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Effect of Feeding Salt Tolerant Plants Silage on Productive Performance and Blood Biochemical Changes of Barki Ewes and their Lambs during the First Month Post-Partum

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ABSTRACT

The objectives of this work were to study productive performance and blood biochemical alterations in Barki ewes fed silage from salt tolerant plants mixture (SSP), and its impact on the growth rate and blood biochemical parameters of neonatal lambs. Forty-eight adult estrus synchronized Barki ewes at 2–3 years old with average of 38.39±1.85 kg live body weight were randomly divided into two experimental groups (24 in each). The first group (BH) was fed a control diet of berseem (*Trofolium alexandrenum)* hay and commercial concentrate, while the second one (SSP) was fed silage made from a mixture of four salt-tolerant plants (*Atriplex halimus* 50%; *Beta vulgaris* 25%; *Pearl millet* 15% and *Carthamus tinctorius* 10%). All born lambs were housed with their mothers during neonatal period. Live body weight changes, blood biochemical parameters of Barki ewes and their lambs were recorded immediately after birth and weekly until the end of the neonatal period (28 d post-partum). Results showed that during the first month of lactation, ewes of both groups lost weight without any significant effect of treatment on total weight loss. Male and female lambs obtained from ewes fed SSP had higher birth and final body weight. However, lambs of ewes fed hay showed insignificantly higher daily gain and total gain. There was no effect of age on total gain and daily gain. Male lambs were heavier at birth than females in both groups and consistently higher allover the neonatal period. Milk yield and composition were not affected by dietary treatment, except for ash percentage that increased in milk of ewes fed SSP ration. Ewes fed SSP had significantly lower concentrations of plasma total proteins (TP) and albumin (AL), while insignificantly lowered concentration of globulin (GL) and AL/GL ratio than. Concentration of TP was lower ($P<0.05$) in lambs of SSP group. Also in lambs, the effect of age was significant ($P<0.01$) on TP, GL and AL/GL ratio, with the higher values were recorded at birth and at the first week of age. Ewes of SSP group had significantly lower values of plasma glucose and total lipids, while cholesterol was not affected by treatment. Time after parturition affected only total lipids. Lambs responded to treatment like mothers, but day after lambing had no effect. Ewes of SSP group recorded significantly higher values of liver and kidney function parameters in plasma (AST, ALT, ALP. urea and creatinine), being within the normal range. In conclusion, utilization of silage made from salt-tolerant plants as animal feeds seems to be alternative and acceptable feed resources without serious adverse effects on ewes and their lambs during neonatal period under harsh conditions.

Keywords: *Barki sheep, Neonatal period, blood biochemicals, ewes, lambs.*

INTRODUCTION

Under the arid and semi-arid conditions of South Sinai Peninsula in Egypt, where sheep are raised in mainly extensive production systems, feedstuffs shortage and lack of fresh water are the main controlling factors for sufficient animal production. Halophytes and salt plants can represent a main part of the feeding program of animals in arid areas. Therefore, many researches mentioned cultivating salt tolerant shrubs (e.g. *Atriplex spp*.), grasses and legumes that tolerate salt and drought conditions such as Pearl millet and sorghum which might cover the gap partially in feed production in these regions (El-Shaer, 2010). Several studies demonstrated that high salt element of the salt plants is possibly a major constraint. Also, some plant secondary metabolites (PSM) as lignin, nitrates and oxalates could limit the consumption of halophytes and salt-tolerant forages in animal feeding mainly when they are used as sole diets. Therefore, adopt processing of these species as silage form, based on their complementary roles, could reduce the negative effects of these PSM (Abou El-Nasr *et al*., 1996 and El-Shaer, 2010).

Barki sheep is one of the three main breeds in Egypt. About one million head of this breed are maintained along the North Western Coastal Area (MolAR, 2004), out of which 300-350 thousand weaned male lambs may be produced yearly. The maternal nutrition is a major essential factor that affects intrauterine fetal growth and organogenesis (Elnageeb and Abdelatif, 2013).

The first month post-partum is a critical stage for newly born lambs which all organs' functions must adapt to extra-uterine life (Chniter *et al*., 2013). Throughout this stage, known as the adaptive period, metabolic mechanisms complete their maturation. Therefore, the newly born lamb is in a metabolically unstable state that makes it particularly sensitive to hazardous environmental conditions (Dwyer, 2008). Changes of extra-uterine environment according to the needs of neonate in the first week of life can greatly reduce mortality rate (Sawalha *et al*., 2007).

To keep stable hemostasis, numerous morphological and physiological factors are of important such as the surface area to body mass ratio of the newborn lambs, glucose, lipids, and protein delivered mostly from the colostrum that is ingested soon after birth (Dwyer and Morgan, 2006). Therefore, examining blood constituents such as protein profile, lipids profile and glucose is used to monitor and evaluate health and nutritional status of animals (Waziri *et al*., 2010).

The aim of this study was to investigate some physiological responses of Barki ewes and their offsprings to feeding silage of some salt tolerant plants during early lactation period. These responses included changes in live body weight and some blood biochemical parameters during this period, thus it could be judging the viability and productivity of both ewes and their neonatal lambs when nourishing these salt tolerant plants under South Sinai condition.

MATERIALS AND METHODS

This study was carried out at Ras Sudr Research Station, localized at South Sinai governorate, belonging to Desert Research Center, Ministry of Agriculture and Land Reclamation.

Animals and management:

Estrus synchronized forty-eight adult Barki ewes (2.5 – 3 years old with average 38.39 ± 1.85 kg body weights were randomly divided into two match groups (24 each). The one group (BH) was fed the control diet of Berseem (*Trofolium alexandrenum)* hay and concentrate feed mixture while the second group (SSP) was fed silage made from four salt-tolerant plants (*Atriplex halimus* 50%; *fodder beet* 25%; *Pearl millet* 15% and *Carthamus tinctorius* hay 10%). Animals of both groups were naturally mated and fed these diets for an adaptation period of 21 days before breeding and continued all over the gestation and after parturition till the neonatal period. The lambs born from each ewe were fed only with colostrum and dam's milk and were kept in a protected pen with their dams.

Experimental animals were fed their feeding requirements during different pregnancy status according to Kearl (1982). Chemical compositions of tested rations were concluded according to A.O.A.C. (1990) as shown in Table (1). Fresh and clean drinkable water was offered *ad libitum* all over the experimental period.

Table 1. Chemical composition (%) of experimental feed (as % on DM basis)

Ingredients	DM	OM	CP	EE	CF	NFE	Ash
Berseem hay	85.1	88.95	12.22	1.18	28.55	47.00	11.05
Silage of the mixture	35.93	79.94	10.95	1.43	20.16	47.40	20.06
Concentrate feed mixture	91.42	89.71	13.61	2.54	15.67	57.89	10.29

DM: dry matter, OM: organic matter, CP: Crude protein, EE: ether extract: CF: crude fiber, NFE: Nitrogen free extract

Experimental procedures:

Each experimental dam in both groups was weighed before mating and parturition, after that these ewes and their lambs weighted directly after parturition and then weekly in the early morning before feeding and suckling.

Milk yield was recorded from all ewes in both groups directly after birth and every week during the month after parturition. Chemical composition of milk was determined using milk scan (Bently-Belguim).

Once a week at the same hour in the morning (8 am), during the first month after parturition, 5 ml of blood were collected from the external jugular vein of ewes in vacuum tubes containing heparin. The first sampling in the lambs was performed little hours after the colostrum intake. From lambs only 2 ml of blood were collected with the same modality. Plasma was obtained for chemical analysis by centrifugation of blood at 3000 *rpm* then preserved at −20 ^{o}C. Biochemical analyses including total protein, albumin, glucose, urea, creatinine, aspartate transaminase (AST), alanine transaminase (ALT), alkaline phosphatase (ALP), total lipids and cholesterol assays were recorded in plasma using kits supplemented by Diamond Company.

Statistical analyses:

Results were presented as mean±SE. A two-ways repeated measurement analysis of variance (ANOVA) was used to determine statistical the effect of feeding group, experimental time and their interaction on each studied parameter. Values that were expressed in percentages were transformed by arcsine before statistical analysis and were resumed to its original values thereafter. Data were analyzed by generalized linear model using statistical software Minitab 12.1 (SAS, 2004).

RESULTS AND DUSSCICION

Live body weight of ewes:

Ewes fed SSP during gestation period had significantly (P<0.01) higher overall mean of body weight than those fed BH, although body weight of ewes at the start of experiment before mating season was nearly similar in BH and SSP, being 38.17 and 38.60 kg, respectively. It is of interest to note that LBW of ewes significantly (P<0.05) showed sharp reduction immediately after lambing due to parturition, and then slight reduction up to 28 d after lambing in terms of LBW loss or as percentage of change in LBW. The effect of interaction between feeding group and experimental time was significant (P<0.01) on LBW of ewes, reflecting higher LBW of ewes in SSP than in BH group at all experimental times (Table 2).

Table 2. Live body weight (BW) of Barki ewes as affected by feeding the experimental rations, experimental time (post-partum period) and their interaction.

Item	Feeding group (FG)	Pre-partum	Lambing time (LT)					Overall	±SEM		
			Immed. after lambing	7 d after lambing	14 d after lambing	21 d after Lambing	28 d after Lambing		FG	LT	FG x LT
Body weight, kg	Hay	46.21	41.64	40.30	39.28	38.28	37.80	40.58^{b}	0.05 **	0.09 **	0.13 **
	Silage	48.17	43.89	42.42	41.46	40.42	39.14	42.57^{a}			
	Overall	47.17^{a}	42.76^{b}	41.36^{c}	40.37^{d}	39.35^{e}	38.47^{e}				
Weekly BW loss, Kg	Hay	-	-4.57	-1.33	-1.02	-1.00	-0.47	-1.68	0.05 NS	0.11 **	0.15 **
	Silage	-	-4.25	-1.46	-0.97	-1.03	-1.28	-1.80			
	Overall	-	- 4.41^{a}	- 1.40^{b}	- 0.99^{c}	- 1.01^{c}	- 0.88^{c}				
Body weight Change, %	Hay	-	-9.92	-3.20	-2.52	-2.57	-1.16	-3.87	0.17 NS	0.31 **	0.51 **
	Silage	-	-8.90	-3.38	-2.25	-2.54	-3.20	-4.05			
	Overall	-	-9.42^{a}	-3.29^{b}	-2.38B^{b}	-2.55B^{b}	-2.18^{c}				

NS, non-significant. ** Significant at P<0.01.

a, b….e : Values in the same column or row for each trait with different superscripts are significantly differed at P<0.05.

These results confirmed the potentiality of salt tolerant plants mixture as a silage to achieve the animal requirements to maintain higher loss in their body weight during the 1st post-partum month. This observed increase in live body weight in SSP as compared to BH group at all times might be due to the increase in water retention by ewes of SSP group. Similar trend was obtained by Shaker *et al*. (2014).

Live body weight of lambs:

Average of live body, weekly and daily weight gain, and percentage of changes in body weight of male and female lambs at birth, 7, 14, 21 and 28 days of age as affected by the experimental diet, lamb age and their interaction are presented in Tables (3 and 4).

Regardless the experimental ration, males were heavier than females at different ages studied. Average body weight was higher in male than in female lambs by about 20.9% at birth.. Abdel-Fattah *et al*. (2013) explained that male lambs generally stay slightly longer in mother's womb than females and henceforth heavier at birth. The present results agreed with those of Chniter *et al*. (2013). After parturition, survival of the neonate depends upon the quality of the interactions with the mother, feeding type, the amount of milk available and the competition with relatives (Nowak and Poindron, 2006).

It is of interest to note that average of body weight, weekly and daily gain, percentage of change in body weight of females (Table 3) or females (Table 4) showed significantly (P<0.05) gradual increase by age progress, but only absolute and relative male weight of males were affected significantly by the type of mother feeding. Overall mean of body weight was significantly (P<0.01) higher for SSP than BH (Table 3), but relative weight of males showed significantly (P<0.05) an opposite trend. Neither type of mother feeding affected overall mean of absolute weight, gain and relative weight of females (Table 4).

Table 3. Body weight (BW) changes of male lambs as affected by feeding their dams, lamb age and their interaction.

Item	Feeding group (FG)	Lamb age (LA, day)					Overall	±SEM		
		0	7	14	21	28		FG	LA	FG x LA
Body weight, kg	Hay	3.59	4.74	6.12	7.34	8.55	6.07^{b}	0.02	0.04	0.06
	Silage	3.80	4.89	6.23	7.44	8.65	6.20^{a}	**	**	NS
	Overall	3.69^{e}	4.82^{d}	6.18^{c}	7.37^{b}	8.60^{a}				
daily weight gain, gm/d	Hay	-	163.67	197.96	173.67	173.06	177.09	2.12	3.35	4.74
	Silage	-	156.22	190.51	173.36	172.86	173.38	NS	**	NS
	Overall	-	159.94^{c}	194.23^{a}	173.52^{b}	172.96^{b}				
Weekly BW gain, kg/wk	Hay	-	1.14	1.38	1.21	1.21	1.24	0.01	0.02	0.03
	Silage	-	1.09	1.33	1.21	1.21	1.21	NS	**	NS
	Overall	-	1.12^{c}	1.366^{a}	1.21^{b}	1.21^{b}				
Body weight change, %	Hay	-	32.07	29.29	19.90	16.56	24.46^{a}	0.35	0.55	0.78
	Silage	-	28.82	27.22	19.44	16.31	22.95^{b}	*	**	NS
	Overall	-	30.44^{a}	28.25^{b}	19.67^{c}	16.44^{d}				

NS, non-significant. * Significant at P<0.05. ** Significant at P<0.01.
a, b….d : Values in the same column or row for each trait with different superscripts are significantly differed at P<0.05.

Table 4. Body weight (BW) changes of female lambs as affected by feeding their dams, lamb age (LA) and their interaction.

Item	Feeding group (FG)	Lamb age (LA, day)					Overall	±SEM		
		0	7	14	21	28		FG	LA	FG x LA
Body weight, kg	Hay	2.95	4.04	5.21	6.27	7.32	5.16	0.06	0.11	0.15
	Silage	3.15	4.09	5.26	6.27	7.49	5.25	NS	**	NS
	Overall	3.05^{e}	4.06^{d}	5.24^{c}	6.27^{b}	7.40^{a}				
daily gain, gm/d	Hay	-	155.61	167.44	150.30	150.30	155.91	4.40	6.97	9.86
	Silage	-	133.16	167.44	144.69	174.28	154.89	NS	**	NS
	Overall	-	144.38^{b}	167.44^{a}	147.50^{ab}	162.29^{ab}				
Weekly BW gain, kg/wk	Hay	-	1.09	1.17	1.05	1.05	1.09	0.03	0.04	0.06
	Silage	-	0.93	1.17	1.01	1.22	1.08	NS	**	NS
	Overall	-	0.01^{b}	1.17^{a}	1.03^{ab}	1.13^{ab}				
Body weight change, %	Hay	-	36.75	28.86	20.01	16.65	25.57	0.90	1.42	2.02
	Silage	-	29.42	28.50	19.23	19.37	24.13	NS	**	NS
	Overall	-	33.09^{a}	28.68^{b}	19.62^{c}	18.01^{c}				

NS, non-significant. ** Significant at P<0.01.
a, b….e : Values in the same column or row for each trait with different superscripts are significantly differed at P<0.05.

Milk yield and milk consumption:

Milk yield was slightly higher in ewes fed SSP than that in those fed BH (Fig. 1). The obtained results in this study are in agreement with those described by Abu-Zanat and Tabbaa (2006), who recorded insignificant effect of feeding 0, 50 and 100% of *Atriplex* on milk yield of Awassi ewes. Similarly, Digby *et al.* (2008) found no significant differences in milk yield and composition between two groups of Merino ewes fed either a high salt diet (NaCl 13% of dry matter) or control diet (NaCl 0.5% of dry matter). Furthermore, the milk fat, protein, lactose and total solids percentages were insignificantly differed between the two groups. However, ash percentage increased (P<0.05) in the SSP group as compared to the BH group (Fig. 1). These results may indicate that, higher salt intake increased water consumption, reflecting higher milk yield and ash content.

Blood metabolites of ewes and their lambs:

Total proteins and their fractions:

The obtained results revealed that ewes fed SSP significantly (P<0.01) decreased concentrations of total proteins (TP) by 10.89% and albumin (AL) by 22.31%, while insignificantly decreased globulin (GL) by 5.21% and AL/GL ratio by 7.61% as compared to those in BH group. These findings are in agreement with those registered by Abdel- Halim (2003) and Shaker (2014) in sheep and Shaker *et al*. (2014) in goats. This reduction of TP in animals fed SSP may be assigned to the high tannins content in these plants that reported to reduce the digestibility of crude protein (Reed *et al*., 1990). Lambing time did not affect the total protein profile. It is well known that blood metabolic profile is a set of diagnostic measures that are based on defining the various markers in the blood of animals and used in evaluating nutritional status and animal health (Antunovic *et al.,* 2011).

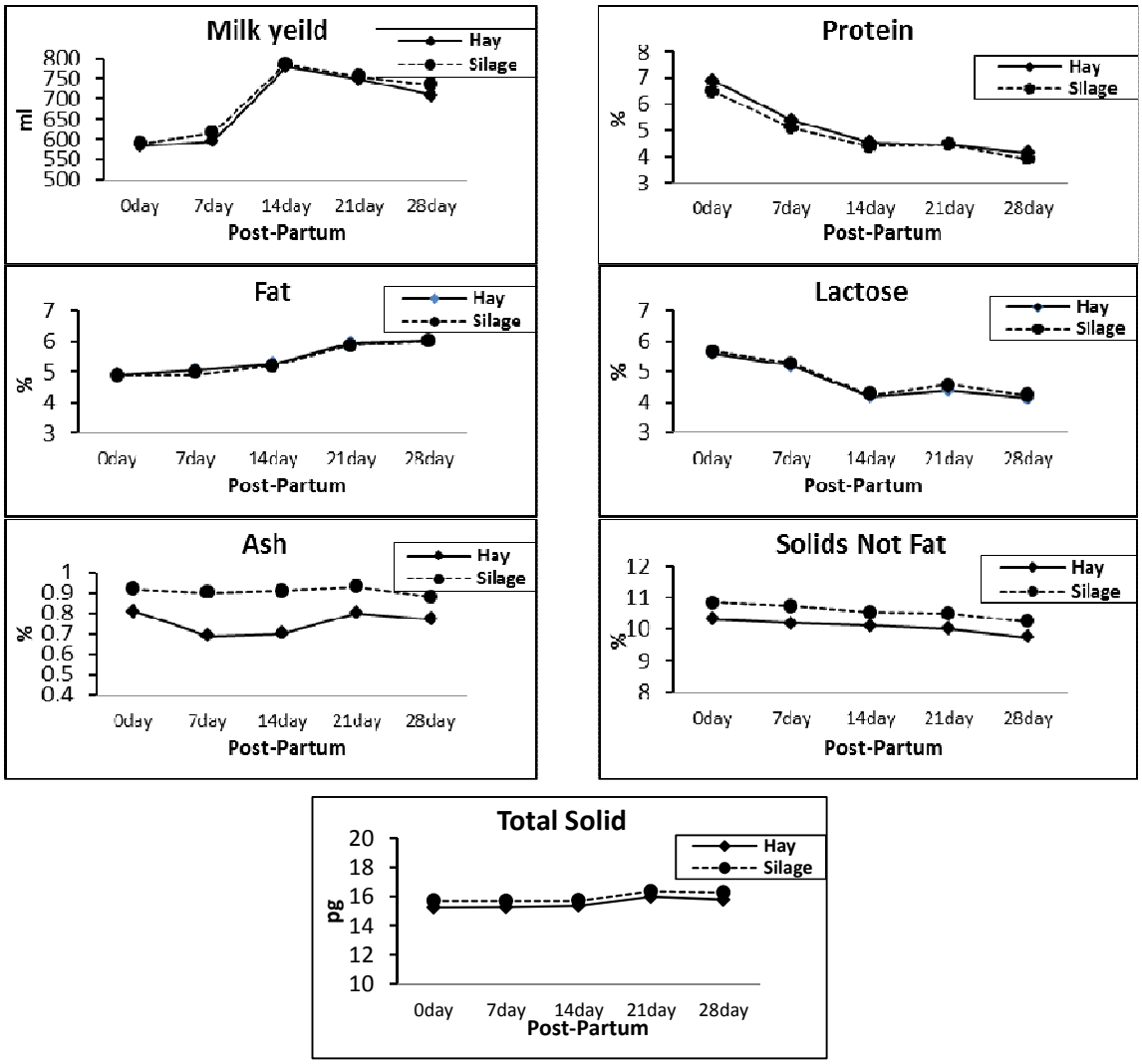

Figure 1. Milk yield and composition of Barki ewes fed silage from salt tolerant plants or berseem hay during different days of the first month post-partum.

Table 5. Concentration of plasma total proteins, albumin, globulin and albumin to globulin ratio (A/G) of Barki ewes as affected by feeding the experimental ration, lambing time (LT) and their interaction.

Blood parameter	Feeding group (FG)	Lambing time (LT)					Overall	±SEM		
		Immed. after lambing	7 d after lambing	14 d after lambing	21 d after lambing	28 d after lambing		FG	LT	FG x LT
Total proteins, g/dl	Hay	6.84	6.04	6.55	6.72	6.47	6.52^{a}	0.16**	0.26^{NS}	0.36^{NS}
	Silage	6.13	4.99	5.92	6.20	5.84	5.81^{b}			
	Overall	6.48	5.51	6.23	6.46	6.16				
Albumin, g/dl	Hay	3.15	3.40	3.18	3.33	3.28	3.72^{a}	0.06**	0.09^{NS}	0.13^{NS}
	Silage	3.06	2.52	2.78	2.99	3.14	2.89^{b}			
	Overall	3.11	2.96	2.98	3.16	3.21				
Globulin, g/dl	Hay	3.68	2.64	3.37	2.46	3.19	3.07	0.15^{NS}	0.24^{NS}	0.34^{NS}
	Silage	3.06	2.47	3.15	3.20	2.70	2.91			
	Overall	3.37	2.55	3.26	2.83	2.95				
AL/GL ratio	Hay	0.81	1.22	0.92	1.27	1.03	1.05	0.05^{NS}	0.08^{NS}	0.11^{NS}
	Silage	0.94	0.96	0.83	0.99	1.12	0.97			
	Overall	0.87	1.09	0.87	1.13	1.08				

NS: Non-significant. ** Significant at P<0.01.

a and b: Values of each parameter with different letters on the same column differ significantly at P<0.05.

Lambs of SSP group showed significantly lower (P<0.05) value of TP (6.26 g/dl) than those of HB group (7.00 g/dl), and insignificantly lower values of AL (3.54 vs. 3.61 g/dl) and GL (2.92 vs. 3.39 g/dl). As a result, AL/GL ratio was higher in lams of SSP group (1.26) than in those of BH group (1.16). Effect of lamb age was significant (P<0.05) on concentration of TP, GL and AL/GL ratio. However, GL concentration decreased with age progress, resulting in a decrease in TP, and an increase in AL/GL ratio. These results agreed with those of Shaker *et al*. (2008), who worked on growing Barki lambs. Increasing salt intake might be a reason to introduce such variations in TP, AL,

GL and AL/GL ratio (Badawy, 1999). The significant decrease in TP in both ewes and lambs of SSP group could be assigned to the lower crude protein determined in ration of salt tolerant plants silage (Table 1). In this respect, Abdel-Ghani *et al.* (2011) recorded a positive correlation between dietary protein and level of serum TP in sheep.

Table 6. Concentration of plasma total proteins, albumin, globulin and albumin to globulin ratio (A/G) of Barki lambs as affected by feeding their dams, birth day (BD) and their interaction.

Blood parameter	Feeding group (FG)	Birth day (BD)					Overall	±SEM		
		Immed. after birth	7d after Birth	14 d after Birth	21d after birth	28 d after birth		FG	BD	FG x BD
Total proteins, g/dl	Hay	8.01	7.73	7.03	6.32	5.92	7.00^{a}	0.19 *	0.29 **	0.42 NS
	Silage	8.00	6.17	6.25	5.56	5.35	6.26^{b}			
	Overall	8.01^{a}	6.95^{b}	6.64^{b}	5.94^{c}	5.63^{c}				
Albumin, g/dl	Hay	3.65	3.51	3.57	3.64	3.67	3.61	0.06 NS	0.10 NS	0.15 NS
	Silage	3.58	2.98	3.30	3.43	3.40	3.54			
	Overall	3.86	3.24	3.43	3.53	3.53				
Globulin, g/dl	Hay	4.36	4.22	3.45	2.68	2.24	3.39	0.14 NS	0.22 **	0.31 NS
	Silage	4.42	3.19	2.94	2.12	1.95	2.92			
	Overall	4.39^{a}	3.70^{b}	3.20^{b}	3.40^{b}	2.09^{c}				
AL/GL ratio	Hay	0.83	0.83	1.04	1.42	1.66	1.16	0.05 NS	0.07 **	0.10 NS
	Silage	0.81	0.93	1.16	1.63	1.76	1.26			
	Overall	0.82^{c}	0.89^{bc}	1.10^{b}	1.52^{a}	1.71^{a}				

NS: Non-significant. * Significant at P<0.05. ** Significant at P<0.01.
a, b and c: Values of each parameter with different letters on the same row or column differ significantly at P<0.05.

Glucose concentration:

Plasma glucose (GLU) concentration of ewes in SSP group was significantly (P<0.01) lower (37.88 mg/dl) than in BH group (47.37 mg/dl, Table 7). This decrease might be attributed to the high tannins content in salt plants. These tannins can decrease digestibility and absorption of nutrients such as protein, carbohydrate and lipids by inhibiting digestive enzymes (Streeter *et al*., 1993 and Ortiz *et al*., 1993). These results agreed with those recorded by Shaker *et al*. (2008); Shaker (2014) and Shaker *et al*. (2014). On the other side, increasing salt in these forages might be another reason for such decrease in glucose level. In this way, Assad *et al*. (1997) found similar GLU reduction in rams receiving saline water. The same significant reduction in GLU was found in lambs of SSP group (Table 8). However, plasma GLU level in ewes and lambs were not affected by age.

Table 7. Concentration of plasma glucose, total lipids and cholesterol of Barki ewes as affected by feeding the experimental ration, lambing time (LT) and their interaction.

Blood parameter	Feeding group (FG)	Lambing time (LT)					Overall	±SEM		
		Immed. after lambing	7 d after lambing	14 d after lambing	21 d after lambing	28 d after lambing		FG	LT	FG x LT
Glucose, mg/dl	Hay	40.74	44.18	44.47	51.23	51.23	47.37^{a}	1.43 **	2.62 NS	3.20 NS
	Silage	35.35	35.59	38.66	39.78	40.03	37.88^{b}			
	Overall	38.05	39.88	41.56	45.50	45.63				
Total lipids, g/l	Hay	2.64	2.47	2.84	2.95	3.43	2.87^{a}	0.08 **	0.12 *	0.17 NS
	Silage	2.41	2.26	2.27	2.55	2.44	2.39^{b}			
	Overall	2.52^{b}	2.37^{b}	2.55^{ab}	2.75^{ab}	2.94^{a}				
Cholesterol, g/dl	Hay	93.85	96.35	93.74	94.73	102.08	96.15	1.95 NS	3.09 NS	4.37 NS
	Silage	87.04	90.77	89.71	92.95	95.43	91.18			
	Overall	90.45	93.56	91.73	93.84	98.76				

NS: Non-significant. * Significant at P<0.05. ** Significant at P<0.01.
a and b: Values of each parameter with different letters on the same row or column differ significantly at P<0.05.

Concentration of total lipids:

Ewes of SSP had significantly (P<0.01) lower total lipids (TL) concentration than in BH group (2.39 vs. 2.87 g/l, Table 7). These results could be attributed to the low fat content in salt plants silage. It was reported that, feeding animals for long times on these plants led the use of the stored body fats for supply of energy. These results are in harmony with those recorded in Shami goats by Shaker *et al*. (2014). Generally, lipid profile have an necessary role in all positions of life, helping as hormones or hormones predecessors, aiding in digestion, delivering energy storage and metabolic energy and acting as practical and essential constituents in bio membranes (Tietz, 1990).

It is of interest to note that plasma TL concentration in lambs was similar to that observed in ewes. Also, age had significant effect on TL concentration in both ewes and lambs, which increased by advancing age, reaching its maximum value by the end of experiment, that is in consistent with the increase in milk fat concentration (Table 8).

Concentration of total cholesterol:

Results concerning plasma total cholesterol (TC), either in ewes or lambs showed nearly similar trend as TP and GLU concentrations, but with insignificant effect of treatment. The results of this study demonstrated that ewes fed SSP had lower TC concentration than BH group (Table 7). This decrease in plasma TC might be attributed to the PSM in salt tolerant plants that indirectly affect lipids profile, where tannins play a large role in lipids digestibility by concluding with fatty acids (Romero *et al.,* 2000), reducing TC absorption and rising fat excretion (Bravo *et al.,* 1993).

The day after parturition had no significant effect on TC concentration of both ewes and lambs (Tables 7 and 8). All animals had the highest levels at the end of the first month post-partum. These results are in agreement with those recorded by Shaker *et al*., (2014), who observed that plasma TC concentration in Shami goats followed similar trend to that of the present study.

Table 8. Concentration of plasma glucose, total lipids and cholesterol of Barki lambs as affected by feeding their dams, birth day (BD) and their interaction.

Blood parameter	Feeding group (FG)	Birth day (BD)					Overall mean	±SEM		
		Immed. After Birth	7 d after birth	14 d after Birth	21 d after birth	28 d after birth		FG	BD	FG x BD
Glucose, mg/dl	Hay	41.51	44.95	45.24	52.00	52.00	47.14[a]	1.43 **	2.26 NS	3.20 NS
	Silage	36.12	36.36	39.43	40.45	40.80	38.66[b]			
	Overall	38.82	40.65	42.38	46.27	46.40				
Total lipids, g/l	Hay	2.18	2.12	2.48	2.59	3.07	2.49[a]	0.08 **	0.12 *	0.17 NS
	Silage	2.05	1.90	1.91	2.19	2.08	2.03[b]			
	Overall	2.11[b]	2.01[b]	2.19[ab]	2.39[ab]	2.58[a]				
Cholesterol, g/dl	Hay	65.91	68.41	65.80	66.79	74.14	68.21	1.95 NS	3.09 NS	4.37 NS
	Silage	59.10	62.83	61.77	65.01	67.49	63.24			
	Overall	62.51	65.62	63.79	65.90	70.82				

NS: Non-significant. * Significant at P<0.05. ** Significant at P<0.01.
a and b: Values of each parameter with different letters on the same row or column differ significantly at P<0.05.

Enzyme activity (AST, ALT and ALP):

Activity of ALT AST and ALP are conventionally used for diagnosing hepatic damage. These enzymes recorded (P<0.01) higher values in blood of ewes fed SSP than in BH (Table 9). The increase of ALT, AST and ALP activities might be produced by high oxalates, tannins, alkaloids and sodium chloride in salt tolerant plants. These results agreed with those reported by Shaker *et al*. (2008), who attained that the activity of ALT increased in blood of male Barki lambs fed on fresh or silage of *Atriplex halimus* and acacia mixture than control lambs. Also, Hussein *et al*. (1990) reported high significant increase of plasma AST and ALT activities in rams receiving 0.7 or 1.3 % NaCl salt water after 2, 3 and 4 months of treatment. Only ALP concentration was found to decrease significantly (P<0.05) with advancing time after parturition. This might indicate an adoption to feeding SSP leading to recovery of kidney function. In lambs, these enzymes were not affected either by treatment or age (Table 10).

Table 9. Enzyme activity of plasma aspartate transferase (AST), alanine transferase (ALT) and alkaline phosphatase (ALP), and plasma urea and creatinine concentrations of Barki ewes as affected by feeding the experimental ration, lambing time (LT) and their interaction

Blood parameter	Feeding group (FG)	Lambing time (LT)					Overall	±SEM		
		Immed. after lambing	7 d after lambing	14 d after lambing	21 d after lambing	28 d after lambing		FG	LT	FG x LT
AST, IU	Hay	29.01	21.33	21.48	24.32	25.25	24.28[b]	2.16 **	3.41 NS	4.83 NS
	Silage	44.82	33.30	33.24	32.46	33.83	35.53[a]			
	Overall	36.92	27.32	27.36	28.39	29.54				
ALT, IU	Hay	22.27	21.07	22.02	22.61	23.79	22.35[b]	0.91 **	1.43 NS	2.03 NS
	Silage	29.63	26.68	23.16	24.20	25.66	25.87[a]			
	Overall	25.95	23.88	22.59	23.40	24.72				
ALP, IU	Hay	169.2	137.9	125.8	126.1	137.6	139.74[b]	2.09 **	3.31 **	4.68 NS
	Silage	180.3	148.8	143.8	139.3	144.6	151.39[a]			
	Overall	180.3[a]	143.4[b]	134.4[b]	132.7[b]	141.1[b]				
Urea, mg/dl	Hay	33.50	38.95	38.61	37.19	38.91	37.67[b]	0.83 **	1.31 *	1.85 NS
	Silage	38.60	39.14	39.80	44.45	44.45	41.05[a]			
	Overall	36.05[b]	39.05[ab]	39.20[ab]	40.82[a]	41.68[a]				
Creatinine, mg/dl	Hay	1.02	1.02	0.96	1.10	1.27	1.07[b]	0.07 **	0.10 *	0.15 NS
	Silage	1.17	1.12	1.23	1.73	1.73	1.30[a]			
	Overall	1.10[b]	1.07[b]	1.10[b]	1.41[ab]	1.50[a]				

NS: Non-significant. * Significant at P<0.05. ** Significant at P<0.01.
a and b: Values of each parameter with different letters on the same row or column differ significantly at P<0.05.

Kidney function parameters:

Results of the present study regarding kidney function parameters (Table 9) indicated that feeding SSP exerted a stress on kidneys of ewes leading to high (P<0.01) concentration of BUN and CR than their counterparts in the BH group (Table 9). Blood urea nitrogen (BUN) and creatinine (CR) are the two major nitrogenous elements ultimately excreted by kidney. Consequently, any alteration of their level would indicate compromised glomerular filtration and / or deficiency of renal tubules (Kaneko, 1989). These results are in agreement with those recorded by Fayed *et al*. (2010), who recorded that blood urea significantly increased in Barki sheep fed salt-tolerant alfalfa compared to control group fed berseem hay. Also, Badawy *et al*. (2002) noted that animals fed on fresh *Atriplex halimaus* had high BUN value compared with control group fed on berseem hay. Moreover, Hussein *et al*. (1990) reported that drinking saline water caused significant increase in sheep plasma CR.

Generally, BUN and CR concentrations observed in this study are in the normal range recorded by El-Ashry *et al*. (1997) in sheep, indicating that these levels of salinity do not have serious adverse effects on kidney functions. Both BUN and CR increased (P<0.05) with advancing time after parturition, reaching its maximum value by the end of experiment. In lambs, concentrations of BUN and CR were not affected either by the type of mother feeding or time after lambing (Table 10).

This study indicated that the impact of salinity load was obvious in animals fed silage from salt tolerant plants than those fed berseem hay. However, the changes in all studied parameters in ewes and their lambs were within the normal range. In conclusion, the results documented in the

current study could be helpful in adjusting feeding and management strategies for ewes during neonatal period in order to improve lamb performances and to obtain appropriates breeding practices under harsh conditions.

Table 10 . Activity of aspartate amino transferase (AST), alanine amino transferase (ALT), alkaline phosphatase (ALP), and urea and creatinine concentrations of Barki lambs as affected by feeding their dams, birth day and their interaction.

Blood parameters	Feeding group (FG)	Birth day (BD)					Overall	±SEM		
		Immed. after birth	7 d after birth	14 d after birth	21 d after Birth	28 d after birth		FG	BD	FG x BD
AST, IU	Hay	22.01	21.33	21.48	24.32	22.99	22.42	0.86 NS	2.79 NS	3.95 NS
	Silage	22.70	22.54	21.07	23.49	23.33	22.62			
	Overall	22.35	21.94	21.28	23.90	23.16				
ALT, IU	Hay	23.60	27.29	23.35	23.94	25.12	24.66	0.88 NS	1.36 NS	1.93 NS
	Silage	23.99	27.49	24.49	25.53	26.99	25.23			
	Overall	23.79	27.39	23.92	24.73	26.05				
ALP, IU	Hay	124.76	91.25	76.31	79.13	91.17	92.52	2.28 NS	3.60 **	5.10 NS
	Silage	107.15	88.31	83.65	91.36	93.00	92.69			
	Overall	115.95^{a}	89.78^{bc}	79.98^{c}	85.24^{bc}	92.08^{b}				
Urea, mg/dl	Hay	25.13	24.15	23.71	23.59	22.96	23.91	0.95 NS	1.25 NS	1.27 NS
	Silage	24.66	23.68	23.24	23.12	22.49	23.44			
	Overall	24.90	23.92	23.48	23.36	22.73				
Creatinine, mg/dl	Hay	0.95	0.97	0.98	1.07	1.29	1.05	0.05 NS	0.08 NS	0.11 NS
	Silage	0.95	0.98	0.96	1.02	1.26	1.03			
	Overall	0.95	0.97	0.97	1.04	1.28				

NS: Non-significant. ** Significant at P<0.01.

a, b and c: Values of each parameter with different letters on the same row differ significantly at P<0.05.

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تأثير التغذية على سيلاج النباتات المتحملة للملوحة على الأداء الإنتاجي والتغيرات البيوكيميائية للأغنام البرقي وحملانها خلال الشهر الأول بعد الولادة

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أجريت هذه الدراسة بهدف دراسة الأداء الإنتاجي والتغيرات البيوكيميائية للأغنام البرقي المغذاه علي السيلاج المصنع من مخلوط النباتات المتحملة للملوحة وتأثيرها علي معدل نمو المواليد والتغيرات البيوكيميائية للحملان حديثى الولادة. استخدمت في هذه الدراسة 48 من النعاج البرقي البالغة والمجرى لها تزامن شبقي (والتى يتراوح أعمارها من 2. : 3 سنوات ومتوسط أوزانها 38.39 كجم) والتي قسمت عشوائيا الى مجموعتين متساويتين و تمت تغذية المجموعة الأولى (المجموعه الكنترول) على دريس برسيم مصرى والعلف المركز في حين تم تغذية المجموعه الثانية (المجموعة المعاملة) على السيلاج المصنع من مخلوط من النباتات ملحية وهى القطف بنسبة (50%) وبنجر العلف بنسبة (25٪) والدخن (15%) وحطب القرطم بنسبة (10%) بالإضافة للعلف المركز استخدم كنسبة من العليقة فى كلا المجموعتين. وتمت تغذية المجموعتين على هذه الأعلاف لمدة 21 يوما قبل إجراء موسم التلقيح كفترة تكيف (فترة تمهيدية) على هذه الأعلاف واستمرت طوال فترة الحمل والولادة حتى الفطام الحملان. خلال الشهر الأول بعد الولادة تم تسجيل التغييرات فى وزن الجسم، والتغيرات البيوكيميائية لجميع النعاج وحملانها بعد الولادة مباشرة واستمرت أسبوعيا حتي نهاية فترة حديثى الولادة (الشهر الأول بعد الولادة). وخلال تلك الفترة تم تقدير محصول اللبن ومكوناته لجميع النعاج في كلا المجموعتين بعد الولادة وكل أسبوع خلال الشهر الأول بعد الولادة. و أوضحت نتائج الدراسة أن كل من الحملان الإناث والذكور المنتجة من النعاج المغذاه على سيلاج النباتات الملحية كانت أعلى في كل من وزن الميلاد والوزن النهائي خلال فترة حديثى الولادة في حين اظهرت الحملان الناتجة من النعاج المغذاه على الدريس ارتفاع غير معنوي في معدل الزيادة اليومية واجمالي النمو. كما أوضحت النتائج ان وزن الحملان الذكور كانت أعلى من الحملان الإناث في كلا المجموعتين واستمرت كذلك خلال جميع فترات حديثى الولادة.كما أوضحت النتائج أن محصول اللبن والتركيب الكيماوي له لم يتأثر بالتغذيه عدا نسبة الرماد والتى ارتفعت في لبن النعاج المغذاه على سيلاج النباتات الملحية. كما أوضحت النتائج انخفاض معنوي للبروتين الكلي والألبيومين في بلازما النعاج المغذاه على سيلاج النباتات الملحية بينما حدث انخفاض غير معنوي للجلوبيولين ونسبة الألبيومين الي الجلوبيولين وذلك مقارنة بالنعاج الكنترول المغذاه على دريس البرسيم المصري. اما بالنسبة للحملان الناتجة من النعاج المغذاه علي سيلاج النباتات الملحية فحدث انخفاض معنوي فقط في البروتين الكلي لبلازما تلك الحملان . كذلك كان لتقدم عمر الحملان خلال مرحلة حديثي الولادة تأثير معنوي في تركيز كل من البروتين الكلي والجلوبيولين ونسبة الألبيومين الى الجلوبيولين وسجلت أعلى قيمة لهم بعد الولادة مباشرة وكذلك الأسبوع الأول بعد الميلاد. كما أوضحت النتائج انخفاض معنوي في كل من مستوى الجلوكوز ومستوى الدهون الكلية في بلازما النعاج المغذاه على النباتات الملحية مقارنة بمستوياتها في بلازما النعاج المغذاه على دريس البرسيم المصري في حين لم يتأثر مستوى الكلوستيرول باختلاف التغذية. كما أثرت الفترة بعد الولادة للنعاج على مستوى الدهون الكلية فقط. كما اظهرت النتائج نفس التأثير للمواليد بالنسبة لأمهاتها في حين لم يؤثر تقدم عمر المواليد خلال فترة حديثى الولادة على تلك الصفات. كما أوضحت النتائج ان النعاج المغذاه على سيلاج النباتات الملحية سجلت ارتفاعا معنويا في كل من قياسات وظائف الكبد والكلى وهي (أسبارتيت ترانسفيريز- ألانين ترانسفيريز- ألكالين فوسفاتيز- يوريا- كرياتينين) إلا انها جميعا داخل المعدلات الطبيعية. ونستخلص من هذه الدراسة أنه يمكن الاستفادة من سيلاج النباتات الملحية في تغذية النعاج البرقى كمصادر علفية بديلة ومقبولة دون ظهور آثار ضارة خطيرة على النعاج وحملانها خلال فترة حديثى الولادة وذلك تحت الظروف القاسية.