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Effect of Tannin Protected Sunflower Meal without or with Chamomile Flowers Supplementation on Productive Performance of Zaraibi Dairy Goats and their Offspring

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ABSTRACT

This study aimed to investigate the effect of treated sunflower meal with 2% condensed tannins (Quebracho tannins, QT; Unitan, Argentina) or/and Chamomile Flowers supplementation on productive performance of Zaraibi dairy goats and their offspring. A feeding trial was conducted using twenty pregnant goats at the 3rd and 4th parities and initial body weight 35.55 ± 0.62 kg at the last month before parturition and lasted for 90 days after parturition. Animals were divided into four similar groups (n=5does/each) using the randomized complete block design. Goats were fed concentrate feed mixture (CFM) to cover 50% of their requirements according to NRC (1985) for goats and rice straw (RS) was given by 150 g/head/day; while berseem was given at ad-libitum. Group G1 (control) received CFM contained untreated sunflower meal, while group G2 fed CFM contained untreated sunflower meal and supplemented with 0.25% Chamomile Flowers (Ch-F) and G3 fed CFM contained treated sunflower meal with 2% tannin (Quebracho) and G4 fed CFM contained treated sunflower meal with 2% tannin (Quebracho) and supplemented with 0.25% (Ch-F) on DM basis. Results indicated that digestibility of most nutrients and feeding values were significantly higher ($P<0.05$) with G2 than those of other groups. While, digestibility of CP was significantly higher ($P<0.05$) for all tested groups than that of control one. Ruminal ammonia-N and total volatile fatty acids concentrations were lower significantly ($P<0.05$) in G3 and G4 than G1 and G2. Daily milk yield was significantly ($P<0.05$) higher with G4 over the whole experimental period than that of control and insignificant higher than the other tested rations . Meantime, the improvement in 4% fat corrected milk yield being 124, 110 and 103% for G4, G3 and G2 compared to that of G1 over the whole experimental period. Milk constituent contents did not significantly affected by dietary treatments despite there were slightly increases in milk constituents with G4 ration in comparison with the other treatments. Also, feed conversion as kg DMI, TDNI or DCPI per kg milk improved for G4 in comparison of other groups. Economic efficiency of G4 recorded the best one among the experimental treatments and increased by 21.18% based on control ration (G1). Also, G4 revealed significant ($P<0.05$) positive effect on final weight, total and daily weight gains for kids during suckling period. No deleterious effects on liver, kidney functions and general health of animals fed the manipulated rations. It could be concluded that the protection process of sunflower meal with 2% QT and supplemented with 0.25% Chamomile Flower (G4) was more beneficially effective on Zaraibi dairy goats performance and economic efficiency.

Keywords: Zaraibi goats, sunflower meal, Chamomile flowers, digestibility, rumen parameters, milk yield, blood parameters, economic efficiency.

INTRODUCTION

Sunflower meal is the fourth largest source of protein supplement behind soybean, Cottonseed, and canola meals (Hesley, 1994). It is an excellent livestock feed, especially for ruminants (Nishino *et al.,* 1980), and can be used as the sole source of protein for milk production in dairy rations (Lardy and Anderson, 2002). It has been received as more economical source of protein and energy in ruminant nutrition (Jabbar *et al.,* 2006 and Yunus *et al.,* 2004) and also sunflower meal contains an excellent level of methionine, tryptophan and arginine, but low level of lysine (Delic *et al.,* 1983). Sunflower meal have working as high-protein supplement and it contains 30-46 % CP, 13-15 % CF, 9-12 Mj ME, NDF 47 % and EE 1.5 % (Irshaid *et al.,* 2003). In addition this protein source is considering as an excellent source of essential fatty acids, vitamins and minerals and beside of all these sunflower meal advantages, it has more degradable protein in the rumen (74%) than SBM (66%) or canola meal (68%) (NRC, 1996). Various treatments (Owens and Zinn, 1988) such as heating (Stern *et al.,* 1985) and formaldehyde treatments (Hussein, 2008) have been used to protect proteins from rumen degradation and thereby to provide by-pass protein to the lower gut. However, these treatments may impair the subsequent intestinal availability of some amino acids, notably lysine, cysteine, tyrosine and leucine (Schonhusen *et al.,* 1986). It is therefore essential to explore alternative protection of protein to improve protein utilization and animal productivity.

Tannins have been widely used as an effective method for protein protection in ruminant animals. Tannins are performing as a complex group of polyphenolic compounds which classified into two classes of hydrolysable tannins and condensed tannins where they reducing protein degradation by forming the protein-tannin complex and increases the availability of feed proteins for digestion and more amino acids are absorbed post-ruminally (Makkar, 2003; Min *et al.,* 2003 and Frutos *et al.,* 2004) and also reduced ruminal methane production that reflect positively on dietary protein utilization (Goel and makkar, 2012).

Recently, medicinal herbs and plants can be used as feed additives to improve immunity and performance parameters (Abdel-Galil, 2007). Chamomile Flowers are used in cure a various diseases in human. It has been used as an herbal medication since ancient times and still popular today and probably will continue to be used in the future because it contains various effective substances like Azule (cynaroside, luteolin, umbeliferone) and herniarin as anti-flammatory, wound healing, antiseptic, spasmolytic, appetizer, blood circulatory stimulant (Mericili, 1990) and bioactive phytochemicals that could provide therapeutic effects. Chamomile can help in improving cardiovascular conditions, stimulate immune system and provide some protection against cancer (Srivastava, *et al.,* 2010), and improve the health and milk production and performance of animal (El-Saadany and Mostafa, 1999).

The objective of this work was to study the effect of using protected protein (sunflower meal) with Quebracho tannins (2%) in rations of lactating Zaraibi goats without or with Chamomile Flowers herb on nutrient digestibility, feeding values, rumen parameters, milk yield and its composition, blood parameters, feed and economic

efficiency of lactating goats as well as their suckling kids performance.

MATERIALS AND METHODS

This work was conducted at Sakha Animal Production Research Station, Kafer El-Sheikh Governorate belonging to Animal Production Research Institute (APRI), Agricultural Research Center, Ministry of Agriculture, Egypt, to investigate the effect of using protected protein of sunflower meal by Quebracho tannins (2%) in rations of lactating Zaraibi goats without or with Chamomile Flowers (Ch-F) herb on productive performance of lactating goats and their suckling kids.

Animals and feeding trial:

Twenty Zaraibi goats at the last month of gestation, 3rd and 4th parities and an average of 35.55 ± 0.62 kg LBW were divided into four similar groups (5 does per each) using randomized complete block design. The experimental period lasted 120 days; 30 days pre-partum and continued by 90 days post-partum (lactation period). Feeding requirements were adjusted biweekly according to weight changes and milk yield. Goats were fed by grouping regime on a basal ration where concentrate feed mixture (CFM) was represented by 50% of the requirements according to NRC (1985) and rice straw (RS) was given by150 g/head/day; while berseem was given at *ad-libitum* level. Animals were randomly assigned to receive one of the dietary treatments as following: Group G1 (control) received CFM contained untreated sunflower meal, while group G2 fed CFM contained untreated sunflower meal and supplemented with 0.25% Chamomile Flowers (Ch-F) and G3 fed CFM contained treated sunflower meal with 2% tannin (Quebracho) and G4 fed CFM contained treated sunflower meal with 2% tannin (Quebracho) and supplemented with 0.25% (Ch-F) on DM basis. The experimental goats were in good health conditions and free from internal and external parasites and kept in pens at similar conditions. Water was available for animals throughout the experimental period. The CFM formulation are illustrated in Table (1) for experimental treatments.

Table 1. Formulation of different concentrate feed mixtures of experimental rations.

Ingredients (%)	CFM1	CFM2	CFM3	CFM4
Yellow corn	40	40	40	40
Wheat bran	30	29.75	30	29.75
Untreated sunflower meal	24	24	-	-
Treated sunflower meal*	-	-	24	24
Chamomile Flowers**	-	0.25	-	0.25
Molasses	3	3	3	3
Common salt	1	1	1	1
Limestone	2	2	2	2
Total	100	100	100	100

* **Treated sunflower meal with 2% tannin (Quebracho).**

* * **Chamomile Flowers added at 0.25% by 60 mg/head/day according to El-Hosseiny *et al.* (2000).**

Methods of protein protection in sunflower meal:

Protein of sunflower meal used in CFM in the present study was protected by 2% condensed tannins (Quebracho tannins, QT, *Unitan, Argentina*) which represent the better economic level according to Khayyal and Ashmawy (2013) and Abo El-Fadel and Ashmawy (2015). Quebracho tannin was dissolved in a one little of warm water then mixed with sunflower meal and the treated sunflower meal was aerated before mixing with the other ingredients.

Digestibility trials and rumen liquor parameters:

At the end of the feeding trial, four digestibility trials were conducted simultaneously on the animals of the feeding trial (3does in each group) to determine the digestibility coefficients and feeding values of the experimental rations using Acid Insoluble Ash (AIA) method (Van Keulen and Young, 1977). Feces samples were taken two times daily with 12 hours interval for 5 days and composited for each animal and representative samples were taken and stored at -20 °C until analysis. Feces and fresh berseem were dried at 60 °C for 72 hours. Feed and feces samples were ground through 1 mm screen on a wiley mill grinder and about of 100 g of feed and feces samples were taken for analysis. The representative samples of feeds and feces were analysis for chemical composition according to A.O.A.C (2000). At the end of the digestibility trials, rumen liquor samples were taken from three does for each group using stomach tube before feeding (0 hr), 3 and 6 hr post feeding. The rumen liquor samples were strained through 3 layers of cheese-cloth and immediately determine pH using digital pH meter. Ammonia nitrogen (NH3-N) concentration were determined according to Conway (1957). Rumen liquor samples were kept in the deep freezer until the estimation of TVFA's according to Warner (1964).

Lactation period assessments:

After kidding, does and kids were weighed directly after 15 hr. and every two weeks over 90 days experimental period. Kids were weaned at 90 days of their age and isolated from their dams in separate pens after the second meal (15:00 hr) till the next day morning. Kids were daily separate than their mothers for 8 hr. then they weighed before and after suckling, in order to calculate milk weight by difference and then added to the amount of milk which completely hand milking until stripping, and milk yield was record biweekly. Individually, milk samples were taken for analysis of fat, protein, lactose, solids not fat and total solids by the automated infrared spectrophotometry (Foss 120 Milko-Scan, Foss Electric, Hillerød, Denmark) according to A.O.A.C. (1997) procedures. Fat corrected milk (FCM) for goats was calculated according to Mavrogenis and Papachristoforou (1988) equation, FCM for goat = milk yield (0.411 + 0.147*% fat). Feed conversion was calculated as the amount of DM, TDN or DCP units/ 1kg milk. Also, simple economical efficiency was calculated for the dietary treatments according to the prevailing prices of ingredients during the time of experimental work. Economic efficiency was expressed as the ratio between the input and the cost of output based on the price (LE/ton) during experiment.

Blood samples:

Blood samples were taken from juggler vein at the end of the experimental period from does and their kids. Samples were centrifuged at 3000 rpm for 20 min to obtain blood serum. The supernatant was frozen and stored at -20 °C for subsequent analysis. Serum total protein (TP) was determined according to Gornal et al. (1949). Serum albumin was determined according to Doumas et al. (1971) and serum urea was determined according to Fawcett and Scott (1960). Glucose was determined according to Tinder (1969), Serum Aspartate

(AST) and alanine (ALT) aminotransaminases activities were determined according to Reitman and Frankle (1957). The serum globulin (GL) was calculated by the differences (TP - AL).

Statistical analysis:

Data were analyzed using the general linear models procedure of SAS (2000) and data that expressed as percentage values were subjected to arc-sin transformation to approximate normal distribution before being analyzed and means were separated using Duncan's multiple range tests (Duncan, 1955) for the comparison among means of the experimental rations when the main effects were significant. The model used was:

$$YIJ = \mu + Ti + e\,ij$$

YIJ = the observation of ij, μ=overall mean of Yij , Ti=Effect of i (treatment), eij=the experimental random error.

RESULTS AND DISCUSSION

Chemical composition of experimental rations:

Data of chemical composition of berseem, rice straw and concentrate feed mixtures (CFM1, CFM2, CFM3 and CFM4) are presented in Table (2). The Ch-F were added to CFM2 and CFM4 at o.25 % (on DM basis), which equal to 60 mg/kg LBW of goats according to El-Hosseiny et al. (2000). Chemical composition of barseem and RS were within the normal values that widely recorded in the literature.

Table 2. Chemical composition of feed ingredients and experimental rations (% on DM basis).

Item	DM	OM	CP	CF	EE	NFE	Ash
Ingredients							
Berseem	15.50	87.53	14.20	26.24	1.30	45.79	12.47
RS	90.00	84.50	4.21	36.50	1.10	42.69	15.50
CFM1	90.51	92.11	16.34	8.51	3.53	63.73	7.89
CFM2	90.06	90.21	16.32	8.57	3.45	61.87	9.79
CFM3	89.56	94.42	16.44	8.43	3.66	65.89	5.58
CFM4	88.86	94.51	16.63	8.65	3.86	65.37	5.49
Experimental rations							
G1	30.81	89.56	14.34	18.25	2.41	54.56	10.44
G2	30.25	88.58	14.32	18.43	2.35	53.48	11.42
G3	32.27	90.87	14.39	17.85	2.53	56.11	9.13
G4	31.94	90.88	14.48	18.05	2.62	55.74	9.12

Results in Table (2) showed that chemical composition of the experimental rations seemed to be similar in all nutrients. This similarity of the main nutrients including in all experimental rations would be seemed that any significant effects among the dietary treatments could be due to treated for protection of tannin or addition of Chamomile Flowers. The protection by treated sunflower meal with 2% Quebracho tannin did not cause clear differences in the chemical composition among the experimental rations. These results are in agreement with those of Abo El-Fadel and Ashmawy (2015).

Feed intake:

Animals in the different groups were fed according to the group feeding system and the daily feed intake, total DM, TDNI and DCPI for the experimental rations are presented in Table (3). The results showed that DMI was nearly similar among treatments, being 1.433, 1.452, 1.355 and 1.357 kg for G1, G2, G3 and G4, respectively. The values of both TDN and DCP intakes behaved the same trend of total DM intake among the dietary treatments, however G2 was achieved the highest values intake which might be due to the favourite effect of Chamomile Flowers addition which lead to increased microbial population as showed in result of Wenke (2003).On the other hand, the lower of feed intake with G3 and G4 might be due to effect of Quebracho tannins treatment where tannins specially with the relatively high content may reduce feed intake by decreasing palatability due to astringent of tannins. Astringency is the sensation caused by the formation of complex substances between tannins and salivary glycoprotein's or through a direct reaction with the taste receptors, which gives an astringent or bitter sensation (Reed, 1995).The possible reason behind this may be due to the low ruminal degradation rate of feeds that slower the rate of passage and digestion leading to greater rumen fill and thereby decreasing DMI (Chizzotti *et al.,* 2005).

Table 3. Daily feed intake by goats in different experimental groups.

Item	Experimental groups			
	G1	G2	G3	G4
Feed intake as fed (Kg)				
CFM	0.80	0.80	0.80	0.80
Barseem	3.70	3.85	3.25	3.30
RS	0.15	0.15	0.15	0.15
As DM basis (Kg)				
Total DM /h/d	1.433	1.452	1.355	1.357
TDN /h/d	0.92	0.98	0.86	0.91
DCP /h/d	0.129	0.139	0.131	0.133

Digestibility and feeding values:

The date of digestibility coefficients and feeding values of the experimental rations are presented in Table (4). Results demonstrated that digestibility coefficients of most nutrients and feeding values (TDN & DCP %) were significant ($P<0.05$) higher with Ch-F ration (G2) than those of other groups. Otherwise, except digestibility of CP and DCP %, the other nutrient digestibilities and TDN value in G3 that received sunflower meal treated by 2% tannin seemed to be the lowest among the dietary treatments. While significant improvement were happened with all tested groups (G2, G3 and G4) regarding CP digestibility and DCP, in comparison of control one (G1). Regarding CF digestibility, its value was significantly lower with tannin-sunflower treatment (G3) and its combination with Ch-F in G4, than that of control one. These results are in agreement with those obtained by Abdelhamid *et al*. (2004) who concluded that most digestion

coefficients and feeding values were higher as a result of using Ch-F in diets of Rahmani sheep than those of control diet that free from this supplement. The positive effect of Ch-F on digestibility coefficients and feeding values might be due to the arise of digestive juice secretion (Abo El-Nor *et al.*, 2007) who evaluated the effect of diets containing Ch-F which stimulated the digestion efficiency either as microbial or chemical digestion all over the digestive tract. Also, Ch-F could be working as antimicrobial disease, against some pathogenic micro flora habitant in the rumen and to the chelating effect with heavy metals as lead (Rode, 1989) and antifungal and anti-flammatory (Abou Zaid, 1986 and Merrcili, 1990). The marked improvement in digestibility of CP in dietary treatment by tannin (G3 and G4) might be due to insolubility of dietary protein - tannin complex in order inhibit protein degradation through spontaneous binding of protein and make protein feed complex insoluble and unavailable to rumen digestive enzyme and will available in abomasum and digested in intestine, thus counteracting the benefits of by-pass dietary protein (reduced the rate of degradable protein) Min *et al.* (2005). On the other hand, the decreases in digestibility of most nutrients especially CF are in agreement with the explanation of Silanikove *et al.,* (2006) who found a negative effect of tannins in feed throughout binding with protein, carbohydrate and saliva protein and consequently inhibit microorganisms in the rumen and therefore these results illustrated the reduction of TDN in G3. Lastly there were somewhat positive effect specially in respect of DM and CP digestibility and consequently the feeding values (TDN and DCP %) with the combination of Tannin-Ch-F ration (G4) in comparison with G1.

Table 4. Digestibility coefficients and feeding values of rations used in feeding experimental groups.

Item	Experimental groups				MSE
	G1	G2	G3	G4	
Digestibility coefficients %					
DM	63.25^{c}	69.01^{a}	59.02^{d}	66.46^{b}	0.31
OM	69.79^{bc}	73.81^{a}	68.48^{c}	71.28^{b}	0.49
CP	63.00^{b}	66.94^{a}	67.29^{a}	67.67^{a}	0.51
CF	63.03^{b}	67.06^{a}	49.03^{d}	59.18^{c}	0.47
EE	63.84^{a}	65.41^{a}	49.61^{b}	69.67^{a}	2.20
NFE	74.10^{b}	78.35^{a}	75.81^{ab}	76.21^{ab}	0.80
Feeding values (DM %)					
TDN	64.02^{b}	67.30^{a}	63.79^{b}	68.01^{a}	0.42
DCP	8.95^{b}	9.59^{a}	9.68^{a}	9.99^{a}	0.07

a, b and c: means in the same row with different subscripts differed significantly (P<0.05).

Rumen parameters:

Ruminal pH values which presented in Table (5) was unaffected significantly by dietary treatments over zero sampling time, while on 3 or 6 hrs of sampling G3 had achieved the highest value of pH among the experimental treatments. Otherwise, the lowest values were recorded with G1 and G2. The ruminal pH values of the current study are within the normal range (5.50-7.30) that suggested by Hungate (1966). The highest pH value with G3 may be due to the low TVFA's concentration and the lowest pH value with G2 also was corresponding to increase its TVFA's concentration. Generally, ruminal pH and TVFA's concentration are inversely correlated (Phillipson , 1982). Ruminal TVFA's concentration was significant higher with Ch-F ration (G2) than that of other tested rations G3 and G4, while the concentration of TVFA's with Ch-F ration was insignificant higher than control one at 3 and 6 hrs sampling time. The value of TVFA's for G4 was higher than G3 due to Ch-F addition. Similar results were given by Maged (2011) who using diet supplemented by Ch-F for dairy Zaraibi goats. On the other hand, the decreases in digestibility of most nutrients especially CF led to decrease of TVFA's concentration where this correlation are in agreement with the finding of Silanikove *et al.* (2006).

Table 5. Rumen fermentation activity of goats in different experimental groups.

Item	Experimental groups				MSE
	G1	G2	G3	G4	
pH value					
0h	6.67	6.74	6.67	6.57	0.07
3h	5.67^{b}	5.48^{c}	6.07^{a}	5.76^{ab}	0.06
6h	5.97^{b}	5.98^{b}	6.44^{a}	6.33^{ab}	0.12
TVFA's meq/100 ml					
0h	7.13^{b}	7.67^{a}	5.67^{c}	6.80^{b}	0.15
3h	8.07^{ab}	8.47^{a}	6.40^{b}	7.40^{b}	0.21
6h	6.73^{ab}	7.40^{a}	5.40^{c}	6.40^{b}	0.27
NH_3-N mg/100 ml					
0h	30.80^{a}	30.80^{a}	25.20^{b}	28.00^{ab}	1.19
3h	44.33^{a}	45.27^{a}	35.80^{b}	39.40^{b}	1.40
6h	35.93^{b}	39.67^{a}	30.89^{c}	33.54^{c}	0.52

a, b and c: means in the same row with different subscripts differed significantly (P<0.05).

Results in Table (5) showed that ammonia concentration was significantly lower (P<0.05) in G3 and G4 than that of G1 and G2 being 35.8 and 39.40 *vs.* 44.33 and 45.27 mg/100 ml on 3 hrs sampling time, respectively. Similar trends of NH3-N concentration among treatments were observed respecting the other samples at 0 hrs or 6 hrs. Highest ammonia concentration in G2 might be due to Ch-F addition which lead to increasing microbial population as showed in the results of Shehata *et al.* (2007) who found that adding Ch-F to ration improved feed conversion, which might be accompanied by rapid metabolism of ruminal microbial protein in goat. But reduced NH3-N concentration in the rumen for G3 which accompanied by the decreases in digestibility of most nutrients especially CF that in turn led to decrease of TVFA's where those biological processes are in agreement with the finding of Silanikove *et al.* (2006) and Abdel-Moaty *et al.* (2010) who demonstrated that the decline in NH3- N concentration might be due to protection of protein which playing an important role to protect the protein from microbial degradation in the rumen and improve the by-pass properties of protein and which led to increase its digestibility post rumen, so increase amino acids available for growth and milk production. In addition, tannins mainly exert this effect on protein, but they also affect other feed components to different degrees (Kumar and Singh, 1984). Moreover, Min *et al.*(2005) concluded that condensed tannin reduced the rate of proteolysis and inhibited the growth of proteolytic rumen microorganism and there negative effects were correlated to the level of condensed tannin in the ration.

Blood parameters:

Data in Table (6) showed that serum total protein and its fractions are considered as a biological index reflecting health and performance of animal (Singh and Jha, 2009). Similarly, the trend of total protein and its fractions for both dams and kids was observed. The concentration of total protein in serum of dams and their kids in G4 was significantly (P<0.05) higher than those of G2 and G3 but, no significant differences were recorded between G1 and G4. This effect might be due to significant improvement that happened with G4 regarding CP digestibility and DCP, in comparison of groups G3, G2 and control one (G1). The increase in blood protein when goats fed protected protein may be due to improvement of rumen fermentation, digestation rate and subsequently absorption of nutrients (Bengaly *et al.,* 2007). Similar results were observed by Shehata *et al.* (2004) who found that serum protein concentration improved as a result of using some medicinal herbs in rations of dairy goats. The concentrations of albumin and globulin for dams and their kids were similar as that observed with total protein concentration but, without significant differences among the experimental groups. These results are in agreement with those of Bengaly *et al.* (2007) and Shehata *et al.* (2004).

The result of blood glucose concentration indicated that G2 had significant (P<0.05) highest value compared with other groups for dams and but, the glucose concentration with kids was only different significantly (P<0.05) between G2 and G3 with the highest value among treatments occurred with G2. This might be due to the addition (Ch-F) which can be enhance the TVFA's production throughout increasing the digestibility of nutrients especially CF and therefore finally arising the blood glucose in G2 ration. Similar results were given by Maged (2011) with using of Chamomile in diets of dairy Zaraibi goats. For this reason glucose concentration was higher with G4 that having the mixture of 2% tannin plus Ch-F than that as only tannin treatment (G3). In perspective, Makkar *et al.*(1988) who revealed that tannin depressed the digestibilities of all nutrients at the level of 5% of the diet and this depression in digestibilities associated with tannin might have been due to the formation of complexes between tannin and dietary protein and carbohydrates as well as reducing rumen microbial proteolysis, ureolytic and cellulolytic enzyme activities. On the other hand, the present results are in harmony with those found by Zeid *et al.*(2011) who revealed that Chamomile Flowers addition to the diet of sheep increased markedly the blood glucose concentration in comparison with the control one.

The result of blood AST indicated that G2 had significant (P<0.05) lower than that of other groups for dams and their kids and also, concentration of AST for G4 was slightly lower than that of G3 and this is greatly as result to Ch-F addition. Similarly, the trend was observed with ALT but the differences among dietary treatments did not significant. The AST and ALT values are within the normal range as reported by Maged (2011). These results indicated that Ch-F addition to lactating goats rations in G2 and G4 did not negatively affect liver activity or animal's health and similar results were given by Maged (2011) with using Chamomile in diets of dairy Zaraibi goats. While, tannin treatments in G3 and G4 led to increases of both concentration of AST and ALT and this seemed to be matching with the same trend given by serum total protein. These results are in agreement with those of (Bengaly *et al.,* 2007).

Table 6. Blood serum parameters of goats and kids in different experimental groups.

Item	Experimental groups				MSE
	G1	G2	G3	G4	
Dams					
Total protein(g)	7.61^{a}	7.43^{b}	7.42^{b}	7.67^{a}	0.20
Albumin (g/dl)	4.22	3.91	4.38	4.35	0.13
Globulin (g/dl)	3.39	3.52	3.04	3.32	0.33
Glucose (g/dl)	90.61^{b}	99.09^{a}	83.43^{c}	86.06^{c}	1.07
AST (IU/L)	37.28^{a}	33.97^{b}	39.86^{a}	38.50^{a}	0.95
ALT (IU/L)	26.92	26.26	27.07	26.42	0.55
Urea (mg/dl)	7.10^{a}	6.65^{b}	6.38^{b}	5.98^{c}	0.08
Kids					
Total protein(g)	7.76^{a}	7.61^{b}	7.57^{b}	7.82^{a}	0.18
Albumin (g/dl	4.31	3.98	4.48	4.44	0.06
Globulin (g/dl)	3.45	3.63	3.09	3.38	0.19
Glucose (g/dl)	78.58^{ab}	82.43^{a}	74.55^{b}	76.67^{ab}	1.81
AST (IU/L)	52.61^{ab}	47.63^{b}	57.15^{a}	55.90^{a}	2.28
ALT (IU/L)	28.62	28.17	29.56	28.23	0.45
Urea (mg/dl)	5.75^{a}	5.56^{a}	4.99^{b}	4.66^{b}	0.12

a, b and c: means in the same row with different subscripts differed significantly (P<0.05)

As for the concentration of urea for dams and their kids being the lowest in G4 and increased mostly significant (P<0.05) in G3 and G2 and reached to the highest value (P<0.05) with control ration (G1). The reduction of urea concentration for G4 might be due to effect of addition Ch-F on increasing microbial population which might be accompanied by rapid metabolism of ruminal microbial protein by rumen micro flora activity and to improve utilization from microbial protein (Pathak *et al.,* 2017).

While the reduction of urea concentration for G3 and G4 exactly due to protection of protein in which relatively great protein of dietary protein converted to undegradable (due to tannin action) and by-pass to the lower gut for enzymatic digestion. These results are in agreement with those obtained by (Pedreira *et al.,* 2013) who found a

negative effect of tannins in feed by inhibit protein degradation through spontaneous binding of protein and reduced the rate of degradable protein and will available in abomasum and digested in intestine, thus counteracting the benefits of by-pass dietary protein.

Milk yield and its composition:

Daily milk yield and its composition for lactating does in the different groups are presented in Table (7). Daily milk yield and 4% FCM yield were significantly higher ($P<0.05$) for G4 than those of control (G1), while those of both G3 and G2 were higher insignificantly than those of control (G1) that being have the lowest milk yield. The relative improvement of milk production of G4 (associative effect of protected protein and Ch-F) might be due to the healthy effect of herbal additives and the associated effect between acetate and succinate on rumen microflora which lead to an improvement of feed efficiency and milk production (Abo El-Nor and Kholif, 2005). Also, The values obtained are in agreement with those reported by Khayyal and Ashmawy (2013) and Abo EL-Fadel and Ashmawy (2015) who illustrated that inclusion protected protein in dairy animal's ration resulted in increasing milk yield. On the other hand, milk composition did not differ significantly affected ($P<0.05$) for most milk constituents (fat, protein, lactose, total solid), but solid not fat % was higher significant (8.28%) with G4 than that control (G1). Also, an improvements were observed for yield of fat, protein, lactose and total solids for all tested rations which might be largely due to the differences in milk yield. The addition of herbs could be increased the net energy of milk for dairy goat responding to higher OM digestibility, thus leading to an increase in milk yield.

The obtained results are in agreement with those of Allam *et al.,* (1999) who reported that Chamomile Flowers improved daily milk yield of goats by 10% compared to the control group and this might be due to one or more of the following reasons, 1) higher DMI and higher nutrient digestibilies and 2) increased rumen micro flora activities which lead to an improvement of feed efficiency, hence increase milk production. Also, medicinal plant seeds improved the productivity of lactating animals and its hormonal alert effect through increasing prolactin and growth hormone release, in addition to activating udder tissues in line with increasing glucose concentration (Abo El-Nor *et al.,* 2007 and Drackley *et al.,* 2001). However, the mechanism through which milk yield increased resulting from Chamomile Flowers supplementation may be due to the remarkable vasodilator action of chamomile essential oil, particularly bisabolol and bisabolol oxides, (Achterrath-Tuckermann *et al.,* 1980) where with the vasodilator action blood flow increased in blood vessels which normally supplies the mammary glands by all components required for milk production. Also, an increase in protected protein that reach to small intestine as well as microbial produced in the rumen and microbial protein which produced from increase the digestibility post rumen, all favorable biological processes can be increases the availability of amino acids for growth and milk production. Improving the digestion coefficients of most nutrients and feeding values with G4 responding to protected protein plus Ch-F was reflected on more milk yield produced by does fed such ration. These results are in agreement with Khayyal and Ashmawy (2013) and Abo EL-Fadel and Ashmawy (2015).

Table 7. Body weight, daily milk yield, milk composition and milk constituent's yield of goats in different experimental groups.

Item	Experimental groups				MSE
	G1	G2	G3	R4	
Body weight (Kg)	26.95^{c}	28.90^{ab}	30.90^{ab}	31.30^{a}	0.26
Daily milk yield (g/day)	919.00^{b}	973.43^{ab}	997.42^{ab}	1130.85^{a}	0.98
Daily 4% FCM yield (g/day)	789.74^{b}	809.33^{ab}	870.33^{ab}	986.76^{a}	0.93
Milk composition (%):					
Fat	3.05	2.86	3.14	3.14	0.14
Protein	2.57	2.65	2.71	2.88	0.03
Lactose	4.69	4.76	4.67	4.68	0.05
Total solid	10.88	10.98	11.22	11.34	0.16
Solid not fat	7.83^{b}	8.11^{ab}	8.06^{ab}	8.28^{a}	0.09
Ash	0.57	0.71	0.70	0.64	0.03
Milk constituents yield (g/day):					
Fat	28.07^{b}	27.73^{b}	31.17^{ab}	35.45^{a}	2.01
Protein	23.61^{b}	25.86^{b}	26.97^{b}	32.61^{a}	1.57
Lactose	43.14^{b}	46.34^{ab}	46.54^{ab}	52.97^{a}	3.00
Total solids	100.05^{b}	106.79^{b}	111.57^{ab}	128.16^{a}	6.59
Solid not fat	71.98^{b}	79.04^{ab}	80.24^{ab}	93.60^{a}	5.01

a, b and c: means value in the same row with different subscripts differed significantly ($P<0.05$).

Live body weight changes of lactating goats:

Data in Table (8) showed significant effects ($P<0.05$) of experimental rations on live body weights of does from kidding until the weaning. In general, body weight and its changes were sharply decreased by -6.6, -6.0, -4.4 and -4.0 kg for G1, G2, G3 and G4, respectively from Pre- kidding up to at kidding. The sharp decrease in body weight and gain results from kidding and removal of fetus and its attachments. Over the period from kidding to weaning body weight of does were increased gradually from 28.8, 29.8, 31.2 and 31.4 kg for G1, G2, G3 and G4, respectively at kidding to reach 31.2, 33.2, 35.6 and 36.0 kg, respectively at weaning. However, these changes in body weight were the highest ($P<0.05$) in G4, G3 and G2 than that of G1 (4.6, 4.4 and 3.4 *vs.* 2.4 kg, respectively) as observed in Table (8). Accordingly, in the present study, body weight and its

changes were sharply decreased to -3.6, -3.4, -2.5 and -2.2 kg for G1, G2, G3 and G4, respectively after kidding then gradually decreased up to 45 day of lactation and began to increase later that may be related to the stress of lactation and milk production (Table 8). These findings are in close agreement with those recorded by Kalbande and Thomas (1999) who also reported that higher levels of protected protein (2% tannins) reduced line weight loss in lactating jersey cows. It means that addition of protected protein plus Ch-F into the ration of goats in their early lactation phase could be alleviate the effect of negative energy balance that almost appeared in this critical period. Also, obtained results may be due to positive effect specially in respect of DM and CP digestibilities and also the feeding values (TDN and DCP) with the combination of Tannin- Ch-F (G4) in comparison with G1where it being attributed to higher nutrients digestibility and increased rumen micro flora activity which lead to improve utilization from nutrients hence an increase body weight and lower loss of body weight to recover body condition. These results are in agreement with Abo EL-Fadel and Ashmawy (2015) and Shehata *et al.* (2004) who using protected protein and Ch-F supplementation with Zaraibi goats in their rations during the late pregnancy and early lactation.

Table 8. Effect of feeding experimental rations on live body weight and change in body weight of lactating Goats during experimental period.

Item	Pre- kidding	At- kidding	Post- kidding				Change weaning – kidding
	LBW 30 d Initial	LBW 0 d kidding	Change 0 - Pre kidding	LBW 45d	Change 45d Post-kidding	LBW 90d weaning	
G1	35.4	28.8^{c}	$- 6.6^{a}$	25.2^{b}	$- 3.6^{a}$	31.2^{c}	$+ 2.4^{b}$
G2	35.8	29.8^{bc}	$- 6.0^{a}$	26.4^{b}	$- 3.4^{a}$	33.2^{b}	$+ 3.4^{ab}$
G3	35.6	31.2^{ab}	$- 4.4^{b}$	28.7^{a}	-2.5^{ab}	35.6^{a}	$+ 4.4^{a}$
G4	35.4	31.4^{a}	$- 4.0^{b}$	29.2^{a}	$- 2.2^{b}$	36.0^{a}	$+ 4.6^{a}$
MSE	0.61	0.46	0.38	0.50	0.22	0.57	0.41

a, b and c: means value in the same row with different subscripts differed significantly (P<0.05).

Birth weight and daily gain of kids:

Data of the birth weight, weaning weight and daily gain of kids during suckling period are presented in Table (9). The differences among treatments were significant (P<0.05), where birth weight were significantly higher with all tested rations than that of control one that recorded the lowest weight (2.69 kg). Meantime, no significant differences were observed (P<0.05) between G2 and G3 (2.79 and 2.93 kg) respectively. Does given ration treated with 2% tannin plus Ch-F in G4 showed highest values of birth weight as compared with the other rations and this might be due to the improvement of feed utilization and resulted in lower loss of body weight of dams during late-pregnancy period. This was in consistent with the results of Abo EL-Fadel and Ashmawy (2015) and EL-Hosseiny *et al.* (2000) who using protected protein and Ch-F with Zaraibi goats in their rations during the late pregnancy. Similarly, kids of G4 showed significantly (P<0.05) the highest total and daily gain (11.06 kg and 123 g) followed by G3 (9.97 kg and 111 g) and G2 (9.11 kg and 101 g), while G1 had the lowest values (8.51 kg and 95 g). These results are in accordance with those reported by Abo EL-Fadel and Ashmawy (2015) and EL-Hosseiny *et al.*, (2000) who using protected protein and Ch-F supplementation with Zaraibi goats in their rations.

Table 9. Body weight and daily gain of kids in different groups.

Item	Experimental groups				MSE
	G1	G2	G3	G4	
No. born kids	8	7	8	8	
Birth weight (kg)	2.69^{c}	2.79^{b}	2.93^{ab}	3.04^{a}	0.07
Weaning weight (kg)	11.20^{c}	11.9^{bc}	$12. 9^{b}$	14.1^{a}	0.37
Total gain (kg)	8.51^{c}	9.11^{bc}	9.97^{b}	11.06^{a}	0.24
Daily gain (g)	95^{c}	101^{bc}	111^{b}	123^{a}	0.31

a, b and c: means value in the same row with different subscripts differed significantly (P<0.05).

Feed conversion:

Data in Table (10) showed that including tannin treated sunflower meal and/or Chamomile Flowers in tested rations had improved the feed conversion in terms of kg DM, TDN and DCP / 1 kg milk as compared with control ration being the best feed conversion was associated with ration G4 that supplemented with mixture of tannin treated sunflower meal plus Ch-F followed by G3, G2 while G1 recorded the poorest one. These results are in agreement with those recorded by Amal AL-Kindi *et al*. (2016) and Shehata *et al.* (2004) who using protected protein (tannin treated sunflower meal) and Chamomile Flowers, with the ration of goats during the early lactation period where this treatment led to an improvement in feed conversion for G4 as DMI and CPI/milk yield reached to about 8.5 and 11.3%, respectively compared to control.

Economic efficiency:

It is of interest to observe that feed cost was the highest with G2 while, the G3 showed the lowest one. The net revenue was pronouncedly higher with G4 that including tannin treated sunflower meal plus Ch-F than the other rations. The economic efficiency was improved by 1.69, 10.17 and 21.18% with G2, G3 and G4 respectively as compared to control group. The improvement in economic efficiency for (G4) could be related to the high feed conversion efficiency, as well as to the positive associative effect of including tannin treated sunflower meal plus Ch-F on the feeding value, where this interaction are in matching with that reported by Wenke (2003); Abo EL-Fadel and Ashmawy (2015) and EL-Hosseiny *et al*. (2000). The current study confirmed that there is a positive relation between tannin treated sunflower meal plus Ch-F and economic efficiency that correspondingly increasing milk yield for does fed such ration. These results are confirmed by Wenke (2003); Abo EL-Fadel and Ashmawy (2015) and EL-Hosseiny *et al*. (2000) who reported that utilization of tannin treated protein or Chamomile Flowers addition led to support the farmer's income through produce more milk per animal to improve economic efficiency and increasing the net revenue as well.

Table 10. Feed conversion and economic efficiency (during total period, 90 days) for different groups.

Item	Experimental groups			
	G1	G2	G3	G4
Feed Conversion				
DM, kg /kg milk	1.56	1.49	1.36	1.20
TDN, Kg/ kg milk	1.01	1.01	0.86	0.81
DCP, Kg / kg milk	0.14	0.14	0.13	0.11
Economic Efficiency				
Daily feed cost (h/d) L.E.	2.72	2.83	2.68	2.77
Daily milk price (L.E.)	3.22	3.41	3.49	3.96
Net revenue [1], L.E./ head	0.50	0.58	0.81	1.19
Economic Efficiency [2]	1.18	1.20	1.30	1.43
Economic Improvement, %	-	1.69	10.17	21.18

Price of feedstuffs and supplementation: 2370 LE/Ton of Concentrate feed mixture (CFM), 217 L.E./Ton Berseem, 200 L.E./Ton of Rice straw, 36 L.E./kg Chamomile flowers, price of tannin=16 L.E. and 3.5 L.E./kg raw milk according to the prices of year 2015.

[1] Net revenue (LE/goat/day) = money output – money input

[2] Economic efficiency = money output/money input

CONCLUSION

From the foregoing results it could be concluded that the rations containing tannin treated sunflower meal with 2% QT plus supplemented with 0.25% Chamomile Flowers (G4) could be improved digestibility, rumen fermentation, milk yield and composition, feed conversion and economic efficiency of lactating Zaraibi goats as well as growth rate of suckling kids.

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تأثير حماية كسب عباد الشمس بالتانين بدون أو مع اضافه زهور البابونج علي الاداء الإنتاجي للماعز الزرايبي الحلاب ونتاجها

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تهدف هذه الدراسة الى معرفه تأثير معاملة كسب عباد الشمس ب ٢% تانينات الكبراتشو و/او اضافة زهور البابونج على أداء الماعز الحلابة ونتاجها. وذلك باستخدام عشرون عنزة زرايبي في الشهر الاخير من الحمل بمتوسط وزن الجسم (٣٥.٥٥ كجم ± ٠.٦١) كجم واستمرت التجربة لفترة ما بعد الولادة لمدة٩٠ يوما (حتي الفطام) . قسمت الحيوانات الى اربع مجموعات متماثلة (٥ عنزة / مجموعة) باستخدام التصميم العشوائي الكامل٠ حيث تتغذى الحيوانات على حسب الاحتياجات اليومية طبقا لل NRC(1985) وكانت العلائق كالاتي:-١- ٥٠% علف مركز يحتوي كسب عباد الشمس غير معامل + ١٥٠جم قش ارز + البرسيم للشبع (كنترول). ٢-٥٠% علف مركز يحتوي كسب عباد الشمس غير معامل مع ٠.٢٥% زهور البابونج +١٥٠جم قش ارز+ البرسيم للشبع. ٣- ٥٠% علف مركز يحتوي كسب عباد الشمس معامل ب٢% تانين الكبراتشو + ١٥٠جم قش ارز + البرسيم للشبع. ٤- ٥٠% علف مركز يحتوي كسب عباد الشمس معامل ب٢% تانين الكبراتشو مع ٠.٢٥% زهور البابونج + ١٥٠جم قش ارز + البرسيم للشبع. وفى نهاية التجربة اجريت اربعة تجارب لتقدير معاملات هضم المركبات الغذائية المهضومة. واشارت النتائج الى ان معاملات هضم المادة الجافة والعضوية والالياف و المركبات الغذائية المهضومة زادت بصورة معنوية مع عليقة (٢) بينما هضم البروتين كان الاعلى معنويا مع العلائق (٢ و٣ و٤) مقارنة بعليقة ١(كنترول)٠اما مقاييس الكرش فكان قيم الاس الهيدروجيني غير واضحة الاتجاه بين المعاملات التجريبية اما تركيز الامونيا والاحماض الدهنية الطيارة الكلية بالكرش انخفضت معنويا مع عليقتين (٣ ، ٤) . اما العليقة (٤) حسنت معنويا كمية اللبن ومكونات اللبن واللبن المعدل ٤% دهن والذي سجل ١٢٤ و١١٠ و١٠٣% للعلائق (٤و٣و٢) علي التوالي مقارنة بالعليقة الاولي . وقد حسنت العليقة (٤) من كفاءة التحويل الغذائي للمادة الجافة المأكولة والمواد الغذائية المهضومة الكلية والبروتين المهضوم/كجم لبن مما انعكس ذلك على الكفاءة الاقتصادية التي سجلت زيادة قدرها ٢١.١٨ % مع عليقة (٤) خلال الفترة التجريبية , كما اعطيت عليقة (٤) افضل زيادة معنوية للوزن النهائي (الفطام) ومتوسط الزيادة اليومية للجداء خلال فترة الرضاعة. بدون اثار ضارة على صحة الحيوان و وظائف الكبد. ويستنتج من ذلك بان حماية كسب عباد الشمس ب ٢% تانين مع اضافة ٠.٢٥ % زهور البابونج (معامله ٤) ادت الي زيادة فى اداء الماعز الحلاب ونتاجها من حيث معاملات الهضم و زيادة انتاج اللبن واللبن المعدل ٤% والكفاءة التحويلية والاقتصادية والنمو الجداء خلال فترة الرضاعه .