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Effect of Feeding Barki Ewesby Halophytic Plants on the Gross Chemical Composition, Elements Content and Anti- Oxidants Compounds

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ABSTRACT

To study the effect of feeding halophytic plants on the composition and quality of Barki ewes milk. Forty Barki ewes 3-4 years old with average live body weight of (45.2 ± 0.47 kg) were divided into lower similar groups (ten lactating ewes in every group).The first group (control) fed on the rationconsisted of concentrate feed mixture (CFM),rice straw plus Berseem Hay (BH) at levels of 60:10:30 % respectively.Berseem Hay (BH) for the other three group's was replaced by leaves and stems of (Acacia, Atriplex and Cassava) for 2nd, 3rd and 4th groups , respectively. Ewes were suckled from delivery until weaning kids. Milk samples were collected for each group from second week till to seventh week. Results showed that, the milkyield increased in the experimental groups than in control, either weekly or after 7 weeks of lactating period , with the exception of (Atriplex) treatment . Cassava treatment had the maximum total milk yields all over the suckling period , followed by Acacia , Hay and Atriplex treatments ,respectively.The highest content of milk fat was noticedat seventh week for control group (BH) , while Cassava group scored the lowest one . Protein content was higher in Acacia and Atriplex than in Hay and Cassava at all lactation weeks.Lactose content was the highest inAcacia group milk , and the lowest in Cassava group , at seventh week . Total solids (TS) content was lower in Cassava than in the other groups during the 1st six weeks of lactation.The highest value of TS was noticed in Hay group , at the seventh lactation week.Atriplex group had the highest ash content at seventh week. Acidity values of milk among the four groups ranged betwee0.16 to 0,20% ,density values were found lower in control group than in the other groups along the lactation period . Frozen points of milk of all groups were found approximately similar of– 0.61, after 7 weeks. Macro-elements ; calcium , phosphorus , sodium and potassium of (Atriplex) had the highest contentsat 7thweek, while the lowest were obtained in control (BH) group . Micro elements; ferric , manganese , magnesium , zinc and copper were higher in some treatments , and lower in the others , during the lactating period . Anti-oxidants compunds were determined in milk , curd and whey of each group separately.Average of total anti-oxidants values of phenols,flavonoids, carotenoids and tannins were found higher in milk of groups fed on the halophytic plants, and the highest value was found in (Cassava) group milk, while the lowest was in control group.Control groupmilk curd contained the lowest total anti-oxidant compounds, compared with the other groups fed on the halophytic stems and leaves. Cassava group milk curd had the highest values. Total anti-oxidant compounds in whey of the four groups were found lower than that of the milk or curd ,and the highest value was in Cassava group, while the lowest value was found with control group. Generally ,it was found that milk yield of control group was lower than the yield of the other groups , with the exception of Atriplex group. Gross composition of milk groups Cassava , Acacia and Atriplex was superior than the other one of control group . Similar trend was noticed in macro-elements. Values of micro-elements varied among the four groups. Concerning milk anti-oxidants compounds , control group recorded the lowest values , and Cassava group had the highest values.

INTRODUCTION

Milk and its products are considered one of the most important sources of nutrients for human diets along his life. The sheep's milk is an important source of nutritive substances in the diet of growing up animals and human (Ivanova, 2011). Sheep milk contain higher total solids and major nutrient contents than goat, cow and human milk. Fat contents of goat, sheep , cow and human milk were : 3.8, 7.8 , 3.6 and 4.0% ; while solid not fat (SNF) were 8.9 , 12.0 , 8.75 and 8.70 %respectively (park 1991, 2006 , 2007,) .Rincon *et al* 1994 declared that sheep milk has around 0 .9% total minerals or ash compared to 0.7% in cow milk . Twenty mineral elements are essential for human population , Na , K, Cl, Ca, Mn, Se, I, Cr, Co, Mo, F, Ar, Ni, Si, Po,) (Cashman, 2006) , and they are categorized in 2 groups , macro-elements and micro-elements. All essential elements have to be given in milk because of the lambs development (Bates and Prentice, 1996). Their concentration in milk depends on various factors: genetic characteristics, and from environmental condition during pasture, feeding, breeding stage and number of lactation, climate to post-milking handling, transportation and processing (Vahčić *et al*., 2010 Zamberlin *et al.* 2012). Suttle (2010) pointed out that sheep milk is rich source of Ca, P, K, Cl and Zn, but poor source in Mg, Fe, Cu and Mn. Changes in sheep milk composition occurs during seasons , especially at the end of the lactation period , so , the fat , protein , total solids and minerals contents increased .Haenlein, (2001).

Antioxidant compounds have a beneficial effect on the consumer`s health by giving them a potentially greater protection from exposure to the oxidative stress that is recognized as a feature of many acute and chronic disease , Dalle–Donee, *et al,* (2006).Therefore, milk anti-oxidants including proteins, carotenoids, flavonoids as well as vitamins such as vitamins E and C, not only carry out important roles in preventing lipid peroxidation (which cause hydrolytic off-flavors) , but they also could help in reducing the loss of important nutrients and bioactive agents that promote health of offspring or of older consumers, Salimei, *et al.* (2012).

This work aimed to study the effect of feeding lactating Barkiewes on halophytic plants namely, Acacia, Atriplex and Cassava on theyield , chemical composition , macro and micro elements and anti-oxidants compounds of the resultant milks, during 7 weeks of the lactating period .

MATERIALS AND METHODS

Materials:

Animals and plan of experimental feeding:

This study was carried outat Borg EL-Arab Experimental station. Forty mature healthy milking Barki ewes 3-4 years old with average live body weight of 45.2 ± 0.47 kg were divided into four similar groups (10 lactatingewes in each group) . Animals were fed according to NRC (1985) allowances which were adjusted according to the physiological and productive stage. Ewes of the first group were fed on the traditional diet consisted of concentrate feed mixture (CFM),ricestraw plus Berseem Hay (BH) at levels of 60:10:30 %, respectively.Only Berseem hay (BH) was replaced by leaves and stems of the A triplex orAcaciaor Cassava , planted in the saline soils,in the 2nd , 3rd and 4th treatmentgroups at the same level of BH (30 %) .The feeding started from early pregnancy up to the end of lactation period at weaning .Samples of bulk milk were taken from the 2nd week of lactation up to the 7th week of lactation .

Bulkmilk:

Bulk milk was collected from the ten ewes of each group, from the individual morning milking. 120 ml. of milk was taken individually from each of the ten ewes, well mixed (morning milking) for each group, and kept in refrigerator at (5±1) ^{o}C. The same manner was done for the evening milking period.

All samples were weekly chemically analyzed , sample for each group was divided into 4 portions, the first was used for determine the gross chemical composition, the second for macro- elements, the third for micro- elements and the 4th for detection of anti-oxidants compounds in milk , curd and whey after coagulated the milk of each treatment in 50 minutes at 40oC). After complete coagulation, each curd was separately filtrated through Watt-man paper No.1 to separate curd from the whey.

Analytical Methods:

Samples of the bulk milks were chemically analyzed fortotal solids, acidity, total protein and fat contents as described by ling (1963) ,Lactose content (Barnet and AbdEl-tawab ,1957) Ash content(A.O.A.C. ,1984) ,pH values were measured using a glass electrode PH meter , (Digital, Model 3305,Jenway)., Density and frozen point (Milko Scan (Mark® , 133B , N.FOSS , Electric , Den mark).Total polyphenol compounds (singleton and Rossi, 1965 and Han *et al*. ,2011) , Flavonoids (Carnachan& Harris ,2000) , Carotenoids (Nagata and Yamashita , 1992) , and total tannins (as tannic acid) AOAC (2000).The major and the minor minerals (A.O.A.C ,1995) using flames, atomic absorption spectrophotometer (Perkin Elmer Model 460).

RESULTS AND DISCUSSION

Milk Yield

Results presented in Table (1) indicated a significant differences in weekly and total milk yield among the experimental groups throughout the experimented lactation period (7 weeks). Ewes fed Cassava and Acacia diets characterized with significantly ($P < 0.05$) higher total milk yields than those in Hay control group , while those fed Atriplex diet showed significantly ($P < 0.05$) the lowest values . Throughout 7 lactation weeks ,Average weekly milk yields showed the same trend . Cassava treatment had the highest total milk yields allover the lactation period. These agree with Phanthavong Vongsamphanh and Metha Wanaphat (2004) found that increasing levels of Cassava Hay and dried Cassava rood increased milk yield and decreased feed coast.

Table 1. Milk yield (kg/h) of ewes in the experimental groups, feeding on halophytic plants.

Milk Yield (kg)	Experimental groups (Means ± S.E.)			
	Hay	Acacia	Atriplex	Cassava
Average kg /head/week	5.69^{b}±0.42	6.27^{b}±0.39	4.63^{c}±0.22^{c}	7.17^{a}±0.49
Total kg/h/7weeks	45.59^{b}±3.32	50.19^{b}±3.14	37.04^{c}±1.77	57.41^{a}±3.93^{a}

a,bandc ; Means denoted within the same row with different superscripts are significantly (p< 0.05) different at P < 0.05.

Chemical composition of Milk:

Data presented in Table (2) cleared that fat content in milk of ewes was not affected by the dietary treatment during all lactation weeks, although there was a slight tendency of decrease in milk fat of ewes fed on (Cassava). Fat content ranged between 6.6 and 7.8 % during lactation period, being highest at week 7, in control ewes fed (BH) group. In all groups, fat content showed gradual increase by advancing lactation period , and slightly differences were found among all groups.These results were agreed with those found by, Abdalla *et al*., (2013). Protein content was , as a general ,low significantly affected by dietary treatment, being slightly higher in milk of ewes fed on Acacia and Atriplex than in Hay or Cassava groups ,at all lactation weeks. In all groups, protein content showed gradual increase by advancing lactation pereiod. Wilson (1984) reported that dietary protein content will directly affect milk protein content. This finding was true in Acacia because it contained higher crude protein content.A significantly effect of dietary treatment was observed on lactose content from week 2 – 4 among all treatment being in- significant after that and Cassava treatment recorded the lowest values . Lactose content ranged between 4.20 and 4.96% in all groups at all lactation weeks. It is well known that lactose levels in milk are highly affected by genetic factors and minor by feeding. However, (Khaskheli *et al*., 2005) found that there is insignificant effect of experimental diets on lactose content in ewes milk could be due to similar type of vegetation eaten. Results, also, appeared that a significant effect was found In total solids content,among all treatments, all over the suckling period . Reduced total solids content in milk of Cassava group was related with a decrease in both fat and protein contents, than the other treatments. There was a gradual increase in total solids content of milk as time of lactation progressed in all treatments. These results might be related to the type of feed intake of different forages in the experimental groups, which might be due to the high palatability of clover Hay as compared with halophytic plants , which contained higher levels of Na, K, Ca and silica (Bayoumi, 1990).A significant effect was observed among the treatments in ash content in the week 2 only and became insignificant thereafter . Ash content was apparently the highest in (Atriplex) and the lowest in (Hay) .The highest ash content in milk of ewes fed (Atriplex) diet was attributed to the highest ash content in this forage compared with the other types of forages. (Atriplex) scored the highest value (0.96) while the (Hay) scored the lowest one (0.82)in the last week of lactation. Mervat Mohammed (2008) found wide variation in ash content of Barki sheep milk at mid-lactation, ranging between 0.62 and 0.96%.

Table 2. Changes in milk composition of ewes fed on halophytic plants during suckling period.

Experimental Groups	Suckling period (week)					
	2	3	4	5	6	7
			Fat %			
Hay	7.3±0.44	7.4±0.23	7.4±0.12	7.6±0.12	7.7±0.23	7.8±0.29
Acacia	7.1±0.35	7.2±0.29	7.4±0.23	7.5±0.29	7.6±0.35	7.7±0.23
Atriplex	6.8±0.17	7.1±0.29	7.1±0.23	7.2±0.35	7.4±0.29	7.5±0.40
Cassava	6.6±0.23	6.8±0.29	6.9±0.23	7.0±0.35	7.2±0.29	7.4±0.23
			Protein %			
Hay	4.50^{ab}±0.14	4.51±0.17	4.58±0.13	4.71±0.06	4.73±0.06	4.86±0.05
Acacia	4.70^{a}±0.05	4.75±0.05	4.80±0.07	4.86±0.07	4.89±0.06	5.02±0.04
Atriplex	4.65^{a}±0.06	4.69±0.05	4.82±0.06	4.87±0.05	4.88±0.07	4.92±0.06
Cassava	4.21^{b}±0.07	4.58±0.07	4.60±0.08	4.71±0.07	4.77±0.06	4.80±0.08
			Lactose %			
Hay	4.60^{a}±0.06	4.63^{a}±0.06	4.68^{ab}±0.05	4.76±0.06	4.81±0.05	4.90±0.05
Acacia	4.69^{a}±0.06	4.76^{a}±0.05	4.80^{ab}±0.06	4.85±0.05	4.89±0.05	4.96±0.07
Atriplex	4.69^{a}±0.05	4.80^{a}±0.06	4.83^{a}±0.07	4.85±0.06	4.89±0.06	4.93±0.08
Cassava	4.20^{b}±0.06	4.33^{b}±0.05	4.60^{b}±0.06	4.72±0.06	4.80±0.05	4.86±0.06
			T.S. %			
Hay	17.67^{a}±0.08	17.93^{a}±0.06	17.18^{c}±0.029	18.57^{a}±0.012	18.66^{a}±0.012	18.95^{a}±0.014
Acacia	17.79^{a}±0.05	17.92^{a}±0.08	18.39^{a}±0.06	18.43^{a}±0.08	18.75^{a}±0.06	18.94^{a}±0.05
Atriplex	17.05^{b}±0.06	17.55^{b}±0.09	17.81^{b}±0.09	17.91^{b}±0.010	18.18^{b}±0.09	18.38^{b}±0.014
Cassava	15.86^{c}±0.06	16.71^{c}±0.07	17.02^{c}±0.09	17.35^{c}±0.010	17.94^{b}±0.09	18.36^{b}±0.09
			Ash %			
Hay	0.57^{b}±0.04	0.59±0.05	0.62±0.04	0.70±0.06	0.75±0.07	0.82±0.06
Acacia	0.70^{a}±0.04	0.71±0.05	0.74±0.06	0.79±0.06	0.87±0.06	0.93±0.03
Atriplex	0.71^{a}±0.03	0.73±0.05	0.75±0.06	0.80±0.07	0.88±0.05	0.96±0.05
Cassava	0.65^{ab}±0.03	0.67±0.04	0.69±0.04	0.73±0.05	0.80±0.05	0.90±0.04

a ,b,c and d: Means denoted within the same column with different superscripts are significantly(P<0.05) different.

Changes in physico-chemical properties of ewes milk:

Results in (Table 3) showed that there is insignificant effect in acidity values among the treatments all over the lactating period. On the other hand, a significant differences were found, generally, in pH value, density and frozen point of ewe milk of the experimental groups. Milk acidity ranged between 0.17 – 0.19% for fresh milk at the second week, decreased gradually to be between 0.16-0.17% at 7th week. The pH values of fresh milk ranged between 6.62–6.72at week 2, reaching 6.61-6.81 at 7thweek. Density and frozen point showed in consistent trend of changes among the experimental groups at different lactation weeks. In general, acidity, pH value, density and frozen point ranged between 0.16-0.20%, 6.62-6.81, 30.47-36.27g/cm3and from - 0.52: - 0.064 ºC with in the lactating period, respectively. It is well known that acidity and pH value of ewes milk was mainly affected by the chemical composition of the milk.

Table 3. Physico- chemical properties of ewes milk , duringthe suckling period ,asaffectedbyfeedingon halophytic plants.

Groups	Suckling period (week)					
	2	3	4	5	6	7
			Acidity (%)			
Hay	0.18±0.01	0.18±0.01	0.19±0.01	0.18±0.01	0.17±0.01	0.17±0.01
Acacia	0.19±0.01	0.18±0.01	0.18±0.01	0.18±0.01	0.17±0.01	0.16±0.01
Atriplex	0.18±0.01	0.17±0.01	0.19±0.01	0.18±0.01	0.16±0.01	0.16±0.01
Cassava	0.17±0.01	0.17±0.01	0.20±0.01	0.19±0.01	0.18±0.01	0.17±0.01
			P^{H} Value			
Hay	6.68^{b}±0.02	6.67^{c}±0.01	6.58^{b}±0.02	6.59±0.09	6.60^{b}±0.02	6.61^{c}±0.02
Acacia	6.72^{a}±0.01	6.71^{b}±0.01	6.72^{a}±0.01	6.77±0.01	6.78^{a}±0.02	6.81^{a}±0.02
Atriplex	6.72^{a}±0.01	6.79^{a}±0.02	6.73^{a}±0.01	6.71±0.01	6.74^{a}±0.02	6.77^{a}±0.02
Cassava	6.62^{c}±0.01	6.61^{d}±0.01	6.60^{b}±0.01	6.62±0.01	6.65^{b}±0.02	6.69^{b}±0.01
			Density (g/cm^3)			
Hay	32.72^{c}±0.02	32.60^{d}±0.01	33.35^{c}±0.02	33.34^{b}±0.01	30.44^{d}±0.02	32.34^{d}±0.01
Acacia	36.27^{a}±0.01	34.04^{b}±0.01	34.34^{a}±0.01	33.59^{a}±0.01	32.09^{c}±0.02	35.13^{a}±0.02
Atriplex	35.90^{b}±0.01	34.62^{a}±0.01	34.26^{a}±0.01	32.84^{c}±0.01	34.54^{a}±0.01	34.34^{b}±0.01
Cassava	30.47^{d}±0.01	33.93^{c}±0.01	34.25^{b}±0.02	32.69^{d}±0.01	33.04^{b}±0.02	34.11^{c}±0.01
			Frozen Point (ºC)			
Hay	-0.57^{b}±0.01	- 0.58^{b}±0.01	- 0.58±0.01	-0.59^{ab}±0.01	- 0.60±0.01	- 0.61±0.01
Acacia	- 0.60^{c}±0.01	- 0.59^{b}±0.01	- 0.61±0.01	- 0.62^{b}±0.01	- 0.61±0.01	- 0.61±0.01
Atriplex	- 0.61^{c}±0.01	- 0.64^{c}±0.01	- 0.61±0.02	-0.60^{ab}±0.01	- 0.62±0.01	- 0.61±0.01
Cassava	- 0.52^{a}±0.01	- 0.49^{a}±0.02	- 0.63±0.01	- 0.57^{a}±0.02	- 0.59±0.02	- 0.61±0.01

a ,b , c and d: Means denoted within the same column with different superscripts are significantly(P<0.05) different.

Milk Mineral Concentrations:

Minerals play an important role in the synthesis of some types of vital components, e.g.hormones and enzymes, in the animal health and aid well in the performance of much of physiological reactions during the metabolism process.Table (4) summarizes the results of feeding halophytic forage shrubs on the mineral concentrations in milk of Barki ewes. Feeding by Acacia or Atriplex or Cassava, as a substitute to Berseem hay (BH) increased of the concentrations of the most of minerals in the resultantmilk.type of feed (halophytic plants) has remarkable effect on minerals content. (Atriplex) treatment was accompanied by high level of Ca and P. Calcium and phosphorus content were affected significantly (P<0.05) by dietary treatment, being higher significantly (P<0.05) in milk of ewes fed on (Atriplex) than in the other treatments, at all lactation weeks. The differences were found significantly (P<0.05) between (Acacia) and (Hay) and (Cassava), at all lactation weeks. No significant different of calcium content between (Hay) and (Cassava), except in the 6^{th} and 7^{th} weeks . Data also revealed that no significant differences of phosphorus content were observed between (Acacia and Cassava), and between them and Hay , at all lactation weeks. These results are in line with findings by Hassan, (2009) and Rincon *et al*, (1994). In addition, Renner (1982) reported that minerals contents of sheep milk seem to be very much higher than those of cow milk due to differences in feeding systems and seasons of the years. Moreover, these results were in agreement with Bayoumi, (1990) who found that the halophytic plants contained higher level of Na, K, Ca.

The treatments effect on macro-elements (Ca, P, Na and K) in the experimental groups were found higher than that of (BH) treatment. Contrarily , the treatment effects on micro-elements (Fe, Mn and Zn)varied, so it were higher in (BH) treatment than in the rest groups , with the exception of (Zn) concentrationin (Cassava) treatment and Cu in(Acacia) group . Manganese concentration was found lower in (BH) treatment than in the other treatments.Ewes which fed on (Atriplex) had the highest effect for all of the examined macro elements (Ca, P, Na, and K) than the other 2 groups or the (BH) treatment, being2.66,0.88 g/L, 0.55 and 2.15 mm/L respectively. On the other hand, there were no marked variations (p >0.05) among experimental groups in (Na and K) concentrations, with the exception of treatment effect of (Atriplex) , compared to (BH). Results also, show that concentrations of micro-elements (Mn,Zn, and Cu) decreased in (Atriplex) treatment than in the other groups.With regard to concentrations of (Fe) feeding on halophytic forage shrubs did not increase their concentrations in milk, compared to (BH). Treatment effect of (Fe and Cu) concentrations indicated significant difference, compared with (BH),In contrast no significant differences were recorded for (Zn) concentrations. Increasing of the mineral concentrations of (Ca and K), and decrease of (Fe) in the present study were agreed with the results obtained by (Chadwick *et al*, 2009) who reported that ewes grazing on saltbush had higher total mineral contents in their milk than pasture fed ewes, with higher concentrations of (K and P), and lower of (Fe).In contrast, feeding on halophytic forage shrubs increased slightly the level of (Na) in milkand this result disagreed with that obtained byAbbeddou *et al*, (2001). Moreover, milk of camel fed on (Atriplex) diet had higher (P< 0.05) concentrations of (Na, K and Ca) than camels fed on Berseem Hay (BH) diet (Shawket and Ibrahim, 2012) which agreed with our results

Antioxidant compounds:

Results shown in Table (5) revealed significant differences (P≤0.05) among the different experimental groups. The phenol compounds were higher in ewe's milk and its whey and curd when ewes fed on halophytic plants (Atriplex, Acacia and Cassava) compared with ewes fed on Hay (control). The high level of phenols in milk of previous treatments was due to the influence of nutritional composition of forages from halophytic plants. These results agree with Mario, *et al*., (2010)) who indicated that the polyphenol content in the cheese extracts were affected by animal feeding. Also The presence of phenolic compounds in the milk and later in the cheese is a result of their transfer from plant to milk.According to Hilario *et al*. (2010). The present results , also,show differences in contents of total phenolic compounds between milk treatments of Atriplex,Acaciaand Cassava, where the ewes fed on (Cassava) attained the highest content of14.336 mg/100 ml. , while the lowestone was for (Atriplex) of 13.625 mg/ 100 ml. Flavonoids in milk , curd and whey of ewes fed on halophytic plants were found higher than that in the control (Hay) and were highest in (Acacia) milk , curd and whey being (0.147 mg /100ml.) , (0.577 mg /100 g and 0.056 mg /100ml.) , in order . This was probably due to the diet which is rich in flavonoid compounds coming from the vegetation grazed by ewes. Moreover , (Mario,*et al*., (2010))found that animal feeding system, grazing management represent a better option for indoor feeding to produce a health profile of bioactive compounds, providing an increase of (total polyphenol, hydroxyl-cinnamic acids and flavonoid)concentrations. Our results showed, also, insignificant effect between (Atriplex and Cassava) treatments in flavonoids content of ewes milk and its whey (P≤0.05),. There were significant differences in flavonoid contents in ewes milk curd between different treatments, and values were 0.508, 0.577, 0.541 and 0.529mg/100g. Results, inaddition, showed a significant effect on carotenoids content among different treatments of ewes milk and its whey and curd. Carotenoids content of ewes milk depending on its dietary source. These results agree with Noziere, *et al*. (2006)who found that milk concentration of β-carotiene depends on its dietary supply. The values of carotenoids in ewes milk and its whey and curd fed on (Hay or Acacia orAtriplex, and Cassava) were (0.073, 0.087, 0.095and 0.094) , (0.012 , 0.030 , 0.072and 0.033)mg/100ml. , 0.281, 0.302 , 0.302and, 0.339 mg/100g. respectively, and it was higher in the curd, due to the presence of retinol and carotenoids in the original milk are recovered in the curd during cheese manufacturing according to (Hartman and Dyrden, 1965). Data in the same Table indicate that tannins content of ewe's milk were affected by animal feeding (P≤0.05). Ewes fed on halophytic forages characterized with lowest levels in milk fed on (Hay) (0.020) mg/100ml., while the highest tannins content was to ewes fed on(Cassava) forages (0.054) mg/100ml., Values of tannins in curd were higher than that in milk and whey. These results were coincided with Patra and Saxana,(2011) who indicated that the tannins share an affinity to bind proteins in and to a lesser extent with metal ions,amino acids and carbohydrate in aqueous solution._Total anti- oxidant compounds were found higher in curd followed by milk and whey , of all experimental groups , in order .

Table 4. Minerals contents (mean ± S.E.) in milk of Barki ewes fed on halophytic plants, during suckling period.

Treatments	Suckling week	Minerals								
		Macro				Micro				
		Ca g/L	P g/L	Na mm/L	K mm/L	Fe mg/l	Mn mg/l	Mg mg/l	Zn mg/l	Cu mg/l
Hay	2nd	0.47^{c}	0.30^{c}	0.33^{b}	1.77^{b}	2.67^{a}	0.042^{b}	0.087^{c}	1.390^{c}	0.007^{b}
		±0.01	±0.03	±0.01	±0.02	±0.06	±0.001	±0.062	±0.121	±0.005
	3rd	0.44^{c}	0.33^{d}	0.36^{b}	1.82^{b}	2.27^{a}	0.041^{a}	0.110^{c}	1.382^{bc}	0.031^{b}
		±0.02	±0.02	±0.02	±0.03	±0.02	±0.001	±0.095	±0.095	±0.008
	4th	0.40^{c}	0.35^{d}	0.44^{a}	1.90^{a}	2.53^{a}	0.056^{a}	0.120^{b}	1.900^{a}	0.059^{a}
		±0.2	±0.02	±0.04	±0.04	±0.05	±0.0111	±0.067	±0.132	±0.008
	5th	0.38^{c}	0.38^{c}	0.51^{a}	1.95^{a}	1.88^{a}	0.038^{a}	0.150^{b}	1.268^{b}	0.058^{a}
		±0.02	±0.03	±0.04	±0.03	±0.05	±0.003	±0.026	±0.086	±0.015
	6th	0.37^{d}	0.39^{c}	0.56^{a}	1.99^{c}	1.80^{a}	0.042^{ab}	0.180^{b}	1.457^{a}	0.060^{a}
		±0.01	±0.02	±0.03	±0.02	±0.08	±0.004	±0.092	±0.087	±0.006
	7th	0.35^{d}	0.42^{c}	0.60^{a}	2.02^{b}	1.60^{a}	0.053^{a}	0.193^{b}	1.677^{a}	0.061^{a}
		±0.02	±0.02	±0.02	±0.03	±0.09	±0.011	±0.070	±0.054	±0.009
	Treatment effect	0.40^{d}	0.36^{c}	0.47^{b}	1.90^{b}	2.13^{a}	0.045^{a}	0.140^{b}	1.512^{a}	0.046^{a}
		±0.01	±0.01	±0.03	±0.02	±0.09	±0.033	±0.027	±0.062	±0.006
Acacia	2nd	1.51^{b}	0.39^{bc}	0.36^{b}	1.82^{b}	0.84	0.045^{a}	0.170^{b}	2.520^{a}	0.082^{a}
		±0.24	±0.01	±0.02	±0.02	^{d}±0.01	±0.001	±0.060	±0.061	±0.016
	3rd	1.64^{b}	0.46^{c}	0.040^{b}	1.84^{b}	1.03	0.040^{a}	0.180^{b}	1.726^{a}	0.065^{a}
		±0.20	±0.01	±0.02	±0.02	^{c}±0.02	±0.001	±0.056	±0.008	±0.018
	4th	1.73^{b}	0.57^{b}	0.46^{a}	1.94^{a}	1.55^{b}	0.54^{a}	0.190^{b}	1.437^{bc}	0.045^{a}
		±0.109	±0.01	±0.03	±0.03	±0.03	±0.006	±0.115	±0.041	±0.004
	5th	1.75^{b}	0.66^{b}	0.55^{a}	1.98^{a}	1.21^{d}	0.042^{a}	0.200^{b}	0.931^{c}	0.049^{a}
		±0.2	±0.02	±0.03	±0.02	±0.03	±0.005	±0.165	±0.056	±0.018
	6th	1.85^{b}	0.78^{b}	0.59^{a}	2.01^{c}	1.36^{b}	0.026^{bc}	0.220^{b}	0.849^{b}	0.042^{a}
		±0.18	±0.02	±0.02	±0.03	±0.05	±0.004	±0.075	±0.042	±0.012
	7th	2.01^{b}	0.93^{b}	0.63^{a}	2.10^{ab}	1.64^{a}	0.031^{a}	0.200^{b}	1.213^{b}	0.034^{b}
		±0.14	±0.03	±0.02	±0.02	±0.15	±0.006	±0.124	±0.058	±0.003
	Treatment effect	1.57^{b}	0.62^{b}	0.50^{ab}	1.95^{b}	1.27^{c}	0039^{a}	0.193^{b}	1.446^{a}	0.053^{a}
		±0.08	±0.04	±0.03	±0.03	±0.07	±0.003	±0.037	±0.138	±0.008
Atriplex	2nd	2.57^{a}	0.78^{a}	0.045^{a}	1.90^{a}	1.08^{b}	0.015^{d}	0.250^{a}	1.253^{d}	0.006^{b}
		±0.01	±0.02	±0.02	±0.02	±0.01	±0.001	±0.006	±0.114	±0.005
	3rd	2.60^{a}	0.81^{a}	0.48^{a}	1.95^{a}	1.31^{b}	0.025^{c}	0.280^{a}	1.240^{c}	0.012^{d}
		±0.20	±0.01	±0.02	±0.03	±0.1	±0.001	±0.012	±0.109	±0.001
	4th	2.47^{a}	0.86^{a}	0.51^{a}	1.97^{a}	1.65^{b}	0.078^{a}	0.310^{a}	1.328^{c}	0.043^{a}
		±0.16	±0.02	±0.01	±0.03	±0.06	±0.008	±0.017	±0.067	±0.006
	5th	2.73^{a}	0.91^{a}	0.58^{a}	2.02^{a}	1.57^{c}	0.038^{a}	0.330^{a}	1.227^{b}	0.017^{c}
		±0.04	±0.02	±0.01	±0.03	±0.03	±0.004	±0.012	±0.061	±0.009
	6th	2.77^{a}	0.94^{a}	0.63^{a}	2.90^{a}	1.81^{a}	0.030^{c}	0.330^{a}	1.502^{a}	0.015^{b}
		±0.03	±0.03	±0.02	±0.03	±0.05	±0.004b	±0.017	±0.015	±0.003
	7th	2.82^{a}	0.99^{a}	0.65^{a}	2.13^{a}	1.78^{a}	0.032^{a}	0.340^{a}	1.783^{a}	0.022^{b}
		±0.03	±0.04	±0.03	±0.03	±0.11	±0.006	±0.012	±0.108	±0.013
	Treatment effect	2.66^{a}	0.88^{a}	0.55^{a}	2.15^{a}	1.54^{b}	0.036^{a}	0.307^{a}	1.389^{a}	0.019^{b}
		±0.04	±0.02	±0.02	±0.08	±0.07	±0.005	±0.043	±0.057	±0.004
Cassava	2nd	0.54^{c}	0.55^{b}	0.34	1.93^{a}	0.97^{c}	0.022^{c}	0.110^{c}	1.574^{b}	0.007^{b}
		±0.02	±0.12	^{b}±0.02	±0.01	±0.01	±0.001	±0.095	±0.177	±0.006
	3rd	0.59^{c}	0.54^{b}	0.38^{b}	1.96^{a}	1.34^{b}	0.32^{b}	0.110^{c}	1.521^{b}	0.017^{c}
		±0.02	±0.03	±0.02	±0.02	±0.01	±0.001	±0.046	±0.176	±0.007
	4th	0.64^{c}	0.63^{b}	0.64^{a}	1.99^{a}	1.75^{b}	0.057^{a}	0.140^{b}	1.617^{b}	0.057^{a}
		±0.02	±0.03	±0.03	±0.02	±0.09	±0.003	±0.067	±0.029	±0.018
	5th	0.71^{c}	0.74^{b}	0.55^{a}	2.04^{a}	1.72^{b}	0.041^{a}	0.170^{b}	1.463^{a}	0.029^{b}
		±0.03	±0.05	±0.03	±0.02	±0.02	±0.002	±0.051	±0.020	±0.010
	6th	0.80^{c}	0.80^{ab}	0.059^{a}	2.11^{b}	1.79^{a}	0.0470^{a}	0.200^{b}	1.627^{a}	0.036^{ab}
		±0.02	±0.004	±0.05	±0.03	±0.11	±0.005	±0.068	±0.177	±0.006
	7th	0.93^{c}	0.90^{ab}	0.62^{a}	2.15^{a}	1.62^{a}	0.048^{a}	0.210^{b}	1.667^{a}	0.039^{b}
		±0.02	±0.04	±0.06	±0.03	±0.13	±0.004	±0.114	±0.097	±0.010
	Treatment effect	0.70^{c}	0.70^{ab}	0.49^{ab}	2.03^{ab}	1.53^{b}	0.041^{a}	0.157^{b}	1.578^{a}	0.031^{b}
		±0.03	±0.04	±0.03	±0.02	±0.08	±0.003	±0.028	±0.048	±0.005

a, b , c and d: Means denoted within the same column with different superscripts are significantly($P<0.05$) different.

Table 5. Anti-oxidants concentrations in ewes milk,curd and whey in the experimental groups fed on halophytic plants , during the suckling period.

Items	Experimental groups			
	Hay	Acacia	A triplex	Cassava
	Anti-oxidants concentrations in ewes milk (mg/100ml.)			
Phenols	12.854^{c}±0.61	14.203^{a}±0.0113	13.625^{b}±0.096	14.336^{a}±0.105
Flavonoids	0.129^{b}±0.003	0.147^{a}±0.007	0.140^{ab}±0.004	0.135^{ab}±0.002
Carotenoids	0.073^{c}±0.003	0.087^{b}±0.002	0.095^{a}±0.003	0.094^{a}±0.001
Tannins	0.020^{b}±0.009	0.045^{ab}±0.006	0.046^{ab}±0.002	0.0541^{a}±0.013
Total Anti-oxidant compounds	13.076^{c}±0.057	14.482^{a}±0.125	13.906^{b}±0.104	14.619^{a}±0.111
	Anti-oxidants concentrations in curd of ewes milk (mg/100g)			
Phenols	50.951^{d}±0.011	54.653^{b}±0.046	54.653^{c}±0.089	57.082^{a}±0.017
Flavonoids	0.508^{d}±0.001	0.577^{a}±0.003	0.541^{b}±0.003	0.529^{c}±0.001
Carotenoids	0.281^{c}±0.006	0.302^{b}±0.007	0.302^{b}±0.007	0.339^{a}±0.011
Tannins	0.072^{a}±0.04	0.170^{a}±0.040	0.150^{a}±0.035	0.180^{a}±0.034
Total Antioxidant Compounds	51.812^{d}±0.116	55.702^{b}±0.044	55.646^{c}±0.047	58.130^{a}±0.054
	Anti-oxidants concentrations in whey of ewes milk (mg/100ml.)			
Phenols	4.954^{b}±0.031	5.410^{a}±0.122	5.010^{b}±0.046	5.201^{ab}±0.111
Flavonoids	0.049^{a}±0.011	0.056^{a}±0.002	0.052^{a}±0.015	0.051^{a}±0.016
Carotenoids	0.012^{b}±0.004	0.030^{b}±0.006	0.072^{a}±0.018	0.033^{b}±0.001
Tannins	0.007^{a}±0.001	0.012^{a}±0.002	0.009^{a}±0.003	0.011^{a}±0.002
Total Anti-oxidant compounds	5.022^{a}±0.034	5.508^{b}±0.127	5.143^{a}±0.051	5.296^{ab}±0.115

a,b,c and d:Means denoted within the same Row with different superscripts are significantly($p<0.05$) different at ($p<0.05$).

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تاثير تغذية النعاج البرقى على بعض النباتات التى تنمو فى الأراضى الملحية على تركيب اللبنومحتواه من المعادن ومضادات الاكسدة

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تم فى هذا البحث دراسة أثر تغذية النعاج البرقي التى عمرها من 3 : 4 سنوات والمقسمة لأربع مجموعات متساويةكل مجموعة تتكون من 10 حيوانات يتراوح وزنها بين (45.2± 0.47 كجم/ حيوان) لمدة 7 اسابيع بعد الولادة على كل من الاكاسيا ، الاتربلكس ، الكاسافاوالمنزرعة في أرض ملحية و ذلك على محصول اللبن الناتج ، التركيب الكيماوىوالمحتوي من العناصر المعدنية و المركبات المضادة للاكسدة فى اللبن الناتج . وتم تغذية النعاج فى عينة المقارنة على العليقة التقليدية (60% عليقة مركزة ، 10% قش الارز ، 30% برسيم مجفف) واستبدال نسبة البرسيم المجفف فقط بأوراق وسيقان النباتات السابق ذكرها كل علي حده في المعاملات الثلاثة واظهرت النتائج ما يلي :* كانت كمية اللبن الناتجة من عينة المقارنة اقل منالاكاسياوالكاسافا واعلي من معاملة الاتربلكس. *كان التركيب الكيماوى للبن الناتج في معظم المعاملات افضل من نظيرة فى لبن عينة المقارنة طوال مدة الحلابة .* لوحظ نفس الاتجاة فى قيم العناصر المعدنية الكبرى ....فى حين كانت قيم العناصر المعدنية الصغرى متباينة فى جميع المعاملات بما فيها عينة المقارنة.* لوحظ في الاسبوع الأخير أن % للدهن كانت الأعلي في معاملة (المقارنة) وأقل نسبة في الكاسافا– أما اللاكتوز فكانت نسبته الأعلي في الأكاسيا وأقل نسبة سجلها في معاملة الكاسافا– بينما كانت نسبة البروتين الاعلي في الاتربلكسوالأكاسيا وأقل في معاملتيالكاسافا والمقارنة .* لوحظ أن محتوي اللبن من الجوامد الكلية كانت أعلي قيمة له في المقارنة وكانت أقل قيمة في الكاسافا– أما الرماد كانت أعلي قيمة له في معاملة الأتربلكس (0.96%) وأقل قيمة له كانت في المقارنة.* تراوحت الحموضة بين المعاملات الاربعة من(0.16 – 0.20%) وقيم ال pH بين (6.58 , 6.81).* كانت قيم الوزن النوعى (الكثافة) الاقل فى عينة المقارنة عن باقى المعاملات طوال فترة الحلابة ماعدا معاملة الكاسافا.* كانت نقطة التجمد بين جميع المعاملات متقاربة وبلغت 0.61 - بعد 7 اسابيع .* سجلت عينة المقارنة اقل القيم للمركبات المضادة للاكسدة فى حين احتوى اللبن الناتج من معاملة الكاسافا على اعلى القيم يليها معاملة الاكاسيا ثم الاتربلكس طوال مدة الحلابة .* وقد أظهرت النتائج تأثير عمليات التصنيع متمثلة في تجبن اللبن علي توزيع مضادات الاكسدة بين كل من الخثرة والشرش – فقد وجد انها تركزت في الخثرة عن الشرش وكانت اعلي في المعاملات المغذاة علي الشجيرات الملحية عن المقارنة – وأعلاها في الخثرة الناتجة من معاملة الكاسافا يليها معاملة الاكاسيا ثم الاتربلكس * من هذه الدراسة يتبين اهمية التغذية علي النباتات الملحية عن الدريس- وزيادة ملحوظة في كل من الاملاح المعدنية الهامة - وايضا مضادات الاكسدة والتي تعكس اثرها علي صحة الانسان والحملان الصغيرة.