

EFFECT OF SELENIUM AND VITAMIN E INJECTION ON DIGESTIBILITY COEFFICIENTS AND NUTRITIVE VALUE OF BALADI DOE GOATS IN SOUTHERN SINAI.

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SUMMARY

The present study aimed to investigate the effect of different injection levels of selenium plus vitamin E on goat performance, intake, digestibility, nutritive value and body weight of kids. Forty Baladi doe goats 2-3 year old and (20.47±1.82 kg) average live body weight were randomly divided into four groups (10 does each). The first group was a control group, does of 2nd, 3rd and 4th groups received two injections of selenium and Vit. E; at early and late periods of gestation as follows, 0.125 mg Se+ 1.7 IU Vit. E/kg BW for 2nd group (T1), 0.250 mg Se + 3.4 IU Vit. E/kg BW for 3rd group (T2) and 0.310 mg Se + 4.2 IU Vit. E/kg BW for 4th group (T3). Digestibility trials were carried out after each injection. Does were fed a basal ration of concentrate feed mixture and the roughage portion of the diet was Berseem hay. Body weight of dams and kids were recorded. Results revealed that, the injection of both Se and Vit. E did not show any significant effects on TDMI and CPI of treated groups at either period of pregnancy. Control group showed higher (P<0.05) CPD% than treatments. Whereas, EED% was increased with Se supplementation. Supplementation of Se and Vit. E increased TDN% at late period and decreased NB at early and late pregnancy compared to control. Supplementation increased weight gain during pregnancy. Control and T2 recorded higher (P<0.05) average weaning weight, and daily gain than T3 and T1 groups. It could be concluded that lower level (0.125 mg Se plus 1.7 IU Vit. E/ kg /kg BW) injection during early and late gestation improved nutrients digestibility, nutritive values, nitrogen utilization

Keywords: *Goats, selenium, vitamin E, digestibility coefficients, growth.*

INTRODUCTION

Many regions in the world are poor in soil selenium (Se) content which in turn, resulted in inadequate selenium levels in forages and crops. Furthermore, under south Sinai conditions of high salinity of water irrigation, growing plants aren't capable to maintain their needs of selenium from the poor soil (Mikkelsen *et al.*, 1988 and Sadek, 1995). Subsequently, selenium supplementation is used to enhance dietary utilization (Ceballos *et al.*, 2009).

Vitamin E is very important for the development of the immune system of young animals and this is an important factor in improving performance of lambs receiving high levels of vitamin E supplementation (Kolb and Seehawer, 1998). Moreover, vitamin E inhibits the conversion of existing lipid peroxides to the much more reactive and destructive peroxide radicals (Chris *et al.*, 2003). After reviewing vitamin E studies, in human and animals, Kelleher (1991) concluded that vitamin E requirements were based on lymphocyte proliferation or, more generally, on immune function than the indicators to muscle degeneration. The biological effects of vitamin E are predominantly seen in the prevention of resumption of fetuses, testicular degeneration, muscle dystrophy, anemia and encephalomalacia, the classical signs of vitamin E deficiency in animals (Salama *et al.*, 2015). A major contributor to non- enzymatic protection against lipid peroxidation is vitamin E, a known free radical scavenger (Rikans *et al.*, 1991). Both selenium and vitamin E are antioxidants because they both protect the membranes from oxidative damage (Gutteridge and Halliwell, 1994). Selenium (Se) plays important roles in several metabolic processes including antioxidant defense systems, thyroid hormone metabolism and immune function (Brown and Arthur, 2001). Selenium is an essential component of glutathione peroxidase, an enzyme involved in detoxification of hydrogen peroxide and lipid hydro-peroxides. Selenium has also been shown to improve immune responses (Sheffy, 1979) as it is required for the development and expression of non-specific humeral and cell mediated immune responses. Selenium

deficiency plays a role in numerous economically important livestock disease, problems that include impaired fertility, abortion, retained placenta and neonatal weakness (Mc Dowell *et al.*, 1996). Earlier, National Research Council NRC (1985) recommended a dietary level of (0.1 to 0.2 ppm) of Se for sheep. Selenium is known to be required (0.05-0.1 mg Se/kg diet) for animal health (Mayland *et al.*, 1989). Marai *et al* (2009) reported that dietary selenium supplementation improved reproductive performance in sheep.

Supplementation of Se improves lambs' growth rate and reproductive performance in ewes (Ibrahim 2017). Selenium has high importance to human health due to its role in immune system activation and reduction of the risk of cardiovascular disease and cancer. Therefore, the objective of this experiment was to determine the effect of different levels of Se/vitamin E injections on the productivity of pregnant of goats in Southern Sinai.

MATERIALS AND METHODS

The present study was carried out at Ras Suder Experimental Station, Desert Research Center to investigate the effect of injections of Se+ Vit E at different levels on the productivity of Baladi doe goats under the conditions of South Sinai

Animals, experimental design and feeding

Forty Baladi doe goats 2-3 year old and (20.47± 1.82 kg) average live body weight were randomly divided after mating into four groups (10 of each).

The first group was served as control; the other experimental groups (T1, T2 and T3) received the following intramuscular injection according to Ramirez-Bribiesca *et al.*, (2005)

The first group was a control group.

The second group (T1): 0.125 mg Se + 1.7 IU Vit. E/kg body weight.

The third group (T2): 0.250 mg Se + 3.4 IU Vit. E/kg body weight.

The four group (T3): 0.310 mg Se + 4.2 IU Vit. E/kg body weight.

The experimental groups (1, 2 and 3) were injected two times; the first injection was done after 60 days of pregnancy (early pregnancy), while the second injection was done after 108 days of pregnancy (late pregnancy). Animal evaluations were carried out 20 days after injections.

Animals were fed a basal ration of concentrate feed mixture (CFM) consisted of 43% yellow corn, 22% cotton seed meal, 20% wheat bran, 12% rice bran 1.5% limestone, 1% sodium chloride and 0.5% mineral mixture). Roughage portion of the diet was Berseem hay. Rations were formulated on basis concentrate/roughage ratio of 60:40 and 70:30 in early and late pregnancy, respectively. Concentrate feeds were calculated and formulated depending on the physiological status of does according to Kearn (1982).

The experimental period covers the whole pregnancy and weaning (4 months) periods. Kids were assigned to four groups to study the effect of injection on kids' growth performance past birth up to 16 weeks. Same treatments were applied to kids as dams. Chemical composition of the experimental diet was shown in Table (1).

Digestibility trials

Digestibility trials were carried out after 20 days of each injection. Three goats from each group were selected at random and subjected to the digestibility trials. Each trial lasted for 14 days as preliminary period followed by a 5-day collection period. The concentrate feed mixture (CFM) was offered daily at 8.00 a.m. and Berseem hay at 12.00 p.m. Daily amounts of feed intake, feces and urine output were recorded during the collection period. Collected feces samples were weighed and mixed thoroughly by hand and sub samples representing 10% of daily fecal production from each doe were weighed. Representative samples of each daily collection of diets and feces were pre-dried in drying oven at 60-70 °C for 48 hrs. and then ground to pass through a one mm mill screen. Chemical composition and digestibility coefficients of DM, CP, EE, CF and NFE were determined according to AOAC (1997). Digestible energy (DE M cal/kg DM) was calculated according to NRC (1985).

Body weight

Does were weighed at the beginning of the experiment and, then, biweekly basis before and after lambing. This process took place in the morning just before offering feed and water. Throughout the experimental period, body weight changes were recorded for each animal during early and late pregnancy. After kidding body weights of does were recorded biweekly. Weights of kids were recorded from birth up to 16 weeks of age at two week intervals.

Statistical analysis was carried out using General Linear Model (GLM) procedures by SAS (2004). Fixed models, one, two and three-way analysis of variance, were used. Firstly, one way analysis was used to body weight of goats, body weight of kids, and milk yield, according to the following model:

$$y_{ij} = \mu + T_i + e_{ij}$$

Where y_{ij} : is the j^{th} sample of the i^{th} substitution level, μ : overall mean, T_i : the fixed effect of the i^{th} substitution level ($i= 1$ to 4) and e_{ij} : experiment error assumed to be normally and independently distributed.

Secondly, two- way analysis of variance was used to examine the effect of substitution levels, and the interactions between them, according to the following model:

$$Y_{ijk} = \mu + T_i + Z_j + TZ_{ij} + e_{ijk}$$

Where: Y_{ijk} = observations value of the k^{th} animal, T_i = effect of i^{th} period ($i: 1-2$), Z_j = effect of j^{th} treatment ($j: 1-4$), TZ_{ij} = the interaction between groups. Significant differences among treatment means were tested using Duncan multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

Feed intake

Feed intake (FI), total dry matter intake (TDMI) and crude protein intakes (CPI, g/ Kg BW) as well as digestible energy (DE) of the experimental does are shown in Table (2). The obtained results demonstrated that TDMI at early period of pregnancy (22.62 g/Kg BW) was significantly lower ($P<0.05$) than that of the late pregnancy (28.92 g/Kg BW) (Table 2). Also crude protein intake (CPI, g/Kg BW) at early period of pregnancy (3.64 g/Kg BW) was significantly lower ($P<0.01$) than that of the late pregnancy (4.71 g/Kg BW). On the other hand, injection of both Se and Vit E did not affect significantly either the TDMI or CPI at both periods of pregnancy (Table 2).

Intake of digestible energy (DE) differed significantly ($P<0.001$) between the two periods of pregnancy being 625.62 and 836.92 Mcal/ Kg BW at early and late period of pregnancy, respectively. On the other hand, T2 (0.250mg Se +3.4 IU Vit E/kg Body weight) showed higher ($P<0.05$) values of total digestible energy intake (TDEI) in both periods for early and late periods of pregnancy than those of T1 and T3. Control group did not differ from other treatments with regard to DE intake (Table 2). These results are in agreement with the findings of Neeraj *et al.* (2008) where supplementation of selenium at 0.15 and 0.30 ppm levels had no effect on palatability and DMI pattern of the animals. Vinu *et al.* (2012) reported that TDMI of calves was not significantly affected by the supplementation of 0.3 ppm organic selenium as compared with control. Juniper *et al.* (2008) observed no effect of different dietary levels of selenium yeast (0.2 to 6.74 ppm) on the dry matter intake of male buffalo calves. Tufarelli and Laudadio (2011) registered no significant differences ($P<0.05$) in dry matter intake of dairy goats when Se was supplement in concentrate (0.20 mg/head per day of Na-selenite and 20 mg/day per head of Vit. E).

Serra *et al.* (1994) reported that supplementation of 0.2 ppm Se to the basal diet (31.74 ppb Se) did not affect the DM consumption of sheep.

Digestion coefficients

Data of Table (3) clearly showed that as the level of Se and Vit. E increased the digestibility's of DM, OM, CP and NFE were significantly decreased at both early and late pregnancy.

Injection of Se and Vit. E showed a significant decreasing trend of DMD as the level of Se increased at both early and late pregnancy (Table 3). Early pregnancy control group of animals had the highest significant DMD (74.48%), T1, T2 and T3 showed lower significant DMD values (71.59%, 68.87% and 67.22%, respectively). During the late period of pregnancy, the same trend of DMD was found as that of

early period of pregnancy; yet the values were 76.13%, 75.60%, 73.46% and 70.37% for control, T1, T2 and T3, respectively. The overall mean of dry matter digestibility (DMD %) at the early pregnancy period was 70.54% compared to 73.89% for the late pregnancy period with insignificant manner.

At early pregnancy, control group showed the highest ($P<0.05$) CPD value (76.74%). while, at late pregnancy, T1 had the highest CPD (%) value. Among treatments, the injection of Se and Vit E at the level of (0.310mg Se + 4.2 IU Vit. E/ kg Body weight, T3) at both periods of pregnancy showed the lowest significant ($P<0.05$) CPD (70.12 and 72.03%) for early and late pregnancy periods, respectively. The overall mean of crude protein digestibility (CPD, %) at early period of pregnancy was 72.78% and that of late period was 73.89% with insignificant manner (Table 3).

Among treatments, EED (%) was increased insignificantly with the Se + Vit. E supplementation at early and late pregnancy periods. Ether extract digestibility (EED, %) of goats at the early pregnancy period was higher ($P<0.01$) (77.87%) compared to (71.54%) for the late pregnancy period. Digestibility of CF was significantly decreased with increased Se plus vitamin E in late pregnancy (Table 3).

These results are in agreement with those found by Kholif and Kholif (2008) who found that digestibility of OM, EE, CF and NFE were significantly increased with buffaloes fed low amount of selenium enriched yeast followed by high amount of selenium enriched yeast and then control. Furthermore, Nicholson *et al.* (1991) observed that upon the supplementation of 1ppm of Se, there was no effect on the digestibility of OM, CP and NDF in calves. Neeraj *et al.* (2008) noticed that the supplementation of 0.15 and 0.3 ppm Se (through sodium selenite) had no effect on digestibility of these nutrients in lambs. Zohreh *et al.* (2018) found that, apart from crude fat, no significant differences for all other apparent nutrient digestibility, as well as total digestible nutrients ($P<0.05$). Shi *et al.* (2011) attributed the improvements in total dry mater, crude protein, and ether extract digestibility's to the increase in Se level from 0.15 to 0.45 mg Se/Kg DM in male goats.

Kassab and Mohammed (2014) where nutrient digestibility coefficients were slightly improved with vitamin E plus Se- injected ewes.

The improvements in nutrient digestibility's may be due to positive effects of Se on rumen microorganisms rather than the host ruminants (Wang *et al.*, 2009). Microbial efficiency was lower for the 70% grain included diet plus supplemental Se, yet, the lower level of grains (50%) showed improved digestibility coefficients when supplemental Se was included. Also, Del Razo *et al.* (2013) found improved microbial and N efficiency with the 50% grain diet plus 0.9 mg Se/kg DM. Absorption is less in ruminants compared to monogastric animals and this is because selenium gets reduced to insoluble compounds in the rumen Chander (1998).

Nutritive values and Nitrogen balance

Data of Table (4) showed significant decrements of TDN, DCP, DE and nitrogen balance as the level of Se + Vit. E injection was increased. Corresponding values were significant higher in late pregnancy than early pregnancy. The results of DCP (%) declared that there weren't any significant differences among the treatments and overall of the two periods. In agreement results were found by, Kumar *et al.* (2008) who reported non-significant effect of supplemental Se at 0.15 or 0.30 mg/kg DM on intake of DCP and TDN in sheep. Nicholson *et al* (1991) found no effect with Se supplementation to all ration of lambs and buffalo calves on nutritive value of ration TDN and DCP.

The overall means of TDN, DCP, DE and nitrogen balance at early period of pregnancy were significantly lower ($p<0.05$) than that of the late period of pregnancy. The results of DCP (%) declared that there weren't any significant differences among the experimental treatments and overall means of the two periods.

Nitrogen balance (NB) of doe goats were (1.48g/h/d) and (6.95 g/h/d) for the early and late pregnancy periods, respectively. On the other hand, supplementation of both Se plus Vit. E was found to decrease NB at early pregnancy. During late pregnancy, T1 and T2; yet the value was lower (3.87g/h/d) for T3 may be because of the decrease intake and TNI in total CP with increase Selenium plus vitamin E supplementation (Table 4).

Generally, the superiority in nitrogen retention due to specific ration is affected by several factors such as increasing presence of fermentable energy and possible production of microbial protein synthesis (Hagemeister *et al.*, 1981). Tekchandani and Arom (1978), Khirwar and Arora (1976) and Hansard (1983) noticed that animals fed on high Se diets were in negative state of N balance and the digestibility of CP and other nutrients were also lower in high-Se groups. It is possible that microbial protein synthesis might have been reduced due to high Se intake. Bakshi *et al.* (1986) observed significantly higher

excretion of N through feces and urine in male buffaloes given high-Se urea treated straw (2.14 ppm Se) as compared to those given low-Se urea treated wheat straw (0.21 ppm Se). Oldham *et al.* (1977) reported that there are several factors which can affect protein/nitrogen utilization in ruminants including level, source and degradability of dietary nitrogen, level and type of carbohydrates which match the protein synthetic ability of rumen microbes. Nitrogen balance gives an idea regarding the extent of utilization of dietary nitrogen and finally the amount lost or retained in the body. It is well known that tissue needs for nitrogen of a ruminant animal are met by the microbial protein synthesized in the rumen and the degraded protein that escapes from microbial breakdown further gets digested and absorbed from small intestine. Fecal excretion was comparable in animals given Seleno-methionine or sodium selenite but urinary excretion was reduced in animals given Seleno-methionine (Ehlig *et al.*, 1967). Fecal excretion is generally greater than urinary excretion in ruminants and exhalation a major route of Se excretion only when toxic concentrations are consumed Chander (1998).

Body weight of goats

Final body weight and total body weight gain are shown in Table (5). Injection of Se plus vitamin E did not have any significant effects on live body weight at 90 days, before and after kidding. The highest final live body weight was recorded for injection 0.125 mg Se plus 1.71u Vitamin E; T1(23.87) followed by that 0.250 mg Se plus 3.41u vitamin E; T2 (21.95) and the lowest one was observed with level 0.310 mg Se plus 4.2 Vitamin E; T3(20.17 Kg). In general, final live body weight was increased with decreasing level of Se plus vitamin E. Also, treatment increased weight gain during pregnancy period in Baladi doe goats after parturition in T2 (2.40 Kg), T1 (2.33 Kg), control (1.80 Kg) compared with T3 (0.917 Kg).

These results are in agreement with those reported by Tufarelli and Laudadio (2011) who found non-significant differences ($P < 0.05$) in body weight gain among groups of dairy Jonica goats fed rations containing sodium selenite as the Se supplement in concentrate (0.20 mg/head per day of Na-selenite and 20 mg/day per head of Vit. E). On the contrary, Yue *et al.* (2009) reported that dietary supplemental Se improved significantly the average gain and the final body weight and average daily gain.

Body weight of kids

Results of Table (6) clearly indicated that Se+ vit E injection significantly decreased birth weight, 60 days and weaning weights and daily gain of kids compared with control. These results are in agreement with those obtained by Gunter *et al.* (2003) who mentioned that in pregnant cows, Se supplementation had no effect on body weight; birth weight; total body weight gain, and average daily gain (ADG) of calves. Moreover, Vinu *et al.* (2012) found that supplemented Se- yeast at rate of 0.3 ppm to calves diets did not reveal any significant difference on daily body weight gain as compared with control.

However, Ibrahim (2016) found that maternal Se supplementation improved body gain of their lambs. The beneficial effects of supplemental Se on animal performance was reported to improve birth weight of lambs (Ali *et al.*, 2004) and average body weight for new born lambs (Hefnawy *et al.*, 2014). Gabryszuk and Klewicz (2002). Supplementation of Se (0.15mg Se/kg of diet) through sodium selenite increased average daily gain improving the growth rate (Kumar *et al.*, 2009). In consistence, Se supplementation increased cow BW, and calf birth, weaning, and post weaning weights, or weight per day of age in early lactation (Sprinkle *et al.*, 2006).

CONCLUSION

Selenium concentrations change considerably during pregnancy depending on the level of Se injected. The results of the current study revealed that lower level (0.125 mg Se plus 1.7 IU Vit. E/ kg /kg BW) injection during early and late gestation periods improved nutrients digestibility, nutritive values, nitrogen utilization

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تأثير الحقن بالسيلينيوم وفيتامين هـ على معاملات الهضم والقيمة الغذائية لإناث الماعز البلدي في جنوب سيناء

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قسم تغذية الحيوان والدواجن – شعبة الإنتاج الحيواني والدواجن – مركز بحوث الصحراء – القاهرة - مصر

الهدف من البحث: تحديد الجرعة المناسبة من السيلينيوم بالإضافة إلى فيتامين هـ على أداء الإنتاجي للماعز خلال فترتي الحمل والحليب. خطة الدراسة. واستخدم في هذه الدراسة عدد أربعين أنثى ماعز بلدى في عمر 2-3 سنين بمتوسط وزن (20.47 كجم) في تصميم عشوائي تم تقسيمها عشوائيا إلى أربع مجموعات (عشرة في كل مجموعة) تم حقن الحيوانات بالسيلينيوم وفيتامين هـ خلال فترتين الأولى والثانية من الحمل بالجرعات الآتية:

المجموعة: (كنترول)

المعاملة الأولى: 0.125 ملليجرام سيلينيوم + 1.7 وحدة دولية فيتامين هـ لكل كجم من وزن الجسم

المعاملة الثانية: 0.250 ملليجرام سيلينيوم + 3.4 وحدة دولية فيتامين هـ لكل كجم من وزن الجسم

المعاملة الثالثة: 0.310 ملليجرام سيلينيوم + 4.2 وحدة دولية فيتامين هـ لكل كجم من وزن الجسم

وأجريت تجارب هضم بعد كل حقنة وتم تقدير وزن الجسم للامهات والمواليد وتم تقدير قياسات الدم والاملاح واللبين

أهم النتائج المتحصل عليها:

1. أوضحت النتائج أن الحقن بالسيلينيوم وفيتامين هـ عدم وجود اختلافات معنوية في المادة الجافة المأكولة والبروتين الخام المأكول خلال فترتي الحمل
2. أظهرت مجموعته الكنترول اعلى قيمة في معامل هضم البروتين عن المجموعات المعاملة وزاد معامل هضم الدهن مع زيادة السيلينيوم وفيتامين هـ
3. حدث زيادة في مجموع المركبات الكلية المهضومة في الفترة الأخيرة من الحمل وانخفاض ميزان النيتروجين في أول وأخر الحمل بالمقارنة بالكنترول.
4. جدول 6 يوضح أن اعلى متوسط وزن فطام كان للمجموعة T2 (جرعة متوسطة) يليها الكنترول ثم T1 وان أعلى زيادة وزنية كان T2 ويليها T1

Table (1): Chemical composition of concentrate diet and Berseem hay (on DM basis, %).

Item	Chemical composition								
	DM	OM	CP	CF	EE	NFE	Ash	Se mg/kg DM	DE**
CFM*	92.40	93.76	16.87	7.47	2.80	66.62	6.24	0.076	3290
Berseem hay	91.33	85.75	15.16	30.94	2.11	37.54	14.25	0.058	2100

*CFM concentrates feed mixture, DE** Digestible energy (DE, Mcal//kg DM)

Table (2): Effect of treatment on feed intake and body weight of Baladi doe goats during pregnancy periods.

Item	Early pregnancy					Late pregnancy					Overall mean	±SE ¹
	Control	T1	T2	T3	Overall mean	Control	T1	T2	T3			
Average body weight (Kg)	25.83	31.33	26.33	28	27.87±0.89	28.33	31.33	29.33	25.66	28.66±0.89	±1.77	
Voluntary intake (g/kg BW/day):												
Concentrate	13.08 ^c	11.77 ^c	13.01 ^c	12.75 ^c	12.65 ^B ±0.25	19.55 ^{ab}	17.98 ^b	19.39 ^{ab}	20.25 ^a	19.29 ^A ±0.25	±0.499	
Berseem hay	9.64 ^{ab}	10.28 ^a	10.25 ^a	9.68 ^{ab}	9.96±0.25	10.04 ^a	9.68 ^{ab}	10.61 ^a	8.17 ^b	9.62±0.25	±0.506	
Total dry matter intake	22.72 ^b	22.05 ^b	23.26 ^b	22.44 ^b	22.62 ^B ±0.37	29.59 ^a	27.66 ^a	29.99 ^a	28.43 ^a	28.92 ^A ±0.37	±0.744	
DEI* (Mcal/kg BW):												
Concentrate	430.29 ^c	387.28 ^c	428.21 ^c	419.66 ^c	416.4 ^B ±8.22	643.22 ^{ab}	591.74 ^b	637.87 ^{ab}	666.34 ^a	634.8 ^A ±8.22	±16.43	
Hay	202.48 ^{ab}	215.90 ^a	215.25 ^a	203.38 ^{ab}	209.2 ^A ±5.31	210.77 ^a	203.27 ^{ab}	222.76 ^a	171.68 ^b	202.1 ^A ±5.31	±10.63	
TDEI**	632.78 ^b	603.19 ^b	643.47 ^b	623.04 ^b	625.6 ^B ±10.20	854.0 ^a	795.01 ^a	860.64 ^a	838.03 ^a	836.9 ^A ±10.20	±20.41	
Total CP intake (g/head/d)	94.44 ^d	111.02 ^{cd}	98.50 ^{cd}	101.27 ^{cd}	101.31 ^B ±3.44	136.66 ^{ab}	141.02 ^a	142.29 ^a	119.17 ^{bc}	134.78 ^A ±3.44	±6.88	
Total CP intake (g/kg BW)	3.66 ^b	3.54 ^b	3.75 ^b	3.62 ^b	3.64 ^B ±0.06	4.82 ^a	4.50 ^a	4.88 ^a	4.65 ^a	4.71 ^A ±0.06	±0.119	

a, b, c and d: values with different letters in the same row means statistically significant at (P<0.05), A, B of overall mean with different superscripts are significant differences (p<0.05). ±SE¹, Standard error for treatments = Early pregnancy and Late pregnancy, DEI* (Mcal/kg Bw) Digestible energy intake, TDEI** Total Digestible energy intake.

Table (3): Effect of treatment on nutrients digestibility of Baladi doe goats during early and late pregnancy period.

Item	Early pregnancy					Overall mean	Late pregnancy					Overall mean	±SE ¹
	Control	T1	T2	T3	Control		T1	T2	T3				
DM	74.48 ^{ab}	71.59 ^{abc}	68.87 ^c	67.22 ^c	70.54 ^B ±0.71	76.13 ^a	75.60 ^a	73.46 ^{ab}	70.37 ^{bc}	73.89 ^A ±0.71	±1.41		
OM	76.53 ^{a b}	73.22 ^{abcd}	70.68 ^{dc}	69.44 ^d	72.46 ^B ±0.68	77.32 ^a	76.94 ^a	74.75 ^{abc}	72.16 ^{bcd}	75.29 ^A ±0.68	±1.36		
CP	76.74 ^a	72.18 ^{bc}	72.07 ^{bc}	70.12 ^c	72.78±0.59	74.96 ^{ab}	75.60 ^{ab}	72.99 ^{abc}	72.03 ^{bc}	73.89±0.59	±1.17		
EE	76.72	77.61	79.86	77.29	77.87 ^A ±0.94	72.54	72.14	68.30	73.21	71.54 ^B ±0.94	±7.87		
CF	60.38 ^a	58.79 ^a	49.53 ^c	52.16 ^{bc}	55.92±0.92	58.59 ^a	59.28 ^a	56.77 ^{ab}	48.36 ^c	55.75±0.92	±1.83		
NFE	81.61 ^{abc}	78.33 ^{bcd}	76.83 ^{de}	75.21 ^e	77.99 ^B ±0.66	83.29 ^a	82.46 ^{ab}	80.59 ^{abc}	77.97 ^{cde}	81.08 ^A ±0.66	±1.33		

a, b, c and d: values with different letters in the same row means statistically significant at (P<0.05), A, B of overall mean with different superscripts are significant differences (p<0.05). ±SE¹, Standard error for treatments = Early pregnancy and Late pregnancy

Table (4): Effect of treatment on nutritive values and nitrogen utilization of Baladi doe goats during early and late pregnancy periods.

Item	Early pregnancy					Overall mean	Late pregnancy					Overall mean	±SE ¹
	Control	T1	T2	T3	Control		T1	T2	T3				
Nutritive values:													
TDN %*	71.57 ^{ab}	68.32 ^{bc}	66.26 ^c	65.52 ^c	67.92 ^B ±0.59	72.72 ^a	72.29 ^a	70.14 ^{ab}	68.37 ^{bc}	70.88 ^A ±0.59	±1.19		
DCP %**	12.39	11.16	11.61	11.19	11.59±0.15	12.21	12.30	11.87	11.80	12.04±0.15	±0.307		
DE (Mcal/kg DM) ***	3.15 ^{ab}	3.01 ^{bc}	2.92 ^c	2.89 ^c	2.99 ^B ±0.03	3.21 ^a	3.19 ^a	3.09 ^{ab}	3.01 ^{bc}	3.12 ^A ±0.03	±0.052		
Nitrogen utilization g/h/d:													
Nitrogen intake g/h/d	15.11	17.76	15.76	16.20	16.21 ^B ±0.55	21.86	22.56	22.76	19.06	21.56 ^A ±0.55	±1.10		
Execration nitrogen g/h/d ²	12.95	16.23	14.51	15.19	14.72±0.45	13.47	14.27	15.49	15.19	14.61±0.45	±0.899		
Nitrogen balance g/h/d	2.16 ^c	1.53 ^c	1.24 ^c	1.01 ^c	1.48 ^B ±0.18	8.38 ^a	8.29 ^a	7.27 ^a	3.87 ^b	6.95 ^A ±0.18	±0.362		
N- balance as % of nitrogen intake	14.23 ^d	8.58 ^e	7.89 ^e	6.20 ^e	9.23 ^B ±0.74	38.53 ^a	36.7 ^a	31.9 ^b	19.83 ^c	31.80 ^A ±0.74	±1.48		

*a, b, c and d: values with different letters in the same row means statistically significant at (P<0.05), A, B of overall mean with different superscripts are significant differences (p<0.05). TDN, *Total digestible nutrients, DCP, **Digestible crude protein, DE***Digestible energy (M cal/kg DM) = 0.04409*TDN% was calculated according to N.R.C (1988), ±SE¹, Standard error = Early pregnancy and Late pregnancy, Execration nitrogen g/h/d²=N faces+ N urine*

Table (5): Effect of treatment on body weight changes of Baladi doe goats during gestation.

Item	Control	T1	T2	T3
Initial body weight(kg)	20.30±1.91	21.92±1.74	19.90±1.91	19.75±1.74
Body weight at 90 days (kg)	24.71±1.86	25.96±1.70	23.70±1.86	22.56±1.70
Body weight before kidding	28.50±1.93	30.52±1.76	28.96±1.93	26.21±1.76
Body weight after kidding	21.10±1.67	24.25±1.52	22.30±1.67	20.66±1.52
Body weight loss, just after kidding(kg)	6.40±0.827	6.27±0.755	6.66±0.827	5.55±0.755
%of body weight loss,	22.25±2.28	20.93±2.08	23.12±2.28	20.86±2.08
Final live body weight (kg)	21.74±1.66	23.87±1.52	21.95±1.66	20.17±1.52
body weight gain(g/day)	1.80±0.767	2.33±0.700	2.40±0.767	0.917±0.700
Total body weight gain (g/day)	1.44±0.762	1.96±0.695	2.05±0.762	0.421±0.695

a, b, c and d: values with different letters in the same row means statistically significant at (P<0.05).

Table (6): Effect of treatment on birth weight and daily gain of kids.

Item	Control	T1	T2	T3
Number of kids born alive	7	9	8	8
Birth weight(kg)	2.55 ^a ±0.206	2.14 ^{ab} ±0.168	1.98 ^{ab} ±0.184	1.86 ^b ±0.148
Body weight of kid at 60 days, kg	8.50±0.458	7.83±0.374	7.70±0.409	7.30±0.409
No. of weaned kids	5	7	6	6
Average weaning weight (kg)	13.25±0.709	13.0±0.579	13.30±0.635	12.10±0.635
Total body weight gain (kg)	10.70±0.659	10.86±0.538	11.32±0.589	10.24±0.589
Total daily gain gm/day	89.16±5.49	90.48±4.48	91.25±4.91	85.28±4.91

a, b, c and d: values with different letters in the same row means statistically significant at (P<0.05).