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Effect of Feeding Different Percentages of *Acacia saligna* Foliage Hay on Barki Ewes Performance

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Abstract: The study was conducted to evaluate the effect of replacing berseem hay (BH) with dried *Acacia saligna* foliage (AFH) on the performance and some blood parameters of pregnant Barki ewes. Thirty-Two aged 2-3 years old at the last third of pregnancy (eight in each group, 40.5 ± 0.96 Kg body weight) were fed 0 (Control), 25, 50 and 75% of AFH in replacement of BH. All animals fed 2% of their body weight concentrate feed mixture and *ad libitum* quantities of BH or AFH forages for 84 days. Average daily change in body weight of ewesduring lactation, milk yield and composition, rumen liquor parameters (pH, volatile fatty acids, ammonia-N and protozoa count), lamb's growth performance and some serum biochemical parameters weredetermined.Economic evaluation for the tested levels of forages was also estimated. Data were statistically analyzed using SAS computer program software utilizing the general linear model (GLM) procedure. The findings revealed that while AFH had greater neutral detergent fiber (NDF), acid detergent fiber (ADF) andcrude proteins (CP) values than BH, it had lower amounts of dry matter (DM), crude fiber (CF), ether extracts (EE) and fiber fractions. Total DM intake (g/h/day or g/Kg $W^{0.75}$) of lactating ewes did not influence significantly by AFH replacement in the diets. The replacement of BH with AFH at the rate of 75% resulted in increasing ($P<0.05$) individual (Acetic, butyric and propionic) and total volatile fatty acids (VFA) concentrations compared with the control treatment. The tested incorporation levels of AFH did not influence the live body weight during the lactation period. Neglecting the lamb's sex, the tested levels of AFH had noeffect onbirth weight and body weight changes from birth till weaning. Ewes fed 75% AFH recorded the highest total milk yield and daily milk yield compared to the other tested diets.Treatmentsaffects insignificantlyfat and protein yields. Moreover, no significant effect noticed among the experimental groups in serum biochemical tested parameters. Ewes fed ration containing 75% AFH recorded the best economic efficiency compared to other tested rations.

Key words: Pregnant Ewes · Intake · Milk · Rumen parameters · Body Weight · Birth Weight · Blood Parameters

INTRODUCTION

Agricultural byproducts, herbal plants and/or their extracts have seen a surge in use as feed additives in ruminant production systems in recent years because of their comparatively low cost, ability to replace synthetic goods and the rising desire for organic animal products among consumers. Significant concentrations of bioactive substances, such polyphenols (tannins or flavonoids), which have antibacterial effects and lower stress levels, are present in agro-industrial outputs. Because of their capacity to boost oxidative stability, shrubs and plants are utilized in animal nutrition to improve performance, feed efficiency, nutrient utilization, general animal health and quality of livestock products.Growing in marshy places near fresh and saltwater on sandy soils, Acacia is a perennial legume shrub that produces green forages all year seasons. Acacia bushes are regarded as palatable,

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protein-rich pasture shrubs because they can withstand flooding and drought [1]. In general, the foliage of these plants and shrubs are abundant in anti-nutritional elements, especially tannins [2]. *Acacia saligna* (Labill.) H.L. Wendl. is a species of evergreen that has been evolved to grow in the arid coastal environment and has the right traits for that [3, 4].Usually, farmers use this resource to feed sheep and goats, particularly in the summer and fall seasonsduring the shortage and high expenses of available berseem hay. During the dry season, they gather Acacia leaves and stems (foliage) from young and mature trees to augment their daily grazing.So, the present study was conducted to evaluate the effect of replacing berseem hay (BH) with dried *Acacia saligna* foliage (AFH) on the performance and some blood parameters of pregnant Barki ewes. The performance of either ewes or their growing lambs and the economic evaluation were determined. The purpose of this experiment was to examine the effects of feeding *Acacia saligna* (fodder legumes trees) as hay (dried leaves and twigs; foliage) on performance of Barki sheep.

MATERIALS AND METHODS

The current study was conducted at the Animal Production Research Station, Borg El Arab, which is a part of the Animal Production Research Institute, Agricultural Research Center, Egyptof latitudes 21° and 31° North and longitudes 25° and 35° East, this location is located 525 kilometers West of Alexandria on the Mediterranean Sea. The minimum environmental temperature was 13°C (56°F) in December and January and the maximum one was 26°C (79°F) in July and August.

***Acacia saligna* Hay Preparation:** Enough amounts of the fresh *Acacia* foliage (leaves and twigs "AF") were collected from the farm of Borg El-Arab Station and chopped to 3-5 cm length. After chopping, foliage dried at shaded area for 3-4 days by spreading on plastic sheets, (air-drying). Samples of AFhay (AFH) were taken for subsequent proximate chemical analyses.

Experimental Diets and Feeding Trial: The requirements of digestible CP and metabolizable energy (ME) needed during the lactation period of ewes were calculated according to the recommended feeding standards [5]. The experimental diets were prepared to replace berseem hay (BH) by 0% (Control), 25, 50 and 75% AFH. The composition and chemical analysis of diets are presented in Table (1). Proximate analysis of feeds and milk samples were determined according to the procedure of A.O.A.C. [6].

Animals and Management: Barki ewes that had just given birth (2 days prior) were divided into four groups of eight animals each at random. Ewes averaged 40.5±0.96 kg in body weight (BW) and had one lamb when they were between two and three years old. Each dam and her young were placed together in individual pens in a semi-sheltered barn measuring 4 x 3 x 5 meters after lambing. All animals received 2% of their body weight concentrated feed mixture (CFM) for 84 days. BH hays and *Acacia saligna* were fed *ad libitum*. Feed and water were freely available to the ewes. Water was constantly available for the lambs, but they were unable to use the ewes' feeders. Forage and a concentrated combination made up the basic diet (Offered twice daily at 8:00 am and 4:00 pm) in a different level (concentrate: forage) ratio. The difference between the amount of diet offered and the amount rejected was used to calculate the dry matter intake (DMI). Water was readily available to animals. Every 14 days until weaning (about three months age), the maternal body weight was measured for adjusting the amount of feed given to each ewe [7].The initial (IBW/ kg) and final (FBW/ kg) body weights were determined. Calculated attributes included the average daily change in body weight of sheep during lactation (BWC, Kg), which was calculated as the difference between FBW and IBW divided by 84 days.

Milk Yield and its Composition: Throughout the experimental period, measurements of milk yields (MY, Kg) and lamb body weights (LBW, Kg) were taken every two weeks for 12 weeks. At 7:00 pm, the lambs were taken away from their mother. The ewes were hand-milked after 12 hours of separation following an intramuscular injection of 3 international units of oxytocin. The teats were cleansed with an iodine solution and dried with paper towels before to milking. The milk produced over the course of 12 hours was multiplied by 2 to reflect the daily milk yield (DMY, g) of ewes throughout the two weeks of assessment.Additionally, Fat-corrected milk (FCM) and energy-corrected milk (ECM) were calculated [8, 9] using the following equations:

$FCM = (0.28 + 0.12F) \times MY$; where: F = Fat percentage.
$ECM = (0.071 \times F + 0.043\,P + 0.2224) \times MY$; Where: P=Protein percentage.

Table 1: Chemical composition of the used experimental feed stuffs (%; on DM basis)

Items	Berseemhay (BH)	*Acacia saligna* foliage hay (AFH)	CFM
DM	89.5	50.45	93.90
CP	10.63	15.66	15.69
CF	35.02	31.39	16.41
EE	1.55	1.47	3.18
NFE	42.30	39.14	58.62
Ash	10.50	12.34	6.10
NDF	55.89	60.86	40.00
ADF	43.27	54.57	17.30
ADL	8.70	48.96	12.00
Hemicellulose	8.30	8.80	20.70
Cellulose	38.50	28.90	17.90
CT	-	14.50	-
TDN	56.56	62.96	58.72
DCP	6.65	11.48	11.51

CFM: Concentrate feed mixture, DM: Dry matter; OM: Organic matter; CP: Crude protein; CF: Crudefiber; EE: Ether extract; NFE: Nitrogen free extract; NDF: Neutral detergent fiber; ADF: Acid detergent fiber;ADL: Aciddetergentlignin; CT= Condensed Tannin; TDN: Total digestible nutrients and DCP: Digestible crude protein.

Rumen Liquorsamples: Three rumen liquor samples were collected after 4 hours from morning feeding ofthe four experimental groups using a stomach tube.Samples were filtered through three layers of cheese cloth and kept in 500 ml glass jar where pH was recorded within 4-5 minutes of sampling using digital pH meter (model HI 8424). The concentration of total volatile fatty acid (TVFA's) was determined [10]. Twenty milliliters of strained rumen fluid were prepared for volatile fatty acids fractions analysis by GLC. Aliquot of samples were acidified with 18.6 N H_2SO_4 (0.02 mL per mL of ruminal fluid) to prevent ammonia volatilization and stored at -20°C for further analysis. The concentration of NH_3-N was determined using saturated solution of magnesium oxide [11].Total protozoa count was determined according to the method descried by Abou Akkada *et al*. [12].

Blood Samples: A samples volume of about 10 ml blood were collectedat 8 am before feeding via the jugular vein, and kept in non-heparinized tubes from three lambs within each group treatment at the end of the growing period. The collected blood samples were centrifuged at 4000 rpm for 20 min. Then plasma was transferred into clean and dried glass vials to be stored in a deep freezer at -20ºC for subsequent specific chemical analysis. The concentration of total blood glucose, urea, creatinine total protein, albumin and cholesterol were determined by spectrophotometer using commercial bio-Merioux kits (France). Globulin values were derived by subtracting values of albumin from total protein values and A/G ratio was also calculated.

Economic Efficiency: Economic efficiency was calculated as total output/total input according to the local prices (The price was calculated due to the local market where one-ton of CFM, hay, Acacia&Kg BW/lambs were7000, 3000, 600 &95 L.E, respectively).

Statistical Analysis: Data were statistically analyzed using of SAS [13]computer program software utilizing the GLM procedure according to the following model:

$$Yij = \mu + Ti + eijk;$$

where:

Y_{ij} = an observation, μ = Overall mean, T_i = Effect of using different levels of dried Acacia foliage (0, 25, 50 and 75%) and e_{ijk} = Residual (Random error)

Differences among means were determined by Duncan's New Multiple Range Test [14].

RESULTS AND DISCUSSION

Chemical Composition of Feed Ingredients and Feed Intake: The analysis of the chemical composition of feed ingredients (Table 1) indicated that dry matter (DM), crude fiber (CF), ether extracts (EE) and fiber fraction contents of *Acacia saligna* foliage hay (AFH) were lower than those of berseem hay (BH).While, AFH had higher neutral detergent fiber (NDF), acid detergent fiber (ADF) and crud protein (CP) content than BH.

Table 2: Effect of different levels of AFH in diets of lactating Barki ewes on their feed intake (g/h/day) and the nutritive values

	Experimental diets				
Item	Control	25% AFH	50% AFH	75% AFH	P-value
CFM	900.5±3.80	850.5±2.60	900.5±2.55	920.5±2.50	----
BH	582.7±3.40	490.8±3.45	360.2±3.50	250.3±3.22	----
AFH	-----	120.5±5.89	250.6±6.68	370.6±7.90	----
TDMI	1480.8±4.60	1475.3±3.55	1490.6±3.66	1530.0±4.22	0.65
TDMI (g/Kg $W^{0.75}$)	71.35±16.23	70.11 ± 13.11	72.70 ± 13.33	72. 82 ± 15.33	0.05
TDNI*	1040.6±2.20^{b}	1060.4±3.44^{ab}	1080.7±2.75^{ab}	1100.0±3.33^{a}	0.66
TDNI(g/Kg $W^{0.75}$)	48.44 ±11.22^{b}	47.50 ± 12.33^{b}	51.90 ± 8.77^{a}	50.45 ± 12.40^{a}	0.05
DCPI	132.5±1.30^{b}	138.6±1.80^{ab}	132.7±1.30^{ab}	138.5±1.25^{a}	0.05
DCPI(g/Kg $W^{0.75}$)	116.6±2.11^{b}	117.1 ± 1.43^{ab}	118.8± 2.55^{ab}	120.0 ± 1.20^{a}	0.05

CFM: Concentrate feed mixture, BH: Berseem hay, AFH: Acacia foliage hay, TDMI: Total dry matter intake. TDNI: Total digestible nutrients intake, DCPI: Digestible crude protein intake and $W^{0.75}$: Metabolizable body weight.

a, b, c, means in the same raw with different superscriptsare significantly different (P<0.05)

Table 3: Effect of feeding different levels of AFHonsome rumen fermentation parameters of Barki sheep

	Experimental diets				
Item	Control	25% AFH	50% AFH	75% AFH	P-value
Ruminal pH	6.94±0.08^{a}	7.08±0.08^{a}	7.01±0.08^{b}	6.87±0.08^{b}	0.05
Lactate, mg/mL	3.22±0.58	2.26±0.58	2.45 ±0.58	3.21 ±0.58	0.94
Acetic Acid, %	55.28±0.90	56.20±0.90	57.91±0.90	58.78±0.90	0.18
Propionic Acid, %	33.21 ±1.02	34.59± 1.02	34.60 ± 1.02	34.82± 1.02	0.80
Butyric Acid, %	9.42±0.71^{c}	10.68 ±0.71^{b}	10.97±0.71^{b}	11.99 ±0.71^{a}	0.01
Total VFA, mmol/L	62.94±5.07	63.60±5.07	68.71 ±5.07	79.21±5.07	0.60
NH_3-N (mg/100ml)	19.81 ±0.03^{a}	18.74±0.04^{b}	16.12±0.03^{c}	15.11±0.04^{c}	0.02
Protozoa (10^5/ml)	7.01±0.05^{a}	6.61±0.06^{a}	6.65 ±0.06^{a}	4.8±0.05^{b}	0.02

VFA: Volatile fatty acids.

a, b, c, means in the same raw with different superscriptsare significantly different (P<0.05)

Also, acid detergent lignin (ADL) and hemicellulose contents of AFH were higher than of BH, while cellulose was noticeably lower. It is clearly obvious that the superiority of AFH contents of TDN and DCP over that recorded with BH. The present results of the chemical composition of BH are similarto the values reported by Shawket *et al.* [15] and Younan *et al.* [16]. The wide variations of AFH chemical composition may be due to differences in environmental and climatic conditions, the vegetation period of plants, the processing method of drying under shade or in the sun and handling and storage conditions [17].

Feed intake by lactating Barki ewes fed the experimental diets (Table 2) expressed as total DM intake (TDMI; g/h/day or g/Kg $W^{0.75}$) was not influenced by the level of AFH replacement. However, the inclusion of graded levels of AFH in the diets of lactating ewes had increased (P<0.05) DCP intake (DCPI; g/h/day or g/Kg $W^{0.75}$) and total digestible nutrients intake (TDNI; g/h/day or g/Kg $W^{0.75}$) compared to control (138.6, 132.7 and 138.5 *Vs.* 132.5 g/h/day in the control, or 117.1, 118.8, 120.0 *Vs.* 116.6 g/Kg $W^{0.}$75 in the control, respectively). The differences between DCPI values of lactating ewes fed the three tested AFH levels were not significant in this respect. When feed intake values were expressed as total digestible nutrient intake (TDNI) it was noticeable that 75% AFH diet recorded the highest value (1100 g/h/day), followed by 50% AFH (1080.7 g/h/day), 25% AFH (1060.4g/h/day) and the control diet (1040.6g/h/day).

Maamouri *et al.* [18] conducted a study to evaluate the effects of natural protection of protein from microbial degradation in the rumen by Acacia tannins on DM intake and milk production in dairy ewes. They indicated that the total DM intake of ewes receiving concentrate and Acacia supplement was significantly higher (P<0.001) than the intake of ewes receiving only concentrate (300 g) which was higher than that of ewes receiving only Acacia (100 g). At the same trend, Meneses *et al.* [19] fed lactating ewes Acacia instead of alfalfa (*Medicago sativa*, L.) hay at the rates of 0, 25, 50, 75 and 100%and found increased (*P*<0.01) intake of DM, CP and ME in the lactation stage over the control with a high percentage of Acacia, with differentresults from that during pregnancy. In the pregnancy period, the increase in fetus growth which reduced abdominal space led to reduce the intake from Acacia and thereby loweredthe digestibility of the diet due to tannins fixation for both N and ruminal ammonia, which reduces rumen bacterial amino acid synthesis [20, 21].

Moujahed *et al.* [22] reported that increasing the level of Acacia leaves in animal diets decreased the DMI which may be attributed to the un-palatability of the diet as a result of increasing tannins content or the lower intestinal motility which led to a higher retention time of the digestion in the gut.

The lack of significance in DM intake in the present study may be due to the low concentration of condensed tannins (TC) in the DM of the three levels of AFH consumption. It was previously reported that CT concentration in dried *Acacia saligna* leaves ranged from 31.5 [18] to 36 g/Kg DM [20].

Rumen Parameters: The effects of partially replacing BH with AFH in ewe's diets on ruminal fermentation parameters, ruminal pH, NH_3-N and protozoal counts are shown in Table (3). The minimum pH and ruminal ammonia-N higher values were recorded in lactating ewes fed 25% and 50% AFH diets. The replacement level of 75% BHby AFH resulted in increasing ($P<0.05$) individual (Acetate, butyric and propionic acids) and total volatile fatty acids (VFA) concentrations compared with control treatment. The decrease in the percent of *Acacia saligna* increased ruminal pH, NH_3-N and protozoal counts and vice versa. Ruminal NH_3-N concentration and total protozoa were decreased ($P<0.05$) with 75% AFH replacement compared with control and the pH of ruminal fluid was changed by dietary treatment. El-Deeb *et al.* [23] mentioned that ruminal NH_3-N concentrations serve as a good indicator of both CP degradability and energy availability and this sets NH_3-N incorporation into microbial protein synthesis process.

The presence of plant bioactive Phyto-factors like tannins and/or cyanogenic glycosides present in *Acacia saligna* might have a positive effect on animal productivity by affecting the ruminal microbial ecosystem [24]. The lower protozoa count in the supplemented treatments was illustrated by Moujahed *et al.* [22] who found that *A. saligna* contained condensed tannins (CT) may inhibit extracellular microbial enzymes or deprive the microbes of the substrates required for growth or directly inhibit their oxidative phosphorylation. In addition, the presence of CT in AFH serve as a protector for feed crude protein degradability in the rumen which accompanied by increased digestibility of DCP and TDN [25]. They suggested the explanationfor this by the increase in the favorable N source for rumen microbes beside the higher available carbohydrates that may improve the fermentation which may increases microbial protein synthesis capability. In contrast [20], found that supplementation of *A. saligna* to the concentrate mixture did not affect the protozoa numbers in the ruminal fluid. The present study results are in agreement with Meneses *et al.* [19] who concluded that the inclusion of dried *Acacia saligna* leaves at 50% promotes good growth performance, nutrient digestibility and nitrogen utilization in West African dwarf goats and reduces feeding costs.

Live Body Weight Changes: Results of the effect of feeding diets containing different levels of dried AFH (25, 50 and 75%) instead of BH on the live body weight of Barki ewes during the lactation period are presented in Table (4). Body weight of lactating Barki ewes ranged from 40.1 to 40.5 Kg with no significant differences among treatments, which means a random distribution of the ewes on the different treatments. The results showed that the incorporation of AFH instead of BH in the experimental diets at levels of 25%, 50 and 75% resulted in non-significant differences in live body weight during the whole lactation periods (2, 4, 6, 8, 10and 12 weeks). It was noticeable that all four groups fed control and treated with experimental diets showed a leaner decrease in the values of their body weight every two weeks during the lactation period (12weeks).

Also, the body weight changes at the end of lactation period and at weaning of the offspring showed the same trend. The lost values of body weight of lactating ewes fed control, 25, 50 and 75% AFH diets (-1.7, -2.2, -1.7 and -1.4 Kg, respectively) from the start to the end of lactation and weaning of offspring may be due to that the nursing lambs beyond the age of 6–8 weeks consume increasing amounts of concentrates (and possibly hay) as indicated by Farid *et al.* [26, 27] and represent serious competition to their dams.

These present body weight values are below the recorded values for Barki ewes fed according to NRC [28] standards (44.0 Kg) or (45.8 Kg) for those fed *ad lib* BH + 200 g concentrate/ewe/day as reported by Farid *et al.* [26]. These differences may be due to the condition of the ewes at the start of the experiment being below optimum. The overall average live body weight was about 38 Kg [27]. This is much less than the 45 Kg considered optimum for Barki, one of the smaller Egyptian breeds [18].

Table 4: Effect of feeding different levels of AFH on Barkiewe's body weight changes from birth to weaning

	Experimental diets				
Item	Control	25% AFH	50% AFH	75% AFH	P-value
At start	40.1±0.90	40.2±0.92	40.3±0.94	40.5±0.96	0.26
2nd week	39.7±0.88	39.5±0.95	39.9±0.95	39.8±0.94	0.29
4th week	39.3±0.76	39.1±0.88	39.7±0.90	39.5±0.82	0.49
6th week	39.1±0.90	38.9±0.70	39.3±0.95	39.2±0.95	0.40
8th week	38.7±0.80	38.6±0.85	39.0±0.80	39.0±0.80	0.45
10th week	38.5±0.86	38.3±0.75	38.8±0.60	38.7±0.90	0.41
12th week	38.2±0.83	38.0±0.75	38.6±0.65	38.1±0.90	0.41
Body weight change, Kg	-1.7	-2.2	-1.7	-1.4	

a, b, c, means in the same raw with different superscripts are significantly different (P<0.05).

Table 5: Effect of feeding different levels of AFH on Barkilamb's body weight changes from birth to weaning

	Experimental diets				
Item	Control	25% AFH	50% AFH	75% AFH	P-value
Birth weight	3.5±0.32	3.4±0.22	3.5±0.30	3.4±0.27	0.28
2 weeks	5.0±0.42	5.0±0.35	5.5±0.42	5.7±0.22	0.53
4 weeks	7.1±0.68	7.6±0.73	8.1±082	8.4±0.82	0.51
6 weeks	9.4±0.55	10.8±0.88	11.1±0.92	11.2±0.50	0.43
8 weeks	12.1±0.70	12.8±0.65	13.3±085	13.6±0.54	0.41
10 weeks	13.9±0.74	14.3±0.81	15.0±0.60	15.3±0.70	0.42
12 weeks	15.6±0.52	16.0±0.61	16.4±0.55	16.7±0.55	0.52
ADG, g/d	144.05±0.32	150.00±0.32	153.57±0.32	158.33±0.32	0.72

ADG: Average daily gain

The loss in body weight at calving and loss percentage was a significantly (P<0.05) differed among the experimental groups. It is worth noting that 75% AFH ewes group recorded the lowest (P<0.05) loss value in body weight of the other three ewe groups with no significant differences among them. The percent of lost weight pre-lambing took the same trend.

Lamb's Growth Performance: Results of the effect of feeding AFH at levels 25, 50 and 75%instead of BH on birth weight and biweekly body weight are presented in Table (5). Neglecting the lamb's sex, results showed that the inclusion of AFH instead of BH at levels of 25, 50 and 75% resulted in non-significant differences in birth weight and body weight change from birth to weaning at all periods of the experiment (2, 4, 6, 8, 10 and 12 weeks). The present birth weight values are lower than the average values (males and females) 3.7 and 3.9 Kg of lambs born for Barki ewe dams fed *ad lib*BH according to NRC [28] and one-third hay plus *ad lib* rice straw, respectively and higher than the average birth weight 3.2 Kg of lambs born for Barki ewe dams fed *ad lib* rice straw with added a commercial molasses-urea mixture [29]. Weaning weights of lambs (neglecting lamb's sex) are 15.6, 16.0, 16.4 and 16.7Kg of lambs from dams fed control, 25, 50 and 75% AFH diets, respectively. These values are away from the value of 21.8 Kg for lambs born from ewes fed according to NRC [28] recommended allowances as recorded by Farid *et al.* [26]. The measured growth indicates a relatively stable increase in live body weight throughout the 12-week period supporting contention [27] that as milk production decreased and weights increased the lambs shared the diets offered to the dams, especially the concentrates (and possibly hay) and in particular beyond the age of eight weeks.

In general, growth was particularly fast between 4 and 8 weeks in the control lambs' group. But, the fast growth for 25, 50 and 75% AFH lamb groups started early between 2 and 8 weeks. The present results of daily growth gain indicate that the graded levels of AFH inclusion instead of BH did not significantly (P>0.05) affect the daily gain. These values of lamb's daily gain are almost equal to the recorded daily gain value of 150 g/day for lambs born for Barki ewes fed 30% BH plus *ad lib* rice straw and below the value of 160 g/day for lamb groups born for Barki ewes fed according to the recommended allowances of NRC[28] and Farid *et al.* [26].

Milk Production and Composition: Milk production and milk analysis data are shown in Table (6). There was an insignificant increase in milk yield and milk compositionamong all diets. A similar trend was observed

Table 6: Milk yield and composition of lactating ewes fed diets contained different levelsof AFH

	Experimental diets				
Item	Control	25% AFH	50% AFH	75% AFH	P-value
Total milk yield (kg)	67.2±4.12	71.4±4.12	75.6±6.15	79.8±6.13	0.66
Daily milk yield (g)	800±0.13	850±0.12	900±0.12	950±0.13	0.87
Milk composition:					
Total solids (TS, %)	17.5±0.40	17.7±0.40	17.8±0.60	17.9±0.30	0.48
Solid not fat (SNF, %)	12.4±0.50	12.5±0.40	12.4±0.70	12.6±0.80	0.47
Fat (%)	5.1±0.20	5.2±0.10	5.3±0.20	5.4±0.30	0.54
Ash (%)	1.5±0.10	1.4±0.03	1.2±0.05	1.3±0.02	0.25
Protein (%)	6.6±0.20	6.7±0.20	6.5±0.30	6.4±0.10	0.69
Lactose (%)	5.6±0.50	5.4±0.50	5.1±0.70	5.7±0.40	0.88
Fat-corrected milk (Kg/d)	0.60±0.07[c]	0.65±0.07[b]	0.69±0.09[b]	0.74±0.09[a]	0.59
Energy-corrected milk (Kg/d)	0.58±0.06[c]	0.63±0.06[b]	0.66±0.08[b]	0.70±0.08[a]	0.68
Fat yield (Kg/d)	0.07±0.003[c]	0.08±0.003[b]	0.09±0.005[a]	0.09±0.005[a]	0.004
Protein yield (Kg/d)	0.07±0.004[a]	0.06±0.004[b]	0.06±0.004[b]	0.07±0.004[a]	0.004

Means in the same raw with different superscripts (a, b, c,)are significantly different (P<0.05).

Table 7: Effect of feeding different levels of AFH on some blood serum biochemistry of Barkilambs

	Experimental diets				
Item	Control	25% AFH	50% AFH	75% AFH	P-value
Glucose, mg/dL	55.12±2.42	55.75±2.42	58.12±2.42	58.10±2.42	0.33
Urea, mg/dL	31.90±2.64	31.25±2.64	31.75±2.64	31.00±2.64	0.47
Creatinine, mg/dL	1.17±0.12	1.16±0.12	1.17±0.12	1.15± 0.12	0.15
Total protein, g/dL	7.50±0.23	7.53±0.23	7.50±0.23	7.60±0.23	0.49
Albumin (A), g/dL	4.00±0.15	4.10±0.15	4.08±0.15	4.37±0.15	0.11
Globulin (G), g/dL	3.50±0.18	3.52[a]±0.18	3.42±0.18	3.53±0.18	0.36
Ratio A/G	1.16±0.07	1.24±0.07	1.26±0.07	1.32±0.07	0.14
Cholesterol, mg/dL	89.73±0.90	90.33±0.90	92.63±0.90	95.63±0.90	0.78

by ewes fed 75% AFH diets that recorded the highest total milk yield (79.8 kg) and daily milk yield (950±0.13g/h/d) compared to other diets, which was attributed to higher content from both TDNI and DCPI in the diet [30]. The reason for the difference between the effect of BH and AFH on milk yield is likely the higher organic matter digestibility [31]. The apparent digestibility of DM, organic matter, NDF and hemicellulose were larger in diets with AFH [32]. The present results are also in agreement with those of Zegeye *et al.* [24] who reported that there was no significant difference in milk fat, lactose, solids not fat, density, protein and mineral content of dairy cows fed diets containing a graded level of *Acacia saligna* leaves. Feeding *A. saligna* leaves did not affect milk composition, but it increased milk yield which implied that the tree can be used as an alternative source of feed for dairy animals. Similarly, milk yield was higher for ewes fed higher levels of *A. saligna* leaves [18].

Milk composition (protein, total solids, lactose and fat%) were insignificantly affected by the tested AFH levels, but fat yield (Kg/d) and protein yield (Kg/d) was significantlyaffectedby treatments.These results are in agreement with Shtaya [33], Saidi and Abo Omar [34] and Badran *et al.* [35]. However, ewes fed 75% AFH diets recorded the highest values of fat (5.4%) and total solids (17.9%) was without insignificant differences. Butfat-corrected milk, energy-corrected milk, fat yield and protein yield recorded the significant differences. Some studies reported that increasing protein content in the diets showed no increase in DMI, milk yield, milk protein and total solids [36, 37].

Serum Biochemistry: Blood serum parameters presented in Table (7) revealed that there was no significant effect due to replacing AFH on total protein, albumin, globulin, creatinine, total cholesterol, glucose, urea concentration and plasma glucose. El-Bassiony [38] and Shaker *et al.* [39] worked on Shami goats and Barki sheep fed on a mixture of Prosopis, Acacia and Leucaenahays (sundried) in comparison with those fed BH and found a decrease in plasma total protein and total cholesterol, while plasma glucose was not affected. With reference to kidney functions, urea and creatinine are the two chief nitrogenous composites excreted by the kidney. Thus, any change in their concentration would reflect impaired glomerular filtration and/or inefficiency of renal tubules [40]. In the present results, feeding tanniniferous plants and shrubs resulted in an insignificant decrease in urea-N levels. The present results come in the same direction as those obtained by Pearce *et al.* [41] and Shaker *et al.* [39] who reported that Barki sheep that fed a mixture of salt-tolerant plants (STP) showed lower

Table 8: Economic analysis of using AFH as alternative to BH in Barki ewes diets

	Experimental diets			
Item	Control	25% AFH	50% AFH	75% AFH
Total feed intake (g/h/d)	1483.2	1461.8	1511.3	1541.4
CFM	900.5	850.5	900.5	920.5
BH	582.7	490.8	360.2	250.3
AFH	-	120.5	250.6	370.6
Price of total feed intake (LE/h/d):				
CFM	6.30	5.95	6.30	6.44
BH	1.75	1.47	1.08	0.75
AFH	-	0.07	0.15	0.22
Total feeding cost (LE)	8.05	7.49	7.59	7.41
Average daily gain (g/h/d)	144.05	150.0	153.57	158.3
Price of daily gain (LE)	13.68	14.25	14.56	15.03
Net profit (LE/h/d)[1]	5, 63	6.76	6.97	7.62
Economic efficiency (EE, %)[2]	69.94	90.25	91.83	102.83
Relative improvement[3]	100	129.04	131.30	147.03

Total price for feeds was calculated according to the price of different ingredients available in ARE.The price was calculated due to the local market where one-ton of CFM, hay, acacia&Kg BW/lamb were7000, 3000, 600&95 L.E, respectively. • Net profit = Price of daily gain (LE) - Total feeding cost (LE); • Economic efficiency= Net profit / Total feeding cost (LE). • Relative improvement of the control, assuming that the EE of the control =100.

values of urea-N when compared with that fed BH. It is worth noticing that these plants in spite of having higher levels of CP than BH have a lower content of EE and NFE, while having higher percentages of ash. This might mean that the utilization of this protein is low to exert stress on kidney function. Creatinine level increased little only in plasma of ewes fed AFH in comparison to control group.

However, in all cases, creatinine levels stayed within the normal range without any sign of kidney exhaustion. However, Melladoa *et al.* [42] and Shaker *et al.* [39] reported that feeding STP mixture significantly decreased creatinine levels. On the other hand, higher creatinine levels found in animals' serum when fed fresh Atriplex or Acacia than those fed BH by Badawy *et al.* [43] and Shaker *et al.* [44]. EL-Saadany *et al.* [45] recorded an increase in creatinine concentration in Barki ewes fed tanniniferous plants shrubs (Acacia, Atriplex and Cassava) and attributed this increase to the anti-nutritional factors and/or high salt content in these plants. Blood plasma total proteins (TP) and their fractions, albumin (Al) and globulin (Gl) have great importance as good indicators of nutritional status. Feeding tanniniferous shrubs resulted in an insignificant increase in plasma concentration of total proteins and albumin as shown in Table (7). The highest mean of total proteins and albumin was recorded by ewes-fed AFH, while the mean of plasma globulin was moderate as a result albumin to globulin ratio (Al/Gl) appreciably increased in the plasma of ewes fed these plants. Total cholesterol increased in plasma of ewes-fed AFH when compared with ewes fed BH. In general, plasma protein increased by feeding tanniniferous plants through increasing albumin fraction and total cholesterol. Albumin is known to play an important role in body fluids regulation hence coping with salt stress [46]. Moreover, Ibrahim [47], Shaker *et al.* [39] and Hassan *et al.* [48] recorded a decrease in goats' plasma energy components due to feeding some forage shrubs. They attributed this decrease due to the lower production of total volatile fatty acids (VFA's) in the rumen which is probably due to lower solubility of nitrogen and reduced availability of amino acids for the production of VFA's.

Economic Evaluation: The economic evaluation of Barki ewes feeding different levels of AFH is shown in Table (8). Data indicated that ewes fed on a ration containing 75% AFH as alternative to BH had recorded the best economic efficiency compared to rations containing 25% or 50 % AFH or the control one which recorded the lowest value. The same trend was noticed for the improvement in the economic evaluation as a result of the replacement of BH with dried AFH. These results are in agreement with those obtained by Allam *et al*. [49] who decided that using dried orange pulp as an alternative energy source by 50% replacement to corn grains with soybean meal as a protein source to obtain higher performance with the lowest cost of feeding. Also, comparable results were obtained by Omer and Tawila [50] who demonstrated that the replacement of corn grains with citrus by-products in goat rations improved ADG, feed efficiency and decreased daily feeding cost and consequently improved economic efficiency.

Moreover, the results obtained herein are on line with findings of Eissa *et al.* [51] who reported improvement in Barkiewes' economics when fed 60% CFM + 40% *Acacia saligna* leaves.

CONCLUSION

The replacement of BH with dried foliage of *A. saligna* as hay in lactating ewes 'dietsdid not affect the studied productive performance parameters of Barki ewes as well as their growing lambs till their weaning. The obtained results led to conclude that dried *A. saligna* foliage (hay) can participate partially as economic alternative feed source for traditional cost-effective forages in lactating sheep diets in the arid and coastal areas.

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