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Effect of Using Tanniniferous Plants Shrubs in Feeding Barki Ewes on some Productive and Physiological Parameters

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ABSTRACT

Tanniniferous plants shrubs are those plants which tolerate the high levels of salts in the soil, they are well grown in the northern coast of Egypt, and they include *Acacia nilotica*, *Atriplex nummularia* and *Cassava manihot esculenta*. This study aimed at exploring the possibility of complete replacement of berseem hay (control) in the diet by leaves and stems of tanniniferous shrubs plants and its effect on productive and physiological responses, in addition to some milk and blood biochemical constituents. Forty mature healthy Barki ewes at late pregnancy, 3-4 years old with an average live body weight (LBW) 51.5±0.46 kg were randomly divided into 4 similar groups. The 1st group (Hay) was fed the control diet which consisted of 40% concentrate feed mixture plus 60% berseem hay (BH), while in the 2nd,3rd and 4th groups, BH as percentage was replaced by *Acacia*, *Atriplex* and *Cassava* respectively. Body weight of ewes and their offsprings were recorded biweekly. Milk yield was measured weekly and milk samples of each animal were taken for milk analysis. Blood samples were collected biweekly for measuring some hematological and biochemical parameters. Feeding tanniniferous plants shrubs did not result in significant differences on body weight of Barki ewes and their offsprings, while improved milk productivity and increased milk protein and lactose. According to the results of biochemical parameters of blood, it could be concluded that feeding tanniniferous plants shrubs did not cause any negative effects on blood parameters of the experimental animals under the present study.

Keywords: Barki ewes, tanniniferous plants, milk, blood parameters.

INTRODUCTION

Sheep play an important role in agriculture environment especially in desert lands. Feed stuffs and fresh water scarcity are the main restraining factors for adequate animal production under the arid conditions in Egypt. Sheep, goats and camels always over graze the palatable plants. The less and inedible plant species represent roughly 70% of the total green coverage (El-Shaer *et al*., 1997). Thus under these challenging conditions, unusual feed resources such as tanniniferous plants shrubs and other salt-tolerant plants can offer practical alternatives in marginal areas as stated by El-Shaer and Gihad (1994) and Squires and Ayoub (1994). The edible parts of these plants could be used as animal feed resources, mainly in dry seasons.

Tanniniferous plants shrubs under study include *Acacia nilotica, Atriplex nummularia* and *Cassava manihot esculenta*. Mixing tanniniferous plants shrubs into rations is recommended for feeding animals. Tanniniferous plants shrubs are distinguished with minimum use of brackish or saline irrigating water and tolerable to arid or semi-arid conditions. They also give good biomass yield which could be used for feeding sheep and goat (EL-Saadany *et al.*, 2016).

Atriplex is characterized by moderate digestible crude protein and high oxalate, while digestible ether extract and soluble carbohydrates are low (El-Shaer and Gihad, (1994) and Ben Salem *et al.* (2002). Moreover, due to high ash content, *Atriplex* foliage is relatively low in energy contents. It is reported that sheep fed on *Atriplex* only decreased or maintained their live weights (Hassan and Abdel-Aziz, 1979 and Warren *et al*., 1990). In the presence of energy sources such as barely grains, *Atriplex* proved to be an excellent source of alternative nitrogen supplement for sheep that fed low quality roughage as cereal straws (Ben Salem *et al.*, 2005). Goats can depend unharmed in their feeding on *Atriplex halimus* and *Acacia saligna* plus barley (100% of their energy maintenance requirements) without any serious influence for less than 26 weeks (Ibrahim, 2001).

Feeding of tanniniferous plants shrubs is considered a suitable solution to conquer the expected lack of feed and its scarcity in Egypt (Shawket *et al.*, 2010). This forage shrubs species are well grown in the northern coast of Egypt (Degan, *et al.*, 1997). Feeding tanniniferous plants shrubs for a long duration exhibited changes in the body fluids, haemogram and histopathology of different organs, which did not return back to normal conditions after exclusion of the plants from the diet (Ibrahim, 2001).

Barki sheep lambs' LBW or average daily gain (ADG) did not affected by grazing on more than one type of forages shrubs like *Atriplex halimus* and *Acacia saligna* under arid and semi-arid conditions when compared with feeding berseem hay without unfavorable biological effects (Mohammady *et al.*, 2014).

Milk yield and milk composition of ruminants vary by system of feeding, breed, parity, season of feeding, managerial practices, environmental circumstances, lactation stage and health state of the Mammary gland. Sheep milk contains high total solids and major nutrient contents. Many changes in sheep milk composition occurred during the late stage of lactation because towards the end of lactation the fat, protein, total solids and minerals contents increased, while the lactose content decreased (Haenlein, 2001).

Furthermore, Vongsamphanh and Wanapat (2004) found that feeding of high levels of *Cassava* hay and dried *Cassava* root increased the milk yield and decreased the feed conversion ratio and feed cost, while concentration of blood urea-N were not affected by the level of *Cassava* hay in the diet.

Somatic cell count (SCC) is a measure of the white blood cell figure in milk. The level of SCC in milk of a particular ewe reflects the health condition of her mammary glands. Recently, researchers have indicated that the upper threshold for SCC in udder of healthy ewes should be 250,000 cells/ml (Pengov, 2001 and Menzies and Ramanoon, 2001).

Therefore, this study aimed at exploring the possibility of complete replacement of berseem hay (control) in the diet by leaves and stems of tanniniferous shrubs plants (*Acacia nilotica, Atriplex nummularia* and *Cassava manihot esculenta*) and its effect on some productive and physiological responses, in addition to some milk and blood biochemical constituents.

MATERIALS AND METHODS

This study was carried out at Borg El-Arab Experimental station, Alexandria Governorate, belonging to the Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture, whereas the fodder trees of *Acacia niloitca, Atriplex nummularia* and *Cassava manihot esculenta* were harvested along the sub-roads of the North Western Coast of Egypt near the Mediterranean Sea, west of Alexandria city, latitudes 21° and 31° North and longitudes 25° and 35° East.

Animals and experimental managements:

Forty mature healthy Barki ewes at late pregnancy, aged 3-4 years with average live body weight 51.5±0.46 kg were used in this study. The animals were randomly divided into 4 similar groups (10 ewes each) according to their live body weight (LBW) and age. All animals were kept in a semi-open shaded yard and kept under the same managerial conditions during the experimental periods.

Animals of the first group (G1) were fed the control diet consisted of 40% concentrate feed mixture (CFM), plus 60% berseem hay (BH), while in the 2nd, 3rd and 4th groups, BH as percentage had been replaced by leaves and stems of *Acacia*, *Atriplex* and *Cassava*, respectively. The CFM consisted of 25% un decorticated cotton meal, 43% yellow corn, 25% wheat bran, 3.5% molasses, 2% limestone, 1% common salt and 0.5% minerals mixtures.

Animals were fed on experimental diets to cover their nutrient allowances according to the physiological and productive stage (NRC, 1985). Ewes were adapted to experimental diets for 4 weeks as preliminary period, and then fed experimental rations 4 weeks before parturition and continued to weaning their lambs. All animals were fed daily at 9 a.m. and 4 p.m., fresh water and block minerals were available all times. Chemical composition on DM% (DM, OM, CP, EE, NFE and Ash), of feed stuffs were analyzed according to A.O.A.C. (1995) Table (1).

Table 1. Chemical composition of feed ingredients on DM% basis

Item	Experimental Feed Stuff				
	CFM	**Hay**	***Acacia***	***Atriplex***	***Cassava***
	Chemical Composition on DM% basis				
DM	91.20	95.12	71.62	45.32	44.39
OM	93.09	89.59	81.88	73.92	88.26
CP	15.70	10.64	10.03	12.19	22.94
CF	14.23	38.54	16.54	25.12	28.05
EE	3.13	1.03	1.74	1.72	2.92
NFE	60.84	39.38	53.57	34.89	34.35
Ash	6.10	10.41	18.12	26.08	11.74

Experimental measurements and samples collection:

Experimental periods were consisted of 2 intervals, late pregnancy (4 weeks before lambing) and suckling period (8 weeks). Live body weights (LBW) of ewes and their lambs were recorded biweekly. Milk yield was measured weekly throughout the lactation period by using of milk suckling technique in which, lambs were isolated from their mothers during previous night and body weight was recorded (to the nearest 10 gm) at the morning (7 a.m.). Lambs were left to suckle their dams for 30 minutes, and then immediately were weighed again. The difference between pre and post-suckling weights was defined as milk consumption or milk intake. The residual milk was hand milked and recorded. Similar procedures were repeated at the evening suckling at 5.30 p.m. difference between pre and post-suckling weights were added to previous milk intake quantity to calculate the daily milk intake (milk consumption) of suckling lambs. Milk intake plus milk removed by hand milking represented daily milk yield. All lambs were weaned irrespective of weight at 8 weeks of age.

Individual milk samples of each ewe in each group, representing morning and evening milking were collected weekly from the 2nd up to 7th wk. of the suckling period. Approximately 100 ml milk of each animal was sampled for the determination of milk composition. Somatic cell count (SCC) was determined using milk analyzer, (model EKOMILK-M, Eon Trading LLC, USA). The SCC was converted into the somatic cell score (SCS) according to the following equation that given by Wiggans and Shook (1987):-

$$\mathbf{SCS = \log2\ [SCC/\ (100{,}000)\ +3]}$$

Milk samples were directly analyzed for fat, total solids (TS) and total proteins using the methods described by Ling (1963). Lactose content was determined calorimetrically according to Barnett and Abd El-Tawab (1957). Ash content was determined according the methods reported in A.O.A.C. (1984).

Blood samples were collected biweekly during experimental periods from the jugular vein of ewes into clean test tubes with anticoagulant. Blood samples were divided into two portions. In the 1st portion, hematological parameters including count of red (RBC's x10^6/mm^3) and white (WBC's x10^3/mm^3) blood cells, hematocrit value (Ht %) and hemoglobin (Hg g/dl) concentration in the whole blood were immediately measured after collection. The 2nd portion was centrifuged at 3000 rpm for 20 minutes to obtain plasma and frozen at -20C̊ for late biochemical assay. Plasma concentrations total proteins, albumin, total

Lipids, triglycerides, total cholesterol, total antioxidant capacity (TAC), glucose, liver activity enzymes and kidney functions were estimated calorimetrically using commercial chemical reagent kits (Bio-diagnostic product Kit, Egypt). However, globulin concentration and albumin/globulin ratio were calculated.

Statistical analysis:

Live body weights of ewes and their offspring, average weekly milk yield, milk composition were statistically analyzed using General Linear Model's procedures of SAS GLM (SAS, 2004), the model includes the effect of treatments (four variables). Means were tested using (Duncan's multiple Range test procedure 1995).

Blood hematological and biochemical parameters were statistically analyzed by General Linear Model's procedures of SAS GLM (SAS, 2004). The model includes the effect of treatments (four variables), sampling time (three times) and their interaction. Means were compared via the LSMEANS/PDIFF of the same procedure. Values were considered significant at $P \leq 0.05$.

RESULTS AND DISCUSSION

Impact of feeding tanniniferous plants shrubs on:

Live body weight (LBW) of ewes:

Results show the influence of feeding tanniniferous plants shrubs (*Atriplex*, *Acacia* and *Cassava*) as alternatives to BH on live body weights (LBW) of Barki ewes (Figure 1). There was no significant differences between animals in the initial (LBW) at the start of experiment (4 weeks pre-lambing). Moreover, at lambing and at 4 weeks post-lambing LBW of Barki ewes revealed also insignificant differences between the different experimental groups. At weaning (8 weeks post-lambing) there was significant difference between ewes fed *Acacia* and those fed Hay (50.90 *vs*. 47.40 kg.). Animals fed *Acacia* recorded the highest LBW when compared with the other experimental groups.

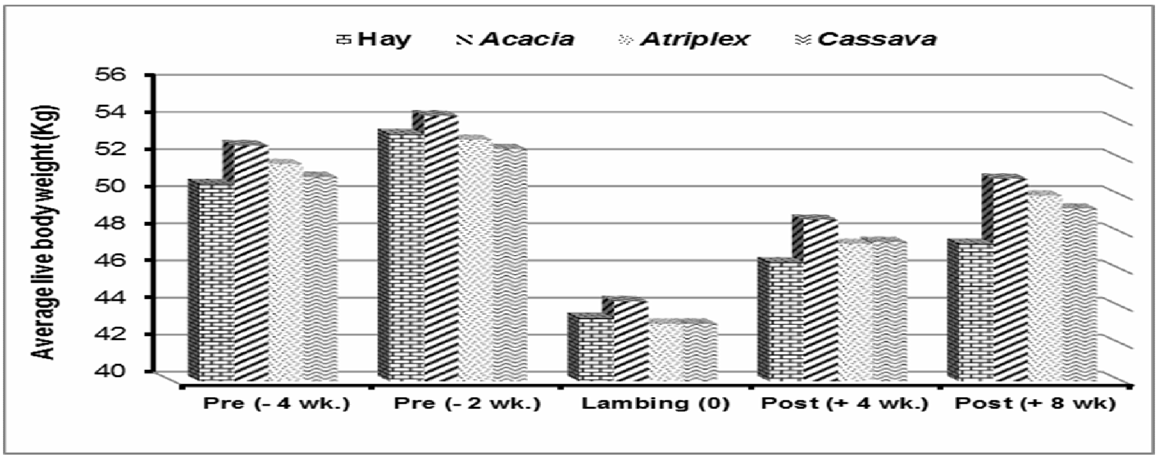

Figure 1. Changes of live body weights (kg) of Barki ewes pre and post lambing.

The present results are in the same direction with those obtained by EL-Saadany *et al*. (2016) who recorded insignificant differences among different experimental groups (*Acacia, Atriplex* and *Cassava vs*. berseem hay) in LBW of Barki ewes during the 15 days pre-partum, at lambing and at 60 days post-partum. Likewise, Abu-Zanat, and Tabbaa (2006) and Shaker *et al*. (2014) found insignificant differences due to adding *Atriplex* and *Acacia* in ration of ewes and Shami goats. These obtained results revealed that these forage shrubs can be used for maintaining growth and body weight of sheep as berseem hay (BH) without negative impacts, although these plants have high ash and low energy contents especially *Acacia* and *Cassava*.

Average weekly milk production:

Statistical results presented in Table (2) show the effect of feeding tanniniferous plants shrubs on milk yield of Barki ewes under the experiment. Generally Barki ewes fed *Cassava* produced the highest ($P<0.05$) total milk yield followed by ewes fed Hay, and then ewes fed *Atriplex* and *Acacia*, respectively. The milk yield of ewes in different experimental groups increased till the end of 3rd week then decreased gradually till the end of lactation period. The peaks of average weekly milk yield that recorded in the 3rd week from lambing were 10.783, 8.483, 6.441 and 10.018 kg for *Cassava*, *Atriplex*, *Acacia*, and Hay groups respectively. Concerning the average daily milk yield kg/head, the highest ($P<0.05$) value was recorded by ewes fed *Cassava* (1.052 kg/head), while the averages of other groups were 0.662, 0.814 and 0.916 kg/head for ewes fed *Acacia, Atriplex* and Hay respectively.

In agreement with the present results, Abu-Zanat and Tabbaa (2006) found that the highest milk yield was recorded by ewes fed *Cassava* when compared to those fed other types of forages. They attributed the high milk yield due to higher dietary CP and EE in *Cassava*. In contrast, Shawket *et al*. (2010) found that inclusion of fresh *Atriplex* instead of BH in the diet increased ($P<0.05$) the milk production of camel.

Live body weight of newly born lambs:

Table (2) demonstrates the results of LBW of newly born lambs from lambing to the 8th week of age after birth. Feeding tanniniferous plants shrubs (*Acacia, Atriplex* and *Cassava* as alternatives to berseem hay) did not exhibit any significant differences between the different experimental groups. There were no significant differences in lambs birth weight between experimental groups. The highest values of biweekly live body weights, total body gain and average daily gain of newly born lambs were recorded in animals fed *Cassava* while the lowest recorded in those fed *Acacia*.

The concurrent results come in agreement with those obtained by Shetaewi *et al*. (2001); Fasae *et al*. (2015) and EL-Saadany *et al*. (2016) who recorded differences ($P<0.05$) between ewes fed *Acacia, Atriplex* and *Cassava* when compared with those fed Berseem hay in total gain and average daily gain of lambs. On the other hand, these results are not in accordance with those obtained by Mohammady *et al*. (2014) who reported higher weaning weight and daily gain ($P<0.05$) in Barki lambs fed BH when compared with those fed tanniniferous plants shrubs.

Table 2. Impact of feeding tanniniferous plants shrubs on average weekly milk yield of Barki ewes and live body weight changes of newly born lambs. (Means ± SE)

Lactation period (Kg/h)	Experimental group			
	Hay	***Acacia***	***Atriplex***	***Cassava***
	Weekly milk yield(kg/h)			
1st wk.	5.231 ± 0.32^{a}	4.080 ± 0.26^{b}	4.795 ± 0.31^{ab}	5.111 ± 0.32^{a}
2nd wk.	7.926 ± 0.65^{a}	4.788 ± 0.16^{b}	6.150 ± 0.48^{b}	8.855 ± 0.51^{a}
3rd wk.	10.018 ± 0.29^{a}	6.441 ± 0.35^{c}	8.483 ± 0.72^{b}	10.783 ± 0.54^{a}
4th wk.	7.576 ± 0.30^{b}	5.824 ± 0.08^{c}	6.955 ± 0.48^{b}	9.431 ± 0.24^{a}
5th wk.	6.389 ± 0.34^{b}	4.929 ± 0.26^{c}	$5.975 \pm 0.47b^{c}$	7.936 ± 0.46^{a}
6th wk.	5.978 ± 0.32^{b}	4.303 ± 0.22^{c}	5.003 ± 0.26^{c}	6.955 ± 0.48^{a}
7thwk.	4.466 ± 0.43^{bc}	3.573 ± 0.20^{c}	4.536 ± 0.24^{b}	5.531 ± 0.33^{a}
8th wk.	3.685 ± 0.30^{ab}	3.111 ± 0.13^{b}	3.679 ± 0.36^{ab}	4.324 ± 0.49^{a}
Total milk yield/kg/h	51.269 ± 1.76^{b}	37.048 ± 1.41^{d}	45.575 ± 2.58^{c}	58.926 ± 1.86^{a}
Average daily milk yield (kg/h/d)	0.916 ± 0.03^{b}	0.662 ± 0.03^{d}	0.814 ± 0.05^{c}	1.052 ± 0.03^{a}
	Changes in live body weights (kg) of lambs			
Lamb's birth weight	3.678 ± 0.10^{a}	3.700 ± 0.14^{a}	3.789 ± 0.17^{a}	3.676 ± 0.24^{a}
After 2 weeks	7.027 ± 0.15^{a}	6.615 ± 0.52^{a}	6.868 ± 0.31^{a}	7.448 ± 0.39^{a}
After 4 weeks	10.367 ± 0.23^{a}	9.530 ± 0.96^{a}	9.946 ± 0.63^{a}	11.020 ± 0.58^{a}
After 6 weeks	11.136 ± 0.22^{a}	10.610 ± 0.95^{a}	11.231 ± 0.52^{a}	11.871 ± 0.48^{a}
After 8 weeks	11.818 ± 0.34^{a}	11.370 ± 0.96^{a}	11.975 ± 0.47^{a}	12.520 ± 0.75^{a}
Total gain	8.140 ± 0.31^{a}	7.670 ± 0.92^{a}	8.186 ± 0.55^{a}	8.844 ± 0.70^{a}
Average daily gain	0.145 ± 0.01^{a}	0.137 ± 0.02^{a}	0.146 ± 0.01^{a}	0.158 ± 0.01^{a}

a, b and c, Means within the same row with different superscript are significantly differ ($P<0.05$).

Chemical composition of milk:

Data in Table (3) revealed that there were no significant differences between the different experimental groups for overall means of milk fat% that were 6.56, 6.70, 6.86 and 6.78% for Hay, *Acacia, Atriplex* and *Cassava* groups, respectively. However, ewes fed *Acacia* showed the highest ($P<0.05$) milk fat (7.90%) at the 6th week of lactation. It worth notice, that these ewes also gave the least ($P<0.05$) weekly yield during the same week.

Ewes of Hay group had the lowest ($P<0.05$) milk protein% (3.77%). Milk protein percentages in other groups were 3.95, 3.99 and 3.93% for *Acacia, Atriplex* and *Cassava*, respectively.

The same trend of protein% was also occurred for lactose%, and the overall means were 4.82, 5.06, 5.13 and 5.05% for Hay, *Acacia, Atriplex* and *Cassava* groups, respectively.

Ewes of Hay group showed the lowest ($P<0.05$) overall mean of milk ash (0.79%), while those fed *Acacia* had the highest (0.95%). Overall means of milk total solids percentages revealed insignificant differences and were 17.18, 17.88, 18.01 and 17.61% for Hay, *Acacia, Atriplex* and *Cassava* groups, respectively.

With reference to somatic cell score (SCC) there was no difference between experimental groups. Overall means of SCC were 4.503, 4.691, 4.193 and 4.502 for *Acacia*, *Atriplex* and *Cassava* groups, respectively.

The concurrent results match those obtained by Shawket and Ibrahem (2012) who reported that substitution of *Atriplex* for berseem hay in the diet caused marked increase ($P<0.05$) in protein content of camel milk. However, Ahmed *et al*. (2013) found no effect to feeding tanniniferous plants shrubs on milk constituents. Moreover, Shetaewi *et al*. (2001) reported that milk fat percentages decreased in does fed concentrate diet plus green *Acacia* in comparison to those fed concentrate diet plus BH. They attributed this result to the higher digestibility coefficients of the nutrients in berseem hay than those in *Acacia* leaves.

Generally, in the present study feeding lactating ewes with tanniniferous plants shrubs as alternative to berseem hay resulted in increasing milk protein, lactose and ash percentages, while did not affect fat and total solids percentages and somatic cell score. Based on these results we can say that using of tanniniferous plants shrubs as alternative to berseem hay did not show adverse effects on mammary glands of experimental Barki ewes.

Ewes blood biochemical:

A. Blood picture:

Feeding tanniniferous plants shrubs revealed an increase ($P<0.05$) in red blood corpuscles (RBC's), white blood corpuscles (WBC's), hemoglobin (Hb) and hematocrit% (Ht %) than found in ewes fed BH, as shown in Table (4). The highest values of these parameters were exhibited by ewes fed *Cassava* plant.

For the effect of the physiological status, ewes fed BH did not show big variation from pre- to post-partum, while those fed tanniniferous plants showed significant decrease in all these parameters after parturition.

These results come in opposite direction to those results obtained by Abdelhameed *et al*. (2006); El-Bassiony (2013) and El-Hawy (2013) who reported highly significant decrease in RBC's and WBC's in different animals species (sheep, goats, camels, and cattle) that fed tanniniferous plants when compared to the control group which fed BH. In addition, Abdelhameed *et al.* (2006) found insignificant effect to feeding tanniniferous plants shrubs on Hb and Ht %.

Table 3. Milk composition of Barki ewes fed tanniniferous plants shrubs during suckling period. (Means ± SE)

Item	Suckling Wk.	Experimental group			
		Hay	*Acacia*	*Atriplex*	*Cassava*
Fat %	2nd wk.	$6.47±0.442^a$	$6.85±0.340^a$	$6.80±0.218^a$	$6.83±0.300^a$
	3rd wk.	$6.93±0.365^a$	$6.16±0.485^a$	$7.40±0.301^a$	$7.15±0.420^a$
	4th wk.	$5.70±0.650^a$	$6.15±0.344^a$	$6.73±0.301^a$	$6.54±0.370^a$
	5th wk.	$6.60±0.287^a$	$6.28±0.548^a$	$6.93±0.433^a$	$6.95±0.321^a$
	6th wk.	$6.51±0.537^b$	$7.90±0.207^a$	$6.61±0.370^b$	$6.71±0.225^b$
	7th wk.	$6.91±0.300^a$	$6.64±0.444^a$	$6.58±0.335^a$	$6.49±0.331^a$
	Overall mean ± SE	$6.56±0.254^a$	$6.70±0.220^a$	$6.86±0.224^a$	$6.78±0.157^a$
Protein %	2nd wk.	$3.81±0.061^b$	$4.00±0.066^a$	$4.09±0.069^a$	$3.94±0.038^{ab}$
	3rd wk.	$3.81±0.061^b$	$3.88±0.059^b$	$4.05±0.050^a$	$3.98±0.049^{ab}$
	4th wk.	$3.66±0.124^b$	$3.95±0.071^a$	$3.99±0.035^a$	$3.99±0.044^a$
	5th wk.	$3.89±0.023^a$	$3.94±0.068^a$	$3.89±0.035^a$	$3.85±0.153^a$
	6th wk.	$3.59±0.160^b$	$3.90±0.057^a$	$3.99±0.055^a$	$3.86±0.063^a$
	7th wk.	$3.88±0.045^b$	$4.06±0.053^a$	$3.95±0.057^{ab}$	$3.98±0.073^{ab}$
	Overall mean ± SE	$3.77±0.033^b$	$3.95±0.041^a$	$3.99±0.035^a$	$3.93±0.041^a$
Lactose %	2nd wk.	$4.88±0.075^b$	$5.10±0.097^{ab}$	$5.29±0.103^a$	$5.06±0.068^{ab}$
	3rd wk.	$4.85±0.085^b$	$4.94±0.080^b$	$5.21±0.086^a$	$5.09±0.088^{ab}$
	4th wk.	$4.88±0.086^b$	$5.04±0.091^{ab}$	$5.09±0.052^{ab}$	$5.13±0.053^a$
	5th wk.	$4.94±0.038^a$	$5.05±0.107^a$	$4.96±0.050^a$	$4.93±0.229^a$
	6th wk.	$4.40±0.257^b$	$4.99±0.074^a$	$5.14±0.091^a$	$4.94±0.093^a$
	7th wk.	$4.98±0.060^a$	$5.24±0.087^a$	$5.06±0.091^a$	$5.13±0.113^a$
	Overall mean ± SE	$4.82±0.063^b$	$5.06±0.060^a$	$5.13±0.056^a$	$5.05±0.062^a$
Ash %	2nd wk.	$0.76±0.060^a$	$0.92±0.103^a$	$0.89±0.081^a$	$0.94±0.076^a$
	3rd wk.	$0.78±0.056^a$	$1.00±0.124^a$	$0.93±0.116^a$	$0.89±0.106^a$
	4th wk.	$0.69±0.040^a$	$0.86±0.073^a$	$0.84±0.107^a$	$0.86±0.080^a$
	5th wk.	$0.78±0.073^a$	$0.79±0.105^a$	$0.75±0.050^a$	$0.68±0.041^a$
	6th wk.	$0.85±0.107^b$	$1.21±0.111^a$	$0.98±0.127^{ab}$	$0.84±0.114^b$
	7th wk.	$0.88±0.094^a$	$0.93±0.127^a$	$0.94±0.098^a$	$0.86±0.068^a$
	Overall mean ± SE	$0.79±0.022^b$	$0.95±0.041^a$	$0.89±0.047^{ab}$	$0.84±0.042^{ab}$
Total solids %	2nd wk.	$17.60±0.806^a$	$18.06±0.427^a$	$18.06±0.374^a$	$17.81±0.301^a$
	3rd wk.	$17.36±0.453^b$	$16.98±0.511^b$	$19.23±0.714^a$	$18.10±0.468^{ab}$
	4th wk.	$15.93±0.692^a$	$17.29±0.605^a$	$17.64±0.377^a$	$17.51±0.455^a$
	5th wk.	$17.20±0.302^a$	$17.29±0.904^a$	$17.86±0.627^a$	$17.40±0.618^a$
	6th wk.	$16.35±0.795^b$	$19.33±0.400^a$	$17.71±0.515^b$	$17.35±0.193^b$
	7th wk.	$18.63±0.795^a$	$18.34±0.898^a$	$17.53±0.407^a$	$17.45±0.478^a$
	Overall mean ± SE	$17.18±0.352^a$	$17.88±0.362^a$	$18.01±0.258^a$	$17.61±0.151^a$
Somatic cell score	2nd wk.	$4.361±0.378^a$	$4.778±0.375^a$	$4.260±0.237^a$	$5.060±0.435^a$
	3rd wk.	$3.447±0.203^a$	$3.808±0.380^a$	$3.715±0.300^a$	$3.912±0.460^a$
	4th wk.	$4.700±0.684^a$	$3.776±0.266^{ab}$	$3.263±0.169^b$	$3.545±0.273^{ab}$
	5th wk.	$3.247±0.147^a$	$4.020±0.504^a$	$3.891±0.240^a$	$3.830±0.457^a$
	6th wk.	$5.149±0.231^a$	$5.866±0.310^a$	$5.182±0.334^a$	$5.038±0.256^a$
	7th wk.	$3.065±0.040^a$	$3.288±0.225^a$	$2.987±0.013^a$	$3.058±0.074^a$
	Overall mean ± SE	$4.503±0.227^a$	$4.691±0.264^a$	$4.193±0.180^a$	$4.502±0.260^a$

a and b, Means within the same row with different superscript are significantly differ (P<0.05).

B. Protein fractions:

Blood plasma total proteins (TP) and its fractions, albumin (Al) and globulin (Gl) have a great importance as good indicators of nutritional status. Feeding tanniniferous plants shrubs resulted in significant increase in plasma concentration of total proteins and albumin as shown in Table (5). The highest mean of total proteins was recorded by ewes fed *Cassava*, while the highest mean of albumin was recorded by ewes fed *Acacia*. Plasma globulin did not affected by feeding tanniniferous plants. As a result albumin to globulin ratio (Al/Gl) appreciably increased in plasma of ewes fed these plants. In general plasma protein increased by feeding tanniniferous plants through increasing albumin fraction. Albumin is known to play an important role in body fluids regulation hence coping with salt stress (Abdel-Bary, 1990).

The effects of physiological status were not constant on plasma protein fractions. Total plasma proteins increased in all groups from pre- to post-partum reaching the highest values at the end of lactation period. For plasma albumin it increased in ewes fed BH, but decreased in ewes fed *Cassava* plant. In the other two groups, albumin decreased after parturition then increased again at time of weaning lambs. Plasma globulin while increased in ewes fed BH it decreased in those fed tanniniferous plants.

EL-Saadany *et al.* (2016) found significant increase in total plasma protein concentration between experimental groups (*Acacia*, *Atriplex* and *Cassava vs.* Hay). With regard to albumin, Shaker *et al.* (2008) recorded that plasma albumin was higher in Barki lambs fed mixture of *Acacia* and *Atriplex*. For globulin concentrations, the obtained results come in accordance with those obtained by El-hawy (2013) who recorded insignificant difference in doe goats by feeding mixture of *Atriplex* and *Acacia* compared to BH feeding.

However, the present results differ from those obtained by Badawy *et al.* (2002) and Shaker *et al.* (2008 and 2014) who reported that feeding fresh *Acacia* decreased plasma TP, Al and Gl values in growing Barki lambs. Similarly, Ibrahim (2001) reported that goats fed *Atriplex* or *Acacia* had lower value of TP compared with those fed BH. In addition, Badawy *et al.* (2002) reported that the animals fed *Atriplex nummularia* or *Acacia saligna* showed lower Al/Gl ratio.

In general, the present results showed clearly that all values of plasma protein fractions were within the normal reference ranges of these metabolites. This indicated that the animals under the study were in good nutritional status and their liver had no damage since these metabolites are mainly synthesized in it.

Table 4. Means ± SE of some blood parameters of Barki ewes fed tanniniferous plants shrubs during different physiological periods.

Item	Sampling time	Experimental group			
		Hay	*Acacia*	*Atriplex*	*Cassava*
RBC's (10^6/mm^3)	Pre-parturition	4.852±0.151^d	6.398±0.174^b	5.775±0.284^c	7.394±0.306^a
	At lambing	4.939±0.129^a	4.748±0.0593^a	4.900±0.019^a	5.079±0.099^a
	At weaning	4.610± 0.206^{ab}	4.570±0.045^b	4.676±0.072^{ab}	5.051±0.078^a
	Overall mean ± SE	4.799±0.096^c	5.239±0.164^b	5.117±0.129b^c	5.841±0.23^a
WBC's (10^3/mm^3)	Pre-parturition	9.988±0.308^c	11.292±0.697^b	11.885±0.585^b	15.214±0.631^a
	At lambing	10.163±0.265^a	9.891±0.083^a	9.986±0.115^a	10.435±0.206^a
	At weaning	9.486±0.425^a	9.405±0.093^a	9.622±0.149^a	10.394± 0.162^a
	Overall mean ± SE	9.879±0.196^b	10.196±0.272^b	10.498±0.270^b	12.010±0.47^a
Hg (g/dl)	Pre-parturition	9.460± 0.291^c	12.428± 0.336^b	12.255± 0.493^b	14.408± 0.5970^a
	At lambing	9.669±0.234^a	9.359±0.114^a	9.447±0.116^a	10.023± 0.210^a
	At weaning	8.983± 0.403^b	8.895± 0.086^b	9.102± 0.143^{ab}	9.846± 0.154^a
	Overall mean ± SE	9.371±0.184^c	10.227±0.314^b	10.268±0.312^b	11.430±0.44^a
Ht (%)	Pre-parturition	31.218±0.962^d	41.143±1.120^b	37.135±1.829^c	47.548±1.969^a
	At lambing	31.900±0.775^a	30.730±0.310^a	31.580±0.125^a	32.810±0.614^a
	At weaning	29.643± 1.328^{ab}	29.390± 0.290^b	30.070± 0.465^{ab}	32.482± 0.507^a
	Overall mean ± SE	30.920±0.608^c	33.754±1.048^b	32.928±0.829^{bc}	37.610±1.47^a

a, b, c and d, Means within the same row with different superscript are significantly differ (P<0.05).

Table 5. Effect of feeding tanniniferous plants shrubs on protein fractions of Barki ewes during different physiological periods. (Means ± SE)

Item	Sampling time	Experimental group			
		Hay	*Acacia*	*Atriplex*	*Cassava*
Total Protein, g/dl	Pre-parturition	6.268±0.263^c	7.120±0.142^b	7.189±0.114^{ab}	7.781±0.414^a
	At lambing	7.662±0.220^{ab}	7.874±0.115^a	7.674±0.261^{ab}	7.129±0.131^b
	At weaning	8.141±0.220^a	8.168±0.221^a	8.058±0.157^a	8.587±0.182^a
	Overall mean ± SE	7.357± 0197^b	7.721± 0.123^{ab}	7.640± 0.124^{ab}	7.832± 0.187^a
Albumin, g/dl	Pre-parturition	3.728±0.200^c	5.021±0.133^b	4.951±0.128^b	5.731±0.406^a
	At lambing	4.417±0.321^a	4.871±0.145^a	4.621±0.365^a	4.366±0.299^a
	At weaning	5.478± 0.212^{ab}	5.471± 0.137^{ab}	5.580± 0.102^a	4.899± 0.203^b
	Overall mean ± SE	4.541± 0.193^b	5.121± 0.090^a	5.051± 0.148^a	4.999± 0.203^a
Globulin, g/dl	Pre-parturition	2.541±0.183^a	2.100±0.055^b	2.238±0.074^{ab}	2.049±0.166^b
	At lambing	3.126±0.116^a	3.145±0.071^a	3.181±0.144^a	2.899±0.196^a
	At weaning	2.662±0.191^b	2.697±0.143^b	2.478±0.167^b	3.689±0.110^a
	Overall mean ± SE	2.777± 0.104^a	2.645±0.096^a	2.632±0.105^a	2.879±0.153^a
Al/Gl ratio	Pre-parturition	1.529± 0.136^c	2.407± 0.092^b	2.241±0.112^b	2.966± 0.315^a
	At lambing	1.515±0.140^a	1.563±0.075^a	1.495±0.151^a	1.760±0.163^a
	At weaning	2.182± 0.206^a	2.081± 0.126^a	2.337± 0.152^a	1.344± 0.077^b
	Overall mean ± SE	1.742± 0.108^a	2.017± 0.085^a	2.024± 0.104^a	2.023± 0.173^a

a, b and c, Means within the same row with different superscript are significantly differ (P<0.05).

C. Energy components:

Feeding tanniniferous plants reduced insignificantly plasma total lipids while increased significantly the levels of triglycerides. Total cholesterol increased in plasma of ewes fed tanniniferous plants but only significantly in those fed *Cassava* when compared with ewes fed BH (Table 6).

Physiological status did not affect plasma total lipids. In spite of that, both triglycerides and total cholesterol increased from pre- to post-partum stage in all experimental groups.

Plasma glucose increased significantly by feeding tanniniferous plants and from pre- to post-partum stage. This was more obvious in ewes fed *Atriplex*.

El-Bassiony (2013) and Shaker *et al.* (2014) worked on Shami goats and Barki sheep fed on sun-dried mixture of *Prosopis*, *Acacia* and *Leucaena* in comparison with those fed BH, found a decrease in plasma total lipids and total cholesterol, while plasma glucose did not affected. Also Ibrahim (2001) and Shaker (2014) recorded a decrease in energy components concentration due to feeding goats tanniniferous plants, and they attributed this decrease to high content of tannins and salts. Hassan *et al.* (2015) recorded a decrease in goats plasma energy components due to feeding some forage shrubs. They attributed this decrease due to lower production of Total volatile fatty acids (VFA's) in rumen which are probably due to lower solubility of nitrogen and reduced availability of amino acids for production of VFA's.

D. Liver and kidney functions:

Feeding tanniniferous plants did not affect the concentration of both alanine amino transferase (ALT) and alkaline phosphatase (ALK-P). Concentration of aspartate aminotransferase (AST) increased significantly ($P<0.05$) by feeding *Acacia* and *Atriplex* (Table 7).

For the effect of physiological status, it was found that both AST and ALT in all experimental groups were at the highest concentration in plasma of ewes at pre-parturition stage indicating higher function of liver at late pregnancy. The level of these two enzymes decreased to the lowest level at the end of lactation period (at weaning lambs) that meaning alleviation of physiological stress on liver at this time.

Table 6. Concentrations of energy components in blood plasma of Barki ewes fed tanniniferous plants shrubs in different physiological status. (Means ± SE)

Items	Sampling Time	Experimental group			
		Hay	*Acacia*	*Atriplex*	*Cassava*
Lipid fractions					
Total Lipids, g/dl	Pre-parturition	8.08±0.169^a	8.36±0.505^a	7.73±0.341^a	7.79±0.343^a
	At lambing	7.17±0.541^a	7.45±0.138^a	6.62±0.447^a	6.82±0.419^a
	At weaning	8.18±0.217^a	7.49±0.225^b	8.54±0.093^a	8.00±0.177^{ab}
	Overall mean ± SE	7.81±0.222^a	7.77±0.205^a	7.63±0.262^a	7.54±0.218^a
Triglycerides, mg/dl	Pre-parturition	82.257±3.450^b	93.440±1.877^{ab}	94.339±1.495^{ab}	102.109±5.428^a
	At lambing	89.555±9.147^b	103.516±1.284^a	98.139±4.202^{ab}	91.247±2.534^b
	At weaning	97.337±10.076^b	107.475±3.017^{ab}	105.737±2.056^{ab}	112.718±2.386^a
	Overall mean ± SE	89.716±4.652^b	101.477±1.636^a	99.405±1.806^a	102.025±2.634^a
Total cholesterol, mg/dl	Pre-parturition	97.348±4.083^c	110.596±2.221^b	111.645±1.769^b	120.841±6.424^a
	At lambing	118.052±3.912^{ab}	122.504±1.519^a	116.140±4.973^{ab}	107.986±2.999^b
	At weaning	126.433±3.417^a	126.854±3.430^a	125.134±2.433^a	133.395±2.825^a
	Overall mean ± SE	113.944±3.107^b	119.982±1.894^{ab}	117.640±2.138^{ab}	120.741±3.117^a
Glucose concentration					
Glucose mg/dl	Pre-parturition	44.769±0.438^a	44.189±2.219^a	34.529±1.304^b	37.783±0.586^b
	At lambing	67.331±4.458^b	60.280±0.294^c	88.723± 0.985^a	64.897±2.995^{bc}
	At weaning	50.058±1.303^c	74.60±0.73^b	80.810±1.38^a	72.419±0.508^b
	Overall mean ± SE	54.053±2.333^c	59.689±2.426^b	68.021±4.487^a	58.366±2.934^{bc}

a, b and c, Means within the same row with different superscript are significantly differ ($P<0.05$).

In accordance with the present results, El-Bassiony (2013) and Shaker (2014) reported that feeding Shami goats and Barki sheep with salt tolerant plants resulted in increasing the activity of AST and ALT. This rise of ALT and AST activities might be attributed to the high tannins (Tripathy *et al.,* 1984), oxalates (Mclntosh, 1972), alkaloids (Craig *et al.,* 1991) and salt (Radostits *et al.,* 1994) in such salt tolerant plants.

In spite of the observed variation in the present study in liver enzymes, all the activities values either for treated or control groups were within the normal physiological reference ranges. It could be concluded that feeding tanniniferous plants did not exert any stress on liver of ewes under any physiological status.

With reference to kidney functions, Urea and creatinine are the two chief nitrogenous composites excreted by kidney. Thus, any change of their concentration would reflect impaired glomerular filtration and/or inefficiency of renal tubules (Kaneko *et al.* 2008). In the present results, feeding tanniniferous plants shrubs resulted in significant decrease in Urea-N level. The present results come in the same direction with those obtained by Pearce *et al.* (2008) and Shaker *et al.* (2014) who reported that Barki sheep that fed a mixture of salt tolerant plants (STP) showed lower values of Urea-N when compared with those fed BH. It worth notice that these plants in spite of having comparable level of CP with that of BH, but have lower content of EE and NFE while have higher percentages of ash (Table 1). This might mean that the utilization of this protein is low to exert stress on kidney function.

Creatinine level increased obviously only ($P<0.05$) in plasma of ewes fed *Cassava* plant in comparison to other groups. Also creatinine increased from pre- to post-partum stage in all groups. However, in all cases creatinine levels stayed within normal range without any sign for kidney exhaustion. However, Melladoa *et al*., (2006) and Shaker *et al.* (2014) reported that feeding STP mixture significantly decreased creatinine levels. On the other hand, Badawy *et al.* (2002) and Shaker *et al.* (2008) found that animals fed fresh *Atriplex* or *Acacia* had higher creatinine levels than those fed BH. EL-Saadany *et al.* (2016) 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.

E. Total antioxidant capacity (TAC):

Feeding tanniniferous plants shrubs did not affect significantly the level of TAC Table (7). The level of TAC increased from pre- to post-partum only in plasma of ewes fed BH and *Acacia*. In contrast, Amer *et al.* (2014) recorded decreased level of TAC in pregnant ewes that fed traditional or untraditional (tanniniferous plants) diets. Also, Nawito *et al.* (2016) noted that TAC level in blood of local sheep grazing salt tolerant plants in South Sinai was lower than control group, and concluded that, the nutritional level of the diets had very little effect on blood oxidant and antioxidant status.

Table 7. Impact of feeding tanniniferous plants shrubs on liver and kidney functions and total antioxidant capacity (TAC) of ewes in different physiological periods. (Means ± SE)

Item	Sampling time	Experimental group			
		Hay	***Acacia***	***Atriplex***	***Cassava***
		Liver functions			
AST, iu/l	Pre-parturition	74.67±7.745^{b}	137.83±21.416^{a}	114.83±16.835^{a}	84.00±10.415^{b}
	At lambing	71.00±7.933^{ab}	66.33±6.339^{ab}	91.83±3.439^{a}	59.00±5.342^{b}
	At weaning	37.25±2.007^{a}	33.00±0.856^{a}	37.67±1.483^{a}	43.58±4.623^{a}
	Overall mean ± SE	60.97±5.397^{b}	79.06±12.707^{a}	81.44±9.524^{a}	62.20±5.643^{b}
ALT, iu/l	Pre-parturition	64.17±7.167^{a}	71.17±3.953^{a}	67.83±5.735^{a}	58.17±8.089^{a}
	At lambing	56.00±8.058^{a}	58.83±2.822^{a}	54.50±5.130^{a}	45.67±10.604^{a}
	At weaning	26.67±1.520^{a}	22.17±1.070^{a}	29.46±2.082^{a}	37.79±6.088^{a}
	Overall mean ± SE	48.95±5.184^{a}	50.72±5.282^{a}	50.60±4.595^{a}	47.21±5.021^{a}
ALK-P, iu/l	Pre-parturition	0.445±0.018^{a}	0.432±0.034^{a}	0.421±0.023^{a}	0.439±0.016^{a}
	At lambing	0.382±0.027^{a}	0.406±0.017^{a}	0.377±0.019^{a}	0.372±0.022^{a}
	At weaning	0.475±0.009^{ab}	0.443±0.009^{b}	0.495±0.008^{a}	0.471±0.007^{ab}
	Overall mean ± SE	0.434±0.013^{a}	0.427±0.013^{a}	0.431±0.013^{a}	0.427±0.012^{a}
		Kidney functions			
Urea-N, mg/dl	Pre-parturition	50.41±1.504^{a}	36.06±3.730^{c}	44.14±1.287^{b}	46.44±2.101^{ab}
	At lambing	56.85± 3.430^{a}	61.28± 1.481^{a}	59.12± 2.197^{a}	55.87± 2.126^{a}
	At weaning	86.51± 0.927^{a}	81.13± 1.955^{a}	73.99± 1.073^{b}	71.48± 0.874^{b}
	Overall mean ± SE	64.59± 3.173^{a}	59.49± 3.713^{b}	59.08± 2.431^{b}	57.93± 2.163^{b}
Creatinine, mg/dl	Pre-parturition	0.563± 0.024^{c}	0.641± 0.013^{b}	0.648±0.011^{ab}	0.700±0.037^{a}
	At lambing	0.701± 0.016^{ab}	0.722±0.007^{a}	0.699± 0.030^{ab}	0.656±0.013^{b}
	At weaning	0.730± 0.020^{a}	0.735± 0.019^{a}	0.727±0.014^{a}	0.772± 0.016^{a}
	Overall mean ± SE	0.665± 0.018^{b}	0.699± 0.011^{ab}	0.691± 0.013^{ab}	0.709±0.016^{a}
		Total antioxidant capacity			
TAC mM/L	Pre-parturition	0.058±0.028^{b}	0.055±0.018^{b}	0.206±0.049^{a}	0.214±0.043^{a}
	At lambing	0.268±0.049^{a}	0.259±0.051^{a}	0.300±0.045^{a}	0.202±0.075^{a}
	At weaning	0.261±0.057^{a}	0.236±0.054^{a}	0.177±0.051^{a}	0.236±0.040^{a}
	Overall mean ± SE	0.196±0.041^{a}	0.183±0.039^{a}	0.228±0.031^{a}	0.217±0.028^{a}

a, b and c, Means within the same row with different superscript are significantly differ (P<0.05).

CONCLUSION

Using tanniniferous plants shrubs, *Acacia nilotica*, *Atriplex nummularia* and *Cassava Manihot esculenta* as alternatives to Berseem Hay did not affect body weights of Barki ewes and their lambs, while improved the milk productivity. In addition, feeding these plants did not cause any negative effects on blood parameters of the experimental animals. Moreover, both kidney and liver functions were not largely affected.

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تأثير استخدام النباتات الغنية بالتانينات في تغذيه النعاج البرقي على بعض القياسات الانتاجية و الفسيولوجية

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استخدم في هذا البحث أربعون نعجة برقى ناضجة في أواخر فترة الحمل ، تتراوح أعمارها بين 3-4 سنه وبمتوسط وزن حي 5,51 ±0,47 كجم مقسمه الى أربعه مجموعات متماثله 10 نعاج في كل منها وذلك بهدف تقييم تأثير تغذية أوراق وسيقان كل من نبات الأكاسيا (أكاسيا نيلوتيكا) والأتربلكس (الأتربلكس نيمولاريا) والكاسافا (الكاسافا مانيهوث اسكيولينتا) والنامية في الأراضي الملحية في الساحل الشمالي المصري بديلا عن دريس البرسيم على الانتاج و الاستجابة الفسيولوجيه و بعض مكونات اللبن والدم الحيوية. غذيت النعاج في المجموعة الأولى (مج1) على عليقة المقارنة (دريس) والتى تكونت من مخلوط علف مركز مع دريس برسيم بنسب 40 : 60 % بالترتيب. تم استبدال نسبة دريس البرسيم فقط بأوراق وسيقان كل من الأكاسيا في المجموعة الثانية (مج2), والأتربلكس في (مج 3) والكاسافا في (مج 4). كانت كل الحيوانات تحت ظروف رعاية موحده. تم تسجيل الوزن الحى للنعاج وحملانها كل أسبوعين. تم قياس انتاج اللبن أسبوعيا و أخذت عينات أسبوعيه للتحليل الكيماوي. تم أخذ عينات دم وذلك لعمل صوره الدم وتحليل بعض المكونات الحيوية في البلازما. أظهرت نتائج التغذية على النباتات الشجيرية والغنية بالتانينات الى عدم وجود فروق معنوية في وزن الجسم للنعاج البرقي وحملانها بينما تحسنت انتاجيه اللبن وزاد محتواه من البروتين و اللاكتوز. لم يكن للتغذية على النباتات تحت الدراسة تأثيرا سلبيا على المكونات الحيوية للدم .