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Some Immune Indices of Lactating Ewes Influenced by Feeding some Halophytes and Salt Tolerant Plants in the North Western Coast of Egypt

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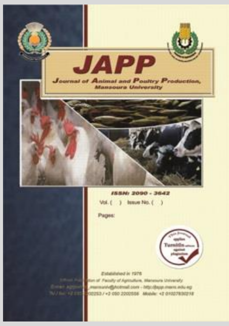

ABSTRACT

Forty mature healthy Barki ewes at late pregnancy, aged 3 - 4 years and weighed 45.2 kg were randomly divided into 4 groups, to evaluate the effect of replacement of Berseem hay (BH) with dried leaves and stems of some halophytes and salt tolerant plants species on some hematological and immunologic indices. The 1st group (G1), fed the control diet while the 2nd (G2), 3rd (G3) and 4th (G4) groups, BH was replaced by *Acacia saligna*, *Atriplex halimus* and *Cassava manihot esculenta,* respectively. Blood samples were collected during suckling period at times 1st, 4th and 8th week from ewes for hematological and immunological analysis. Results showed that, the number of red blood cells, hemoglobin and hematocrit% decreased significantly in time from the 1st to both 4th and 8th weeks. Ewes in group 2 (G2) represented the highest significant values of mean corpuscular volume and mean corpuscular hemoglobin. The highest white blood cells count was in the 1st week. Blood ALPHA 1 % and ALPHA 2 % showed significant differences between groups and the times of treatments. Differences of GAMA GL %, complement 3 and 4 levels were significant between the three times of treatments. Differences of IgG level between groups and time of treatments were significant. In conclusion, the replacement of barseem hay with dried leaves and stems of Acasia, Atriplex and Cassava plants had no adverse side effects on the studied hematological and immunological indices of lactating Barki ewes.

Keywords: Halophytes, ewes, Hematological parameters , Immune markers

INTRODUCTION

Sheep assume a significant role in animal production of arid environment. Lack of feedstuff and fresh water are the main obstacle for enough animal production in arid condition. Halophyte feedstuffs are the most widespread plant species naturally growing in the Mediterranean Basin. It includes salt dry tolerant feed bushes like *Atriplex* spp., *Acacia saligna* and *Kochia indicaetc*; and salt dry grasses and legumes like sorghum, pearl millet, sudan grass, alfalfa and sanfoin. Halophytic forage shrubs represent a valuable solution as an alternative or supplementary animal fodder to overcome the forage shortage problem in arid regions (Ahmed *et al*., 2015). It contain rich amount of bioactive ingredients that posses antioxidant, antimicrobial, antimethanogenic, and immunomodulatory properties (Soltan *et al*., 2012, 2017; Pathak *et al*., 2016). The presence of such bioactive constituents has a positive effect on animal productivity (Soltan *et al*., 2017). Thus, there is an extensive need for using halophyte plants in livestock feeding if not have bad effect on animal health. (Alsersy *et al*., 2015). Mohammady, *et al*., (2014) indicated that, no adverse side effects and no significant change on live body weight or growth rate after grazing on *Atriplex halimus* and *Acacia saligna* comparing with berseem hay in Barki lambs.

Immune response can be detected by estimations of different types of proteins involved in immune system such as immunoglobulins, cytokines and complements. The complement system is an important component of the innate immunity that functions primarily as a first-line host defense against pathogenetic infections (Walport, 2001).

Both of complement 3 (C3) and complement 4 (C4) have a significant role in enhancing the ability of antibodies and phagocytic cells to eliminate both pathogens and pathogen damaged cells (Kuroda *et al*., 2000; Guéguinou *et al*., 2014). All of IgM, IgG and IgE are the major immunoglobulins. These antibodies in normal status, responsible for protection against foreign antigens like bacteria or viruses (Suzuki *et al*., 2007). Interleukins (IL1, IL2, IL6) and tumor necrosis factor (TNF) are proinflammatory cytokines proteins that are secreted by specific cells of immune system, including monocytes, macrophages, and lymphocytes (Tanaka and Kishimoto, 2012; Ghareeb *et al*., 2013). There are scarce reports about the effect of consumption of these plants on the immune response of sheep. Therefore, the present study was aimed to assess the influence of replacement Berseem hay with dried leaves and stems of (*Acacia Niloitica*, *Atriplex Nummularia* and *Cassava manihotesculenta*) on some hematological and immunological markers of Barki lactating ewes in the North Western Egyptian costal region.

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MATERIALS AND METHODS

This study was carried out in Experimental station at Borg El-Arab, Alexandria Governorate, belonging to the Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture, Egypt whereas the fodder trees of *Acacia saligna*, *Atriplex halimus* 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 design:

Total of 40 mature healthy Barki ewes at late pregnancy (3 - 4 years old and 45.2 kg live body weight) were used. The animals were divided into four groups (10 each). All animals were kept in a semi-open shaded yard and kept under the same managerial conditions during the experimental periods. The 1st group (G1) was daily fed the control diet consisted of 0.865 kg concentrate feed mixture (CFM) plus 0.715 kg berseem hay. Berseem hay in the control diet was replaced by leaves and stems of Acacia, Atriplex and Cassava for the 2nd (G2), 3rd (G3) and 4th (G4) groups, respectively. The CFM consisted of 43% yellow corn, 25% undecorticated cotton meal, 25% wheat bran, 3.5% molasses, 2% limestone, 1% common salt and 0.5% minerals mixture. Animals were fed on experimental diets 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 stuffs and calculated nutritive value of tested ration % on DM

Feed stuff	Chemical composition on DM% basis						
	DM	OM	CP	CF	EE	NFE	Ash
CFM	91.80	92.03	13.18	11.96	3.82	63.07	7.97
Berseem Hay	95.12	89.59	10.64	38.54	1.03	39.38	10.41
Acacia saligna	52.45	91.66	15.66	31.59	1.47	42.94	8.34
Atriplex halimus	55.44	75.17	10.07	22.93	1.98	40.19	24.83
Cassava manihot esculenta	44.39	88.26	22.94	28.05	2.92	34.35	11.74

DM = Dry Matter; OM = Organic Matter; CP = Crude Protein; CF = Crude Fiber; EE = Ether Extract; NFE = Nitrogen Free Extract.

Live ewes body weights were recorded biweekly. At first, 4th and 8th weeks postpartum, blood samples were collected from ewe's jugular vein with EDTA in the morning before access to feed or water. These samples were divided into two divisions. The 1st part was used for estimation hemoglobin (Hb g/dl) according to (Campbell, 1995), hematocrit (Ht %), red blood cells (RBCs 10^6/µL) and white blood cells (WBCs 10^3/µL) were counted. Mean corpuscular volume (MCV/fl), mean corpuscular hemoglobin (MCH/pg) and mean corpuscular hemoglobin concentration (MCHC %) were calculated according to Schalm (1965). The 2nd part was centrifuged at 4000 rpm/15 minutes for plasma separation. Plasma samples were used for estimating all protein fractions percentages including alpha 1, alpha 2, beta and gama globulin by using SDS- PAG electrophoresis technique. The other part was stored at -20°C until performing biochemical assay. Total plasma protein (Tp, g/dl) and albumin were determined by colorimetric method using commercial kits supplied by Biodiagnostic-Egyptian Company and albumin % was calculated. Both of (C3) and (C4) complement mg/ml and plasma (IgE IU/ml, IgG g/ml, IgM g/ml) immunoglobulin subsets were measured by ELISA kits according to Abbott Laboratories instructions (Abbot Park, IL 60064 USA). Cytokines, including interleukins (IL-1, IL-2 and IL-6 pg/ml) and tumor necrosis factor-α (TNF-α pg/ml) were determined using commercially ELISA kits.

Statistical analysis:

Data were statistically analyzed by General Linear Model's procedures of SAS GLM (SAS, 2004). The model includes the effect of treatments and sampling times. Means were compared via the LSD means/PDIFF of the same procedure. Values were considered significant at $P \leq 0.05$. Means were tested using Duncan Multiple Range test (Duncan, 1955).

RESULTS AND DISCUSSION

Hematological parameters:

Count of RBCs, Hb and Ht % showed insignificant increase in G2 and G3, while G4 showed significant increase as compared to control group (Table 2). Count of WBCs showed significant increase in treated groups in comparing with G1. No significance differences were found between G2 and G3. However G4 were increased significantly comparing to all the other groups.

In the present study, the increased blood parameters (RBCs, WBcs count, Hb and Ht %) among treatment groups comparable to control may be attributed to the consumption of high amounts of salts especially Na Cl that present in high salt-tolerant and halophytic plants (Masters *et al*., 2001; Abd El-Rahman, 2008). Contrary Abdelhameed *et al*., (2006) showed that camels that were fed fresh halophytic plants (Atriplex or Acacia) showed highly significant decrease of RBCs whether in summer or in winter seasons than that of the control group. On the other hand in the present study, these parameters revealed significant decrease with time progress after parturition. Such decrease may be attributed to the animal adaptation for feeding salt plants. This is agree with a study of (Ibrahim, 2014) in Barki ewes that fed on *Atriplex halimus*, *Beta vulgari*, *Bearl millet* and *Carthamus tinctorius* at South Sinai Peninsula. The increasing of blood parameters in the 1st week than 4th and 8th week after parturition may due to high requirement for oxygen and metabolic rate (Antunovi *et al*., 2011).

Table 2.Means of blood components of lactating ewes as affected by feeding different salt tolerant plants

Item	Time (T)	Group (G) G1	G2	G3	G4	Overall mean	± SE T	G	T X G
RBCs (10^6/µL)	1st wk. post-Lambing	9.99	11.29	11.89	15.21	12.01^A			
	4th wk. post-Lambing	10.43	10.12	10.28	10.78	10.40^B	0.20	0.24	0.41
	8th wk. post-Lambing	9.49	9.41	9.62	10.39	9.73^C	**	**	**
	Overall mean	9.97^b	10.27^b	10.60^b	12.13^a				
Hb (g/dl)	1st wk. post-Lambing	9.46	12.43	12.26	14.41	12.14^A			
	4th wk. post-Lambing	9.78	9.49	9.55	10.14	9.74^B	0.16	0.19	0.33
	8th wk. post-Lambing	8.98	8.90	9.10	9.85	9.21^C	**	**	**
	Overall mean	9.41^c	10.27^b	10.30^b	11.46^a				
Ht (%)	1st wk. post-Lambing	31.24	41.15	37.13	47.56	39.27^A			
	4th wk. post-Lambing	32.69	31.30	31.77	33.55	32.33^B	0.53	0.61	1.05
	8th wk. post-Lambing	29.64	29.39	30.07	32.48	30.40^C	**	**	**
	Overall mean	31.19^c	33.95^b	32.99^b	37.86^a				
MCV (fl)	1st wk. post-Lambing	31.26	37.78	31.25	31.25	32.89^A			
	4th wk. post-Lambing	31.63	31.11	31.22	31.26	31.31^B	0.49	0.57	0.98
	8th wk. post-Lambing	31.25	31.25	31.25	31.25	31.25^B	*	**	**
	Overall mean	31.38^b	33.38^a	31.24^b	31.25^b				
MCH (pg)	1st wk. post-Lambing	9.47	11.41	10.45	9.47	10.20^A			
	4th wk. post-Lambing	9.42	9.40	6.34	6.44	9.40^B	0.15	0.18	0.31
	8th wk. post-Lambing	9.47	9.46	9.46	9.48	9.47^B	**	*	**
	Overall mean	9.45^b	10.09^a	9.75^{ab}	9.46^b				
MCHC (%)	1st wk. post-Lambing	30.30	30.21	33.45	30.30	31.06			
	4th wk. post-Lambing	30.02	30.32	30.07	30.28	30.17	0.33	0.38	0.65
	8th wk. post-Lambing	30.30	30.27	30.27	30.31	30.29	NS	NS	NS
	Overall mean	30.21	30.27	31.26	30.30				
WBCs (10^3/µL)	1st wk. post-Lambing	6.75	8.90	8.03	10.28	8.49^A			
	4th wk. post-Lambing	7.05	6.78	6.92	7.24	7.00^B	0.12	0.13	0.23
	8th wk. post-Lambing	6.41	6.35	6.50	7.02	6.57^C	**	**	**
	Overall mean	6.73^c	7.34^b	7.15^b	8.18^a				

a, b and c mean within the same row with different letters differ significantly among diets (P < 0.05).
A, B and C means within the same column with different letters differ significantly among times (P < 0.05).
NS = non significant, * = significant, ** = highly significant.

Our results showed that no change on MCV, MCH value in G1, G3 & G4 while, G2 showed significant increase compared with G1 (Table 2). It also showed highest value in the 1st week post lambing and significant decreases after 4th week. This is in agreement with (Ibrahim, 2014).

Low MCH caused by iron deficiency as a result of consumption of highly salt tolerant plants that contain high levels of tannin which prevent absorption of iron (Pathak *et al*., 2016). While MCHC % did not showed any significant changes between groups or with time after parturition.

Immune markers:

The estimation of plasma protein fractions is essential for detecting and diagnosis of, immune-deficiency, liver and some hematological diseases. Furthermore, the varieties in plasma protein profile may occur under nutrition and physiological changes that associated with changes in hematological, enzymatic and mineral indices (Mohri *et al*., 2007; Piccione *et al*., 2009; Janku *et al*., 2011).

In the present study, total protein was decreased significantly in G3 comparing to G1. It also decreased insignificantly with time progress after parturition. As well as the plasma protein fractions presented in (Table 3) (Alpha 1, Alpha2, Gama GL) percentage were significantly decreased in all halophytic consumed ewes (G2, G3, G4).

The same trend were obtained with the time progress from 1st to 8th week postpartum except plasma Beta protein %, showed insignificantly decrease in G3 and G4 compared with G1while G2 was slightly increase compared with the other groups, while Beta % showed significant increase from 1st week postpartum.

This is may be attributed to antinutritional effects of tannins that present in halophytic plants (Acacia, Atriplex and Cassava) (Bhat *et al*., 2013), which high dietary tannin in sheep decreases feed intake, forms complexes with proteins in the rumen results in reduction in its digestion and absorption and increase its flow to the intestine (Robins and Brooker, 2005).

The current study rvealed that the albumin % in serum significantly increased in treated groups than G1.While increased insignificantly with time progress after parturition. This is in accordance with Ježek *et al*., (2006) in animals consumed salt-tolerant plants. This is may due to loss of water from the blood as a result of environmental conditions and nutritional factors that leads to dehydration (Hammon and Blum, 2008). This is a physiological phenomenon for maintaining metabolic balance in animals (Davis *et al*., 1998).

The blood C3 level was decreased significantly in treated groups than control one (P≤ 0.01) (Table 4).

Concerning to the time progress after parturition, there was a significant decrease in blood C3 after 4th week comparing to 1st week. While differences of the blood C4 levels were insignificant between these four groups. In addition to that overall mean of blood C4 level between the three times of treatments was the highest in the 4th week, with significant differences between 1st week and other times (P≤ 0.01).

Table 3. Means of plasma total protein and protein fractions of lactating ewes as affected by feeding different salt tolerant plants

Item	Time (T)	Group (G)				Overall mean	± SE		
		G1	G2	G3	G4		T	G	T X G
T. Protein g/dl	1st wk. post-Lambing	9.70	7.58	6.63	9.34	8.31			
	4th wk. post-Lambing	9.65	8.24	6.47	9.84	8.55	0.42	0.48	0.83
	8th wk. post-Lambing	7.99	9.57	7.73	6.05	7.83	NS	*	*
	Overall mean	9.11^{a}	8.46^{a}	6.94^{b}	8.41^{a}				
Albumin %	1st wk. post-Lambing	26.74	39.71	54.33	43.30	41.02			
	4th wk. post-Lambing	38.72	57.80	51.60	46.39	48.62	2.78	3.20	5.55
	8th wk. post-Lambing	33.69	41.55	46.56	62.05	45.96	NS	**	NS
	Overall mean	33.05^{b}	46.35^{a}	50.83^{a}	50.58^{a}				
ALPHA 1%	1st wk. post-Lambing	5.19	2.09	2.83	4.53	3.66^{A}			
	4th wk. post-Lambing	2.35	2.09	5.00	2.98	3.10^{AB}	0.26	0.30	0.52
	8th wk. post-Lambing	5.37	2.40	1.75	1.34	2.72^{B}	*	**	**
	Overall mean	4.30^{a}	2.19^{c}	3.20^{b}	2.95^{bc}				
ALPHA 2%	1st wk. post-Lambing	18.00	7.42	7.79	12.26	11.37^{A}			
	4th wk. post-Lambing	7.62	6.33	13.74	8.76	9.11^{B}	0.34	0.40	0.69
	8th wk. post-Lambing	9.14	10.15	5.35	6.89	7.88^{C}	**	**	**
	Overall mean	11.59^{a}	7.97^{c}	8.96^{bc}	9.30^{b}				
BETA %	1st wk. post-Lambing	12.28	16.01	18.27	15.52	15.52^{B}			
	4th wk. post-Lambing	15.34	18.59	15.40	15.82	16.29^{B}	0.82	0.95	1.65
	8th wk. post-Lambing	29.64	23.63	22.10	18.19	23.39^{A}	**	NS	**
	Overall mean	19.09	19.41	18.59	16.51				
GAMA GL.%	1st wk. post-Lambing	33.84	30.51	19.96	32.87	29.29^{A}			
	4th wk. post-Lambing	41.61	18.94	23.59	19.48	25.90^{AB}	1.67	1.93	3.34
	8th wk. post-Lambing	25.96	25.03	26.10	18.30	23.85^{B}	*	**	**
	Overall mean	33.80^{a}	24.83^{b}	23.21^{b}	23.55^{b}				

^{a}, ^{b} and ^{c} mean within the same row with different letters differ significantly among diets (P < 0.05).
^{A}, ^{B} and ^{C} mean within the same column with different letters differ significantly among times (P < 0.05).
NS = non significant, * = significant, ** = highly significant.

Table 4. Means of Complements (C3, C4) and immune globulins of lactating ewes as affected by feeding different salt tolerant plants

Item	Time (T)	Group (G)				Overall mean	± SE		
		G1	G2	G3	G4		T	G	T X G
C3	1st wk. post-Lambing	9.47	1.52	1.53	3.69	4.05^{A}			
mg/ml	4th wk. post-Lambing	1.82	1.31	0.60	2.02	1.44^{B}	0.29	0.33	0.58
	8th wk. post-Lambing	1.65	1.70	1.20	1.01	1.39^{B}	**	**	**
	Overall mean	4.31^{a}	1.51^{bc}	1.11^{c}	2.24^{b}				
C4	1st wk. post-Lambing	2.78	3.20	4.65	3.35	3.49^{B}			
mg/ml	4th wk. post-Lambing	11.48	4.78	3.65	4.18	6.02^{A}	0.44	0.50	0.87
	8th wk. post-Lambing	3.40	5.83	7.55	7.13	5.98^{A}	**	NS	**
	Overall mean	5.88	4.60	5.28	4.88				
IgE	1st wk. post-Lambing	4.93	7.20	5.88	5.85	5.96			
IU/ml	4th wk. post-Lambing	5.13	4.13	6.20	5.00	5.11	0.37	0.43	0.74
	8th wk. post-Lambing	4.68	5.20	4.68	5.20	4.94	NS	NS	NS
	Overall mean	4.91	5.51	5.58	5.35				
IgG	1st wk. post-Lambing	14.92	0.55	3.20	6.96	6.41^{A}			
g/ml	4th wk. post-Lambing	3.18	2.92	3.93	4.69	3.68^{B}	0.43	0.49	0.85
	8th wk. post-Lambing	3.96	0.83	2.45	2.47	2.43^{C}	**	**	**
	Overall mean	7.35^{a}	1.43^{d}	3.19^{c}	4.71^{b}	4.17			
IgM	1st wk. post-Lambing	1.28	1.25	1.94	1.36	1.46^{A}			
g/ml	4th wk. post-Lambing	0.62	0.79	0.83	0.60	0.71^{B}	0.24	0.28	0.49
	8th wk. post-Lambing	0.52	0.45	0.40	0.36	0.43^{B}	*	NS	NS
	Overall mean	0.81	0.83	1.06	0.77				

$^{a, b, c}$ and d mean within the same row with different letters differ significantly among diets (P < 0.05).
$^{A, B}$ and ^{C} mean within the same column with different letters differ significantly among times (P < 0.05).
NS = non significant, * = significant, ** = highly significant.

The proteins which constitute the complement system are normal components in the fluid portion of blood and other fluids of man and lower animals. Both complement components (C3) and (C4) perform important role in enhancing the ability of antibodies and phagocytic cells to eliminate both pathogens and pathogen damaged cells (Guéguinou *et al*., 2014). The inhibition in C3 may be due to reduced of dietary protein that has a direct effect on physiological and immune functions of lactating sheep (Caroprese *et al*., 2009 and 2012).Whereas tannins in halophytic plants reduce utilization of protein.

Blood IgE level in treated groups were insignificant increased in comparable to G1. While differences of IgE level among three times of treatment were non-significant (Table 4).

Blood IgG level was highest in G1 followed by G4, G3 and G2. The differences between these four groups were significant (P≤ 0.01). The IgG level during three times of treatments was highest in 1st week, followed by 4th week and 8th week and the differences between these three times were significant (P≤ 0.01).

Blood IgM level represent non-significant differences among groups. The highest IgM level was in 1st week followed and the differences between 1st week and other times were significant (P≤ 0.05). However differences between time of 4th and 8th week were non- significant (Table 4).

The increased IgG in G3 than G2 & G4 may be attributed to the high content of crude protein in cassava that provide more nitrogen source suitable for optimal rumen microbial protein synthesis (Soltan *et al*., 2012; Morsy *et al*., 2018). Also, immune response can be stimulated by the presence of cyanide which act as an immunogen or produce a strong antigenic potential by binding macromolecular proteins (Jackson *et al*., 1985). On the other hand, lower organic matter and condensed tannin levels combined with the higher acid detergent lignin contents may lead to the decrease in IgG and IgM concentrations (Morsy *et al*., 2018).

Differences of blood IL1 level in G2, G3 were insignificantly increased compared to G1. While G4 were significant increased than G1. The highest overall mean of blood IL1 level was in the 8th week. Differences between 8th week and other times were significant increased (P≤ 0.01). However differences between time of 1st week and 4th week were non-significant Table (5).

Table 5. Means of Plasma Cytokines of lactating ewes as affected by feeding different salt tolerant plants

Item	Time (T)	Group (G)				Overall Mean	± SE		
		G1	G2	G3	G4		T	G	T X G
	1st wk. post-Lambing	22.23	40.48	32.20	30.60	31.38[B]			
IL1	4th wk. post-Lambing	33.60	30.90	34.03	36.85	33.84[B]	1.45	1.68	2.90
pg/ml	8th wk. post-Lambing	39.63	32.90	41.68	47.40	40.40[A]	**	NS	**
	Overall mean	31.82[b]	34.76[ab]	35.97[ab]	38.28[a]				
	1st wk. post-Lambing	52.43	69.53	77.18	72.53	57.91[B]			
IL2	4th wk. post-Lambing	84.15	148.25	101.68	82.38	104.11[A]	6.85	7.91	13.70
pg/ml	8th wk. post-Lambing	108.73	67.18	71.78	75.28	80.74[B]	**	NS	*
	Overall mean	81.77	94.98	83.54	76.73				
	1st wk. post-Lambing	65.00	88.68	58.80	91.63	73.78			
IL6	4th wk. post-Lambing	73.73	74.95	59.35	86.08	73.53	3.34	3.86	6.68
pg/ml	8th wk. post-Lambing	74.28	52.50	77.85	56.23	65.21	NS	*	**
	Overall mean	68.00[ab]	72.04[ab]	65.33[b]	77.98[a]				
	1st wk. post-Lambing	68.08	94.85	97.80	87.20	86.98			
TNF	4th wk. post-Lambing	94.08	73.98	101.53	80.90	87.62	6.55	7.56	13.09
pg/ml	8th wk. post-Lambing	45.95	71.00	93.55	68.38	69.72	NS	*	NS
	Overall mean	69.37[b]	79.94[ab]	97.63[a]	78.83[ab]				

a, b and c mean within the same row with different letters differ significantly among diets (P < 0.05).
A, B and C mean within the same column with different letters differ significantly among times (P < 0.05).
NS = non significant, * = significant, ** = highly significant.

It is now widely accepted that IL-1 cytokine plays a key role in several kinds of defence responses. On the other hand, there is no significant difference between the blood IL-2 among the different four groups. The maximum overall mean of blood IL-2 was presented in the 4th week compared to the 1st and 8th weeks which are statistically similar. There is a slight difference between the four groups regarding the blood IL-6 since its maximum value is found in G4 which differed significantly compared to G3. There is no significant difference in the blood IL-6 in relation to the different times. However, feeding on salt plants resulted in a significant increase in TNF-α among G3 (97.63) compared to G1 and the two other groups which have statistically similar values. There is no significant difference of TNF-α value between the different experimental times (Table 5).

Cytokines are proteins secreted by specific cells of immune system responsible for modulation of the immune response to infection or inflammation and regulate inflammation via a complex network of interactions (Spaulding *et al*., 1997). In the present study the increased levels of IL-1 and IL-6 may be attributed to consumption of salt plants. Also Rebecca *et al*., (2000) found that salty plant enhanced cellular and humoral immunity in both sheep and goats. Whereas high sodium consumption increase the level pro-inflammatory mediators and tissue infiltration of leukocytes of the innate and adaptive immune system (Lucca and Hafler, 2015).The level of mineral and trace elements contents could lead to an imbalanced mineral intake e.g deficiency or excessive iron might compromise the immune system (Berger, 1996). Immune system can be also affected by dietary supplementation and physiological stresses connected to gestation and lambing through altering immunological and inflammatory processes such increased in plasma secretion of pro-inflammatory cytokines, including IL-6 (Caroprese *et al*., 2006 and 2010). Stress can activate hypothalamic pituitary-adrenal axis to synthesize cortisol, which control the actions and the production of pro-inflammatory cytokines, such as IL-6 and TNF-α(Black, 2002; Caroprese *et al*., 2006). Climatic conditions during the summer season in the Mediterranean basin often result in a depression of the immune system of dairy animals (Lacetera *et al*., 2005). Also malnutrition as a result of a lower protein and adipose tissue could result in impairing in body immunity system making the animal prone to infections and other ailments (Hughes and Kelly, 2006; Mahgoub *et al*., 2008). Lower body fat reserves may affect the immune system (Hughes and Kelly, 2006). Leptin is a 16Da protein produced by adipocytes and released into systemic circulation acts as a master hormone controlling energy acquisition and utilization processes as well as the immune/inflammatory response (Fantuzzi, 2006).

From the present results, it could be concluded that the replacement of barseem hay with dried leaves and stems of Acasia, Atriplex and Cassava plants had no adverse side effects on the studied hematological and immunological indices of lactating Barki ewes. We recommended that, salinity-resistant plants could be used as supplementary feedstuff and not a complete alternative to conventional feed to avoid adverse side effects.

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بعض المؤشرات المناعية للنعاج المرضعات المتأثرة بتغذية بعض النباتات الملحية والنباتات المتحملة للملوحة في الساحل الشمالي الغربي لمصر

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تم تقسيم أربعون نعجة برقى خالية من الأمراض في نهاية مرحلة الحمل يتراوح عمرها بين ثلاث الي أربع سنوات وبمتوسط وزن 45.2 كجم عشوائيا الي أربع مجموعات كل مجموعة بها عشر نعاج وذلك لتقييم تاثير إستبدال دريس البرسيم بنباتات متحملة للملوحة مثل الأكاسيا ساليجناوالأتربلكس هاليمس وكاسافا مانيهوت علي بعض الدلالات المناعية والقياسات في الدم. المجموعة الأولى (G1) هي المجموعة الضابطة، والتي غذيت علي خليط من العلف المركز CFM بمقدار(0.865) كجم بالإضافة إلي دريس البرسيم (0.715) كجم يوميًا ، في حين تم إستبدال دريس البرسيم بأوراق وسيقان مجففة من الاكاسيا (Acacia) و الأتربلكس (Atriplex) و الكاسافا (Cassava) في تغذية المجموعات الثانية (G2) والثالثة (G3) والرابعة (G4) على التوالي. تم وضع جميع النعاج في حظيرة مظللة نصف مفتوحة وكانت كل المجموعات تحت ظروف واحدة من المعاملة خلال فترة التجربة. تم جمع عينات من الدم خلال فترة الرضاعة في الأسبوع الأول والرابع والثامن من النعاج لقياس بعض المؤشرات المناعية وقياسات الدم . أظهرت النتائج إنخفاضا معنويا في عدد كرات الدم الحمراء ونسبة كل من الهيموجلوبين Hb و الهيماتوكريت Ht خلال الأسبوع الأول إلى الأسبوعين الرابع والثامن. وقد أظهرت المجموعة الثانية أعلى إرتفاع معنوي لمتوسط حجم الكريات الوسطى (MCV) ومتوسط كميه الهيموجلوبين الوسطى للكرية و متوسط تركيز الهيموجلوبين الوسطى للكرية (MCH). علاوة على ذلك ، كانت أعلى قيمة لمتوسط عدد كرات الدم البيضاء خلال الأسبوع الأول وكان هناك إختلافات معنوية في عدد كرات الدم البيضاء خلال فترات التجربة الثلاث. وأظهرت نسبة بروتينات بلازما الدم من النوع الفا-1 والفا-2 وجاما -1 إختلافات معنوية بين المجموعات أثناء فترات التجربة. كان هناك إنخفاضا معنويا في مستوي بروتين C3 في الدم بين المجموعات الأربع. بينما كان هناك إنخفاضا معنويا فقط في مستوي بروتين C4 خلال فترات التجربة و غير معنوي بين المجموعات الأربع. أوضحت النتائج إختلافا معنويا في مستوي بروتين IgG بين المجموعات الأربع وخلال فترات التجربة الثلاث .من النتائج الحالية ، يمكن أن نستخلص أن إحلال أوراق وسيقان نباتات الأكاسيا والأتريبلكس والكاسافا المجففة بدلا من دريس البرسيم لم يكن لها أي آثار جانبية ضارة على مؤشرات المناعة وقياسات الدم المدروسة للنعاج البرقي في فترة الحليب.