There is little research on the effect of replacing concentrate mixture (CM) in nursing Zaraibi goats' meals with *S. sesban* hay (SSH). Therefore, the aim of this study was to identify the impact of replacing CM with SH on milk yield and quality, feeding value and feed efficiency, certain rumen parameters, and the blood profile of Zaraibi goats as we came across very limited studies.

MATERIALS AND METHODS

In collaboration with the Department of Animal, Poultry, and Fish Production, Faculty of Agriculture, Damietta University, Egypt, the experimental trials of this study were carried out at El-Serw Animal Production Research Station belonging to Animal Production Research Institute, Agriculture Research Center, Egypt.

Experimental animals and rations: Based on milk yield, live body weight, and twining rate, 45 lactating

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Table 1. Chemical composition of feed ingredients and tested rations

Items	DM %	Composition of DM %					
		OM	CP	CF	EE	NFE	ASH
Concentrate mixture (CM)	91.01	92.88	14.13	10.40	2.94	65.41	7.12
Sesbania sesban hay (SH)	90.15	92.11	17.01	25.57	2.79	46.74	7.89
G1 (60% CM + 40% SH)	90.67	92.57	15.28	16.46	2.88	57.95	7.43
G2 (40% CM + 60% SH)	90.49	92.42	15.86	19.50	2.85	54.21	7.58
G3 (30% CM + 70% SH)	90.41	92.34	16.14	21.01	2.84	52.35	7.66

Zaraibi goats weighing 33-37 kg (average 34.97±0.15 kg) from second to fourth lactation seasons were randomly assigned to three identical groups (15 each). Three experimental diets were fed to the experimental treatment groups: 60% CM + 40% Sesbania sesban hay (SH) for the control group (G1), 40% CM + 60% SH for the second group (G2), and 30% CM + 70% SSH for the third group (G3). The trial was conducted during the mid-lactation phase (after weaning) and lasted for 90 days. Goats were weighed at the start of the trial and then after every two weeks. Before beginning the experimental work, the animals were fed the tested rations for two weeks as a transitional period.

Experimental procedure: Concentrate mixture (CM) and sesbania hay (SH) were provided to lactating Zaraibi does in order to meet their suggested needs in accordance with NRC (2007) dairy goat allowances. Yellow maize grain (*Zea mays*) (41%), wheat bran (Triticum spp.) (25%), undecorticated cotton seed meal (*Gossypium barbadense*) (27%), molasses (3.5%), limestone (2%), common salt (1%), and a blend of minerals and vitamins (0.5%) were all present in the used CM. Free access to drinking water was provided. Every day at 7 a.m. and 3 p.m., the diets were presented in two meals, and any amounts that were denied were noted.

Blood samples: At the conclusion of feeding trials, jugular vein blood samples were taken from four animals per group. Blood samples were centrifuged at 3000 rpm for 15 minutes to extract serum, which then kept at -20°C until the biochemical analysis. Colorimetric biochemical analyses were performed using commercial kits.

Milk production and samples: Every two weeks, representative milk samples were collected from each doe during the same day's morning and evening milking, and they were combined in proration to determine milk yield. Using Ling (1963) methods, milk samples were examined for fat, protein, total solids, and ash. Barnett and Abdel-Tawab (1957) were used to determine the lactose content. Difference between total solids and milk fat was termed as solids non-fat (SNF).

Digestibility trials: Twelve Zaraibi bucks, four in each group, were housed in metabolic cages and fed in plastic boxes for three digestibility tests. A preparatory period of two weeks and a collecting period of seven days comprised each digestion trial's three-week duration. During the collection period, the total amount of feces excreted by each buck was weighed each day, and representative samples (10% by weight) were taken from each daily collection. Feces and feed samples were analyzed as per AOAC (2000).

Rumen fluid samples: Before feeding (0 time) and three and six hours after feeding, samples of rumen fluid were taken from all buck used in digestibility trials. Samples were strained through double layers of cheesecloth, and pH value was recorded using digital pH meters. Conway (1957) methods were placed to measure ammonia-N, and Warner (1964) methods were used to determine total volatile fatty acids (VFAs).

Table 2. Digestion coefficients and feeding values of the tested experimental rations fed to Zaraibi buck

Items	G1	G2	G3	P-values
Digestibility coefficients %				
DM	70.13±0.47^{a}	67.87±0.47^{b}	65.98±0.45^{c}	0.002
OM	72.42±0.53^{a}	70.00±0.43^{b}	68.34±0.45^{c}	0.002
CF	58.27±1.22^{a}	56.16±0.65^{ab}	54.64±0.55^{b}	0.022
CP	79.78±0.67^{a}	77.85±0.40^{b}	76.39±0.58^{b}	0.003
EE	80.22±0.65^{a}	78.10±0.39^{b}	77.02±0.37^{b}	0.001
NFE	74.33±1.15^{a}	73.09±0.50^{ab}	71.52±0.47^{b}	0.046
Feeding values %				
TDN	70.06±0.51^{a}	67.93±0.41^{b}	66.17±0.44^{c}	0.001
DCP	12.19±0.11^{a}	12.35±0.07^{ab}	12.33±0.10^{b}	0.078

Note a, b, and c: Each row's means with distinct superscripts differs significantly at P<0.05.

Table 3. Effect of the tested experimental rations on rumen fermentation parameters in Zaraibi bucks

Items	Time	G1	G2	G3	P-values
pH value	0	6.84±0.05	6.86±0.05	6.90±0.02	0.588
	3	6.33±0.03[b]	6.39±0.03[ab]	6.45±0.03[a]	0.028
	6	6.59±0.03	6.64±0.04	6.67±0.03	0.152
NH_3-N (mg /100 ml)	0	16.18±0.20	16.08±0.025	16.03±0.31	0.890
	3	22.10±0.27	22.03±0.19	21.88±0.33	0.790
	6	19.75±0.18	20.15±0.22	20.30±0.21	0.129
Total VFA's (meq/100 ml)	0	9.09±0.05	9.01±0.05	8.99±0.07	0.362
	3	11.73±0.05[a]	11.44±0.05[b]	11.13±0.03[c]	0.010
	6	10.43±0.05[a]	10.28±0.05[b]	10.19±0.05[b]	0.011

Note a, b, and c: Each row's means with distinct superscripts differs significantly at P<0.05.

Feed conversion and economic efficiency calculations: Feed conversion ratio (FCR) was determined by calculating the amounts of DM, TDN, CP, and DCP needed for each kilogram of 4% FCM output. Additionally, 2024 prices were used to assess economic efficiency in terms of average daily feed cost, 4% FCM yield output, net revenue and economic efficiency as the ratio of output to cost.

Statistical analysis: The SAS general linear model technique (2003) was used to do a one-way analysis of variance on the collected data of measured parameters in compliance with Steel and Torrie (1980). Duncan (1955) was used to assign the significant differences between means.

RESULTS AND DISCUSSION

Chemical composition feed ingredients and experimental rations: The CP, CF and total ash contents are higher in SH than CM (Table 1) and as a result there was gradual increase in CP, CF and total ash contents in G2 and G3 rations. Similar results were also reported by Grawish (2018). In experimental rations, substituting sesbania for concentrate mixture can raise the amount of ash and crude protein (CP) while possibly decreasing dry matter and crude fiber (Salem *et al*. 2022). El-Moghazy *et al.* (2017) discovered that as the amount of SH in rations grew, the contents of CP, CF, and ash increased while the contents of EE and NFE declined. According to Mahgoub *et al.* (2022), the greater percentages of CP, EE, and CF in the experimental group supplemented with sesban hay relative to the control group were significantly influenced by the chemical composition of sesban.

Digestion and feeding values: Digestibility of dry matter, organic matter, crude protein, crude fiber, ether extract and nitrogen free extract was lowered gradually (P<0.05) with the increased inclusion level of SH (Table 2) which may be due to higher fiber and ash contents in these rations. Lower digestibility in these rations also lowered the TDN and DCP contents available to the goat fed these rations. G1 followed G2 with significantly (P<0.05) greater digestibility of DM, OM, CP, CF, EE and NFE and TDN and DCP values, whereas G3 had the lowest values. Fiber is one of the key elements that directly affects diet digestion and passage rate, which have an impact on small ruminants' ability to fill their gastrointestinal tracts and consume feed (Jang *et al.* 2017). Rams fed control diet had considerably lower (P < 0.001) DM, OM, CP, EE, CF, and NFE digestion than rams fed the sesban rations, according to Salem *et al*. (2022). According to El-Maghazy *et al*. (2017), TDN and

Table 4. Effect of the tested experimental rations on some blood biochemical parameters in dairy Zaraibi goats

Items	G1	G2	G3	P-values
Total protein, g/dl	6.92±0.07	6.87±0.06	6.85±0.06	0.778
Albumin, g/dl	3.81±0.04	3.78±0.03	3.77±0.02	0.748
Globulin, g/dl	3.11±0.04	3.09±0.05	3.08±003	0.886
Glucose, mg/dl	74.48±1.24	72.68±1.51	72.13±1.32	0.476
Urea, mg/dl	39.35±0.75	41.00±0.96	42.15±0.75	0.108
Creatinine, mg/dl	1.23±0.03	1.27±0.04	1.30±0.03	0.430
Aspartate transaminase (AST) u/l	35.22±1.18	36.60±1.06	38.03±1.02	0.246
Alanine transaminase (ALT) u/l	19.77±0.68	21.02±0.75	21.13±0.69	0.364
Calcium, mg/dl	9.98±0.21	10.31±0.12	10.60±0.12	0.072
Phosphors, mg/dl	5.96±0.06[a]	5.71±0.03[b]	5.50±0.02[c]	0.001

Note a, b, and c: Each row's means with distinct superscripts differs significantly at P<0.05.

Table 5. Effect of the tested experimental rations on average milk yield, composition and quality of dairy Zaraibi goats

Items	G1	G2	G3	p-values
Average daily milk yield kg/animal	1.31±0.02[a]	1.24±0.02[b]	1.16±0.02[c]	0.001
Average 4% FCM, kg/animal	1.26±0.02[a]	1.21±0.02[b]	1.15±0.02[c]	0.001
Milk composition %				
Protein	2.96±0.03[b]	3.04±0.03[a]	3.07±0.03[a]	0.002
Fat	3.75±0.02[c]	3.87±0.02[b]	3.95±0.04[a]	0.001
Lactose	4.60±0.02	4.62±0.02	4.63±0.02	0.098
Ash	0.69±0.01	0.70±0.01	0.71±0.01	0.081
Total solids	12.0±0.02[c]	12.23±0.02[b]	12.36±0.02[a]	0.001
Total solids non fat	8.26±0.05[b]	8.36±0.05[a]	8.41±0.05[a]	0.009
Milk quality:				
PH	6.66±0.006	6.65±0.007	6.65±0.007	0.648
Acidity	0.16±0.004	0.16±0.005	0.16±0.006	0.929
Somatic cell count, $\times 10^3$	324.00±2.551[c]	337.00±3.176[b]	349.00±2.728[a]	0.001

Note a, b, and c: Each row's means with distinct superscripts differs significantly at $P<0.05$.

DCP values decreased in the tested diets as the concentrate mixture decreased, and the differences were significant in TDN alone. However, Grawish (2018) discovered that reducing concentrate in goat rations from 40% to 30% had no discernible effect on feeding parameters as TDN. Therefore, sesban can be considered as a source of energy and protein to make up for the shortfall in sheep feeds (Sabra *et al*. 2010)

Rumen parameters: No treatment effect was observed at 0 hour in any of the parameter studied (Table 3) however

Table 6. Effect of the tested experimental rations on free fatty acids profile of milk fat

Items	G1	G2	G3	p-values
		Saturated fatty acids, %:		
Butyric a. (C4:0)	0.36±0.02	0.38±0.02	0.37±0.03	0.939
Caproic a. (C6:0)	1.27±0.03	1.26±0.03	1.30±0.04	0.737
Caprylic a. (C8:0)	1.89±0.05	1.94±0.09	1.93±0.07	0.867
Capric a. (C10:0)	8.04±0.19	8.06±0.13	7.97±0.022	0.939
Lauric a. (C12:0)	3.28±0.09	3.34±0.09	3.31±0.12	0.921
Myristic a. (C14:0)	8.00±0.07	8.04±0.10	7.95±0.13	0.812
Palmitic a. (C16:0)	26.9±0.18	26.7±0.12	26.7±0.18	0.514
Heptadecenoic a. (C17:0)	0.92±0.04	0.87±0.05	0.90±0.06	0.789
Stearic a. (C18:0)	11.0±0.13	11.0±0.07	10.9±0.14	0.804
Arachidic a. (C20:0)	0.30±0.07	0.25±0.05	0.29±0.07	0.739
		Unsaturated fatty acids, %:		
Myristoleic a. (C14:1)	0.39±0.04	0.44±0.08	0.43±0.05	0.803
Pentadecytic a. (C15:1)	0.91±0.03	0.87±0.06	0.86±0.04	0.760
Palmiloleic a. (C16:1)	0.74±0.10	0.69±0.05	0.70±0.04	0.750
Margaric a. (C17:1)	0.48±0.04	0.51±0.03	0.47±0.03	0.776
Oleic a. (C18:1) cis	29.0±0.13	29.0±0.18	29.2±0.18	0.485
Oleic a. (C18:1) trans	1.65±0.09	1.71±0.10	1.64±0.16	0.903
Linoleic a. (C18:2) cis	2.88±0.10	2.90±0.09	3.06±0.08	0.350
Linoleic a. (C18:2) trans	0.18±0.04	0.21±0.03	0.19±0.03	0.845
Linoleinic a. (C18:3) n6	0.79±0.04	0.83±0.07	0.82±0.04	0.853
Linoleinic a. (C18:3) n3	0.29±0.06	0.32±0.04	0.31±0.04	0.930
Elcosapentaenoic a. (C20:5)	0.38±0.04	0.41±0.05	0.42±0.03	0.819
Docasahexanaeroic a. (C22:6)	0.30±0.04	0.32±0.04	0.33±0.04	0.915

Table 7. Effect of the tested experimental rations on average feed intake and feed efficiency of dairy Zaraibi goats

Items	G1	G2	G3	
DM intake, g/h/d:				
From CM	841	561	420	
From SSH	560	842	977	
Total DM intake	1401	1403	1397	
DM intake, g/kg$^{0.75}$	97.3	97.6	97.3	
DM intake% BW	4.00	4.01	4.00	
Total TDN intake	981	953	924	
Total CP intake	214	222	226	
Total DCP intake	171	173	172	
Average 4% FCM, kg/h	1.26±0.02^{a}	1.21±0.02^{b}	1.15±0.02^{c}	0.001
Feed conversion				
Kg DM/kg milk	1.11±0.13^{c}	1.16±0.13^{b}	1.22±0.14^{a}	0.005
Kg TDN/kg milk	0.78±0.09	0.79±0.09	0.80±0.09	0.148
g CP/kg milk	170±1.96^{c}	184±2.12^{b}	196±2.27^{a}	0.000
g DCP/kg milk	136±1.57^{c}	143±1.65^{b}	150±1.73^{a}	0.003
Economic efficiency				
Feed cost (LE/h/day)	12.95±0.15^{a}	10.20±0.13^{b}	8.79±0.11^{c}	0.000
Output of 4% FCM (LE/h/day)	25.20±0.29^{a}	24.20±0.28^{b}	23.00±0.27^{c}	0.004
Net revenue (LE/h/day)	12.25±0.14^{b}	14.00±0.15^{a}	14.21±0.16^{a}	0.000
Economic efficiency	1.95±0.02^{c}	2.37±0.03^{b}	2.62±0.03^{a}	0.000

Note a, b, and c: Each row's means with distinct superscripts differs significantly at P<0.05.

at 3 hours post-feeding ruminal pH was increased and TVFA concentration lowered with the increased level of SH in the ration. Similar effect on TVFA was also recorded at 6- hour post-feeding. These results might be due to the decrease the content of rapidly fermentable carbohydrates (NFE) with the increasing the level of SH (Table 1). This may be suggesting that bacteria accumulate ammonia more slowly due to reduced fermentable energy availability and the production of tannin-protein complexes that decrease protein degradability (El-Kholany *et al.* 2016). Additionally, Farghaly *et al.* (2024) found no appreciable changes in ammonia-N when sheep were fed Sesbania instead of alfalfa.

Blood parameters: No effect of *S. sesban* hay feeding on any studied physiological parametrs was observed revealing that it's feeding up to 70% level in goat is safe. Serum phosphorus level was lowered gradually with increased SH feeding which might be due to higher phosphorus (P) content in concentrate feed mixtures (CM) for ruminants as compared SH, typically falling between 0.4% and 0.8% of dry matter, depending on the ingredients. *Sesbania sesban* hay is a high-protein forage, but studies show its phosphorus content is generally moderate to low, typically ranging from 0.2% to 0.37% on a dry matter basis (Soliman *et al.* 1997). El-Maghazy *et al*. (2017) found similar results, stating that the majority of examined blood parameters were not significantly impacted by lowering the concentrate mixture in the tested diets until the 20% level. According to Grawish (2018), Zaraibi goats fed combination silage (50% sesbania + 50% maize) had the highest serum phosphorus levels. Serum calcium tended to rise as the amount of SH in the studied rations increased, according to Madi (2018). All values are in the normal physiological levels of healthy goats (Abdelhamid *et al.* 2011) and consistent with the findings of El-Moghazy *et al.* (2017)

Milk yield, composition and milk quality: Goat in G1 produced much more milk than those in G_2 and G_3, by roughly 5.34 and 11.45%, respectively (Table 5). Average fat corrected milk yield (4% FCM) showed significant differences (P<0.05) with values of 4.13 and 9.57% for G1 compared to G_2 and G_3, respectively. Goats fed high concentrate (G_1) had significantly lower fat content (3.20 and 5.33%), protein content (2.7% and 3.72%), and total solids content (1.92 and 3.00%, respectively) as compared to G_2 and G_3 (Table 5) (P<0.05).

G3 had greatest SCC value, followed by G2, and G1 with significant differences (P<0.05). According to Shehata *et al*. (2007), as the concentrate in the rations increased, the majority of milk constituents tended to decrease. Interestingly, there is a negative correlation between milk output and SCC (El-Moghazy *et al*. 2018). Additionally, a negative correlation of SCC had with milk supply was also recorded by Ahmed *et al.* (2008).

Free fatty acids: No effect of SH feeding was observed on the milk fatty acid profile of goat (Table 6). In different groups, the total amounts of unsaturated fatty acids (USFA) and saturated fatty acids (SFA) were nearly identical.

Palmitic and oleic acids were the most prevalent USFAs in milk, with the five free fatty acids (C18:1 cis, C16:0, C18:0, C10:0, and C14:0) constituting over 80% of the total fatty acids. This finding indicated that its inclusion in the diet does not adversely affect the composition of animal products, and it remains comparable with normal physiological responses and ruminal fermentation. Ahmed *et al.* (2019) and El-Kholany *et al.* (2021) had also found comparable fatty acid profile results in nursing Zaraibi goats.

Feed intake and conversion: The total amount of DM consumed by goats was comparable (Table 7). Furthermore, when the amount of SSH in the diets grew, feed conversion increased (P<0.05). El-Kholany *et al*. (2016) and Shaarawy et al. (2022) had also reported similar feed consumption results. According to Ahmed *et al*. (2017), feed conversion values based on DCP improved when concentrate in goat rations increased from 30 to 40%. It was anticipated that adding a concentrate mixture to ruminant rations will improve feed utilization efficiency and boost dietary calories, proteins, vitamins, and minerals (El-Moghazy *et al*. 2017).

Economic efficiency: The average feed cost and the output of 4% FCM yield production significantly (P<0.05) lowered as the amounts of SSH in the rations increased (Table 7). However, net revenue and economic efficiency increased (P<0.05). Increasing the amount of Sesbania hay in the rations may enhance economic efficiency since feeding expenses are lower because Sesbania hay is less expensive (3 LE/kg) than concentrate mixture (12 LE/kg). These findings concurred with those of Tekliye *et al.* (2018) who found that, considering the net return and marginal rate of return, sheep diets supplemented with the highest concentration of sesban leaves were the most advantageous. According to Mahgoub *et al*. (2022) and Salem *et al*. (2022). EE was considerably higher when sheep diets had higher sesban levels.

Based on prices in the Egyptian market during the experimental period (2024) were 12 and 3 LE/kg for concentrate mixture and sesbania seban hay, respectively. While, price of 4% FCM = 20.0 LE/kg.

It may be concluded high proportion of SH (70%) improved milk fat, protein, solids not fat, total solids, unsaturated fatty acids, and economic efficiency where as a high concentration of concentrate (60%) in goat ration improved digestibility, nutritive value, milk output, and feed conversion.

Ethics statement: The Institutional Animal Care and Use Committee (IACUC No. 2017-020) of LRI authorized all experimental protocols.

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REFERENCES

Abdelhamid A M, Shehata E I and Maged G A. 2011. Effect of some medical herbs on production of lactating Zaraibi goats. *Journal of Animal and Poultry Production* **2** (11): 493–513.

Ahmed M E, Abdelhamid A M, Ibrahim Fathia A and Grawish Sara I M. 2017. Response of lactating Zaraibi goats to diets containing sesbania and Kochia silage as a new and high source of protein. International *Journal of Current research in Biosciences and Plant Biology* **4**(10): 52–62.

Ahmed M I, El-Kholany M E, Sadek W M A and Desoky A L I. 2020. Impact of feeding guar plant as silage or hay for Zaraibi does in Two reproductive stages on newborn performance and some blood and metabolic parameters. *Egyptian Journal of Basic and Applied Sciences* **35** (5): 13–27.

Ahmed M I, Mahdi T M, Mansour A M, Alzahar H and Sadek W M A. 2019. Effect of chemical Flower addition to diets of lactating Zaraibi goats on its productive performance. *Egyptian Journal of Nutrition and Feeds* **22** (3): 479–489.

Ahmed M E, Abd El-Hamid A A, Ibrahim Fathia A and Soliman E S. 2009. Nutritional and economic studies of growing lambs and lactating goats fed different legume-grass mixture. *Egyptian Journal of Nutrition and Feeds* **12**(3): 263–270.

Ahmed M E, Shehata E I, Ibrahim Fathia A, Aiad K M and El-Zalaky O A. 2008. Milk production and quality of dairy Zaraibi goats fed Trifolium alexandrinum (1st cut) silage with some crop residues. *Egyptian Journal of Sheep and Goats Sciences* **3** (2): 27–40.

AOAC. 2000. *Official Methods of Analysis*. 17th Edition, The Association of Official Analytical Chemists, Gaithersburg, MD, USA.

Barnett A J G and Abd El-Tawab G. 1957. Determination of lactose in milk and cheese. *Journal of the Science of Food and Agriculture* **8**: 437–441.

Cantalapiedra-Hijar C, Yanez-Ruiz DR, Martin-Garcia AI and Molina-Alcaide E, 2014. Effects of forage: concentrate ratio and forage type on apparent digestibility, ruminal fermentation and microbial growth in goats. *Journal of Animal Science* **87** (2): 622–631.

Conway E J. 1957. *Microdiffusion analysis and volumetric error*. 4th ed. Crosby Lockwood & Son.

Dowidar Y A, El-Sayed M A, El-Refy A M and Shoura H E. 2018. Detection of myostatin gene MSTN in some goat breeds (*Capra hircus*). *Journal, Genetic Engineering and Biotechnology* **16** (2): 507–512.

Duncan D. 1955. Multiple ranges and multiple F-test. *Biometrics* **11**: 1.

El-Kholany M E, Maged G A, Ahmed M E, Abdel-Gawad A M, Aboul-Omran M A and Al-Mowafy A A. 2016. Response of lactating Zaraibi goats to diets containing *Sesbania sesban* seeds as a new and high source of protein. *Journal of Animal and Poultry Production* **7** (12): 507–513.

El-Kholany M E, Farag Mona E, El-Nimer Amal M, Aboul-Omran M A, Aboelgoud Sh A and Ahmed M I. 2021. Effect of using silage from different mixtures of berseem (Egyptian Clover) and *Panicum mombasa* on production performance and milk properties of lactating Zaraibi goats. *Egyptian Journal of Applied Science* **36**: 37–55.

El-Kholany M M. 2004. Evaluation of some new green fodder for farm animals. Ph.D. Thesis, Fac. of Agric., Mansoura Univ., Egypt.

El-Moghazy M M, Ahmed M E, Abu El-Naser I A M and Madi A M. 2017. Response of Zaraibi goat bucks to rations containing different ratios of Sesbania hay as a new and high source of protein. *Egyptian Journal of Sheep and Goat Sciences* **12** (3): 65–75.

Farghaly M M, Mousa S M, Abd El-Monaime M A, Suliman A I, Kholif A E, Vargas-Bello-Pérez E and Hamdon H A. 2024. Nutrients digestibility, nitrogen balance and rumen fermentation parameters of Farafra sheep fed on Sesbania sesban and reed plants. *Agriculturae Conspectus Scientificus* **89** (1): 83–91.

Grawish S I M. 2018. Using Porage shrubs Contain a high percentage of protein in the rations of ruminants. Ph.D. Thesis, Fac. Agric. Mansoura University, Egypt.

Hanafy M A, Fahmy A A, Faraghaly M S and Shereef A A. 2013. Effect of different treatments on digestibility coefficents and nutritive values of kochia plant by sheep. *Egyptian Journal of Nutrition and Feeds* **16** (2): 257–265.

Jang S Y, Kim E K, Park J H, Oh M R, Tang Y J, Ding Y L and Moon S H. 2017. Effects of physically effective neutral detergent fiber content on dry matter intake, digestibility, and chewing activity in Korean native goats (*Capra hircus* coreanae) fed with total mixed ration. *Asian-Australasian Journal of Animal Sciences* **30** (10): 1405–1409.

Ling E R. 1963. *A Text Book of Dairy Chemistry*. 3rd ED. Chapman and Hall (EDS.) Ltd.37 Esser Str., London.

Madi A M. 2018. Effect of different levels of roughage on feeding value for small ruminants. M. Sci. Thesis, Fac. Agric., Damietta University, Egypt.

Mahgoub A A A S, Abd El-Hafeez A M A, Mohamed M Y, Shaarawy A M and Nassar M I. 2022. Efficiency of feeding sesban hay as a replacement for clover hay on growth performance and semen quality of sheep. *Advances in Animal and Veterinary Sciences* **10** (7): 1434–1443.

Mehrez A Z, Gabr A A, El-Ayek M Y, Ahmed M E and Gad A M. 2013. Supplementing live dried est (*Saccharomyces cerevisiae*) to diets varying in roughage: concentrate ratio: 1- Digestibility coefficients, feeding value and fermentation in the rumen of Zaraibi goat bucks. *Journal of Animal and Poultry Production* **4** (6): 335–347.

NRC. 2007. *Nutrient Requirements of Small Ruminants*: Sheep, Goats, Cervids, and New World Camelids. National Research Council. National Academies Press.

Sabra H A, Hassan S G and Mohamed M I. 2010. Effect of Sesbania Sesban (*Sesbania egyptiaca*) supplementation on the reproductive performances of Baladi sheep as compared to berseem (Egyptian Clover). *Journal of Reproduction and Infertility* **1** (3): 66–70.

Salem A M M, Soliman E B, Abd Ghani A A and Mahgoub A A S. 2022. Effect of feeding sesban and its mixtures with some summer forage crops on productive performance of Ossimi sheep. *Minia Journal of Agricultural Research and Development* **42** (2): 207–222.

SAS. 2003. *SAS. ISTATR User Guid: Statistics*. Ver. 9.1; Fourt "Edition SAS Institute Inc; Cary; Nc. USA.

Shaarawy A M, Mohamed M Y, Abd El-Hafeez A M, Nassar M I and Mahgoub A A S. 2022. Effects of partially substituting Sesbania hay for Berseem hay on Ossimi ewes' and their offspring's performance. *Egyptian Journal of Sheep and Goat Sciences* **17** (1): 27–40.

Shehata E I, Ahmed M E, Abou Ammou Faten F, El-Ashry M A, Soliman A A M and Tawfik S A. 2007. Performance and metabolic profile of Zaraibi goats under different feeding regimes. *Egyptian Journal of Nutrition Feeds* **10** (2):185.

Shehata E I, Ahmed M E, Abdelhamid A M, Abou Amou F F and Haggag M E H. 2001. Comparative nutritive values of silage rations containing different of teosinte and kochia. *Egyptian Journal of Nutrition and Feeds* **4**: 129-140.

Soliman E S, Khinizy A E M, Mohamed B K and El-Haggag M. 1997. Studies on using sesbania and teosinte forages in feeding of growing Zaraibi goats. *Egyptian Journal of Basic and Applied Sciences* **12** (5): 36–47.

Steel R D and Torrie J H. 1980. *Principals and Procedures of Statistics*: *A biometrical approach* 2nd Ed. McGraw Hill Book Company, New York, USA.

Tekliye L, Mekuriaw Y, Asmare B and Mehret F. 2018. Nutrient intake, digestibility, growth performance and carcass characteristics of farta sheep fed urea-treated rice straw supplemented with graded levels of dried *Sesbania sesban* leaves. *Agricultural Food Security* **7** (1): 1–10.

Warner A C I. 1964. Production of volatile fatty acids in the rumen: methods of measurement. *Nutrition Abstracts and Reviews* **34**: 339–352.