IMMUNE AND HEMATO-BIOCHEMICAL INDICES OF BARKI EWES AND THEIR OFFSPRING AS AFFECTED BY FEEDING SOME FORAGE SHRUBS IN EGYPTIAN NORTHERN COAST.

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ABESTRACT

Forty mature healthy Barki ewes at late pregnancy aged 3- 4 years and had average LBW 51.5±0.46 kg were used in this experiment. Ewes were randomly divided into 4 similar groups (10 each), to evaluate the viability of complete replacement of Berseem hay in the diet by leaves and stems of *Acacia Niloitica*, *Atriplex Nummularia* and *Cassava Manihotesculenta* shrubs, as well as to study their effects on the immunity indices of ewes and their lambs, blood biochemical parameters, blood pictures and mortality rates of new born lambs. All animals kept in a semi-open shaded yard and kept under the same managerial condition during the experimental period. The 1st group (G1) was fed the control diet consisted of 40 % concentrate feed mixture (CFM), plus 60% Berseem hay (BH), while the 2nd, 3rd and 4th groups, BH was replaced by leaves and stems of *Acacia* (G2), *Atriplex* (G3*)* or *Cassava* (G4), respectively.

Immunoglobulin's levels (IgG and IgM) were estimated in ewes colostrum and serum of their offspring at 2, 6, 12 and 24 h post-partum. Meanwhile, blood pictures in whole blood, as well as, levels of glucose, total protein, albumin, triglycerides, total cholesterol and Urea-N assayed in plasma of ewes and offspring during suckling period. In addition, mortality rate of newborn lambs were calculated.

Results show that, IgG and IgM levels in ewes colostrum and lambs serum tended to decrease during the first 24 hours post-partum, showing significant (P<0.05) lowest levels at 24 h post-partum. Immunoglobulin (IgG and IgM) levels in colostrum were significantly (P<0.05) affected by replacing Berseem hay with salt plants, where IgG and IgM concentrations were higher in all treated groups (G2, G3 and G4) comparing to control. Moreover, ewes in group G4 fed on *Cassava* showed higher colostrum IgG and IgM concentrations than other treated groups. Levels of IgG in lambs serum were significantly (P<0.05) the highest in G4 (22.64 mg/mL) fed on *Cassava* compared with control and other treatments groups, G1, G3 and G2 (21.71, 17.26 and 16.85, respectively). Moreover, *Acacia*, *Atriplex* and *Cassava* based diets enhanced (P<0.05) the concentration of lamb serum IgM compared to control. *Cassava*, diet (G4) significantly (P<0.05) improved hematological parameters of ewes compared to *Acacia* (G2), *Atriplex* (G3) and control (G1) groups. Groups fed either *Acacia* or *Atriplex* were within the same range of blood picture of the control group. *Cassava* group (G4) had greater percentage of viable lambs till weaning compared with either G2 or G3.

Replacement of Berseem hay in lactating Barki ewes' diets in Egyptian Northern Coast with *Cassava, Atriplex* or *Acacia* plants is recommended, as they did not have negative impact on the blood biochemical parameters of lactating ewes and their lambs, as well as, lambs mortality rates.

Keywords: *Colostrum, immunoglobulin's (IgG), (IgM), salt tolerant forages, blood picture, mortality.*

INTRODUCTION

Berseem (Trifolium alexandrinum) is the main critical leguminous forage harvested in the Mediterranean region and the Middle East. In Egypt, the annually sophisticated area is up to 1.3 million hectares **(Shamseldin *et al*., 2014).** It provides green feed to ruminants during growth seasons, and can used as hay for animals during other seasons. However, berseem has the same growing season as other vital crops such as broad bean (*Vicia faba*), wheat (*Triticum aestivum*) and barley (*Hordeum vulgare*) and thus competes for arable land, which is scarce in the region of these crops, which directly provides food to humans. Thus, there is necessity to find an alternative to berseem.

Acacia, Atriplex and Cassava spp. received particular consideration as livestock feed **(Fernandes dos Santos *et al*., 2015; Ahmed *et al*., 2015; Alsersy *et al*., 2015).** These plants can grow in various range of saline and arid environments **(Hue *et al*., 2010; Ahmed *et al*., 2015; Alsersy *et al*., 2015).** Therefore, there is a great prospective for them as animal feeds.

An immune response generates antibodies or proteins called immunoglobulins (Igs). Antibodies are further classified into multiple isotypes or classes. In immunocytochemistry, the IgG isotype (Immune response to invading pathogens) is preferred because its generation and binding more consistent. IgM antibodies can used if no other isotype is available.

Colostrum is the first source of energy that a lamb receive after birth and it supplies passive immunity via transfer of maternal immunoglobulin's to the neonatal lamb primarily during the first, and perhaps the second day of life **(Halliday, 1971).** Concentration and quantity of IgG in colostrum is proportional to the passive immunity transmitted to newborn lambs **(Al-Sabbagh, 2009).** Limited information is available on the hematological count and characteristics of the kids in relation to their adult life. The results of various studies on age dependent dynamics of hematological variables are different **(Knowles et *al*., 2000).**

The amount of colostrum produced by the dam and its composition can affected by several factors such as nutrition or litter size **(Banchero *et al*., 2004).** In addition, lambs fed an inadequate amount of colostrum in the first hours of life are more susceptible to disease and mortality **(Ahmad *et al*., 2000; Da Nobrega *et al*., 2005; Nowak and Poindron, 2006).**

For ruminants, the period between 12 and 36h after birth is critical for absorption of colostrum IgG **(Chen *et al*., 1999; Nowak and Poindron, 2006; Castro-Alonso *et al*., 2008)** and to acquire an adequate initial immunoglobulin concentration in blood **(O'Doherty and Crosby, 1997; Quigley *et al*., 2000; Christley *et al*., 2003)**.

There were several studies have been conducted with the aforementioned plants on digestibility, animals performance and methane production but there were limited data concerning the immune response (colostrum and serum IgG and IgM), blood picture and biochemical and mortality rate. Therefore, the present study aimed to evaluate the viability due to complete replacement of berseem hay in the diet of Barki ewes by leaves and stems of shrubs plants like, *Acacia Niloitica*, *Atriplex Nummularia* or *Cassava Manihotesculenta* and their effect on immunity indices of ewes and their lambs, as well as, blood pictures, biochemical parameters, and mortality rates of new born lambs.

MATERIALS AND METHODS

This study was carried out at Borg El-Arab, Alexandria Governorate, Experimental station of Animal Production, belonging to the Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture, Egypt, under the research project "Improvement of Nutritive Value of Low Quality Roughage by Biotechnology Options to Overcome Decrease of Animal Fodder and Decreasing Methane

Production in Ruminant" which funded by the Ministry of Agriculture and Land Reclamation.

Plants preparation and collection

The fodder trees (*leaves & stems*) of *Acacia Niloitica*, *Atriplex Nummularia* and *Cassava Manihotesculenta* 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 and have been left in the form of a layer of 20 cm thickness under semi-open shaded yard under room temperature without exposure to direct sun heat for 3 days to wilt as one of the transactions to dispose part of tannins and chopped to 3-5 cm length before submitting them to feed the ewes.

Animals and experimental treatments:

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

The 1st group (G1) was fed the control diet consisted of 40 % concentrate feed mixture (CFM), plus 60% berseem hay (BH), while forthe 2nd, 3rd and 4th groups, berseem hay was replaced by leaves and stems of *Acacia* (G2), *Atriplex* (G3) or *Cassava* (G4), respectively.

Experimental feeding and managements

Animals fed the diets to cover nutrient allowances of the physiological and productive stage **(NRC, 1985).** The CFM consisted of 25% undecorticated cotton seed meal, 43% yellow corn, 25% wheat bran, 3.5% molasses, 2% limestone, 1% common salt and 0.5% minerals mixtures and vitamins. Ewes were adapted to their diets for 4 weeks before parturition and the treatments lasted until 8 weeks of lactation. All animals were fed daily at 9 am and 4 pm, fresh water and minerals blocks were available all times. Chemical composition of feedstuffs were analyzed according to **A.O.A.C. (1995)** and presented in **Table (1).**

Experimental procedures

Experimental periods consisted of 2 intervals, 4 weeks pre-partum and 8 weeks post-partum. Live body weight of ewes and their offspring were recorded and mortality rates were calculated.

Table (1): Chemical composition % on DM of feed stuff.

Feed stuffs	Chemical composition on DM% basis						
	DM	OM	CP	CF	EE	NFE	Ash
CFM	91.20	93.90	15.70	14.23	3.13	60.84	6.10
Berseem Hay	95.12	89.59	10.64	38.54	1.03	39.38	10.41
Acacia Niloitica	71.62	81.88	10.03	16.54	1.74	53.57	18.12
Atriplex Nummularia	45.32	73.92	12.19	25.12	1.72	34.89	26.08
Cassava Manihotesculenta	44.39	88.26	22.94	28.05	2.92	34.35	11.74

Colostrum, blood samples and biochemical analysis

Colostrum samples of 5 ewes and blood samples from their offspring were collected at 2, 6, 12, and 24 h after parturition. Colostrum samples (10 ml) were obtained from one-half of the udder of each ewe by hand. Samples were collected in a plastic vial with a preservative 0.6 mg mL-1 potassium dichromate and kept frozen at -20°C. Blood samples were collected from the jugular vein of lambs and left to clot at room temperature for at least 4 h without anticoagulant for sera preparation, then the clots were removed. Sera were clarified by centrifugation at 2000 rpm for 20 minutes then kept frozen at -20°C.

Concentrations of immunoglobulin G and M (IgG and IgM) in ewe's colostrum and lambs serum were carried out by using a commercial sheep ELISA kit (Cusabio Biotech Cat. No. CSB-E14400sh and CSB-E13682sh, respectively). Samples were counted at wave length 450 nm using MR 700 microplate ELISA reader (Dynatech Laboratories).

Blood samples were collected during the suckling period from the jugular vein of ewes and their offspring into clean test tube with anticoagulant. Blood samples were divided into two portions, the 1st portion was used as a whole blood immediately for estimating red and white blood cell counts (RBCs $x10^6$ and WBCs $x10^3/mm^3$), hematocrite value (Ht, %) and hemoglobin (Hg, g/dl) concentration. The 2nd portion was centrifuged at 3000 g for 20 minutes for plasma preparation, then kept frozen at -20°C for late biochemical assay.

Concentrations of glucose, total protein, albumin, triglycerides, total cholesterol and Urea-N were determined in plasma samples using Bio-diagnostic product Kits (Egypt) used for quantitative colorimetric determination. Globulin concentrations were calculated by difference between total protein and albumin.

Statistical analysis

Data were subjected to statistical analysis, using analysis of variance procedure **(SAS, 2004)** and significant differences between means were separated by Duncan's Multiple Range Test procedure **(Duncan, 1955)**.

Results and Discussions

Immune indices

Results show that the overall mean values of IgG and IgM levels in ewes colostrum and lambs serum tended to decrease during the first 24 hours post-partum, showing significantly ($P<0.05$) the lowest levels at 24 h post- partum (Figure 1 and 2). Levels of IgG and IgM in lamb serum were the highest at the first 2 h post-partum, and then reduced. Meanwhile, the highest values for IgG and IgM level in colostrum were recorded at the 6th and 2nd h postpartum, respectively.

IgG levels observed in the present study were higher than that reported by **Teleb *et al.* (2009)** in Saidi ewes and their offspring. They also observed that serum IgG levels in ewes increased after 24 h from lambing then decreased, while serum IgG in lambs tended to increase, reaching a peak at 24 h after suckling. Suggesting that the increase of IgG levels in lambs' serum was due to the absorption of IgG from colostrum, where lambs absorb maternal immunoglobulin mainly during the first day after birth. Moreover, **Teleb *et al.* (2009)** concluded that, IgG levels in lamb's serum were closely related to the concentration of total protein and globulin, as IgG levels increased with the increase of total protein and globulin. So, determination of serum total protein and globulin can be used as an indicator for the passive transfer of IgG through the colostrum. As well as, proper attention of dam nutrition, in particularly concentrate supplementation, enhances health of dam produce good colostrum rich in protein and immunoglobulin.

Data illustrated in table 2 showed that the overall mean levels of colostrum immunoglobulin (IgG and IgM) during the 1st 24 h post- partum were significantly ($P<0.05$) affected by replacing Berseem hay with salt plants. IgG and IgM concentrations were higher in all treated groups (G2, G3 and G4) comparing to control, being the highest in group G4 fed on Cassava (33.58 and 7.55 mg/mL respectively). During the 1st day post- partum colostrum IgG levels increased by 73.3, 58.3 and 11.7 % for *Cassava (G4), Acacia* (G2) and *Atripl ex* (G3), respectively than the control (G1) group. Meanwhile, colostrum IgM levels increased as 263.0, 173.1 and 137.0% percentages for G4, G3 and G2, respectively than the control group (G1).

Levels of serum IgG in lambs had significantly ($P<0.05$) the highest concentration in G4 (22.64 mg/mL) fed on *Cassava* compared

with control and other treated groups, G1, G3 and G2 (21.71, 17.26 and 16.85, respectively). Meanwhile, IgM concentrations were significantly (P<0.05) higher in all treated groups G3, G4 and G2 (2.05, 1.73 and 1.12 mg/ml, respectively) comparing to control (0.54 mg/ml), being the highest in G3. During 24 h post-partum, IgG levels in lambs serum increased by 4.3% in G4, while its levels reduced by (22.4 %) in G2 and (20.5 %) in G3. Meanwhile, IgM increased by 279.6, 220.4 and 107.4 % percentages for G3, G4, and G2, (**Table 2**).

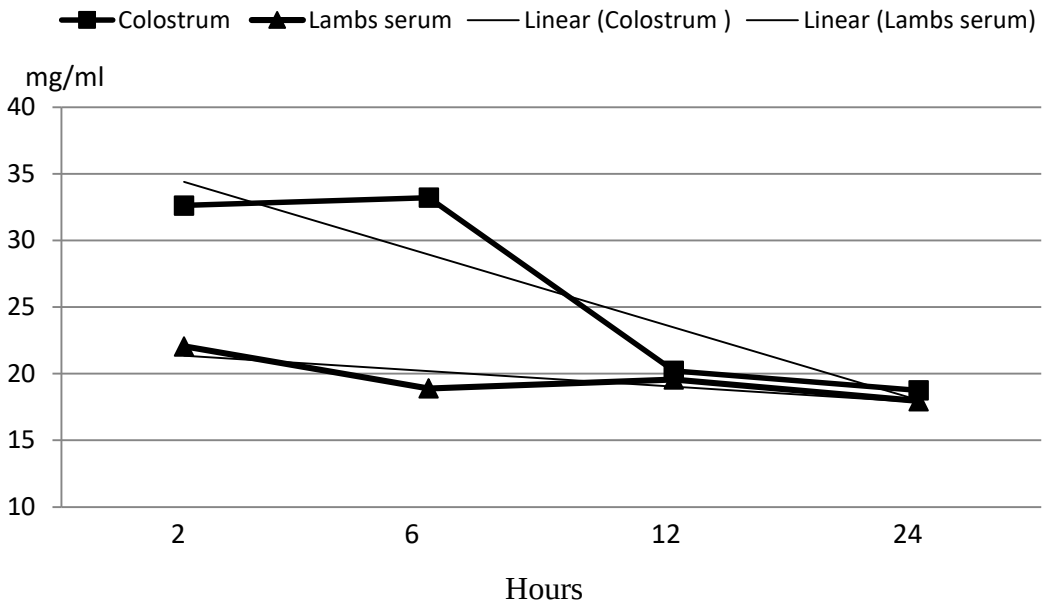

Figure 1: Average levels of IgG in Barki ewes colostrum and lamb serum (mg/ml) at 2, 6, 12 and 24 hours post- partum.

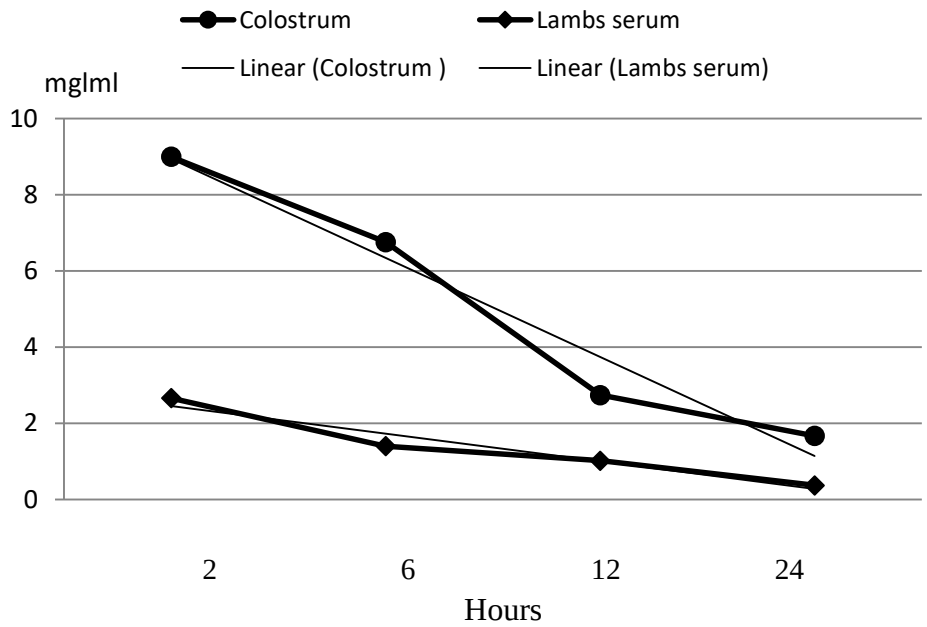

Figure 2: Average levels of IgM in Barki ewes' colostrum and lamb serum (mg/ml) at 2, 6, 12 and 24 hours post- partum.

[a, b, c,] and [d] means within in the same row with different superscripts are significantly different among diets at P<0.05.

Table (2): Effect of replacing hay with shrubs plants in the diets on IgG and IgM (mg/ml) concentrations in Barkiewes' colostrum and serum of their offspring.

Items	Post- partum sampling time	Experimental diets			
		Control (G1)	*Acacia* (G2)	*Atriplex* (G3)	*Cassava* (G4)
Immunoglobulinindices in ewes colostrums					
IgG (mg/mL)	2h	15.26±0.24	32.70±0.41	28.70±0.76	53.80±0.34
	6h	24.3±0.17	39.74±0.57	29.50±0.68	39.30±0.45
	12h	23.68±0.25	22.80±0.56	16.48±0.44	19.90±0.48
	24h	14.30±0.20	27.48±0.40	11.94±0.69	21.30±0.72
	Overall mean	19.38±1.07^{d}	30.68±1.46^{b}	21.65±1.77^{c}	33.58±3.21^{a}
Changes % due to Shrubs Plants		--	+58.3%	+11.7%	+73.3%
IgM (mg/ml)	2h	5.24±0.229	6.30±0.35	9.32±0.30	15.50±0.34
	6h	1.97±0.032	7.52±0.35	8.92±0.71	8.62±0.36
	12h	0.61±0.021	2.93±0.03	1.83±0.13	5.57±0.13
	24h	0.50±0.014	2.98±0.35	2.67±0.08	0.53±0.03
	Overall mean	2.08±0.44^{d}	4.93±0.49^{c}	5.68±0.81^{b}	7.55±1.25^{a}
Changes % due to Shrubs Plants		--	+137.0%	+173.1%	+263.0%
Immunoglobulinindices in lambs serum					
IgG (mg/mL)	2h	19.06±0.14	22.10±0.65	22.32±0.73	24.70±0.19
	6h	22.58±0.17	12.00±0.58	19.20±0.67	21.82±0.70
	12h	23.40±0.44	16.70±0.37	15.59±0.71	22.60±0.71
	24h	21.80±0.41	16.62±0.72	11.94±0.47	21.42±0. 92
	Overall mean	21.71±0.40^{b}	16.85±0.87^{c}	17.26±0.94^{c}	22.64±0.43^{a}
Changes % due to Shrubs Plants		--	-22.4%	-20.5%	+4.3%
IgM (mg/ml)	2h	0.70±0.07	2.04±0.16	3.49±0.17	4.39±0.04
	6h	0.62±0.01	1.34±0.07	2.21±0.03	1.42±0.07
	12h	0.58±0.24	0.57±0.03	2.10±0.32	0.82±0.03
	24h	0.27±0.01	0.55±0.03	0.38±0.01	0.28±0.02
	Overall mean	0.54±0.04^{d}	1.12±0.15^{c}	2.05±0.28^{a}	1.73±0.36^{b}
Changes % due to Shrubs Plants		--	+107.4%	+279.6%	+220.4%

$^{A, B, C,}$ and ^{D} means within in the same column with different superscripts are significantly different among times at P<0.05

Cassava diet increased immunoglobulin (IgG and IgM) in both colostrum and lambs serum. Such increment could be attributed to *Cassava* condensed tannins (CT), hence, CT decreases the degradation of dietary protein and S amino acids to inorganic sulphide in the rumen and absorption of methionine, cystine, arginine and glutamine increase in sheep **(McNabb *et al.*, 1993).** Such amino acids can enhance immune responses as they regulate activation of T and B lymphocytes, natural killer cells and macrophages, gene expression and lymphocyte proliferation, as well as production of antibodies, cytokines and other cytotoxic substances **(Ma Li and Guo RongFu, 2007).** It suggested that the increased by-pass of protein supply caused by the action of CT present in the forage helps counteract of the protein losses and this high-quality protein bypass effect has the potential to enhance the immune response and increase animal resistance **(Min *et al*., 2004).**

The role of tannins on immune response can be also understood as flavonoids, tannins and micronutrients, which have been suggested to act as antioxidants and exert their antioxidant activity by scavenging the lipid peroxidation **(Yuting *et al*., 1990).** The present results are in accordance with the finding of **Pathak *et al*.,**

(2016) who reported a perceptible encouraging impact on immune response (IgG) and cell mediated immune response in sheep fed diet containing 1.5 % CT. **Nawito *et al*. (2016)** showed that total antioxidant peroxide malondialdehyde (MDA) level significantly increased in pregnant animals fed either concentrate or grazed low-quality forage (salt plants) that accompanied by a low level of total antioxidant capacity (TAC). The activity of catalase enzyme (CAT) decreased in pregnant animals fed concentrate or grazed and superoxide dismutase (SOD) significantly decreased in the pregnant grazing group. They suggested that animals might experienced some degree of oxidative stress and lipid peroxidation indicating that redox homeostasis was impaired in those pregnant animals that fed on forage rations. They also reported that, pregnancy constituted the most oxidative stress facing either grazing or feeding concentrate diet to sheep and goats under arid and saline conditions of Southern Sinai, Egypt.

It is important to emphasize that increasing of IgG and IgM percentages in colostrum reflected on increasing such immunoglobulin in blood. Several authors reported that increase in total amount of IgG and IgM present in colostrum intake increases its percentages in lambs **(Halliday and Williams, 1979),** goat kids **(Rodríguez *et al*., 2009)** and calves **(Stott and Fellah, 1983).** Additionally, **Stott and Fellah, (1983)** observed a quadratic relationship between the amount of IgM in colostrum and plasma IgM concentrations in calves.

The present study showed that, the dynamics of changes in the content of IgG and IgM in colostrum of all treated ewes within the first 24 hours post- partum were associated with a rapid decrease in the level of lamb serum immunoglobulin. This coop with that reported by **Kracmar *et al*. (2005).**

Hematological parameters

Data in **Table 3** show the hematological parameters including count of RBCs, WBCs, hemoglobin (Hg, g/dl) and heamatocrite values (Ht, %) of ewes and their offspring. All measures of blood picture of ewes, were significantly (P<0.05) higher in G4 than G1 group, while differences between G4, *G2 and G3* were not significant. Such findings indicate that feeding ewes on *Cassava* significantly (P<0.05) improved hematological parameters of ewes compared to *Acacia*, Atriplex and control groups. Feeding ewes on *Acacia*, *Atriplex* or *Cassava* did not significantly affect components of blood picture of lambs, except RBCs counts.

Table (3): Effect of replacement hay by shrubs plants in diets of Barki ewes on the blood profile of dams and their offspring.

Blood profile	Experimental diets			
	Control (G1)	*Acacia* (G2)	*Atriplex* (G3)	*Cassava* (G4)
Ewes blood picture				
RBCs ($x10^6/mm^3$)	5.01±0.30^{b}	5.77±0.30^{ab}	5.25±0.30^{ab}	6.08±0.30^{a}
WBCs ($x10^3/mm^3$)	10.32±0.60^{b}	10.37±0.60^{b}	10.71±0.60^{b}	12.51±0.60^{a}
Hg (g/dl)	9.77±0.62^{b}	11.22±0.62^{ab}	10.70±0.62^{ab}	11.85±0.62^{a}
Ht (%)	32.24±1.95^{b}	37.09±1.95^{ab}	33.85±1.95^{ab}	39.09±1.95^{a}
lambs blood picture				
RBCsx106/mm3	6.58±0.10^{b}	7.26±0.10^{a}	6.51±0.10^{b}	7.46±0.10^{a}
WBCs(x103/mm3	7.73±0.1^{a}	7.71±0.16^{a}	7.86±0.16^{a}	7.51±0.16^{a}
Hg (g/dl)	10.85±0.21^{a}	10.88±0.21^{a}	10.73±0.21^{a}	11.15±0.21^{a}
Ht (%)	35.70±0.67^{a}	35.80±0.67^{a}	35.40±0.67^{a}	36.70±0.76^{a}

^{a,} and ^{b} Means Means denoted within the same row with different superscripts are significantly different at P<0.05.

Bornez *et al*., (2009) recorded significant higher number of RBC, WBC, hemoglobin level and hematocrit value in the blood of lambs fed concentrate and wheat straw at day 70 comparing to day 30. **Zumbo *et al*., (2011)** found that during the post-partum days does showed a significant decrease in WBC and Ht, while PLT significantly increased from day 7 until day 28. Meanwhile, opposite trends were observed for kids, where RBCs and WBCs increased significantly, as well as, an inconstant increase of PLT noticed from day 14 after birth. Several changes were assessed in kids, during the first month of life, on both hemato-chemical components and the serum proteins profile **(Piccione *et al*., 2011 and Zumbo *et al*., 2011).**

Generally, the present values of blood picture are within the normal range reported by **Habeeb *et al.* (2008)** for Ossimi ewes and their offspring at parturition and weaning which affected by CP level in feeds during the two climatic seasons winter and summer and **by El-Saadany *et al*., (2016)** as affected by feeding shrub plants for Barki ewes.

Blood biochemical parameters:

Overall mean values of glucose, protein, albumin, globulin, triglyceride, total cholesterol and urea N in serum of ewes and their offspring throughout the suckling period are presented in Table 4. A significant (P<0.05) decrease in glucose levels were observed on plasma of ewes fed the experimental diets containing either *Acacia* or *Atriplex* compared with control group. While, total protein significantly (P<0.05) increased in all treated groups (G2, G3 and G4) compared to G1. Triglyceride levels was significantly the highest (P<0.05) with Atriplex diet group (G3) and the lowest in *Cassava* diet group (G4). Moreover, no significant differences were detected in blood plasma albumin, globulin, total cholesterol and urea among ewes groups fed different diets (**Table 4**).

In lambs, Shrubs fed groups had higher total protein and albumin comparing to control, being the highest in G2, where lambs in *Acacia* group (G2) showed significantly (P<0.05) higher plasma total protein and albumin concentration compared to control. Although, glucose level was lower in plasma of lambs born to ewes fed diets containing *Acacia, Atriplex* or *Cassava* no significant differences were detected.

Moreover, insignificant increase in triglycerides levels in lambs' plasma was observed for feeding *Atriplex* (G3). However, globulin, triglycerides, total cholesterol and urea levels in lambs' blood among diets groups did not significantly differ among lambs of the different experimental groups (**Table 4**).

The decline observed in glucose concentration in the present study agrees with the finding of **Shaker, (2014)** and **Ahmed *et al*. (2015). Shaker, (2014)** observed that feeding sheep on salt tolerant plants decreased (P< 0.01) plasma glucose concentration by 17.9%. He, attributed that to the tannin content of these plants or may be their high salt content as a salt tolerant forages that might reduce glucose concentration. This may also due to increase of blood osmolarlity as noticed on goats fed *Atriplex* or *Acacia* **(Ibrahim, 2001).** Also, it might be due to lower production of TVFA in rumen, which probably due to lower solubility of nitrogen and reduced availability of substrates viz. amino acids for production of VFAs **(Hassan *et al*., 2015). Getachew *et al*. (2008)** reported lower VFA production by adding CT in batch culture of mixed rumen microorganisms, or less degradation rate of carbohydrates and nitrogen **(Khattab, 2007)..**

Table (4): Effect of replacement hay with shrubs plants in diets of Barki ewes on blood plasma biochemical parameters of dams and their offspring.

Items	Experimental diets			
	Control (G1)	*Acacia* (G2)	*Atriplex* (G3)	*Cassava* (G4)
Ewes blood plasma				
Glucose (mg/dl)	69.9±4.34[a]	56.0±0.18[b]	55.9±3.54[b]	65.6±1.41[ab]
Total protein (g/dl)	7.06±0.02[b]	7.96±0.03[a]	7.79±0.42[a]	7.79±0.03[a]
Albumin (g/dl)	4.29±0.15	5.14±0.14	4.96±0.16	5.09±0.15
Globulin (g/dl)	2.75±0.09	2.79±0.11	2.74±0.04	2.71±0.11
Triglycerides (mg/dl)	49.3±1.72[ab]	44.94±3.86[ab]	55.50±2.53[a]	39.5±1.13[b]
Total cholesterol (mg/dl)	74.5±0.28	66.90±2.753	72.60±2.73	76.30±5.42
Urea -N (mg/dl)	63.1±0.17	54.87±1.36	60.50±1.70	54.02±3.39
Lambs blood plasma				
Glucose (mg/dl)	69.24±7.92	52.89±3.79	61.34±3.71	61.51±5.55
Total protein (g/dl)	7.14±0.29[b]	7.92±0.26[a]	7.46±0.18[ab]	7.82±0.25[ab]
Albumin (g/dl)	4.31±0.32[b]	5.36±0.18[a]	4.91±0.34[ab]	4.66±0.25[ab]
Globulin (g/dl)	2.84±0.22	2.56±0.14	2.55±0.30	3.15±0.27
Triglycerides (mg/dl)	65.59±10.60	64.06±5.92	70.27±9.05	63.83±8.95
Total cholesterol (mg/dl)	85.38±11.86	81.79±6.15	85.40±9.94	83.72±8.49
Urea -N (mg/dl)	65.21±6.5	62.22±5.08	60.03±4.77	61.22±3.74

[a] and [b] Means denoted within the same row with different superscripts are significantly different at P<0.05.

The higher total proteins detected in ewes and their offspring in all treated groups might due to the high content of crude protein in the plants used. **Kumar *et al*. (1980)** reported a positive correlation between dietary protein and plasma protein concentrations. Moreover, the decrease observed in triglycerides concentrations on *Cassava* group (G4) compared with *Atriplex* (G3) group, may be due to the high levels of tannins in *Cassava*, which interfere with lipid digestion by forming complexes with fatty acids **(Romero *et al*., 2000)** causing a reduction in serum triglycerides. Blood urea levels in Barki ewes fed fresh *Acacia*, *Atriplex* or *Cassava* were slightly lower than those fed control or silage diets. This may be due to the high content of anti-nutritional factors in fresh forage that affect utilization of protein in the rumen by binding feed proteins and converting them to indigestible form, as well as, reducing the digestive enzymatic activity causing a lower rumen ammonia production **as reported by Shawket *et al*. (2015).**

Although, there were changes in some blood biochemical parameters in Barki ewes and their offspring due to replacing Berseem hay with salt plants in ewes diet, the present values are within the range reported for Ossimi ewes and their offspring fed different levels of CP in the two seasons (winter and summer) at parturition and weaning (**Habeeb *et al*., 2008). ;** for Barki ewes at different parity (**Anwar *et al*., 2012);** for Barki and dwarf ewes (**Shawket *et al*., 2015, Fasae *et al*., 2015 and El-Saadany *et al*., 2016**) and for Barki lambs fed saline plants (*Acacia*, *Atriplex* and *Cassava*) **(Eissa *et al*., 2015 and 2016 a and b).** Such findings in general indicate that feeding *Acacia*, *Atriplex* or *Cassava* did not have negative impact on blood biochemical parameters of lactating ewes and their lambs.

Mortality rates:

Low mortality rate was reported in this study mainly at weaning. Mortality rates at weaning were 9.1% (1/11) and 10 % (1/10) for G2 and G3 (Table 5). **Shawket *et al*. (2015)** reported high mortality rates for born alive lambs during the first week after birth (16.7 and 35.3%) when two groups of dams fed halophytic diets (*Atriplex* and *Acacia)* either fresh or silage, respectively. They suggested that the higher mortality rate detected among lambs born to silage fed group might be due to the high amount of minerals squished out

with the silage juice. However, newborn ruminants have three critical periods related to development of their immune system during the first two months of life; colostrum feeding, milk feeding, and weaning. Management during these periods affect animal performance **(Marsico *et al*., 1993; Massimini *et al*., 2007; Mastellone *et al*., 2011)**. Several factors could also affect lambs survival, **Doaa, *et al*. (2009)** concluded that mortality rate increased with the low birth weights. They also reported that lamb birth weights significantly influenced by season of lambing and type of birth. Moreover, the health condition and nutritional status of the ewe before lambing could also influence lambs mortality. Proper attention of dam nutrition in particularly concentrate supplementation enhances lamb survival by increasing birth weight, since healthy dam produce good colostrum rich in protein and immunoglobulin. In addition, improvement of health management practices during different seasons for proper lambing is recommended.

Table (5): Effect of shrubs plants in diets of Barki ewes mortality rate of new born lambs.

Item	Experimental diets			
	Control (G1)	*Acacia* (G2)	*Atriplex* (G3)	*Cassava* (G4)
No. of ewe does	10	10	10	10
No. of total born	11	11	10	12
	Viable Lambs (n-%)			
At birth (n-%)	11 (100%)	11 (100%)	10 (100%)	12 (100%)
At weaning (n-%)	11 (100%)	10 (90.9%)	9 (90%)	12 (100%)

CONCLUSION

Cassava, Atriplex and *Acacia* are valuable alternatives to Berseem hay in lactating Barki ewes' diets in Egyptian Northern Coast, as they did not have negative impact on the blood biochemical parameters of lactating ewes and their lambs, as well as, lambs mortality rates. *Cassava* was more peneficial than *Acacia* and *Atriplex,* however, further study is needed to investigate the amino acid profile and minerals of these salts plants especially *Cassava* (leaves and stems).

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