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Effect of L-carnitine and Co-enzyme Q10 treatments on immune response, productive and reproductive performance of Damascus goats and their offspring. 2- Productive, reproductive performance and some blood metabolites during late pregnancy and lactation periods.

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ABSTRACT

Thirty Damascus does aged 1.5-2 years and weighed 45.7±1.64 kg were used to define the influence of L-carnitine or Coenzyme Q10 supplementation on reproductive performance, milk yield and composition, microbiological analysis in addition to changes in some blood metabolites during late pregnancy and lactation periods of Damascus does. Does were randomly divided into three equal groups (10 each and، fed basal ration according to **NRC (1981)**. The first group (G1) fed basal ration composed of 60% concentrate, feed mixture (CFM) plus 20% clover hay and 20% rice straw and served as control. The treatment groups fed the same basal ration with daily supplement of 40 mg L-carnitine/kg LBW (G2) and 40 mg Coenzyme Q10/kg LBW (G3).

Results indicated that both treated groups, during late pregnancy and suckling periods, showed improve in fecundity, prolificacy, reproductive ability, kids born per does joined, kids born or weaned per does kidded and kg born and weaned per doe kidded, taking in consideration that the flock have history of high mortality rates and still births which indicated in the values presented for the control group.

The L-carnitine supplement reduced mortality rate of kids (from 43% to 15%) from birth to weaning period, while CoQ10 made little reduction (40%) compared to control group.

Daily milk yield of both treated groups were significantly higher than control group (G1). Fat, protein and lactose percentages for both treated groups also were significantly ($P \leq 0.05$) higher compared to the control group. Counts of total bacterial count in milk were lower in treated groups than the control group along the storage times (fresh, 24 and 72 hours) during suckling period.

Either L-carnitine or CoQ10 supplement led to a significant increase in both birth and weaning weights and daily gain of kids. The best weights occurred with L-carnitine.

L-carnitine or CoQ10 supplementation significantly ($P<0.05$) increased blood total protein, albumin, glucose, AST, total antioxidant (TAC). The concentration of cholesterol, urea and creatinine decreased as results of L-carnitine or co-enzyme treatment while blood urea significantly increased with CoQ10 only during late pregnancy and lactation periods as compared to the control does.

***Keywords**: Goats, L-carnitine, Co-enzymeQ10, productive performance, reproductive performance, milk yield and blood metabolites.*

INTRODUCTION

The physiological status of pregnancy and lactation modify metabolism in animals and induce stress (**Iriadam, 2007; Tanritanir *et al*., 2009**). In fact, it known that during pregnancy all metabolic pathways involved in sustaining the foetus growth (**Bell, *et a*l., 2000**). The transition period % between late pregnancy and early lactation represents a huge metabolic challenge to the high-yielding dairy cow where the haematochemical profile is important in evaluating the health status of animals during this transition period (**Bell, *et al*. 2000 and Hagawane *et al*., 2009**). The period before onset of lactation is very critical for the accumulation of lipids in liver, which accompanied with decrease in feed intake (**Hartwell *et al.* 2000)**. The post-partum period for dairy cattle characterized by negative energy balance during the recovery from parturition stage and subsequently for milk production as well as repeating reproduction process (**Piepenbrink and Overton 2003**). Lactation period associates with a physiologically increased rate of metabolic processes, which characterize by high-energy requirement, especially in the early stage when milk yield is high. Cows mobilize body tissues to satisfy the increased energy requirement for milk production, and preferentially use lipids as energy substrate (**Contreras and Sordillo, 2011; Wathes *et a*l., 2013).**

L-carnitine is vitally important and endogenously synthesized from lysine and methionine in the liver and kidneys. L-carnitine plays an important role in the production of energy via mitochondrial β-oxidation in cells (**Greenwood *et al.* 2001**). L-Carnitine effectively involved in some metabolic processes, such as oxidation of long-chain fatty acids, regulation of ketosis, support of the immune system, enhancement of the antioxidant system, and improvement of reproduction (**Citil *et al*. 2009 and Pirestani *et al*. 2009**). L-carnitine administrations increased glucose concentration (the main source of energy) during advanced stage of pregnancy for Damascus goats, especially those have multiple pregnancies (**Kacar *et al*., 2010**).

Researchers reported that L-carnitine regulates metabolic processes of high yielding lactating ewes or cows during advanced stage of pregnancy. Recent studies indicate that although supplemental L-carnitine in the diet is not essential, it is recommended in domestic animals, especially in cattle, to increase performance and to support medical treatment (**Citil *et al*., 2009**). Supplemental carnitine in ruminant affected a selection of biochemical parameters such as triglycerides, cholesterol, urea and glucose, which act as indicators of energy metabolism (**Citil *et al*., 2009**). The effect of L-carnitine could be associated with stimulation of lipid metabolism, through transfer of acyl groups across the mitochondrial membranes (**Oven *et al*., 1996**). A limited number of studies have dealt with effects of supplemental carnitine on metabolism and performance parameters in healthy ruminants (**Chapa *et al*., 2001; Carlson *et al*., 2006; Pancarci *et al*., 2007**).

Several studies have shown that supplementing sows with L-carnitine during pregnancy and lactation increases their reproductive performance. Sows supplemented with L-carnitine had fewer stillborn piglets, more piglets born alive and greater litter weights (**Musser *et al*. 1999b; Eder *et al.* 2001; Ramanau *et al*. 2002, 2004, 2005**). Moreover, it has been shown that litters of sows supplemented with L-carnitine gain more weight during the suckling period than do litters of control sows (**Musser *et al.* 1999b; Eder *et al*. 2001; Ramanau et al. 2002, 2004, 2005)**.

Coenzyme Q**10** (CoQ**10**) is a vitamin-like substance that synthesized in all tissues. CoQ**10** is the coenzyme of at least three mitochondrial enzymes (complexes I, II and III). The electron and proton transfer functions of the quinine ring are of fundamental importance to all life forms **(Gian, 1994)**. The role of ubiquinone (CoQ**10**) as a component of the mitochondrial respiratory chain and as intracellular antioxidant has gained attention. In vitro study demonstrate that CoQ**10** protect membrane phospholipids and serum LDL from lipid peroxidative stress **(Mohr *et al*., 1992)**. In vivo study reported that CoQ**10** reduced myocardial ischemia and reperfusion injury induced by oxidative stress through suppressing the formation of reactive oxygen **(Maulik, *et al*., 2000)**.

This study tried to test possibility to remedy the high losses rates in embryos and borne kids recognized in El-Gemmaiza Experimental farm by treating does, starting from late pregnancy stage until weaning of kids, by L-carnitine or CoQ10. Still born and losses in kids born were estimated to judge the effect.

Little known about the effect of CoQ10 on productive and reproductive performance of ruminants. The objective of the present study was to determine and assess the effect of L-carnitine or CoQ10 supplementation on reproductive performance, milk yield and composition, microbiological parameters in addition to some blood metabolites of Damascus does during late pregnancy and lactation, as a reliable biological indicators of animals performance and health.

MATERIALS AND METHODS

The present study conducted in El-Gemmaiza Experimental Station, Animal Production Research Institute, Agriculture Research Center, Egypt. The work aimed to define the effects of L-carnitine and Coenzyme Q10 supplementation on reproductive performance, milk yield, composition and microbiological parameters in addition to some blood metabolites during late pregnancy and lactation periods of Damascus does.

In this respect, 30 healthy Damascus does aged 1.5-2 years and weighed 45.7±1.64 kg were used. The does assigned to three groups (10 each) according to their body weight and fed basal ration according to **NRC (1981)**. The first group fed basal ration composed of 60% concentrate feed mixture (CFM) plus 20% clover hay, and 20% rice straw and served as control. The other two groups fed the same basal ration and supplemented daily with L-carnitine or Coenzyme Q10 (CoQ10) at rate 40 mg and 3.0 mg/kg live body weight, respectively. Composite feedstuffs samples were taken and stored for proximate analysis, according to A.O.A.C (2000). Chemical composition of ingredients and experimental diets presented in Table (1).

Animals housed in semi open sheds under natural daylight conditions. The does allowed to drink clean fresh water *ad lib*. Vitamins and minerals blocks were available all the time to does.

The reproductive traits recorded for does included; fecundity (percentage of kids born/does joined); prolificacy (percentage of kids born/does kidded); kidding rate; reproductive ability (percentage of kids weaned of does joined); percentage of kids weaned/does kidded; kilograms of kids born/does kidded; kilograms of kids weaned /does kidded; mortality rate and finally percentage of dead kids from birth to weaning.

Table (1): Chemical composition of feed ingredients of the experimental rations.

Item	Rice straw	Berseem hay	Concentrate feed mixture (CFM)*
DM	88.32	90.92	89.21
OM	81.25	85.65	90.85
CP	3.22	14.55	15.40
CF	40.15	26.91	14.85
EE	0.97	1.51	2.88
NFE	36.91	42.68	57.72
Ash	18.75	14.35	8.15

***CFM; concentrate feed mix contained in percentage ; 37% yellow corn , 30% undecorticated cotton seed , 20% wheat bran, 6.5% rice bran, 3% molasses , 2.5% limestone, 1% common salt.**

Daily milk yield for each doe measured individually by suckling kids. The measure applied biweekly for one day, twice (every 12h), starting from the seventh day of parturition throughout the following 12 weeks until weaning. The kids separated from their dams at 16:00 pm before the day of measurement. Kids weighed immediately before and after suckling and hand milked to measure residual milk in the udder. The differences between kids' weights before and after suckling and residual milk denote the produced milk. Milk samples collected during milking and stored at -20 °C for analysis. Butterfat, protein and lactose were determined according to **A.O.A.C. (2000).** Count of total viable bacteria (TBC) determined as described by **APHA (1992).**

Blood samples collected regularly at 3 weeks intervals from 3-4 does of each group, by jugular vein puncture, just before morning feeding and drinking which started at mating day. Harvested plasma, after centrifugation at 4000 rpm for15 minutes, was stored at – 20 °C until chemical analysis of total protein and albumin **(Doumas and Biggs,1972a&b)**; urea **(Henry,1965)**; creatinine **(Bartels,1971)**;

glucose **(Trinder,1969)**, triglycerides **(Mc Gowan *et al.*, 1983)** and cholesterol **(Richmond, 1973)**, using commercial colorimetric kits. Globulin calculated by subtracting concentration of plasma albumin from the corresponding concentration of total protein.

Enzyme activity of aspartate (AST) and alanine (ALT) transaminases (**Reitman and Frankel, 1957)** and total antioxidant **(Sies, 1997) were estimated using** commercial kits by calorimetric determination of plasma.

Data statistically analyzed, using analysis of variance procedure described by **SPSS (2012)** computer program using the following fixed model;

$$Yijk=\mu + T_i + B_j + e_{ijk}$$

Where: μ = Overall means; Ti = Effect of treatments; B_j= Effect of periods and eijk = Standard error association with each observation. Duncan's Multiple Range Test **(Duncan, 1955)** utilized for locating significant differences among means.

RESULTS AND DISCUSSION

Reproductive performance:

Data in Table (2) clearly indicate that dietary supplementation of L-carnitine or Coenzyme Q10 (CoQ10) during late pregnancy and suckling periods improved fecundity, prolificacy, kids born per does joined, kids born or weaned per does kidded and kg born and weaned per doe kidded. The high mortality rate of control group (43%) efficiently reduced by L-carnitine treatment (15%) while lightly reduced by CoQ10 (40%).

Table (2) Reproductive performance of Damascus goats as affected by L- carnitine and CoQ10 supplementation during late pregnancy and lactation periods.

	Treatments		
Items	**Control (G1)**	**L- carnitine (G2)**	**CoQ10 (G3)**
Number of pregnant does used	10	10	10
***Does kidded birth alive/ Tested pregnant does (%)**	50	80	70
Fecundity, Kids born / doe joined (%)	70	130	100
Prolificacy, Kids born / doe kidded	7 (1.40)	13 (1.63)	10 (1.43)
Number of alive kids at weaning	4	11	6
Kids weaned /does kidded, (%)	80^{b}	137^{a}	86^{b}
Kg. of kids born per each doe kidded	$3.90^{b} \pm 0.80$	$4.87^{a} \pm 0.58$	$4.43^{a} \pm 0.27$
Kg. of kids weaned per each doe kidded	$9.80^{b} \pm 4.65$	$17.50^{a} \pm 2.27$	$11.00^{ab} \pm 1.86$
Mortality rate of kids from birth to weaning %	42.86	15.38	40

[a,b] : values in the same column bearing different superscripts significantly differed (P<0.05)

*does kidded stillbirth, G1 (50%); G2 (20%) and G3 (30%).

These results conform with **Musser *et al.*, (1999a)**; **Eder *et al.*, (2001). Ramanau *et al.* (2004)** found that L-carnitine supplementation during pregnancy increased the number of piglets born than that in control. This observation suggest that dietary L-carnitine reduced embryonic mortality (**Musser *et al.*, 1999b)**. Kilograms of kids born or weaned per does joined or does kidded were the highest (P≤0.05) in group supplemented with L-carnitine followed by Co-enzyme G10 supplemented group then the control group. These results are in agreement with the obtained results by **Musser *et al.*, (1999a); Eder *et al.*, (2001)** and **Ramanau *et al.* (2004)** who reported that L-carnitine supplemented to higher live weight at birth and weight gain of offspring. These results might be due to that L-carnitine supplement influence the glucose metabolism. Glucose is the most important energy source for the fetus. The raise in blood glucose levels might due to increase secretion of IGF-1, which provide a hypothetical explanation for the improved intrauterine fetal development that led to higher kids weights at birth (**Musser *et al*., 1999a)**. The results show also that supplementing with L-carnitine increased milk yield than control (Table 3). The increased milk yield of does is an important factor for the production of robust kids at weaning (**Helal and Abdel-Rahman, 2010)**. L-carnitine plays an important role on intrauterine membrane growth because of its effect on the metabolism of insulin. It likely has a growth hormone-like action that affects intrauterine embryonic nutrition, stimulation, and oxidation of glucose (**Pirestani and Aghakhani, 2017**).

Milk yield and composition:

Many factors can affect milk yield including breed of goats, twining rate, feeding level and parity of does (**Latif *et al*, 1988).**

Daily milk yield during suckling period (12 weeks) are shown in Fig (1). Daily milk yield (gram/head/day) increased gradually to reach the peak at the fourth week after parturition Treated groups had significant (P<0.05) more daily milk yield than control group (Table 3). L-carnitine produced more milk (1282±210 g/d) than Co-enzyme (1148±140 g/d), but difference was not significant. These results are in correspondence with the results obtained by **Abu El Ella *et al*. (2014).**

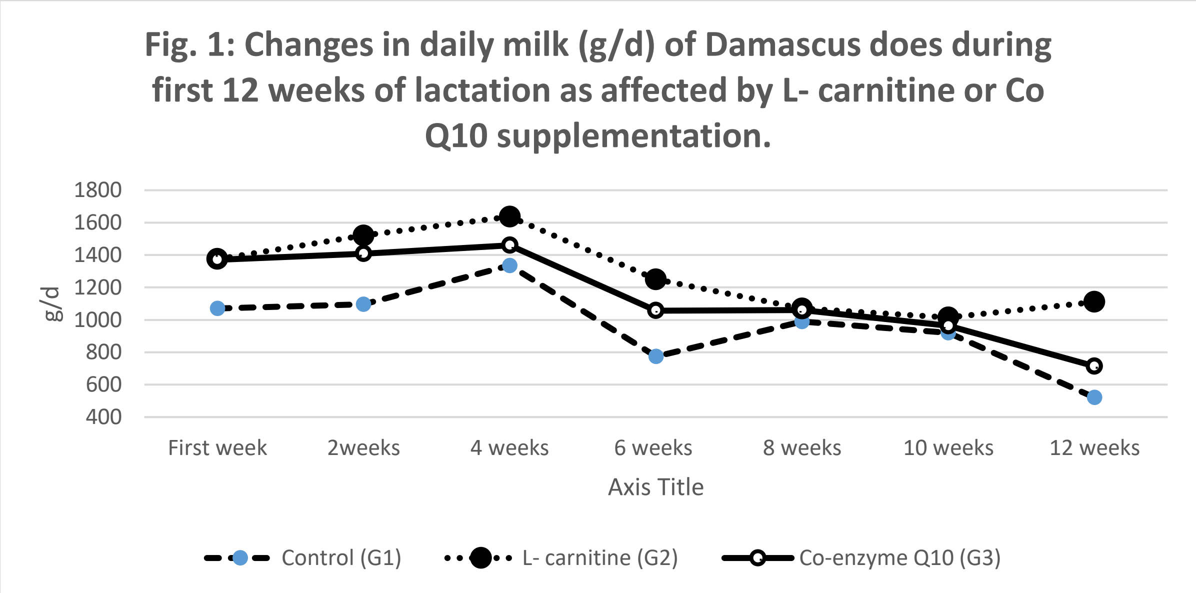

Table (3) show also that fat, protein and lactose percentages increased significantly (P>0.05) in treated groups than control. Meanwhile, G2 (L- carnitine) had less fat % than G3 (CoQ10) (3.46 vs. 3.62%, P<0.05) and less lactose (4.71 vs. 4.77%, P<0.05) while G2 had more protein than G3 (3.26 vs.3.14%, P<0.05), respectively. Yields of different milk components had the same trends of their levels. Similar resulted obtained by **El-Ghandour *et al.* (2017)**. Meanwhile, **Scholz *et al*. (2014)** found that milk fat decreased while protein percentage increased in L-carnitine supplemented dairy cow. The present results agree also with **Ramanau *et al*. (2004) and Pirestani and Aghakhani, (2017)** who found an increase in milk production in response to L-carnitine treatment. This might attributed to the positive effect of L-carnitine on reducing the negative balance of energy and protein production. Reduction of the negative balance of energy and protein production leads to more weight gain by kids, and research has indicated that milk production is higher for overweight kids. Milk production of does influenced by the nutritional status, in particular the energy supply during lactation (**Noblet, *et al*. 1998**).

Ramanau *et al*. (2005) estimated the improvement in milk yield with L-carnitine and CoQ10 as 33.73 % and 19.69%, more than control group. **Ramanau *et al*., (2004)** reported that energy requirement for increasing milk production was covered when L-Carnitine added to the diet. . The increased milk yield of does treated with L-carnitine or CoQ10 mostly attributed to the increase in blood supply

Table (3): Daily milk yield, 4% fat corrected milk (FCM) and milk composition of Damascus does as affected by L- carnitine and Co Q10 supplementation.

Items	Treatments		
	Control (G1)	**L- carnitine** (G2)	**CoQ10 (G3)**
Average daily milk yield			
Actual milk yield, g/d	959 [b] ± 126	1283 [a] ± 210	1148[a] ± 140
Improvement (%)	-	33.73	19.69
Milk composition			
Fat, %	3.33 [c] ± 0.02	3.46 [b] ± 0.02	3.62[a] ± 0.02
Protein, %	2.98 [c] ± 0.03	3.26 [a] ± 0.03	3.14 [b] ± 0.02
Lactose, %	4.57 [c] ± 0.01	4.71 [b] ± 0.02	4.77 [a] ± 0.01
Component yields			
Fat, g/d	31.93 [c] ± 1.86	44.37 [a] ± 1.77	41.55 [b] ± 2.21
Protein, g/d	28.58 [c] ± 1.45	41.81 [a] ± 1.78	36.04 [b] ± 1.83
Lactose, g/d	43.82 [c] ± 2.47	60.41 [a] ± 2.39	54.75 [b] ± 2.74

a, b and c,: values in the same row bearing different superscripts significantly differed ($P<0.05$)

(Mepham, 1982) and the energy intake of mammary gland cells **(Wurtman, 1982**) of treated does compared with control. Moreover, the significant increase in milk yield because of L-carnitine or CoQ10 supplementation may be due to increasing body weight and body condition score of does and/or due to increase of prolactin level.

The reduction in fat percentage in the milk might indicate reduce in fat mobilization, probably because of improved fat metabolism by L-carnitine (**Tasdemir *et al*., 2011**). The significant decrease ($P\leq0.05$) in milk fat of control group than L-carnitine or CoQ10 supplemented groups likely due to increased insulin secretion and/or metabolism of non-esterified fatty acids by L-carnitine, which can lead to the activation of a growth hormone-sensitive lipase. Because L-carnitine transports non-esterified fatty acids into mitochondria, it affects fat metabolism (**Carlson, *et al*., 2007**). The dietary fat resulted in production and storage of triglycerides, cholesterol, and other fatty acids in adipose tissue (**Hartwell *et al*. *2000***). **Ramanau *et al*. (2004)** reported that dietary L-carnitine increased the secretion of protein and lactose in milk. This supports the concept that both carbohydrate and protein metabolism of pigs may be altered by dietary L-carnitine as **Owen *et al*. (2001)** observed altered metabolism in growing pigs fed L-carnitine. These researchers observed increased flux through pyruvate carboxylase and decreased flux through branched chain ά-keto acid dehydrogenase in liver' mitochondria with increasing dietary L-carnitine. These metabolic changes favor gluconeogenesis and reduced oxidation of branched chain amino acids that could provide substrate for milk lactose and protein synthesis. The observed increase in milk protein yield in treated groups might attributed to elevation in the supply of L-carnitine and Co-enzyme Q10 to the mammary gland, to from milk protein. Similar result obtained by **Mepham, (1982) and Gabr, (2012)**.

The total bacterial count in suckling milk was lower in L-carnitine and CoQ10 groups than the control group along the storage times (fresh, 24 and 72 hours). This result may be due to the presence of some residues of L-carnitine and CoQ10 in milk, which may cause partial inhibition to microorganisms.

Table (5): Bacteriological analysis of Damascus goat's milk during suckling period as affected by L- carnitine and Co-enzyme Q10 supplementation.

Treatments	Total bacterial count		
	Fresh	24 h.	72 h.
Control (G1)	2.9 X $10^4 \pm 0.52$	2.9 X $10^7 \pm 0.46$	3.15 X $10^9 \pm 0.60$
L- carnitine (G2)	1.8 X $10^3 \pm 0.43$	1.4 X $10^6 \pm 0.49$	2.2 X $10^7 \pm 0.61$
Co-enzyme Q10 (G3)	2.3 X $10^3 \pm 0.57$	2.9 X $10^6 \pm 0.36$	2.3 X $10^8 \pm 0.46$

(Table 6): Growth performance of Damascus kids during suckling period as affected by L-carnitine or CoQ10 supplementation.

Items	Treatments		
	Control (G1)	L-carnitine (G2)	CoQ10 (G3)
Birth Weight (kg)	$2.78^{b} \pm 0.15$	$3.27^{a} \pm 0.07$	$3.25^{a} \pm 0.13$
Weaning weight (kg)	$12.25^{b} \pm 0.25$	$14.09^{a} \pm 0.25$	$13.83^{a} \pm 0.40$
Daily gain (g)	$102.77^{b} \pm 3.59$	$119.65^{a} \pm 3.02$	$118.52^{a} \pm 3.97$

^{a,b}: values in the same column bearing different superscripts significantly differed (P<0.05)

***Bacteriological analysis*:**

Bacteriological analysis of Damascus goat milk during suckling period are shown in Table (5).

Similar result obtained by **Kalaiselvi and Panneerselvam (1998)** and **El-Ghandour *et al.* (2017). Scholz *et al*. (2014)** working on dairy cow, reported that somatic cell counts during suckling period were lower in L-carnitine group than control group. It known that negative energy balance and subclinical ketosis influence udder health **(Leslie *et al*., 2000 and Suryasathapom *et al*., 2000)**.

Growth performance:

Data in Table (6) show higher values (P<0.05) of birth and weaning weights, and daily gain of kids born from does supplemented with L-carnitine or CoQ10 compared with control group.

This result agree with **Musser *et al*. (1999 a); Eder *et al.* (2001) and Ramanau *el al*. (2002).** This result may be due to the higher milk yield and contents of total solid, total protein and milk fat, which is in consistency with results of **Shakweer *et al*. (2005)** and **Zeedan *et al*. (2014).** On the other hand, this effect might be due to higher milk yield and an increase in transfer of energy and nutrients from doe to the kids through milk. The main action of L-carnitine on mammals is transfer of long-chain fatty acids to the inner membrane of mitochondria where β- oxidation occurs (**Ramanua *et al*., 2004**). Several studies have shown that supplementation of L-carnitine during late pregnancy and lactation periods increased weight gains of kids during suckling period **(Eder, 2009**).

Blood plasma metabolites:

Protein fractions:

Data of total protein (TP), albumin (AL), urea and creatinine concentrations in blood of does supplemented with L-carnitine or Co-Q10 during both pregnancy and suckling periods presented in Table (7). Treated groups had significant (P < 0.05) increase in total protein and albumin concentrations, while globulin concentration showed no significant differences. The significant increase in blood total protein with L-carnitine and Co-Q10 compared to the control group, may refer to an increase in protein synthesis resulted from increased anabolic hormone secretion that is responsible of utilization of amino acids (**El--**

Masry and Habeeb, 1989). The present results agree also with **Sanaa *et al*. (2010) and Laila *et al*. (2008)** who found that supplementation with L-carnitine or Co-Q10 significantly increase serum total protein compared to the control group. **Sumimoto *et al*. (1987)** showed that administration of Co-enzyme Q10 increased level of total protein to the normal range. The marked improvement of total protein achieved by L-carnitine and CoQ10 is in the agreement with results of **Wang *et al*. (2007).** The present results disagree with results reported by **Jain and Singh (2015)** who found that L-carnitine supplementation did not affect plasma protein levels as no change noticed compare to control. Values of total protein concentration, throughout late pregnancy and lactation periods, were significantly ($P < 0.05$) different. Total protein content showed a significant increase during 6^{th} week after parturition and at the end of lactation ($P<0.001$) compared with late gestation stage. This increase reflect the maternal requirements to proteins for milking and providing immunoglobulins (**Mohri *et al*., 2007, Piccione *et al*., 2012; and Roubies *et al*., 2006)**. On the other hand, **Antunovic *et al*. (2002)** reported significant decrease in total protein during late pregnancy compared to early lactation which reflect decrease of maternal plasma protein concentration, that due to increase of foetal growth and especially the utilization of amino acids transferred from the maternal circulation to protein synthesis of foetal muscles. The significant increase, during early lactation, of plasma total protein compared to late gestation might due to a decrease in serum globulin (**El-Sherif and Assad 2001**). The higher values of total protein during lactation compared to late pregnancy prove the high energy need of milk synthesis, especially during early lactation (**Bremmer *et al*. 2000**). Additionally, **El-Masry and Marai (1991)** related the variations in serum proteins to alteration in thyroid hormone level and to albumin or globulin concentration**.**

In the present study, albumin levels insignificantly affected by physiological status, but it decreased during lactation compared to late pregnancy. The substantial decrease in plasma concentration of albumin, with the progress of lactation, is agreeable with previous studies of **Cavestany *et al*., (2005**). This decrease reflect the maternal requirements to proteins for milking and providing immunoglobulins (**Mohri *et al*., 2007 and Roubies *et al*., 2006**).

Administration of L-carnitine or CoQ10 significantly ($P < 0.05$) increased plasma albumin level compared with control group (Table 7). The present results agree with **Sanaa *et al*. (2010).** Normal albumin in the bloodstream is important for many physiological functions and it suggested for normal status of liver function, since liver is the main organ for albumin synthesis. The obtained results are in accordance with those reported by **El-Shaer (2003)** and **Mahrous and Abou-Ammou (2005)** on sheep and **Kholif (2001)** and **Abu-El-Ella and Kommonna (2013)** on goats. The increase of albumin in response to L-carnitine or CoQ10 administration may be associated with nitrogen absorption (**Talha *et al*., 2009**). Plasma albumin has shown as a good indicator for nitrogen status, especially in small ruminants **(Gaskins *et al*., 1991 and Laborde *et al*., 1995**). In addition, store of albumin acts as a significant mobile protein source for amino acids (**Abu-El-Ella and Kommonna, 2013).**

The renal function, principally represented by urea and creatinine concentrations during late pregnancy and lactation periods significantly affected by L-carnitine and co-enzyme compared to the control group (Table 7). The concentration of urea decreased as results of L-carnitine supplement while increased with CoQ10 treatment, both compared to control (untreated). The present results agree with **Kellog and Miller (1977)** who reported that serum urea concentration decreased with L-carnitine administration to cows compared to control while disagree with **Kacar *et al.* (2010)** who found similar results while worked on goats.

Plasma urea concentration is a significant indicator of dietary protein supply in both sheep and goats (**Nazifi *et al.*, 2003**). The increase in urea serum levels during lactation period, despite the late gestation is strictly dependent on dietary intake of proteins, which is more relevant during lactation because of the increased requirements. The requirement to protein more increased during lactation than during late pregnancy, which recognized by the higher urea serum level during lactation (**Roubies *et al.*, 2006**).

Table (7): Blood protein fractions of Damascus does during late pregnancy and suckling periods as affected by L-carnitine and Co Q10 supplementation.

		Treatments			
Items	periods (wk)	Control	**L- carnitine**	**Co-enzyme Q10**	Overall means
Total protein (g/dl)	Frist week	6.43 ± 0.06	5.45 ± 0.52	6.82 ± 0.18	6.23 [b] ± 0.28
	3	6.57 ± 0.44	6.82 ± 0.25	7.20 ± 0.63	6.86 [b] ± 0.25
	6	6.39 ± 0.22	7.39 ± 0.26	7.25 ± 0.47	7.01 [a] ± 0.23
	9	6.84 ± 0.10	7.32 ± 0.52	7.04 ± 0.14	7.07[a] ± 0.17
	12	6.43 ± 0.16	7.69 ± 0.09	7.18 ± 0.18	7.10 [a] ± 0.20
	15	6.88 ± 0.15	7.41 ± 0.13	6.96 ± 0.27	7.08 [a] ± 0.13
Effect of treatment		6.59 [B] ± 0.09	7.01 [A] ± 0.21	7.07[A] ± 0.13	
Albumin (g/dl)	Frist week	4.07 ± 0.39	4.52 ± 0.19	4.81 ± 0.07	4.47 [a] ± 0.17
	3	4.21 ± 0.40	4.36 ± 0.07	4.87 ± 0.51	4.48 [a] ± 0.21
	6	4.36 ± 0.14	4.34 ± 0.13	4.76 ± 0.10	4.49 [a] ± 0.09
	9	4.20 ± 0.13	4.30 ± 0.24	4.66 ± 0.22	4.39 [a] ± 0.12
	12	4.06 ± 0.18	4.64 ± 0.09	4.31 ± 0.24	4.33 [a] ± 0.12
	15	3.96 ± 0.03	4.63 ± 0.06	4.31 ± 0.08	4.30 [a] ± 0.10
Effect of treatment		4.14 [B] ± 0.09	4.47 [A] ± 1.10	4.62 [A] ± 0.25	
Urea (mg/dl)	Frist week	31.67 ± 6.93	21.33 ± 1.85	32.33 ± 5.89	28.44 [bc] ± 4.98
	3	25.00 ± 2.64	28.67 ± 7.31	26.00 ± 6.93	26.56 [bc] ± 5.63
	6	45.00 ± 7.09	47.00 ± 1.52	48.33 ± 3.71	46.78 [a] ± 3.11
	9	28.00 ± 2.52	20.67 ± 0.33	18.67 ± 1.85	22.45 [c] ± 2.78
	12	33.67 ± 7.31	24.67 ± 2.60	40.00 ± 7.21	32.78 [b] ± 5.71
	15	26.33 ± 2.72	26.00 ± 3.60	29.33 ± 8.41	27.22 [bc] ± 4.91
Effect of treatment		31.61 [A] ± 4.87	28.06 [B] ± 2.87	32.44 [A] ± 5.67	
Creatinine (mg/dl)	First week	1.26 ± 0.33	0.97 ± 0.10	1.04 ± 0.04	1.09 [abc] ± 0.16
	3	0.87 ± 0.04	0.99 ± 0.02	0.88 ± 0.03	0.91 [c] ± 0.03
	6	1.14 ± 0.09	1.10 ± 0.05	1.21 ± 0.11	1.15 [a b] ± 0.08
	9	1.00 ± 0.05	0.95 ± 0.08	1.04 ± 0.09	1.00 [b c] ± 0.02
	12	1.24 ± 0.09	1.19 ± 0.08	1.23 ± 0.10	1.22 [a] ± 0.09
	15	1.34 ± 0.03	0.97 ± 0.03	1.10 ± 0.08	1.14 [ab] ± 0.05
Effect of treatment		1.20 [A] ± 0.11	1.03 [B] ± 0.06	1.08 [B] ± 0.07	

[a,b] . : values in the same column bearing different superscripts significantly differed ($P<0.05$)
[A, B], : values in the same row bearing different superscripts significantly differed ($P<0.05$).

The significant drop found in urea content in plasma at the end of lactation is in accordance with the study of **Karaphelivan *et al*. (2007)** on Tuj ewes and **Yokus *et al*. (2006)** on Sakiz-Awassi crossbreds. These findings support the hypothesis that changes in blood urea level during lactation could depend on rate of milk synthesis (**El-Sherif and Assad 2001).** It is probably associated with the use of urea for protein synthesis with the ruminal hepatic pathway to compensate the low protein uptake during the dry period (**Yokus *et al*. 2006**). The elevated values of urea during late gestation could ascribed to the high thyroid activity in pregnant females, which induces an increased protein catabolism. The high requirement for energy by sheep during the second half of pregnancy led to an increase in urea level, which is evident during late pregnancy in present study. The high values of blood urea, in the last trimester of pregnancy, also observed by **Antunovic *et al*. (2002).**

Creatinine considered as the major metabolite produced from protein catabolism. The present study showed lower ($P < 0.05$) creatinine concentrations in plasma of does treated with L-carnitine or CoQ10 compared to control group **(**Table 7**), which** may due to higher utilization of dietary protein in does treated with L- carnitine or CoQ10 compared to control. These results are similar with those of **Abu El Ella *et al*. (2014)** who found that creatinine concentration decreased in plasma of does treated with L-tyrosine compared to control. **Solouma *et al*. (2011)** reported that creatinine concentration was lower in the serum of ewes fed protected protein compared to control**.** These results disagree with **Kacar *et al*. (2010)** who found that creatinine concentration was higher in goats injected with L-carnitine compared to control**.** Creatinine concentration in blood plasma was significantly ($P<0.05$) lower in does treated with L-carnitine or CoQ10 compared to control group, during pregnancy and lactation periods. **Kacar *et al*. (2010) Worked on** goats **and found** that administration of L-carnitine, caused decrease of serum creatinine concentration until one week before parturition, although the same parameter increased in the control group until two weeks before parturition. The difference was significant among groups ($P <0.05$). At this point, it thought that L-carnitine could prevent the increase of serum creatinine concentration caused by lack of energy.

The creatinine plasma level also significantly affected by physiological status where it showed the higher level during late pregnancy and early lactation. This result is in accordance with the study of **Piccione *et al*. (2012)** on dairy cows**,** who reported that serum creatinine level was higher during late pregnancy and early lactation. It is recognized that the foetal maternal circulation function during late gestation is considered by the mother, as they assume the load of organic waste of the newborn (**Ferrell, 1991**). So, the increase in serum creatinine level could attribute to the development of the foetal musculature, which well documented in ewes too (**Roubies *et al*., 2006**). The quantity of creatinine formed daily depends on the total body content of creatinine, which in turn depends on dietary intake, rate of synthesis of creatine and muscle mass (**Gluseppe *et al*., 2009**). Generally, serum creatinine level is a useful indicator for glomerular filtration in the kidney.

Energetic metabolism:

The most important indicators of energy status of ruminants are cholesterol, glucose, and triglycerides (**Pechová and Pavlata, 2005**). It is known that statins inhibit cholesterol biosynthesis in the liver, decrease the intracellular cholesterol content, augment low density lipoprotein-receptor (LDL-R) synthesis, increase cholesterol uptake by the liver, and diminish serum total cholesterol concentration (**Ascaso *et al*., 2004)**. Data in Table (8) indicate that total cholesterol and glucose concentrations were significantly ($P<0.05$) affected with L-carnitine or CoQ10 during late pregnancy and lactation periods, while, the differences in concentrations of triglycerides among treatments were not significant. In our study, the concentration of cholesterol decreased ($P<0.05$) as result of L-carnitine or CoQ10 treatment compared to control. The obtained result is in accordance with those reported by **Jimenez-Santos *et al*. (2014).** This might return to the biological mechanism of which L-carnitine stimulates the lipid metabolism that is responsible of carrying acyl groups from mitochondrial membranes **(Owen and Maxwell, 1996)**. These results are also similar with those of **Kacar *et al.* (2010) on goats. Pietruszka *et al*. (2009)** on pigs, found that total cholesterol concentration decreased in the plasma of does treated with L-carnitine compared to control. In addition, L-carnitine supplementation, promote β-oxidation of fatty acids and decreased concentrations of triglycerides and total cholesterol **(Maccari *et al*. 1987).** On the other hand, it was found in other studies that L-carnitine did not varied in concentration of cholesterol in the blood plasma of piglets and pregnant sows when compared to control (**Birkenfeld *et al*. 2006 and Doberenz *et al*. 2006).**

Total cholesterol and triglycerides, in our study, significantly (P<0.05) affected by the physiological status. Cholesterol showed significant (P<0.05) increase during middle and late stages of lactation, while triglycerides showed significant (P<0.05) increase in the late stage of lactation. This probably because, during the puerperal period, there is an increase demand to regulatory mechanism, responsible of all the processes involved with milking (**Krajnicakova *et al*., 2003**). For this purpose, characteristic changes in lipid metabolism were found during pregnancy and lactation in most mammals (**Roche *et al*., 2009**).

Endocrine profiles change, lipolisis and lipogenesis are regulated to increase lipid reserve during pregnancy, and subsequently, these reserves are utilized for the next parturition and the initiation of lactation (Nazifi et al., 2002 and Roche et al., 2009). The significant decrease in total cholesterol during late pregnancy also reported by Krajničáková et al. (2003) in goats. This probably related to the role of the compound on ovary steroidogenesis, since the total cholesterol concentration controlled by complex of factors. On the other hand, Juma et al. (2009) found that total cholesterol concentration in blood serum increased significantly during pregnancy period. This may be due to enhance of progesterone synthesis in the placenta (Lin et al., 1977), where it decline after parturition due to estrogen decrease in plasma LDL (Ganog, 1995).

Plasma triglycerides concentration showed significant decrease during early and mid-lactation compared to late pregnancy, and its concentration increased during the end of lactation. Piccione et al. (2012) reported the same results. The significant decrease in serum triglycerides, noticed during early and mid-lactation, reported on sheep by Gradinski-Urbanac et al. (1986), while Nazifi et al. (2002) observed the lowest concentration of the compound, 2-3 weeks post-partum. Similar results, however, found by other researchers, demonstrating that concentrations of total lipid and triglycerides increased at parturition, despite the kind of feed administered (**Douglas *et al*., 2004**). This is in accordance with the authors worked on goats and showed that increased values of serum triglycerides occurred just before parturition (**Hussein and Azab 1998)**. During lactation the insulin stimulation of lipogenesis becomes inefficient which is confirmed by the significant decrease in serum triglycerides and total cholesterol *post-partum* **(Watson *et al*. 1993)**, This because increase of lipoprotein lipase activity is consistent with the induction of the enzyme into mammary tissue, to provide milk fat synthesis. The decreasing pattern of serum triglycerides and total cholesterol during early lactation was also reported on dairy cows, which showed the lowest values of these compounds at the onset of lactation due to their growing requirement for energy (**Marcos *et al*. 1990**).

In our study, results show that concentration of glucose was higher (P<0.05) with L-carnitine or CoQ10 supplement during late pregnancy and lactation periods compared to control. These results are similar with those of **Chapa *et al*. (2001)** on lamb;

Table (8): Energetic metabolism, Hepatic functionality and total antioxidant of Damascus does during late pregnancy and suckling periods as affected by L- carnitine and CoQ10 supplementation.

Items	periods	Treatments			
	Week	Control (G1)	L- carnitine (G2)	Co Q10 (G3)	Overall means
Energetic metabolism					
Cholesterol (mg/dl)	Frist	92.67 ± 6.64	88.33 ± 7.42	88.67 ± 13.92	89.89 [ab] ± 9.33
	3	99.33 ± 14.51	77.67 ± 14.52	89.00 ± 8.88	88.67 [b] ± 12.64
	6	99.33 ± 13.57	108.00 ± 12.09	92.33 ± 22.52	99.89 [ab] ± 16.06
	9	110.00 ± 16.19	76.67 ± 2.19	82.00 ± 9.29	89.56 [ab] ± 9.21
	12	112.67 ± 28.50	93.00 ± 13.00	95.67 ± 12.49	100.45 [a] ± 17.99
	15	113.33 ± 15.96	84.67 ± 14.31	93.67 ± 15.35	97.22 [ab] ± 15.21
Effect of treatment		104.56 [A] ± 15.89	88.06 [B] ± 10.59	90.22 [AB] ± 13.74	
Glucose (mg/dl)	Frist	60.00 ± 6.08	61.67 ± 6.64	62.00 ± 4.93	61.22 [b] ± 2.98
	3	62.00 ± 4.04	65.00 ± 4.04	65.00 ± 4.10	64.00 [ab] ± 2.25
	6	57.00 ± 5.65	64.68 ± 5.61	64.33 ± 3.18	62.00 [ab] ± 2.76
	9	61.67 ± 2.60	65.69 ± 5.84	64.43 ± 6.88	64.02 [ab] ± 2.78
	12	61.00 ± 6.25	66.67 ± 7.86	62.33 ± 5.21	63.33 [ab] ± 3.37
	15	62.67 ± 2.57	67.33 ± 1.45	67.00 ± 1.15	65.67 [a] ± 1.15
Effect of treatment		60.72 [B] ± 1.69	65.22 [A] ± 1.98	64.18 [A] ± 1.68	
Triglyceride (mg/dI)	First	70.00 ± 1.15	74.33 ± 1.85	84.00 ± 6.00	76.11 [a b] ± 3.00
	3	55.00 ± 2.08	56.67 ± 6.96	78.33 ± 5.45	63.33 [b] ± 4.83
	6	71.67 ± 23.17	58.67 ± 8.41	60.00 ± 5.56	63.45 [b] ± 12.38
	9	71.67 ± 14.07	59.67 ± 8.68	69.00 ± 7.37	66.78 [a b] ± 10.04
	12	91.67 ± 22.26	84.33 ± 12.44	77.00 ± 13.20	84.33 [a] ± 15.96
	15	90.00 ± 14.57	73.33 ± 6.74	80.00 ± 8.73	81.11 [a b] ± 15.97
Effect of treatment		75.00 [A] ± 12.88	67.83 [A] ± 7.51	74.72 [A] ± 7.72	
Hepatic functionality					
AST (IU/L)	First	33.33 ± 2.03	35.00 ± 1.00	35.67 ± 1.45	35.00 [a b] ± 1.49
	3	32.67 ± 3.48	36.00 ± 1.73	39.00 ± 4.04	35.89 [a] ± 3.08
	6	26.00 ± 0.58	33.33 ± 1.85	32.67 ± 2.67	30.67 [b c] ± 1.70
	9	33.67 ± 1.85	38.00 ± 5.29	32.67 ± 3.18	34.78 [a b] ± 3.44
	12	29.67 ± 1.45	32.00 ± 2.64	28.67 ± 1.85	30.11 [c] ± 1.98
	15	30.67 ± 1.33	28.67 ± 2.72	28.00 ± 0.58	29.11 [c] ± 1.54
Effect of treatment		31.00 [B] ± 1.79	33.83 [A] ± 2.54	32.78 [A] ± 2.29	
ALT (IU/L)	First	14.33 ± 2.18	12.67 ± 0.88	12.00 ± 0.58	13.00 [a] ± 1.21
	3	15.67 ± 0.88	8.00 ± 0.58	11.33 ± 1.33	11.67 [a b] ± 0.93
	6	11.00 ± 1.29	18.00 ± 0.58	11.67 ± 1.85	13.55 [a] ± 1.24
	9	11.33 ± 2.40	9.00 ± 0.58	9.67 ± 0.88	10.00 [b] ± 1.29
	12	8.00 ± 0.58	8.67 ± 0.66	12.00 ± 4.00	9.55 [b] ± 1.75
	15	12.33 ± 1.20	12.67 ± 1.85	14.67 ± 1.45	13.22 [a] ± 1.50
Effect of treatment		12.11 [A] ± 1.42	11.50 [A] ± 0.85	11.89 [A] ± 1.68	
TAC (mmol/L)	First	0.64 ± 0.01	0.64 ± 0.03	0.64 ± 0.03	0.64 [a] ± 0.02
	3	0.63 ± 0.02	0.67 ± 0.03	0.67 ± 0.08	0.66 [a] ± 0.04
	6	0.61 ± 0.03	0.61 ± 0.02	0.64 ± 0.02	0.62 [a b] ± 0.02
	9	0.61 ± 0.03	0.60 ± 0.01	0.56 ± 0.01	0.59 [b] ± 0.02
	12	0.56 ± 0.01	0.58 ± 0.02	0.59 ± 0.01	0.58 [b] ± 0.01
	15	0.60 ± 0.01	0.69 ± 0.01	0.64 ± 0.01	0.64 [a] ± 0.01
Effect of treatment		0.61 [B] ± 0.02	0.63 [A] ± 0.02	0.62 [AB] ± 0.03	

.[a,b and c] : values in the same column bearing different superscripts significantly differed ($P<0.05$)
[A, B], : values in the same row bearing different superscripts significantly differed ($P<0.05$).

Drackley and LaCount (1994) on cow and **Kacar *et al.* (2010) on goats**, who reported that glucose concentration was higher with L-carnitine supplement than control.

On the other hand, other studies showed that dietary L-carnitine reduced the concentrations of insulin and glucose in blood plasma, suggesting enhance of glucose tolerance (**Woodworth *et al*., 2002 and Doberenz *et al*. 2006**). In addition, some reports indicated that CoQ10 increase glucose blood levels **(Jiménez-Santos *et al*. 2014**). In addition, CoQ10 regulates glucose level throughout a diminution of oxidative stress (**Littarru and Tiano, 2007**).

The blood glucose was significantly higher during middle and late lactation than late pregnancy (Table 8). These results may due to that large amount of blood glucose withdrawn by the mammary gland for the synthesis of milk lactose (**Nale, 2003**). These results are similar with those reported by **Eman *et al*. (2014)** and **Slaninal *et al.* (1992)** on dairy cow.

Hepatic functionality:

Data in Table (8) illustrate that the activity of AST increased (P<0.05) in response to supplementation with L-carnitine or CoQ10 during late pregnancy and lactation periods, while ALT concentrations had no significant differences. These results agree with results reported by **Sanaa *et al*. (2010)** that the liver function as AST and ALT activities were significantly increased by dietary supplement with L-carnitine and CoQ10 compared to control group. On the other hand, it was found in other studies that administration of L-carnitine or /and CoQ10 significantly decreased serum ALT and AST activities (**Allis *et al*, 1990**). There was higher level (P<0.05) of plasma AST and ALT activities for does in late pregnancy compared to lactation period. These results agree with earlier reports on goats (**Waziri *et al*., 2010**) and on sheep (**Piccione *et al*., 2009**). The changes in liver enzymes activity in blood due to physiological status, especially during lactation, may be resulted from alteration in hepatic metabolism, and reduce of dry matter intake around parturition **(Greenfield *et al*., 2000).** On the other hand, **Ghada, (2014)** showed that AST activity was significantly higher in early lactation cows. The increase in AST concentration after parturition could explained by the degradation of muscle cells caused by mobilization of body reserves (**Sattler and Furll, 2004**).

Total Antioxidant:

Supplementation with L-carnitine or CoQ10 increased (P<0.05) plasma concentration of total antioxidant (TAC) during late pregnancy and lactation periods compared to control does (Table, 8). In general, TAC concentrations increased during late pregnancy before parturition and start declining until parturition then continued the decline during early and mid-lactation then increased during late lactation again. Pregnancy and lactation periods considered very demanding and stressful physiological stages in ruminants. Pregnancy is associated with oxidative stress in sheep and goats **(Nawito *et al*., 2016)**. The present results are in agreement with results reported by **Al-Hassan *et al*., (2016)** on Aardi goats, that TAC concentrations during the 4th to 2nd week before parturition started to decline until parturition and continued to decline until the second week after parturition then increased again. It previously reported that total antioxidant status did not differ between late pregnant and lactating cows, as well as between early and late-lactating cows (**Castillo *et al*., 2005, 2006).** These results suggest that TAC play a key role in the protection against oxidative damage during lactation, and that early lactation is associated with a higher consumption of enzymatic and nonenzymatic antioxidants, likely due to the increased metabolic activity needed for milk production. The lower antioxidant capacity of early lactating goats was associated with significant differences in the extent of oxidative modifications to plasma proteins and lipids **(Cigliano *et al*., 2014**).

CONCLUSION

From the present study, it could recommend that L-carnitine or CoQ10 could added to does' ration at levels 40 mg and 3.0 mg/head/day, respectively, during late pregnancy and lactation periods. They could improve reproductive and productive performance, milk yield and composition of first 12 weeks of lactation, growth performance and some blood components without any adverse effects on either liver or renal functions. In addition, the use of L-carnitine or CoQ10 as an antioxidant provide effective way of controlling oxidative stress. The best results by using treatment of L-carnitine (G2). More studies are required in this field to confirm such result.

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تأثير المعاملة بـ ل-كارنتين وكوانزيم كيو 10 على الاستجابة المناعية والأداء الإنتاجى والتناسلى للماعز الدمشقى ومواليدها

2- الآداء الإنتاجي والتناسلي وبعض مكونات الدم خلال فترة نهاية الحمل وموسم الحليب.

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الملخص العربى

أجريت هذه الدراسة على 30 عنزة دمشقى عمر 1.5-2 سنة بمتوسط وزن 45.7 ± 1.64 كجم وذلك لمعرفة تاثير إضافة كلا من لـ كارنتين وكو أنزيم كيو 10 على الأداء التناسلي وإنتاج اللبن ومكوناته وتحليل مكونات الدم خلال الفترة الأخيرة من الحمل وموسم إنتاج الحليب.

قسمت العنزات إلى ثلاثة مجاميع (كل مجموعة 10 عنزات عشار)، غذيت العنزات حسب المقررات الغذائية NRC 1981

المجموعة الأولى: العليقة المقارنة (كنترول) تتغذى على 60% مخلوط علف مركز + 20% دريس برسيم + 20% قش ارز .

المجموعة الثانية: العليقة المقارنة + 40 مليجرام ل كارنتين/ كجم وزن حى/ للرأس/ يومياً.

المجموعة الثالثة: العليقة المقارنة + 3 مليجرام كو أنزيم كيو 10/ كجم وزن حى/ للرأس/ يومياً.

أظهرت النتائج ما يلى

أدت المعاملة بكل من ل كارنتين و كو أنزيم كيو 10 الى تحسين صفات الخصوبة والتؤامية وعدد الجداء المولودة لكل الأمهات المعدة للتلقيح وعدد الجداء المفطومة لكل الأمهات الوالدة وتحسين القدرة التناسلية للأمهات وخفض نسبة النفوق في الجداء من الميلاد إلى الفطام.

مجموعة ل كارنتين (G2) حققت خفض بمعدل النفوق من 43 إلى 15% عن المجموعة المقارنة بينما مجموعة كوإنزيم كيو 10 (G3) خفضت معدل النفوق من 43 إلى 40% فقط عن المجموعة المقارنة.

حدث تحسن معنوي (0.05) في محصول اللبن اليومي ومكونات اللبن من نسبة الدهن والبروتين وسكر اللكتوز في كلا مجموعتى ل كارنتين و كو إنزيم كيو 10 مقارنة بمجموعة المقارنة. إنخفض العدد الكلي للبكتريا في اللبن الطازج خلال 48 و72 ساعة أثناء فترة الرضاعة لمجموعتى ل كارنتين وكو إنزيم كيو 10 عن المجموعة المقارنة.

مجموعة ل كارنتين (G2) ومجموعة كوإنزيم كيو 10 (G3) ادتى إلى تحسن معنوي (0.05) في كل من وزن الميلاد والفطام ومعدل الزيادة الوزنية للجداء عن المجموعة المقارنة.

مجموعة ل كارنتين أو مجموعة كو إنزيم كيو 10 أدتى إلى زيادة معنوية (0.05) في تركيز مكونات الدم من البروتينات الكلية والالبيومين والجلوكوز وأنزيم AST ومضادات الأكسدة الكلية عن المجموعة المقارنة، بينما انخفض تركيز مكونات الدم لكل من الكوليسترول واليوريا والكرياتينين عن المجموعة المقارنة للأمهات.

نستخلص من هذه النتائج أن إضافة ل كارنتين بمعدل 40 مليجرام/كجم وزن حى/للرأس/ يومياً أو كوإنزيم كيو 10 بمعدل 3 مليجرام/ كجم وزن حى/للرأس/ يومياً كان لهما الأثر الإيجابي في تحسين الإداء الإنتاجي والتناسلي ومحصول وتركيب مكونات اللبن خلال أول 12 أسبوع من موسم الحليب وكذلك تحسن آداء النمو للجداء وبعض مكونات الدم مع عدم وجود تاثير سلبى على مكونات الدم لوظائف الكبد والكلى مع زيادة تركيز مستوى مضادات الأكسدة الكلية في الدم وأثرها الإيجابي على العنزات. وكانت أفضل معاملة من النتائج السابق ذكرها هي المعاملة ل كارنتين.