

EFFECT OF FEEDING GRADED LEVELS OF DRIED ACACIA SALIGNA LEAVES DURING LATE PREGNANCY ON EWES PERFORMANCE AND LAMBS BIRTH WEIGHT

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SUMMARY

The study was conducted to evaluate the effect of feeding graded levels of dried *Acacia saligna* leaves (ALH) on the performance and some blood parameters of pregnant Barki ewes during late pregnancy. Forty ewes aged 3-5 years old at the last third of pregnancy (ten in each group, 38.0±1.2 kg body weight) were fed 0, 20, 40 and 60% of ALH as replacement of berseem hay in a completely randomized design for 75 days. The results showed non-significant differences in daily DM intake and digestibility coefficients of DM, EE, NFE and cellulose. Diets of 40% and 60% ALH showed higher ($P<0.05$) OM, CF digestibility comparing to 20% ALH and control diets. Diets of 20%, 40% and 60% ALH showed higher ($P<0.05$) CP digestibility comparing to control diet. The highest ($P<0.05$) nitrogen balance was recorded for ewes fed 60% followed by 40% ALH. The incorporation of ALH at levels 20, 40 and 60% resulted in non-significant differences in live body weight at all periods of the late pregnancy. Pregnant ewes fed 60% ALH diet recorded the highest ($P<0.05$) total body weight gain (Kg) and daily gain (g/day) and the lowest ($P<0.05$) weight loss at lambing. Birth weight of lambs were not significantly affected. Blood urea concentrations were decreased ($P<0.05$) with the graded percentage of ALH inclusion. The results of this study revealed that inclusion of dried *Acacia saligna* leaves up to 60% replacement of dietary berseem hay was better for improving nutrient utilization and ewe's performance during late pregnancy stage.

Keywords: *pregnant ewes, feed intake, digestibility, nitrogen utilization, body weight change, birth weight, blood parameters.*

INTRODUCTION

Increasing populations, economic growth and urbanization lead to increasing demands for livestock products, which in turn are driving demand for increasing feed, and generating additional pressure on natural grazing resources. In addition, lack of regulatory mechanisms to control grazing combined with the expansion of cultivation into previously uncultivated areas is aggravating degradation of rangelands worldwide. It has been proposed that fodder shrubs and trees can be integrated into production systems to provide additional feed resources for livestock, to provide a source of fuel, to reduce wind erosion when planted as wind breaks and to stabilize or rehabilitate degraded areas, so, these plants have a potential to prevent desertification and mitigating the effects of droughts (Amira *et al.*, 2014). Under African conditions, *Acacia saligna* and *Acacia nilotica*, leguminous trees are present in sufficient quantities to contribute to ruminant diets (Mlambo *et al.*, 2008). Their foliage may be used as a protein and energy supplement when animals are given low quality roughage (Krebs *et al.*, 2007). Tamira and Asefab (2009)

reported that *Acacia saligna* grows on different soils but does best on light to medium loam and well drained soils. The digestibility of dry matter (DM), organic matter (OM) and energy contents of fresh *A. saligna* has been reported to be generally low mainly due to presence of anti-nutritional factors (Mahipala *et al.*, 2009), such as tannins whose contents range from 47 to 55 g/kg DM (Ben Salem *et al.*, 1998). Condensed tannins in *A. saligna* leaves are considered to be the primary anti-nutritional factors other than the fibre quality that affect its utilization as fodder by livestock (Aganga *et al.*, 1998; Ben Salem *et al.*, 1998). Kaitho *et al.* (1996) noted that drying of fodder trees species (like *Acacia* species) caused a reduction in tannin content of *Acacia*, leading to improvement in palatability and N utilization in the rumen (Ahn *et al.*, 1989). For instances, Ben Salem *et al.* (1998) reported an increased DMI of sheep when *A. saligna* foliage was sun-dried, but did not show significant effect on digestibility or ruminal fermentation as compared to fresh foliage.

The crude protein and mineral contents of *Acacia* foliage are high enough to use it as a supplement to low quality diets (Abdulrazak *et al.*, 2000). Many authors reported that acacia tannins can use as natural products instead of chemical treatment to protect food proteins from microbial degradation in the rumen and increase the retention of nitrogen without negative repercussion (Maamouri *et al.*, 2011). Tannins are tentatively classified into two classes: hydrolysable and condensed tannins (CT), and are considered to have both adverse and beneficial effects depending on their concentration and nature besides other factors such as animal species, physiological state of the animal and composition of the diet (Makkar, 2003 and Frutos *et al.*, 2004). Low concentrations of CT (20–45 g CT/kg DM) reduce rumen forage protein degradation due to reversible binding to these proteins and to reducing the populations of proteolytic rumen bacteria. The present study was carried out to investigate the effect of feeding graded level of dried *Acacia Saligna* leaves (ALH) on ewe's performance during late pregnancy.

MATERIALS AND METHODS

The present study was conducted in Marryot Research Station, Desert Research Center, Ministry of Agriculture, 35 Km south of Alexandria, Egypt during 2014-2015.

***Acacia saligna* hay preparation**

Enough amounts of the fresh *Acacia* leaves were collected from the farm of Marryot station and Borg El-Arab Road and chopped to 3-5 cm length. After chopping, *Acacia* leaves were dried at shaded area for 3-4 days by spreading on plastic sheets, (air-drying). Samples of hay were taken for subsequent proximate chemical analyses.

Feeding and management

Forty of Barki ewes at the last third of pregnancy aged 3-5 years old with an average live body weight 38.0 ± 1.2 kg were randomly allocated to four treatments groups (ten ewes per group); each group was housed separately in shaded 5x5 meter pens and fed their normal allowances according to the experimental assignment during the pregnancy. Feeds were offered twice daily at 9:00 AM and 5:00 PM. Fresh tap water was made available for free choice drinking once daily after the morning feeding. Refusals were collected in the following morning, weighed and sampled, and daily intake was recorded. Pregnant ewe's body weights were recorded.

Blood samples were withdrawn from jugular vein of all ewes at morning before offering feed and water at the last day of experiment. The experimental animals were kept under the same managerial and hygienic condition. Before starting the experiment animals were treated against internal and external parasites and intro-toxemia.

The requirements of digestible CP and metabolizable energy (ME) for ewes at the last period of pregnancy were calculated according to the recommended feeding standards of Kearn (1982). The experimental diets were prepared to replace berseem hay by 0% (Control), 20% (20% ALH), 40% (40%

ALH) and 60% (60% ALH) *Acacia saligna* leaves hay. The compositions and chemical analysis of the experimental diets are presented in Tables (1) and (2).

Table (1). Formulation of ewe’s experimental diets (% , on DM basis).

Ingredient	Experimental Diet			
	Control	20% ALH	40% ALH	60% ALH
CFM*	36.0	36.0	36.0	36.0
Yellow corn	24.0	24.0	24.0	24.0
Berseem hay	40.0	32.0	24.0	16.0
<i>Acacia saligna</i> leaves	0.0	8.0	16.0	24.0

*CFM: commercial concentrate feed mixture.

Digestibility trials

Five ewes chosen randomly for each digestibility trial at weaning. The digestibility trials lasted for three weeks, the first two weeks were considered as preliminary period, followed by 7 days as collection period. Animals were housed in individual metabolic cages. During the trials the animals were fed their normal allowances according to the experimental assignment. Faeces and urine were quantitatively collected from each animal. The daily faeces excreted of each animal were recorded and 10% was sub-sampled, pooled on animal basis and frozen pending chemical analysis. The urine was collected in plastic buckets containing a solution of 100 ml of 10% H₂SO₄ to prevent ammonia-N loss. The daily output from each animal was weighed and 10% sub-sampled, pooled on animal basis and stored at 4°C until the analysis of nitrogen. Feed residues were removed daily at 7 AM and weighed. Daily drinking water volume was recorded. Proximate analysis of feeds, faeces, urine for ash, ether extract, crude protein, crude fiber and fiber fraction were determined according to the procedure of A.O.A.C. (1995).

Statistical analysis

Data were statistically analyzed using the method of least squares analysis of variance using software SPSS 10.0 windows (SPSS, 1999), using the following model; $Y_{ij} = \mu + T_i + e_{ij}$, Where; Y_{ij} is the observation, μ is the overall mean, T_i is the effect of treatments and e_{ij} is the residual error. Differences in mean values between groups were compared by Duncan’s Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

Chemical composition of feed ingredients

The chemical composition of feed ingredients is presented in Table (2). Dry matter (DM), crude protein (CP), crude fibre (CF), ether extract (EE) and fiber fraction contents of *Acacia saligna* hay were comparable to those of berseem hay. Whereas, *Acacia* hay had higher values of NFE and lower value of ash than berseem hay. Also, acid detergent lignin (ADL) and hemicellulose contents of *Acacia* hay were higher than those of berseem hay while cellulose was noticeably lower. The present results of chemical composition of berseem hay are comparable to the values reported by Shawket and Ahmed, (2001) and Shawket et al. (2010). The present chemical analysis (%) of *Acacia* hay was little more or less agreement with the values reported by Abou El Nasr et al. (1996) who indicated, DM: 86.4 and 89.53; CP: 10.1 and 17.63; CF: 28.1 and 22.81; EE: 4.40 and 1.16; NFE: 44.1 and 44.73; ash: 13.3 and 13.67; NDF: 69.5 and 43.90; ADF: 44.7 and 23.83 and ADL: 16.8, respectively, for *Acacia* hay. These wide variations of *Acacia* hay chemical composition may be due to differences in environmental and climatic conditions, the

vegetation period of plant, the processing method of drying under shade or in the sun, handling and storage conditions.

Table (2): Chemical composition of the experimental feedstuffs (on DM basis)

Items	Brseem hay	Acacia hay	CFM	Crushed corn grains
DM	91.5	92.6	91.5	89.7
CP	12.9	11.5	12.9	8.0
CF	27.9	26.6	15.8	1.6
EE	2.6	3.0	3.0	5.3
NFE	44.0	51.7	54.3	83.0
Ash	12.6	7.2	14.0	2.1
NDF	55.0	58.7	50.6	50.5
ADF	47.2	49.9	29.9	7.0
ADL	8.7	21.0	12.0	0.0
Hemicellulose	8.3	8.8	20.7	43.5
Cellulose	38.5	28.9	17.9	7.0

CFM: commercial concentrate feed mixture, DM: dry matter; OM: organic matter; CP: crude protein; CF: crude fiber; EE: ether extract; NFE: nitrogen free extract; NDF: neutral detergent fibre; ADF: acid detergent fiber and ADL: acid detergent lignin.

Table (3). Chemical analysis of the experimental diets (% , on DM basis).

Item	Experimental Diets			
	Control	20% ALH	40% ALH	60% ALH
DM	91.49	91.15	91.24	91.33
OM	86.59	96.74	90.17	90.60
CP	12.90	12.64	11.50	11.39
CF	20.67	19.38	17.05	16.94
EE	2.84	3.63	3.46	3.49
NFE	50.18	61.08	58.16	58.79
Ash	13.41	11.26	9.83	9.40
NDF	52.53	57.21	53.03	53.29
ADF	36.82	35.31	31.75	31.97
ADL	10.67	9.47	9.76	10.74
Hemi-cellulose	15.71	21.90	21.28	21.32
Cellulose	26.15	25.84	21.99	21.23

DM: dry matter; OM: organic matter; CP: crude protein; CF: crude fiber; EE: ether extract; NFE: nitrogen free extract; NDF: neutral detergent fibre; ADF: acid detergent fiber and ADL: acid detergent lignin.

Digestibility coefficient and nutritive value

The digestibility of the experimental diets is presented in Table (4) indicating non-significant effect of Acacia levels on the digestibility coefficients for DM, OM, EE, NFE and cellulose. While, 40% and 60% ALH diets showed the higher ($P < 0.05$) OM digestibility coefficient compared to 20% ALH and control diets (69.60 and 69.40 vs. 66.90 and 65.80%, respectively). Also, 20, 40 and 60% ALH diets recorded higher ($p < 0.05$) CP digestibility compared to control diet (72.69, 73.78 and 73.01 vs. 70.11%, respectively). Inclusion 40 and 60% ALH in ewes diets showed higher ($P < 0.05$) CF digestibility compared to 20% ALH and control diets (68.60 and 70.70 vs. 65.80 and 66.50%, respectively). At the same trend, 20, 40 and 60% ALH diets recorded higher ($P < 0.05$) digestibility coefficients of NDF than control diet (55.5, 56.0, 55.0 vs. 51.1%, respectively), also 60 % ALH diet recorded the highest ($P < 0.05$) ADF digestibility (56.2) compared to control, 20 and 40% ALH diets (53.4, 52.2 and 53.0 %, respectively), similarly, hemicellulose digestibility coefficient showed almost similar values (76.5 , 74.8, 73.6 and 70.8% for 60, 20, 40% ALH and control diets, respectively).

Table (4): Effect of degraded levels of ALH inclusion instead berseem hay in the experimental diets on nutrients digestibility and nutritive value

Item	Experimental Diet				P- value
	Control	20% ALH	40% ALH	60% ALH	
Digestibility (%):					
DM	66.7 ± 0.80	67.5 ± 1.43	66.8 ± 3.01	68.5 ± 1.25	0.903
OM	65.8 ± 0.94	66.9 ± 1.52	69.4 ± 3.40	69.6 ± 1.45	0.772
CP	70.11 ^b ± 2.21	72.69 ^a ± 4.33	73.78 ^a ± 2.80	73.01 ^a ± 3.72	0.955
CF	66.5 ^b ± 3.43	65.80 ^b ± 4.71	68.60 ^a ± 5.23	70.70 ^a ± 5.90	0.031
EE	75.6 ± 2.10	73.20 ± 1.92	70.3 ± 1.84	74.1 ± 1.55	0.447
NFE	73.6 ± 0.15	73.8 ± 0.93	73.5 ± 0.46	72.2 ± 0.26	0.779
Fiber fraction (%):					
NDF	51.1 ^b ± 7.00	55.5 ^a ± 7.31	56.0 ^a ± 7.22	55.0 ^a ± 5.60	0.044
ADF	53.4 ^b ± 3.11	52.2 ^b ± 3.19	53.0 ^b ± 3.09	56.2 ^a ± 2.21	0.040
Hemicellulose	70.8 ^b ± 2.44	74.8 ^{ab} ± 2.50	73.6 ^{ab} ± 2.34	76.5 ^a ± 2.46	0.046
Cellulose	57.7 ± 3.10	56.2 ± 3.31	58.2 ± 3.44	57.4 ± 3.52	0.080
Nutritive value (%):					
TDN	63.92 ± 2.31	67.97 ± 5.62	68.48 ± 3.61	68.94 ± 5.32	0.058
DCP	8.41 ± 0.32	8.58 ± 0.73	8.56 ± 0.36	8.69 ± 0.70	0.078

ALH: dried *Acacia saligna* leaves, DM; dry matter, OM: organic matter, CP: crude protein, CF: crude fiber, EE: ether extract, NFE: nitrogen free extract, TDN: total digestible nutrients and DCP: digestible crude protein.

^{a,b}, means in the same column with different superscripts are differ significantly ($P < 0.05$)

The present result of increasing ($P < 0.05$) NDF digestibility with the inclusion of dried *Acacia saligna* leaves (ALH) instead of berseem hay is in agreement with those reported by Maamouri *et al.* (2011) who found that *Acacia cyanophylla* (*Acacia saligna*) supply leads to a significant ($P < 0.05$) increase in NDF digestibility. Tannins mainly exert their effect on proteins, but they also affect other feed components to different degrees (Kumar and Singh, 1984). Evidently, the modifications of digestibility caused by tannins ingestion are mainly associated with changes in the ruminal fermentation pattern, along with changes in intestinal digestibility. O'Donovan and Brooker (2001) indicated that ruminal bacteria with proteolytic and firoytic activity can be adapted after a short time to tannins administration at low levels ($< 50\text{g/Kg DM}$) and successively continue their function. This may be explaining the improve digestibility of fiber fractions with inclusion ALH instead of berseem hay.

Total digestible nutrients (TDN, %) and digestible crude protein (DCP, %) values of the experimental diets showed no significant difference ($P > 0.05$) due to the graded percentage levels of replacing ALH instead berseem hay. Close to the present results of, El-Lakany *et al.* (1991) reported that replacing 50% of the daily DM alfalfa intake for Barki sheep with *Acacia* foliage slightly increased total digestible nutrients (TDN). The positive present results of DCP% values may be due to drying causing a reduction in tannin content of *Acacia* species foliage by about 11.3% (Van Thanh *et al.*, 2005), thus improving N utilization in the rumen (Ahn *et al.*, 1989 and Tamira and Asefab, 2009).

Nitrogen utilization

The nitrogen utilization results are presented in Table (5). The highest nitrogen intake was recorded for Barki ewes fed control followed by 60% ALH. The lowest ($P > 0.05$) nitrogen intake was recorded for 20% ALH diet (24.2 g/h/d). Dietary treatments did not affect significantly ($P > 0.05$) nitrogen excretion in faeces. But inclusion of ALH at levels of 60 and 40% instead of berseem hay decreased ($P < 0.05$) urinary nitrogen (10.2 and 10.9 g/h/d, respectively). While higher ($P < 0.05$) nitrogen excretions in urine were recorded for ewes fed control and 20% ALH diets (13.5 and 13.1 g/h/d, respectively). This result is in agreement with the previous finding of Maamouri *et al.* (2011) that simultaneous *Acacia* supply decreased ($P < 0.05$) urinary N. They reported that animals receiving protein N and a small quantity of tannins lost ($P < 0.01$) less N proportion in urine. Also, it was found that reduced urinary N is consistent with a reduction in ruminal ammonia losses, due to protein protection by condensed tannins (Krebs *et al.*, 2007). Diets containing 60 and 40 % ALH had higher ($P < 0.05$) nitrogen absorption, while control and

20% ALH diets had less nitrogen absorption (16.4 and 14.2 vs. 13.4 and 11.1 g/h/d, respectively). The urinary N as a proportion of total N excretion (%) was lower ($P<0.05$) with feeding 40 and 60% ALH diets than 20% and control diets resulting in a shift of relative N excretion from urine (47.66 and 52.15 vs. 56.47 and 56.25%, respectively) to faeces (52.34, 47.85 and 43.53 and 43.75, respectively).

Table (5): Nitrogen utilization (g/head/day) by dry Barki ewes fed the experimental diets.

Item	Experimental Diet				P- Value
	Control	20% ALH	40% ALH	60% ALH	
No. of animals	5	5	5	5	----
Nitrogen intake, g/h/d	27.00 ± 0.57	24.20 ± 1.99	25.10 ± 1.29	26.60 ± 0.78	0.605
Faecal nitrogen, g/h/d	8.07 ± 0.58	6.61 ± 1.13	6.58 ± 0.76	7.18 ± 1.33	0.913
Urinary nitrogen, g/h/d	15.22 ^a ± 1.24	12.88 ^b ± 0.74	12.01 ^b ± 1.18	11.12 ^c ± 0.91	0.040
FN % of TNE	43.65 ± 0.34	33.91 ± 0.61	37.41 ± 0.55	39.23 ± 0.63	0.042
UN % of TNE	65.35 ± 0.59	66.09 ± 0.64	68.22 ± 0.48	60.77 ± 0.72	0.047
NB, g/h/d	3.71 ^c ± 0.99	4.71 ^c ± 0.35	7.51 ^b ± 1.72	8.30 ^a ± 1.35	0.038
NB % of NI	13.74 ^a ± 3.73	19.46 ^c ± 1.34	29.92 ^c ± 6.61	31.20 ^c ± 5.05	0.009
NB % of NA	19.60 ^c ± 3.73	26.78 ^c ± 1.34	40.55 ^b ± 6.61	42.74 ^a ± 5.05	0.005

ALH: *Acacia saligna* leaves hay, FN: faecal nitrogen, UN: urinary nitrogen, TNE: total nitrogen excretion, NI: nitrogen intake and NA: nitrogen absorption.

^{a,b,c} Means in the same raw with different superscripts are differ significantly ($P<0.05$) or ($P<0.01$)

In general, all diets showed positive nitrogen balance (NB). The highest ($P<0.05$) nitrogen balance was recorded for ewes fed 60% ALH diet followed by those fed 40% ALH (7.51%) and 20% ALH (4.71%). however, the lowest NB was recorded for the control (3.71). The present values of NB are closer to those reported by Maamouri *et al.* (2011) and ranged from 2.6 to 10.6 g/day. They indicated that concentrate and increasing *Acacia* level supply resulted in the highest ($P<0.01$) nitrogen retention. Moreover, the present results are in agreement with those reported by Barry *et al.* (1986) and Monteils *et al.* (2003).

Nitrogen balance (NB) reported as a percent of N intake had the same tendency as quantity NB. Barki ewes fed 60 and 40% ALH diets showed the highest ($P<0.01$) value of NB % NI (31.20 and 29.92%, respectively), while 20% ALH and control diets showed the lowest ($P<0.01$) values (4.71 and 3.71%, respectively). At the same line, highest ($P<0.01$) NB % of NA values (42.74 and 40.55%, respectively) were recorded for ewes fed 60 and 40% ALH diets while the lowest values (26.78 and 19.60%, respectively) were recorded for those fed 20% ALH and control diets. These results are in agreement with those reported by Maamouri *et al.* (2011), they suggested that tannins supply interacted with the dietary protein and reduced its rumen microbial protein degradation, therefore they played the role of protein protection. Also, the condensed tannins bind protein and other macromolecules in the rumen, may reduce availability of the nutrients to microorganism degradation (McAllister *et al.*, 2005).

The advantage in this process is that excessive ammonia production in the rumen could be reduced, decreasing urinary N losses. As a result, nitrogen retention may increase in ruminants fed tannins-rich plants (Kaitho *et al.*, 1996) or remain without effect (Carulla *et al.*, 2005 and Bengaly *et al.*, 2007). Also, Reed (1995) reported that tannin-protein complex allows more dietary protein to escape rumen degradation to reach the lower digestive tract and allows a better flow of amino acids which had a positive effect on sheep performance grazing on semi-arid ranges (Maamouri *et al.*, 2011).

Last third period of pregnancy

Feed intake

Results of Table (6) indicated that the inclusion of 20% ALH instead of BH slightly decreased ($P>0.05$) the total DM intake (g/h/day or g/kg w^{0.75}). While increasing the inclusion level of ALH to 40

and 60% instead of BH showed a slight increase ($P>0.05$) in daily DM intake (1303.8 g/h/day, 76.60 g/Kgw^{0.75} and 1288.4 g/h/day, 76.98 g/kg w^{0.75}, respectively) in comparison with the control and 20% ALH diets (1270.0 g/h/day, 74.84 g/kg w^{0.75} and 1242.8 g/h/day, 73.45 g/kg w^{0.75}, respectively).

When feed intake values were expressed as total digestible nutrient intake (TDNI) it was noticeable that 40% ALH diet recorded the highest values (910.1 g/h/day, 53.54 g/kg w^{0.75}), followed by 60% ALH (887.7 g/h, 52.00 g/kg w^{0.75}) and control diets (876.3 g/h, 51.64 g/kg w^{0.75}). The lowest value of feed intake was recorded for 20% ALH diet (847.7 and 50.09). However, when the DCP values were expressed as g/kg w^{0.75}, the control and 60% ALH diets recorded the highest values (6.88 and 6.91, respectively) followed by values of 20 and 40% ALH diets (6.68 and 6.98, respectively) At the same trend, pregnant ewes fed 40% ALH recorded the highest value of DCP intake whereas those fed 20% ALH showed the lowest one (118.6, 116.8 and 116.0 vs. 113.1 for 40% ALH, control, 60% ALH and 20% ALH diets, respectively). However, there were no significant differences for TDN and DCP intake due to changing the level of ALH supplementation.

The present results of DM intake are in a good agreement with those obtained by Meneses, *et al.* (2012). They studied the effect of using *Acacia saligna* (Labill.) H.L. forage as an alternative feed supply for goats during the late pregnancy instead of alfalfa (*Medicago sativa L.*) hay 0, 25, 50, 75 and 100%. They found that the level of 25% of *Acacia* hay replacement instead of alfalfa hay slightly decreased the DM intake compared to the values of DM intake of control group. When the level of *Acacia* supplementation was increased to 50% instead of alfalfa hay the DM intake increased by about 1.6% than that of control group however the DM intake decreased ($P<0.001$) in diet with 70% and 100% *Acacia*. Moujahed *et al.*, (2005) reported that increasing the level of *Acacia* leaves in the animal diets decreased the DMI which may be attributed to the un-palatability of the diet as a result of increasing tannins content. Also, the reduction in dry matter intake may be due to the lower intestinal motility which led to a higher retention time of the digest in the gut (Garcia, *et al.*, 1999).

Table (6): Feed intake of the experimental diets supplemented with different levels of Acacia leaves hay (ALH) fed to Barki ewes at late pregnancy stage

Item	Experimental Diets			
	Control	20% ALH	40% ALH	60% ALH
No. animals	10	10	10	10
Initial B. Wt. (Kg)	39.8 ± 4.49	38.9 ± 1.77	39.9 ± 3.15	38.3 ± 1.36
Final B. Wt. (Kg)	47.4 ± 5.15	47.0 ± 3.64	47.5 ± 2.46	47.6 ± 2.60
MBW, Kg ^{0.75}	16.97	16.92	17.00	16.78
Con. DMI, g/h/day				
CFM	600.0	587.2	615.9	608.7
Yellow Corn	160.0	156.6	164.3	162.3
Roug. DMI, g/h/day				
BH	510.0	399.2	314.1	207.0
ALH	----	99.8	209.5	310.4
Total DMI				
g/h/day	1270 ± 14.51	1242.8 ± 18.05	1303.8 ± 12.12	1288.4 ± 13.41
g/Kgw ^{0.75}	74.84 ± 18.02	73.45 ± 15.96	76.69 ± 13.68	76.98 ± 18.55
TDNI				
g/ h/day	876.3 ^c ± 14.74	847.6 ^b ± 7.64	910.1 ^b ± 10.32	887.7 ^a ± 4.47
g/kg w ^{0.75}	51.64 ± 10.11	50.09 ± 10.91	53.54 ± 9.88	52.90 ± 11.02
DCPI				
g/h/day	116.8 ^b ± 3.22	113.1 ^b ± 1.29	118.6 ^b ± 3.28	116.0 ^a ± 2.71
g/kg w ^{0.75}	6.88 ± 6.31	6.68 ± 5.98	6.98 ± 6.11	6.91 ± 5.78

While Ben Salem *et al.* (1997) reported that increasing the level of air-dried *Acacia saligna* foliage in the Lucerne basal diet increased DM intake ($P<0.01$) by sheep up to approximately 600 g DM head/day of *Acacia*. This value (600 DM g /h/day) of voluntary intake of *Acacia* was noticeably greater than 170 g

DM *Acacia*/day and 165 g DM *Acacia*/day that were measured by Reed *et al.* (1990) and Ben Salem and Nefzaoui (1993), respectively in sheep fed straw-based diets. They indicated that feeding sheep with good quality roughage (i.e. Lucerne hay) improve *Acacia* consumption. It may be hypothesized that a component of the Lucerne, possibly protein, interacted with *Acacia* tannins in the rumen and reduced their effects on rumen function and thus voluntary intake. This explanation may confirm the current results of increasing DM intake with increasing the inclusion level of dried *Acacia* hay to 40 and 60% instead of berseem hay.

Pregnant ewes body weight changes, daily gain and body weight loss after lambing and lamb birth weight.

The results of the effect of *Acacia* supplementation on body weight changes, daily gain and body weight loss after lambing of ewes and lamb birth weight are presented in Table (7) and Figure (1). Initial body weight of Barki pregnant ewes ranged from 38.3 to 39.9 kg with no significant differences among treatments, which means a random distribution of the pregnant ewes on the different treatments. The incorporation of *Acacia* leave hay (ALH) at level 60% recorded the highest total live body weight gain and ADG. However, it was observed that pregnant ewes fed 40% ALH diet recorded the same total body weight gain and ADG that were recorded by those fed control, and slightly lower than those fed 40% ALH diet. The present results are in good agreement with those of Meneses, *et al.*, (2012) who reported that when goats in late pregnancy fed alfalfa hay diet (control) and replacement *Acacia* hay instead of alfalfa hay by 25, 50, 75 and 100% diets, the body weight changes did not show a significant differences ($P > 0.05$) among treatments. They illustrated that CP and ME intake during the experimental treatments was probably not sufficient to establish significant responses during the last third period of pregnancy.

During the late pregnancy stage, the increase in live body weight was accounted for both body gain and fetal growth, the 60% ALH fed group was superior ($P < 0.05$) than the 20% ALH followed by 40% ALH and control groups (9.3 vs. 8.1, 7.6 and 7.6 Kg, respectively). These values are closer to that reported by Farid *et al.* (2005a) who reported that pregnant Barki ewes received NRC standards (1985), gained, 9.54 Kg for pregnant group fed *ad lib* berseem hay, 6.09 Kg for ewes group fed one-third berseem hay plus *ad lib* rice straw and 6.63 Kg for the group fed *ad lib* rice straw with added commercial molasses-urea mixture. The present results of ewes body weight gain revealed better feeding during late pregnancy seemed to improve ewe condition more than that of the offspring and production rate (Farid *et al.*, 2005a). The difference in daily body weight gain values were significant ($P < 0.05$) among the Barki ewes groups during the whole experimental period. The minimum value was recorded for both pregnant ewes groups received the control (135.7 g/h/day) and 20% ALH (144.6 g/h/day) diets and the maximum value was recorded for pregnant ewes group received 60% ALH diet (166.7 g/h/d) and consequently had the highest ($P < 0.05$) daily weight gain followed by 40%, 20% ALH and control ewe groups respectively. Live body weight recorded on the first day after lambing was optimum for the 60% ALH group being 39.5 Kg. For the other three groups, live body weights were 38.6 Kg for the 40% ALH group and 38.4 Kg for both 20% ALH and control groups, they had the same body weight after lambing. These present body weight values are below the recorded values for Barki ewes fed according to NRC (1985) standards (44.0 Kg) or (45.8 Kg) for those fed *ad lib* berseem hay + 200 g concentrate /day/ewe (4 parts ground corn grain and 1 part soybean meal) as reported by Farid *et al.* (2005a). These differences may be due to the condition of the ewes at the start of the experiment was below optimum. The overall average live body weight was about 38 Kg (Farid *et al.*, 2005b). This is much less than the 45 kg considered optimum for Barki, one of the smaller Egyptian breeds (Abd El-Aziz, 1983, Mohammed, 1999). Loss in body weight at calving and loss percentage were significant ($P < 0.05$) differ among the experimental groups. It worthy to note that 60% ALH ewes group recorded the lowest ($P < 0.05$) loss value in body weight than the other three ewe groups with no significant differences between them. The values of loss percent of pre-lambing body weight were taken the same trend. Results, showed that the inclusion of ALH instead of berseem hay at levels of 20, 40 and 60% resulted in non-significant differences ($P > 0.05$) in lamb's birth weight (neglecting the lambs sex). 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 dams fed according to NRC standers (1985) and those fed *ad lib* berseem hay + 200g/ewe/day concentrate, 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 + 200g/ewe/day concentrate (Farid *et al.*, 2005b).

Table (7): Effect of graded levels of *Acacia* leaf hay inclusion instead of berseem hay on body weight change (Kg) of pregnant of Barki ewes and lambs birth weight.

Item	Experimental Diet				P-value
	Control	20% ALH	40% ALH	60%ALH	
Initial B. Wt. (Kg)	39.8±4.49	38.9±1.77	39.9±3.15	38.3±1.36	---
Final B. Wt. (Kg)	47.4±5.15	47.0±3.64	47.5±2.46	47.6±2.60	---
Gain (Kg)	7.6 ^b ±3.64	8.1 ^{ab} ±5.12	7.6 ^b ±6.81	9.3 ^a ±5.44	0.042
ADG g/day	135.7 ^b ± 10.11	144.6 ^{ab} ± 12.53	135.7 ^b ± 9.87	166.7 ^a ± 15.26	0.033
Loss in body weight on calving					
B. Wt after calving (Kg)	38.4±6.59	38.4±9.12	38.6±7.66	39.5±9.04	0.068
Loss (Kg)	-9.0 ^a ±0.95	-8.6 ^a ±0.70	-8.9 ^a ±0.82	-8.1 ^b ±0.43	0.025
Loss % of pre-calving weight	19.0 ^a ±0.72	18.3 ^a ±0.96	18.7 ^a ±2.21	17.0 ^b ±1.83	0.050
New born lambs					
Birth weight (Kg)	3.5±0.21	3.4±0.19	3.4±0.25	3.5±0.27	0.088

a, b Means in the same row with different superscripts are differ significantly ($P < 0.05$).

ADG= final – initial body weight/45

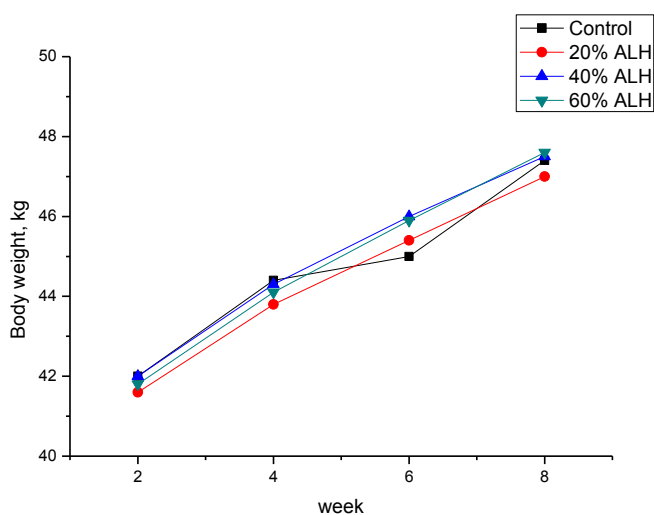


Figure (1): Body weight change of ewes fed diets supplemented with grade levels of *Acacia saligna* hay instead of berseem hay during late pregnancy

Blood parameters

Results of Table (8) clearly show no significant changes concerning total proteins, albumin, globulin, albumin/globulin ratio (A/G ratio) and creatinine concentration among treatments. The present values of blood metabolites except urea are within the normal range reported by Mousa and Shetaewi (2002) on

ewes fed *Acacia* and higher than the blood metabolites value reported by Hassan *et al.* (2015) for ewes fed 300 g ground barley grains + *ad lib* *Acacia saligna*.

On the other hand, blood urea concentrations were decreased ($P<0.05$) with the graded percentage of ALH inclusion (42.59, 47.73, 51.67 vs. 54.68 mg/dL for ewes fed 60, 40, 20% ALH and control diets, respectively). This result is in agreement with that reported by Carulla *et al.* (2005) added tannins to ewes diet decreased ($P<0.01$) blood urea N concentration suggesting that less protein was degraded with reducing microbial proteolytic activity in the rumen. Similar observations have been shown *in vitro* (Hess *et al.*, 2004) and *in vivo* (Carulla *et al.*, 2001) when tanniferous forages supplemented. These studies have demonstrated an overall improvement of N utilization. Also, at the same trend Maamouri *et al.* (2011) and Meneses *et al.* (2012) indicated that blood urea and urinary N loss were decreased ($P<0.05$) when sheep and goats were fed legumes that contained tannins. Generally, the values obtained of blood constituents indicated normal physiological and healthy status of ewes fed the experimental diets.

Table (8): Blood parameters as affected by the graded level of dried *Acacia saligna* leaves inclusion instead of berseem hay.

Item	Experimental Diet				P-value
	Control	20% ALH	40% ALH	60% ALH	
TP, g/dL	7.74 ± 1.21	7.85 ± 1.35	7.48 ± 1.35	7.95 ± 1.35	0.979
Albumin, g/dL	2.86 ± 0.19	2.93 ± 0.21	2.75 ± 0.21	2.88 ± 0.21	0.943
Glubulin, g/dL	4.88 ± 1.28	4.82 ± 1.43	4.73 ± 1.43	5.07 ± 1.43	0.972
A/G ratio	0.59 ± 10.20	0.61 ± 10.24	0.58 ± 10.24	0.57 ± 10.24	0.889
Urea, mg/dL	54.68 ^a ± 3.08	51.67 ^{ab} ± 3.08	47.73 ^b ± 3.08	42.59 ^c ± 2.76	0.048
Creatinin, mg/dL	0.55 ± 0.02	0.56 ± 0.08	0.57 ± 0.13	0.54 ± 0.08	0.882

TP: total protein and A/G: Albumin:Gubulin ratio

^{a,b,c} Means in the same raw with different superscripts are differ significantly ($P<0.05$)

CONCLUSION

Results of this study indicated that the inclusion of dried *Acacia saligna* leaves (ALH) up to 60% of dietary roughage for ewes during late pregnancy stage have a positive impact on their performance and lambs birth weight. Therefore, *Acacia saligna* (Labill.) H.L. Wendl. forage is an alternative feed supply for sheep during dry periods.

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تأثير التغذية بمستويات متدرجة من أوراق الأكاسيا ساليجنا المجففة على أداء النعاج خلال المرحلة الاخيرة من الحمل واوزان الحملان عند الميلاد

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اجريت هذه الدراسة لتقييم تأثير التغذية بمستويات متدرجة من أوراق الأكاسيا ساليجنا المجففة على استجابة الأداء وبعض مكونات الدم للنعاج البرقي في المرحلة الاخيرة من الحمل. تم تغذية عشرة نعاج في كل مجموعة تتراوح أعمارها بين 3-5 سنوات من العمر، في فترة الثلث الأخير من الحمل (وزن الجسم 38.0 ± 1.2 كجم). غذيت النعاج على مستويات 0، 20، 40 و 60% من دريس اوراق الاكاسيا كبدل لدريس البرسيم في تصميم تام العشوائية لمدة 75 يوما. وأظهرت النتائج وجود فروق غير معنوية ($P < 0.05$) في المأكول من المادة الجافة، ومعاملات هضم المادة الجافة والمستخلص الاثيري والمستخلص الخالي من الازوت والسليولوز. وكانت العلائق 40% و 60% أعلى معنويا ($P > 0.05$) في معامل هضم المادة العضوية والالياف الخام مقارنة مع مجموعة 20% والمجموعة الضابطة وكانت العلائق 20 و 40 و 60% أعلى معنوية ($P > 0.05$) في معامل هضم البروتين الخام مقارنة بالمجموعة الضابطة. وسجلت مجموعة 60% أعلى ($P < 0.05$) ميزان ازوت يليها مجموعة 40%. وقد أدى ادخال دريس الاوراق الاكاسيا بمستويات 20 و 40 و 60% الي اختلافات غير معنوية في وزن الجسم الحي في جميع مراحل أواخر الحمل. سجلت النعاج الحوامل في مجموعة 60% أعلى ($P < 0.05$) زيادة في وزن الجسم (كجم) ومعدل زيادة يومية (جم/يوم) وأقل ($P < 0.05$) فقد في الوزن عند الولادة. ولم يتأثر الوزن عند الولادة من الحملان معنويا ($P < 0.05$). وانخفضت تراكيزات اليوريا في الدم ($P < 0.05$) مع الزيادة المتدرجة من دريس اوراق الاكاسيا بدلا من دريس البرسيم. كشفت نتائج هذه الدراسة أن ادخال اوراق الاكاسيا المجففة الى مستوى يصل الى 60% بدلا من دريس البرسيم يمكن أن يؤدي الى تحسين الاستفادة من العناصر الغذائية وأداء النعاج خلال المرحلة الاخيرة من الحمل.