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Impacts of Chromium and Selenium-E on Cortisol Levels, Reproductive and productive Efficiency of Baladi Female Goats under Subtropical Conditions.

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ABSTRACT

The present study was conducted during estrous cycle and pregnancy period in Baladi female goats to study the effect of chromium and selenium with vitamin E on blood serum cortisol concentration. Seventy-two of mature Baladi does with age ranged from 2 to 3 years old and the mean body weight was 25.1±1.5 kg was used under two conditions of winter and summer seasons (36 animals/season). The animals were randomly divided into three groups, the 1st group was kept as control and the 2nd group was supplemented by chromium (chromium chloride trivalent), 0.8 mg/head/day. The 3rd group was intramuscularly injected twice a week with 2ml viteselen®, contained 0.5 mg selenium and 10.7 IU vitamin E (Se-E). Serum cortisol levels were assessed in the three experimental goats during the estrous and pregnancy periods. The results demonstrated that Goats supplementation with Cr or Se-E significantly decreased ($P<0.05$) serum cortisol concentrations than control during estrous cycle. In addition, Cr mostly lowered ($P<0.05$) cortisol than control, but Se-E thoroughly increased it during pregnancy. However, under mild season at pro-estrus phase Cr treatment increased cortisol significantly ($P<0.05$) than control. Also, during pregnancy period Cr decreased cortisol at Mid-Pregnancy and Late-Pregnancy periods; however, Se-E increased cortisol at the Late-Pregnancy period than the control group. Under hot season, Cr treatment decreased ($P<0.05$) cortisol during estrous cycle, pregnancy period. However, injection of Se-E decreased cortisol during estrous cycle and showed a contrary effect during pregnancy period. On the other side, Reproductive traits of female goats showed that, under mild season conditions Cr or Se-E supplementations did not have any effect on goat's reproductive traits, in terms of conception rate, kidding rate, fertility rate, prolificacy and fecundity compared to control group. Under hot season conditions, Cr and Se-E improved both of fertility and conception rate, as well as, increased fecundity percentage more than control. Cr group had lowest prolificacy, however; Se-E had the highest one compared to control. Chromium group had significantly ($P<0.05$) higher birth weight of kids than control and Se-E either at mild or hot season. However, injection of Se-E did not affect litter birth weight under mild and hot conditions. So, It can be concluded that Cr and Se-E supplementation can enhanced the reproductive and productive traits of female Baladi goats under hot season.

INTRODUCTION

Hot summer season conditions cause infertility in farm animals and appears a major source of economic loss. In response to heat stress, leaders can try out a variety of approaches to progress reproduction. These approaches usually include changing the environment (i.e. attempting to cool animals during reproduction), supplementation of antioxidants in case of semi-intensive system as goats are grazed in the open during the most of day, which protect the body defense system against excessively produced free radicals during heat stress and stabilize health status of the animal, or increasing reproductive management at heat stress periods. Heat stress affects reproduction in all major farm species (Ahmed and Tariq, 2010; Sivakumer *et al.*, 2010).

The great focus of chromium research was given on the incorporation between chromium and diabetes. It was as late as in the 1990s that chromium also started to be studied intensively as an essential mineral in livestock animals (Amata, 2013).

The major role of chromium in metabolism is promoting glucose uptake by the cells (Davis and Vincent, 1997). The beneficial effects of chromium can be spotted more efficiently with environmental, dietary, and hormonal stressors.

In ruminants, supplementation of Chromium is recommended during heat stress periods, while, Chromium supplementation decreases the unfavorable effects of heat stress (Sahin *et al.*, 2001).

Selenium (Se) is a perfect trace element, animated for the normal growth and animals healthy. Se has a biological mission related to vitamin E while, Se is the main component of glutathione peroxidase enzyme which involved in detoxification of hydrogen peroxide and lipid hydroperoxides. The vitamin E requirement may, therefore, be defined as the amount required to prevent peroxidation in the particular subcellular membrane which is most susceptible to peroxidation. Furthermore, Se is a main component of selenoproteins and also, involved in immune and neuropsychological function in the nutrition of animals (Meschy, 2000).

However, a few are recognized around the effects of vitamin E supplementation on specific reproductive calamities in sheep (Koyuncu and Yerlikaya, 2007). Se deficiency can give rise to numerous economically important livestock diseases and many reproductive problems that contain impaired fertility, abortion, retained placenta and neonatal weakness (McDowell *et al.*, 1996). However, a little reference is obtainable about goats (Meschy, 2000).

The present work aimed to study the effect of chromium and selenium-E supplementations on blood serum cortisol concentration, reproductive and productive traits of does under heat stress conditions through different reproductive periods (estrous and pregnancy periods) to alleviate heat stress on native Baladi female goats for improving reproductive performance under Egyptian conditions.

MATERAILS AND METHODS

Animals and Feeding:

This experiment was carried out in Goats Experimental Farm, Nuclear Research Center, Atomic Energy Authority, Inshas. The experimental animals were healthy and clinically free of external and internal parasites and were fed a basal ration of concentrate feed mixture (CFM) according to the allowances of NRC (2007) of goats. The CFM composed of 37.4% wheat bran, 27% yellow corn, 12.5% soybean meal, 10.0% undecorticated cottonseed cake, 5% rice bran, 4% sugarcane molasses, 3% limestone, 1% sodium chloride and 0.1 vitamin and minerals premix. Feed mixture was offered once daily at 9:00 a.m., based on 3.5% of body weight. Berseem hay was offered *ad libitum*. Fresh drinking water was available at all times.

Animal Housing:

All experimental animals were protected in semi-open yards with force shade and ventilation during day and night in summer and protection from rain in winter and kept under the same environmental and managerial conditions to the termination of the trail. The does were allowed to graze five hours daily at least.

Experimental Design:

Seventy-two mature female goats (36 animals/ season) aged 2-3 years old with average body weight 25 ± 1.5 kg were randomly divided into three groups. Animals in the 1st group were kept as control, the 2nd group was supplemented by chromium (chromium chloride trivalent), 0.8 mg/head/day as capsules (Williams *et al.*,1994) and the 3rd group was intramuscularly injected with 2 ml viteselen®, contained 0.5 mg selenium and 10.7 IU vitamin E/head/day.

Estrus Synchronization and Blood Sampling:

All groups received 10 ml of PGF2α

(lutalyse) in double dose (5 mg/ dose, IM) at 11 day-intervals, followed by 500IU of hCG; then after 24 hours three fertile bucks (one buck for each group) were introduced to the does and allowed to be with does for two successive estrous cycles for estrous detection and natural mating. Blood samples were collected from the jugular vein in evacuated glass tubes and kept at room temperature from 30 to 60 min for clotting, then centrifuged at 3000 rpm for 15 min to separate serum. Another parallel blood sample was collected in heparinized tubes to obtain plasma for protein fractions analysis. After that serum and plasma were stored at -20°C until analyzed. Samples were collected throughout different stages of estrous cycle, according to Fateta *et al.* (2011) and monthly during pregnancy.

Ambient Temperature, Relative Humidity and Temperature Humidity Index:

The ambient temperature and relative humidity were recorded daily from the meteorological station of Atomic Energy Authority during the whole experimental period. The temperature-humidity index (THI) was calculated during mild and hot seasons according to Marai *et al.* (2000) as: THI = db °C – [(0.31- 0.31RH) × (db °C-14.4)]. (Table 1) Where, THI= temperature-humidity index, db °C= dry bulb temperature in Celsius and RH = relative humidity ÷100.

Table 1: The values of THI during the experimental period

Seasons	Ambient temperature		Relative humidity values %		THI	
	Max	Mini	Max	Mini	Max	Mini
Mild	23.47	14.24	80.01	27.44	22.9	13.9
Hot	34.15	23.28	77.91	20.30	32.8	23.5

Mild= October, November, December, January, and February; Hot= May, June, July, August and September

Cortisol Hormonal Assay:

Cortisol (ng/ml) determination was carried out according to the procedure specified with the RIA kits produced by IZOTOP, Institute of isotopes Ltd., Budapest, Hungary.

Reproductive Traits:

The following reproductive performance traits were recorded for each doe:

Fertility rate = No. of goats kidded / No. of goats joined to the buck x100.

Prolificacy (litter size/doe) = No. of kids born / No. of goats kidded.

Fecundity = No. of kids born / No. of goats joined to the buck x100.

Kidding rate = No. of goats kidded / No. of pregnant goats x100.

Conception rate = No. of pregnant goats (aborted or delivered) / No. of goats joined to the buck x100.

The above parameters were calculated according to Charring *et al.* (1992).

Statistical Analysis:

Statistical data were analyzed using the general linear model (GLM), the procedure of SAS (2000), The statistical model used was:

$$\mathbf{Y_{ijk} = \mu + S_i + T_j + (ST)_{ij} + e_{ijk}}$$

Where, Y_{ijk}= the dependent variables estimated, μ= Overall mean, S_i= the effect of i[th] season (1=mild and 2=hot), T_j= the effect of j[th] treatment (1=control, 2=chromium, and 3=selenium-E), ST_{ij}= the effect of interaction between season and treatment and e_{ijk} = random error, and the significant differences between means verified by Duncan Multiple test (Duncan, 1955).

Chi-square test used to evaluate the association between treatment groups and proportion dichotomous variables (kidding traits and pregnancy rate).

RESULTS

Effect of Climate Conditions and Treatments on Cortisol Levels During Estrus and Pregnancy Periods:

Regardless treatments effect, cortisol concentration was higher during the hot season than mild during different phases of estrous cycle, except at proestrus phase the mild season was higher in cortisol (34.93 ng/ml, P<0.0001) than hot (24.63 ng/ml), as shown in Table (2).

It is worthy to mention that, cortisol significantly (P<0.05) decreased at estrus phase due to Cr or Se-E treatments compared with control. Does of Cr treatment showed lower (P<0.05) cortisol levels than Se-E during estrous phases with lowest concentrations of 13.35 and 15.10 ng/ml at diestrus and estrus phase, respectively. Whereas, the lowest cortisol level due to Se-E (20.89 ng/ml) was at diestrus versus 36.93 ng/ml for control (Table 2).

Does supply with Cr showed significantly (P<0.05) low cortisol levels under hot season more than mild. However, Se-E goats showed lower serum cortisol under hot season than mild, with significance at proestrus and metestrus phases (Table 2).

As affected by the interaction, under mild conditions cortisol levels were not significantly different due to treatments than control. However, under hot conditions does subject by Cr showed significant (P<0.05) decrease in cortisol level during estrous phases with a concentration of 5.99 ng/ml for diestrus and estrus phases and 11.59 ng/ml for proestrus and metestrus phases, respectively. Se-E showed the same decline effect in cortisol during estrous cycle compared with control; the lowest level was (14.65 ng/ml) at metestrus versus 60.93 ng/ml for control (Table 2).

Table 2: Means (±SE) of serum cortisol concentrations (ng/ml) of does during the estrous cycle as affected by season, treatment and their interaction.

Item	**Cortisol (ng/ml)**			
	Diestrus	**Proestrus**	**Estrus**	**Metestrus**
Season (S)				
Mild	21.72 ±1.4	34.93 ±1.5	22.44±1.5	26.75 ±1.6
Hot	25.73 ±3.5	24.63 ±2.5	28.39 ±3.6	29.06 ±3.9
***P*- value**	0.03	0.0001	0.005	0.229
Treatments (T)				
Control	36.93^{A} ±3.6	36.97^{A} ±2.1	36.71^{A} ±4.2	43.44^{A} ±3.8
Cr	13.35^{C} ±1.8	25.29^{B} ±3.2	15.10^{C} ±1.9	17.77^{C} ±1.4
Se-E	20.89^{B} ±1.9	27.08^{B} ±2.4	24.45^{B} ±2.3	22.50^{B} ±2.9
***P*- value**	0.0001	0.0001	0.0001	0.0001
Interaction (S*T) Item				
Mild	-	-	-	-
Control	21.36^{b} ±1.6	31.05^{c} ±2.8	18.55^{b} ±2.6	25.95^{b} ±0.6
Cr	20.71^{b} ±1.7	38.98^{ab} ±2.5	24.21^{b} ±0.66	23.95^{b} ±0.01
Se-E	23.09^{b} ±3.6	34.74^{bc} ±2.5	24.57^{b} ±3.6	30.35^{b} ±4.7
Hot	-	-	-	-
Control	52.49^{a} ±3.0	42.89^{a} ±2.2	54.87^{a} ±2.7	60.93^{a} ±2.1
Cr	5.99^{c} ±0.42	11.59^{e} ±1.3	5.99^{c} ±0.42	11.59^{c} ±2.3
Se-E	18.68^{b} ±1.6	19.41^{d} ±2.5	24.32^{b} ±3.2	14.65^{c} ±1.8
***P*- value**	0.0001	0.0001	0.0001	0.0001

In each factor means in the same column with different superscripts are significantly different.
Cr= chromium, Se-E= Selenium +Vitamin-E.

As shown in Table (3) cortisol levels were lower during the hot season than mild during pregnancy stages showing significance (P<0.0001 or 0.01) at early- and late pregnancy.

Chromium treatment had the upper hand in decreasing cortisol levels compared with control and Se-E groups during pregnancy. The lowest cortisol level due to Cr treatment was about 11.26 ng/ml at late-pregnancy (Table 3). It was found that Se-E injection increased (P<0.05) cortisol levels during pregnancy period especially at mid-pregnancy (46.4 ng/ml) more than control (26.98 ng/ml) as shown in Table (3).

Chromium does show a marked decrease (P<0.05) in cortisol levels under the hot season during pregnancy period compared with other groups. The lowest value was (6.15 ng/ml) at early-pregnancy versus 19.12 ng/ml for control. However, Se-E treatment increased (P<0.05) cortisol levels during pregnancy, although this increase was not significant at late-pregnancy compared with control, the highest level was (55.98 ng/ml) at mid-pregnancy vs. 21.19 ng/ml for control as shown in Table (3).

Table 3: Means (±SE) of serum cortisol concentrations (ng/ml) of does during pregnancy period as affected by season, treatment and their interaction

Item	Cortisol (ng/ml)		
	Early	Mid	Late
Season (S)			
Mild	33.09 ±1.6	31.85 ±1.6	24.35 ±1.9
Hot	18.84 ±1.8	29.46 ±3.2	21.39 ±1.7
***P*- value**	0.0001	0.144	0.004
Treatments (T)			
Control	24.49^{B} ±1.5	26.98^{B} ±1.7	22.87^{B} ±1.2
Cr	25.29^{B} ±4.0	18.60^{C} ±2.0	11.26^{C} ±1.1
Se-E	28.11^{A} ±1.3	46.40^{A} ±2.4	34.49^{A} ±1.4
***P*- value**	0.024	0.0001	0.0001
Interaction (S*T) Item			
Mild	-	-	-
Control	29.86^{b} ±1.7	32.77^{b} ±2.3	18.77^{c} ±1.4
Cr	44.43^{a} ±0.7	25.97^{c} ±2.6	14.81^{d} ±1.5
Se-E	24.96^{c} ±1.9	36.81^{b} ±2.7	39.48^{a} ±1.2
Hot	-	-	-
Control	19.12^{d} ±1.3	21.19^{c} ±0.9	26.97^{b} ±0.83
Cr	6.15^{e} ±0.2	11.22^{d} ±0.4	7.71^{e} ±0.80
Se-E	31.25^{b} ±1.5	55.98^{a} ±1.6	29.49^{b} ±1.3
***P*- value**	0.0001	0.0001	0.0001

In each factor means in the same column with different superscripts are significantly different.
Cr= chromium, Se-E= Selenium +Vitamin-E.

As affected by the interaction, under mild season, Cr decreased ($P<0.05$) cortisol at mid- and late-pregnancy compared with control, in addition to a gradual decrease in cortisol level from early-stage, reached the lowest value (14.81 ng/ml) at late-pregnancy. On the other hand, Se-E showed a fluctuated effect on cortisol at a mild season. Se-E declined cortisol (24.96 ng/ml, $P<0.05$) at early-pregnancy, while increased the level at late-pregnancy (39.48 ng/ml) compared with control.

Effect of Climate Conditions and Treatments on Reproductive and Productive Traits (Litter birth weight):

Goat's reproductive traits of different experimental groups are shown in Table (4). Under mild season conditions, the data obtained illustrated that Cr or Se-E supplementations did not have any effect on goat's reproductive traits, in terms of conception rate, kidding rate, fertility rate, prolificacy and fecundity as compared to control group. Se-E group recorded the lowest percentage of fertility and kidding rate as well as the number of born kids. On the other hand, Cr group was the lowest in prolificacy (litter size), about 1.67 compared with 2 for Se-E and control groups.

Under hot season conditions, it is obviously clear that Cr and Se-E supplementations improved the reproductive traits compared with the control group. Cr and Se-E treatments improved both fertility and conception rate by 75 and 50%, respectively, more than control. Furthermore, the applied treatments increased the fecundity percentage by 125% more than the control group. It noticed that Cr group was the lowest in prolificacy about (1.75) while Se-E group was the highest one (2.3).

From the other side, analysis of variance revealed a significant effect of treatment (Cr) and season on birth weight of kids of treated groups. Birth weight at mild season was higher about 0.44 Kg more than a hot season as shown in Table (5).

Chromium group had significantly ($P<0.001$) birth weight higher than control and Se-E with mean values of 1.87, 1.48 and 1.47 kg, respectively, either at a mild season or hot. The highest birth weight was 2.13 kg due to Cr supplementation under mild season versus 1.61 kg for the hot season, although this difference was not significant. On the other hand, does inject with Se-E did not significantly affect litter birth weight compared with control neither under mild season nor hot (Table 5).

Table 4: Effect of treatments on reproductive traits of female goats at a hot and mild season

Treatment	No. Does	No. Preg. does		No. Kidded does		No. Kids		Conception rate%		Fertility rate%		kidding rate%		Prolificacy		Fecundity%	
		SI	SII	SI	SII	SI	SII	SI	SII	SI	SII	SI	SII	SI	SII	SI	SII
Control	12	12	3	9	3	18	6	100	25	75	25	75	100	2^{a}	2^{a}	150^{a}	50^{b}
Cr	12	12	12	9	12	15	21	100	100	75	100	75	100	1.67^{b}	1.75^{b}	125^{a}	175^{a}
Se-E	12	12	9	6	9	12	21	100	75	50	75	50	100	2^{a}	2.3^{a}	100^{b}	175^{a}
Chi Sq.	-	-		-		-		3.57		4.03		4.03		9.36		9.36	
P-value	-	-		-		-		0.17		0.13		0.13		0.01		0.01	

In each factor means in the same column with different superscripts are significantly different.
Cr= chromium, Se-E= Selenium +Vitamin-E, SI= mild season and SII= hot season.

Table 5: Means (±SE) of litter birth weight (kg) of does as affected by season, treatment and their interaction

Item	Litter birth weight (Kg)
Season (S)	
Mild	1.83 ±0.067
Hot	1.39 ±0.076
***P*- value**	0.0001
Treatments (T)	
Control	1.48^{B} ±0.11
Cr	1.87^{A} ±0.75
Se-E	1.47^{B} ±0.80
***P*- value**	0.001
Interaction (S*T) Item	
Mild	
Control	1.74 ±0.10
Cr	2.13 ±0.12
Se-E	1.61 ±0.13
Hot	
Control	1.23 ±0.18
Cr	1.61 ±0.09
Se-E	1.34 ±0.10
***P*- value**	0.501

In each factor means in the same column with different superscripts are significantly different.
Cr= chromium, Se-E= Selenium +Vitamin-E

DISCUSSION

Effect of Climate Conditions and Treatments on Cortisol Levels During Estrus and Pregnancy Periods:

The current results obviously point to the general decrease in cortisol levels due to chromium supplementation with clear significance at the hot season of estrous, pregnancy periods. These results agreed with the findings of El-Masry *et al.* (2001), who reported that supplementation with 0.6 mg Cr/kg DM to calves under heat stress conditions showed a significant decrease in cortisol concentration compared with non-Cr treated calves. Halder *et al.* (2007) stated that serum cortisol was lower in goats received dietary added Cr, especially in those supplemented with Cr chloride than Cr yeast, as compared with the control group. Moreover, serum cortisol increased in the control group with time (day-120 vs day-60) of the experiment but significantly decreased in Cr treatment groups.

A numeral of researches confirmed the association among Cr and the metabolism during increased physiological, pathological and nutritional stress (Pechova and Pavlata, 2007). Under such stressor influence, secretion of the cortisol increases, acting as an insulin antagonist through increasing blood glucose concentration and reduction of glucose employment by peripheral tissues. Increased blood glucose concentrations encourage the motivation of the Cr reserve, Cr then irreversibly excreted in urine (Borel *et al.,* 1984 and Mertz, 1992).

Cr secrtion in urine promote by all stress motivate factors (Mowat, 1994). Many authors confirmed reduced sensitivity to stress in Cr supplemented animals through a decrease concentration of cortisol in the blood (Mowat *et al.,* 1993 and Pechova *et al.,* 2002). Also, Louise (2003) stated that heat stress causes an increase in cortisol production and chromium supplementation helps to alleviate the effect of stress and reduced blood serum cortisol concentration of calves reared under heat stress by about 36%when compared with the control (Soltan *et al.,* 2012). Chromium supplementation at 200 or 1000 ppb in DM from an organic source found to reduce serum cortisol concentration by 40% and 60% in beef cattle (Almeida and Barajas, 2001).

Concerning the results of Se-E treatment, it generally revealed a decrease in cortisol concentration during estrous cycle but increased it significantly during the pregnancy period. These results disagreed with those of Gupta *et al.* (2005) in dairy cattle who, studied the effect of single treatment (20 ml IM injection) of vitamin E and Se at a 3-week prepartum on cortisol concentrations and found insignificant differences among groups of plasma cortisol concentrations on day-21 prepartum. However, from day-7 prepartum to the day of parturition, plasma cortisol levels were greater ($P < 0.05$) in control cows than those supplemented with vitamin E+Se.

On the other hand, the present results united in opinion with those of Aktas *et al.* (2011) in transmission stressed cattle, who reported an insignificant increase in cortisol level of treated animals than the control group. Regardless the reproductive status, the decrease in serum cortisol during estrous cycle agreed with the findings of Sivakumer *et al.* (2010) in heat-stressed Black Bengal goats, who reported that goats received vitamin E and selenium exhibited significant decrease in plasma cortisol level as compared to control goats group, suggesting that supplementation may have a passive effect on cortisol levels during heat stress. A similar reduction in cortisol levels by vitamin E in heat-stressed goats obtained by Webel *et al.* (1998).

It is known that a higher level of cortisol is sent out in response to a diversity of severe stressors, including estrous and pregnancy (Lyimo *et al.,* 2000) stress in such cases increases the oxidative metabolic reaction. Therefore, supplementation of Se and/ or vitamin E may reduce the reactive oxygen metabolites and/or free radicals, since selenium contributes to enzymes involved in thyroid hormone metabolism, specifically the transformation of T4 to T3. Also, protection of biological membranes against oxidation by hydrogen peroxide and other oxidizing agents, e.g., free radicals, superoxide and organic hydroxiperoxide induced by selenium, might be related with the cortisol reduction (Gupta *et al.*, 2005 and Domínguez-Vara *et al.,* 2009).

Effect of Climate Conditions and Treatments on Reproductive and Productive Traits (Litter birth weight):

Concerning chromium results, it had no improving effect on litter size (prolificacy) that agreed with Campbell (1998), who found no effect on the number of piglets per litter due to Cr supplementation. In contrast to that, Trottier and Wilson (1998); Hagen *et al.* (2000), and Lindemann *et al.* (2000) revealed an improving effect in reproduction in terms of an increase in litter size due to CrPic supplementation.

From another side, Cr administration improved fertility (pregnancy rate), conception rate and fecundity. These results are in agreement with Lindemann *et al.* (2000 and 2004) in swine. In the same respect, Bryan *et al.* (2004) informed that pregnancy rate tended to be higher in intensively grazed dairy cows supplemented with Cr than in controls. Provided that Cr in a free choice mineral improved pregnancy rate in beef cows (Stahlhut *et al.,* 2006).

Chromium plays an important role in the secretion of pregnancy-specific proteins (PSPB) from the uterine endometrium, which is helpful in preventing early embryonic death. Chromium exerts a significant influence on follicular maturation and luteinizing hormone (LH) release (Tuormaa, 2000).

The present hot season results of Se-E are in agreement with Esa (2011) with Baladi goats under Southern Saini conditions. The authors found that supplementation of goats with Se and vitamin E increased significantly fertility, conception and kidding rate, as well as prolificacy. In the same trend, Habeeb *et al.* (2012) with Zaraibi goats reported that the number of kids born per dose was increased from 1.8 in group fed basal diet (Se and vitamin E deficient) to 2.5 in the group fed Se with vitamin E.

A marked increase in fertility of ewes receiving Se is an interesting finding and an increase in fertility by 38% in selenium-deficient areas after Se supplementation was reported for a large group of sheep (Balicka-Ramisz *et al.*, 2006). Harrison *et al.* (1984) approached that vitamin-E and selenium act at the cellular scale by regulating the generation of free radicals in the ovaries.

Staats *et al.* (1988) showed that vitamin-E protected steroidogenic enzymes from oxidative degeneration and Rapoport *et al.* (1998) found that the concentration of a-tocopherol in ovarian tissue was related to the animals' consumption of vitamin E during the period of maximal progesterone production. In contrast with these results, Ramírez-Bribiesca *et al.* (2005) in goats showed that Se-E injections did not affect the reproductive indexes- fertility and prolificacy rates.

Concerning productive trait result point to an increase in litter birth weight due to chromium supplementation, the present results agreed with those of Anonymus (2011) with sows. The authors found that animals supplemented with Cr propionate showed a significant difference in litter birth weight between control and Cr supplemental group.

The chromium given to the animal should cause an increase in glucose supply to the muscle and/or fat tissues when realized. The energy supplied to these tissues allows for increase body condition improvements. Therefore, the animals were able to improve not only born alive but also able to produce a larger litter (Anonymus, 2011).

In contrast, Lindemann *et al. (2*004) found that supplementation of sows with CrPico decreased the individual birth weight of total pigs born. However, Wang *et al.* (2013) reported that there were no significant differences in litter birth mass between control and Cr supplemented group.

Concerning Se-E effect on birth weight, these results agreed with the findings of Swanson *et al.* (2008), who found no effect on birth weight in lambs from ewes consuming either organic or inorganic Se sources at different dosages. On the contrary, Koyuncu and Yerlikaya (2007) reported that injection with Se-E had a positive effect on the birth weight of lambs. Also, Habeeb *et al.* (2012) showed that the average litter weight of kids born was increased in the group fed adequate Se with vitamin E as compared with the control group in Zaraibi goats, which contradict the current study results in Baladi goats.

In conclusion, Cr and Se-E supplementation affected serum cortisol concentration during estrous and pregnancy periods as well as some reproductive and productive traits of female Baladi goats under Egyptian conditions. Cr and Se-E reduced serum cortisol during the estrous cycle, while Se-E increases it during pregnancy period under the hot season, with the marked decrease due to Cr treatment. Moreover, Cr and Se-E improved conception rate, fertility, and fecundity under hot season but Cr only had birth weight higher than other groups under mild and hot seasons.

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RABIC SUMMARY

آثار الكروميوم والسيلينيوم-هـ على هرمون الكورتيزول والكفاءة التناسلية والإنتاجية للماعز البلدي تحت الظروف شبه الحارة

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أجريت هذه التجربة على اناث الماعز البلدية خلال دورة الشبق ومرحلة الحمل لدراسة تأثير المعاملة بالكروميوم والسيلينيوم-هـ علي مستويات هرمون الكورتيزول في سيرم الدم وبعض الصفات التناسلية والإنتاجية للحيوانات كطرق لتحسين أداء الماعز المصرية تحت الظروف المحلية . وقد استخدم في هذا البحث ٧٢ عنزة بلدي ناضجة بمتوسط عمر ٢-٣ سنوات ومتوسط وزن الجسم 25.1±1.5 كجم خلال موسمي دراسة هما موسم الشتاء(معتدل) وموسم الصيف (الجو الحار) بحيث استخدم ٣٦ عنزة في كل موسم وتم تقسيم الحيوانات فى كل موسم عشوائيا الي ثلاث مجاميع الاولي بدون معاملات (مجموعه ضابطه) والمجموعة الثانية تم معاملتها بمادة الكروميوم – في صورة كلوريد الكروميوم بمعدل ٠,٨ ملجم/رأس/ يوم (مجموعة الكروميوم) أما المجموعة الثالثة تم حقنها في العضل مرتين اسبوعياً بـ ٢مل من مخلوط السيلينيوم+فيتامين هـ (فايتسيلين) وهذة الكمية تعادل ٠,٥ ملجم من السيلينيوم و ١٠,٧ وحدة دولية فيتامين هـ /رأس/يوم. وقد تم تقدير مستويات هرمون الكورتيزول في سيرم الدم خلال مرحلتي الشبق والحمل.
وقد أوضحت النتائج مستوى أقل من الكورتيزول فى الحيوانات المعاملة بالكروميوم أو السيلينيوم-هـ مقارنة بالكنترول خلال دورة الشبق. كما أدى الكروميوم إلى نفس النتائج خلال معظم فترات الحمل بينما لوحظ مستوى أعلى من الكورتيزول فى مجموعة السيلينوم-هـ خلال فترة الحمل كلها. وتحت الظروف المعتدلة لوحظ عدم وجود اى اختلاف معنوي فى المعاملات عن الكنترول في مستوى الكورتيزول باستثناء الارتفاع فى مستوى الكورتيزول مع المعاملة بالكروميوم أثناء مرحلة ما قبل الشياع. كما أدى استخدام الكروميوم إلى انخفاض الكورتيزول أثناء فترتي منتصف الحمل وآخره. بينما أدى السيلينيوم-هـ إلى ارتفاعه أثناء الحمل المتأخر فقط مقارنة بالمجموعة الضابطة. كما أدت المعاملة بالكروميوم تحت الظروف الحارة إلى انخفاض معنوي فى الكورتيزول خلال دورة الشبق والحمل. بينما المعاملة بالسيلينيوم- هـ أظهرت نفس التأثير خلال دورة الشبق فقط.
تحت الظروف المعتدلة لم تحدث أيٌ من المعاملتين أي تحسن معنوى في الصفات التناسلية لإناث الماعز البلدية والتى تتمثل في نسبة الحمل والولادة والخصوبة والكفاءة التناسلية مقارنة بالكنترول. بينما أدت المعاملة بالكروميوم والسيلينيوم-هـ تحت الظروف الحارة إلى تحسين كلٍ من معدل الخصوبة والحمل وكذلك ارتفاع نسبة الكفاءة التناسلية مقارنة بالكنترول ، حيث سجلت مجموعة الكروميوم معدلات أقل في حجم الخلفة بينما كانت مجموعة السيلينيوم-ه الأعلي مقارنة بالكنترول.
وقد لوحظ أن المعاملة بالكروميوم أدت إلى تحسن فى وزن ميلاد مقارنة بالكنترول والسيلينيوم-هـ خلال الموسمين المعتدل والحار. بينما لم يتأثر وزن الميلاد بشكل معنوي نتيجة الحقن بالسيلينيوم-هـ مقارنة بالكنترول تحت الظروف المعتدلة أو الحارة. يمكن أن نستنتج مما سبق أن المعاملة بالكروميوم والسيلينيوم-هـ خلال دورة الشبق ومرحلة الحمل يمكن أن يحسن الصفات التناسلية والإنتاجية لإناث الماعز البلدي تحت ظروف الصيف الحار فى مصر.