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Effect of selenium and vitamin E supplementation as a nutritional treatment for some physiological and productive traits of Holstein dairy cows under Egyptian summer conditions

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ABSTRACT

The present study was carried out at Sanad Company for Animal Production, Damietta governorate, Egypt, during the period from June to September 2013 (summer). Twenty healthy Holstein dairy cows, free from diseases, of similar age (3 years old) and average body weight (500±25kg) and (80±10 days in milk) were used in the present study. All animals were at the second season of lactation in summer season. Animals were randomly assigned into four experimental groups (each of 5 animals): G1 was intramuscular injected at biweekly intervals with 10 ml saline solution and served as a control group, G2 was intramuscular injected every two weeks with 10 ml viteselen, G3 was intramuscular injected every two weeks with 20 ml viteselen and G4 was supplemented in their daily ration with 3mg, organic Selenium (O-Se)/ kg DMI. Productive (milk: production, fat, protein, lactose, total solids, solids non-fat and somatic cell count), blood chemical (plasma: Glutathione peroxides, proteins, urea, ALT, AST, glucose, cholesterol and triglycerides) and physiological parameters (rectal temperature and respiration rate) were measured at the start and the end of 60 days experimental period.

Results indicated that Se treatment either in inorganic or in organic forms with or without vit. E. did not affect significantly all productive, blood chemistry and physiological parameters expect somatic cell count and Glutathione peroxides. It can be concluded that, the main effect of Se treatment is the reduction of somatic cell count due to its effect on immunity; meanwhile, Se had no role in alleviation of heat stress under summer conditions at Northern region (Delta) of Egypt.

Key words*:* Selenium, Vitamin E, Dairy cow, Summer.

INTRODUCTION

Minerals and vitamins play an important role in the growth and reproductive performance of farm animals. Selenium (Se) is an important trace mineral, acting in synergism with vitamin E which prevents the oxidation of membrane polyunsaturated fatty acids and DNA by oxygen radicals produced throughout aerobic metabolism (Koyuncu and Yerlikaya 2007). Se has a biological function related to vitamin E in that it is an important component of glutathion peroxidase, an enzyme involved in detoxification of hydrogen peroxide and lipid hydroperoxides. Furthermore, Se is a component of selenoproteins and is involved in immune function in farm animals (Meschy, 2000; Ružić-Muslić *et al.,* 2014). Se deficiency plays a role in several economically important livestock diseases; problems that include decreased fertility, abortion, retained placenta and neonatal weakness (McDowell *et al.,* 1996). According to Moeini *et al*. (2011) a high level of Se and vitamin E in heifers in late pregnancy had positive effect on immune system. It has also been reported that, Se and vitamin E status in the parturient period and during early life is important for health and performance of cows and their offspring (Lacetera *et al.,* 1996). Moreover, the mean milk yield and milk composition of cows receiving supplemental inorganic selenium (as sodium selenite) and organic selenium (as selenium yeast) were greater for cows receiving organic selenium (Silvestre *et al.,* 2007).

Vitamin E, as a dietary essential fat-soluble vitamin, can improve animal performance when provided in amounts above minimal requirements. Due to the potent antioxidant properties of tocopherols, the impact of α-tocopherol in the prevention of chronic diseases believed to be associated with oxidative stress has often been studied and beneficial effects have been demonstrated (Brigelius and Traber 1999). The biological effects of vitamin E are mostly seen in the prevention of resorption of fetuses, testicular degeneration, muscle dystrophy, anemia and encephalomalacia; the classical signs of vitamin E deficiency in animals. The influence of vitamin E on the immune system has also become an important issue (Politis *et al.,* 1995 and 1996). Nockels, (1986) recommended that, vitamin E at 6 to 20 times the NRC-recommended concentrations would improve the immune response of farm animals.

Among the stressors, heat stress has been of major concern in reducing animal's productivity in tropical, sub-tropical and arid areas (Silanikove *et al.,* 1997). Therefore, the objective of the present study was to evaluate the effects of supplementation with selenium in either organic or inorganic forms or vitamin E on some physiological and productive traits of Holstein dairy cows under Egyptian summer conditions.

MATERIALS AND METHODS

The present study was carried out at Sanad Company for Animal Production, Damietta governorate, Egypt, during the period from June to September 2013 (summer).

Animal feeding and management:

Twenty healthy Holstein dairy Cows with similar age (3 years old), average body weight (500±25kg) and (80±10 days in milk) were used in the present study. All animals were at the second season of lactation. They were randomly assigned into four experimental groups (each of 5 animals).

The first group of cows (G1) was intramuscular injected with saline solution 10 ml at biweekly intervals and for 60 days and served as a control group (C).

The second group (G2) was intramuscular injected every two weeks for 60 days with 10 ml viteselen (manufactured by ADWIA Co., S.A.E. 10th of Ramadan City Egypt). Each 1ml of viteselen contains vitamin E, 150 ml acetate and 1.67mg sodium selenite as inorganic vit E and selenium source.

The third group (G3) was intramuscular injected with 20 ml viteselen every two weeks for 60 days.

The fourth group (G4): Animals were supplemented in their daily ration with 0.3mg organic Selenium (O-Se)/kg daily DMI. The daily organic Selenium supplement contained, 1 g Se/kg, produced from *Saccharomyces cerevisiae* (CNCM I-3060, Sel-Plex®, Alltech

Biotechnology, Beijing, China). The experimental period lasted for 60 days; 30 days as an adaptation period followed by 30 days for milk determination.

Samples collection and experimental measurements:

Experimental animals were raised in open yards, under an ambient temperature (24-34 ºC) and relative humidity (63-100%). Animals were daily fed *ad libitum* a total mixed ration (Tables 1 & 2), after each milking, according to recommendation of NRC (2001). Experimental animals were milked three times a day i.e. 0.6, 14.00 and 21 hrs./day, respectively. The total milk yield / cow was recorded weekly during lactation by milk meter apparatus.

Table (1). Daily feed intake /h/day (kg) of Holstein dairy cows in summer on fed basis.

	Ingredients	Daily intake/h/d(kg)
1	Magnabac	0.482
2	Soya bean	1.883
3	Cotton seed	1.234
4	Corn grains	6.025
5	Gluten feed	2.840
6	Linseed meal	2.625
7	Wheat bran	0.550
8	Hay	0.503
9	Alfalfa	11.719
10	Corn silage	12.597
Feed additives /h/d:		
1	Sodium bicarbonate	0.134
2	Sodium chloride	0.134
3	Calcium carbonate	0.188
4	High dairy vitamins.	0.020
5	High dairy minrals.	0.020
6	Potassium phosphate	0.054
	Total feed intake /h/ day (kg)	41.000

Table (2): chemical composition of daily feed intake of Holstein dairy cows in summer (h/day)

Ingredients	Intake/h/d
Dry matter intake /h/d(kg) on (DM basis)	22.547
Crude protein (CP)	4.176
Net energy for lactation (NE_L) ; Mcal	39.414
TDNI (kg)	16.469
NDFI /h/d	6.862
ADFI /h/d	3.860
Non fiber carbohydrate intake /h/d (kg)	7.901
NE_L for lactation / CP	9.438
Ca / P ratio	2.000

Measurements of productive traits and Physiological parameters:

Productive traits:

The total milk yield of different experimental cows groups was recorded at biweekly intervals per each lactating animal for 60 days, by a milky meter apparatus, while samples/ each milking *i.e.* morning, afternoon and evening were collected and a composite sample was kept fresh until later chemical analysis. Milk samples were chemically analyzed to estimate fat, protein, total solids (TS), solids not fat (SNF) and lactose content by Milko Scan instrument and Somatic cell count by Fossomatic 5000 (Combifoss, Denmark) in Milk Laboratory belongs to Animal Production Research Institute (APRI), Kafr El-Sheikh Governorate, Egypt.

Physiological parameters

Blood and plasma parameters

Heparinized blood samples were collected weekly from the jugular vein of cows in at mid-day (14.00.hrs). Plasma samples were collected by centrifugation of heparinized blood samples at 3000 r.p.m for 10 minutes. Blood plasma was kept frozen at -20 ºC until determination of Glutathione peroxidase (GSH-Px), alanine aminotransferase (ALT), aspartate aminotransferase (AST), total protein (TP), Plasma albumin, Plasma urea, Plasma glucose, total cholesterol (TC) and triglycerides (TG) using a commercial kit (Biodiagnostic, Egypt).

Thermoregulatory parameters:

Rectal temperature (RT, ºC) was daily measured at 14:00 using veterinary thermometer with an accuracy of (±0.1°C) inserted about 6-7 cm into the rectum for one minutes. Respiration rate (RR) (breaths / min) was daily counted at 14:00 by observing flank movements for a period of one-minute using stopwatch.

Meteorological parameters:

The meteorological data were obtained from Central Laboratory of Agricultural Climate, including ambient temperature (Ta); percent of relative humidity (RH), while temperature Humidity Index (THI) was calculated according to Amundson *et al.* (2006) and Abd El-Ghany *et al.* (2010), as following:

$$THI = 0.8 \times Ta\ °C + \{(RHi\ \%) \times (Ta\ °C - 14.4) / 100)\} + 46.4.$$

Where; Ta °C is the ambient temperature (°C), and RH is the relative humidity (RH %) /100.

Statistical analysis:

Analysis of variance was computed using the General linear Model procedure using SPSS program (SPSS, 1997). Variable means for treatments indicating significant differences in the ANOVA were compared and the differences were indicating using Duncan, multiple range tests (Duncan, 1955).

RESULTS AND DISSCUSION

Meteorological data

The values of ambient temperature, percent of relative humidity (RH) and temperature Humidity Index (THI) for July and August, 2013 were shown in Table (3). The average ambient temperature during July and August, 2013 ranged from 27.47 ºC to 28.13ºC. While, the respective average RH were 81.03% and 83.47%.

The average values of THI were 78.96 and 80.37 for July and August, respectively. THI value of 68 is considered the upper limit of dairy cattle comfort zone (Johnson *et al*., 1989; Marai and Habeeb, 2010). Temperature humidity index value of 74 to 78 is considered hazardous and represents an alert condition for animals (Abd El-Ghany *et al*., 2010). The present data indicated that animals were under heat stress during day and within the thermoneutral zone during night according to Davis *et al* .(2003).

Table (3): Means of ambient temperature (°C), relative humidity (%) and temperature humidity index (THI) during July and august 2013.

Month	**Ambient Temperature (°C)**			**Relative Humidity (%)**			**THI average**
	high	low	avg	high	low	avg	
July	29.83	24.73	27.47	93.03	62.83	81.03	78.96
August	30.97	25.63	28.13	95.43	66.63	83.47	80.37

Milk production parameters

Milk production

Table (4) indicated that there was no significant difference between the treatments groups, while all treatments were higher than the control group and the third group was the highest one, followed by the fourth group and then the second group. These results are in accordance with that of EL-Nenaey, (1993) who found that, milk yield was higher in treated groups than control. However, the differences were not significant. Lacetera *et al.* (1996), Pauselli *et al.*(2001), Harrison *et al.* (2005) reported that the replacement of mineral Se supplement in dairy cow diets by Sel-Plex selenium yeast resulted in productivity increase on average of 1.4 kg / cow daily. Wang *et al.* (2009) founded that supplementation of diet with selenium-yeast improved the milk yields. Milk yields were higher ($P \leq 0.05$) for 150, 300 mg selenium yeast per kg of diet dry matter (DM), than for 450 mg selenium yeast per kg of diet dry matter (DM) and the control (Qureshi *et al.,* 2010 ; Eulogio *et al.,* 2012). An increase in milk yields was recorded when cows supplemented with SY or injected with veteselin as compared with control and this resulted from the improvement of feed digestion since DM intake did not differ (Wang *et al.,* 2009). In addition, in dairy cows selenium deficiency results in a decrease in milk production and in the functioning of the immune system, resulting in an increase of vulnerability to illnesses, including the illnesses of the mammary gland (Krzyżewski *et al.,* 2014). Selenium and vitamin E can prevent the occurrence of mastitis and subsequently improve milk compositions and quality.

Milk fat:

Milk fat did differ significantly between the groups, although the fourth group was the highest, followed by the third group then the control group and the second group (Table 3). The present result was in agreement with Harrison *et al*. (2005), Wang *et al.* (2009), Faye *et al.* (2014), but the little increment in fat percentage agreed with the results of Silvestre *et al.* (2007) who reported that both monthly fat and protein percent were greater for cows receiving Sel-Plex. Pechová *et al.* (2008) and Liu *et al*. (2008) founded that vitamin E and selenium supplementation increased the concentration and production of milk fat which were significantly higher ($p<0.05$) in HVE and HSeVE groups. Compared with the control diet, the milk fat percentage was increased 15.1 and 16.6% by the HVE and HSeVE diet, respectively. Since the main precursors of milk fat originate in the rumen, the increased milk fat content may have been influenced by rumen fermentation. The effect of Se supplementation in the form of yeast on the rumen fermentation was studied by Faixová *et al*. (2007) who found significantly higher activity of alkaline phosphatase and glutamate dehydrogenase in ruminal fluid in Se-supplemented group. They explained it by the supportive effect of Se on rumen microbial population, increasing their resistance and activity. Similarly Mihaliková *et al*. (2005) documented a protective effect of Se feed supplementation on the development of some rumen ciliate species in young sheep. This increase can be connected with the decrease in Serum cells count and with the cases of clinical mastitis that occurred in this treatment. According to Duncan *et al*. (1991) animals with low incidence of mastitis presented larger concentrations of milk fat, due to the lower enzymatic action of lipases of leukocytes origin, which increases in conditions of immune stress.

Milk protein

Table (4) showed that in the summer season the effect of treatments on milk protein was significantly where G3 was significantly higher than other treatments and control, also G2 and G4 were significantly higher than control.

The significant effect of treatment with Se or Se+Vit. E was in accordance with the result of Silvestre *et al.* (2007) who showed that, monthly fat percent was greater for cows receiving Sel-Plex. Eulogio *et al.* (2012) reported that performance responses to selenium and vitamin E supplementation increases ($p<0.05$) percentage of Crude Protein (CP). Pirestani *et al.* (2014) found that selenium + vitamin E significantly enhanced milk protein compared to other treatments. Selenium and vitamin E can prevent the occurrence of mastitis and subsequently improve milk compositions and quality (Erskine *et al*., 1990; Erskine *et al*., 1989; Weiss, 2002).

Milk lactose

Table (4) revealed that in the summer season the effect of treatments on milk lactose was not significantly but all treatments trended to be higher than control. This result was in agreement with Pirestani *et al.* (2014) who found that selenium + vitamin E increased milk lactose compared to control and other treatment groups but no significant difference was found. Oliver and Calvinho (1995) showed that the major components of milk such as lactose, fat, and casein are decreased during inflammation, indicating that cellular synthesis has been altered.

Milk total solids (TS)

Table (4) indicated that in summer, all treatments did not affect milk TS significantly although all treatment were higher than control. This was in accordance with that of Juniper *et al*. (2006), Heard *et al*. (2007), Paschoal (2007), Wang *et al*. (2009) and Eulogio *et al*. (2012) who found that the total solids (TS) was not affected by treatment. Oltramari *et al*., (2014) showed that the experimental diets had no effect on solids-not-fat percentage in the milk.

Milk solids not fat (SNF)

Table (4) revealed that treatments did not affect milk SNF significantly although all treatment were higher than control. This result was in accordance with the previous result given by Eulogio *et al*. (2012) who found that selenium and vitamin E supplementation increases ($p<0.05$) percentage solids not fat (SNF). Pirestani *et al*. (2014) reported that selenium + vitamin E treatment group also increased milk SNF compared to control and other treatment groups but no significant difference was found. Oltramari *et al*. (2014) showed that the experimental diets had no effect on solids not-fat percentage in the milk ($P=0.05$). Similar results were obtained by Juniper *et al*. (2006), Heard *et al*. (2007), Paschoal (2007) and Wang *et al*. (2009).

Somatic cells count

Table (4) indicated that somatic cells count was higher in G1 (control) than all other groups and being significant with G4, where, the lowest value was recorded in G4. These results are in accordance with that of Morgante *et al.* (1999) who showed that selenium and vitamin E administration in selenium-deficient pregnant ewes 45 days before parturition lead to reduce somatic cell counts post-lambing and there were a positive association between selenium and/or vitamin E with reduced incidence of clinical mastitis and lower numbers of somatic cell counts in dairy cow.

After adding Se-yeast to the daily ration, cows somatic cells counts decreased significantly ($p<0.01$) with the increase of Se-yeast and feeding time. By the end of this experiment, somatic cells counts of the control group had no significant change while the treat groups decreased respectively by 22.76%, 24.57% and 31.59% ($P<0.01$) compared with those before this experiment (Zong-yum *et al.,* 2007). Sánchez *et al.* (2007) concluded that Se supplement is indispensable for the prevention of mastitis in goats. Eulogio *et al.* (2012) showed that decreased number of Somatic Cells Count was attributable to dietary Se and vitamin E supplementation. Pirestani *et al.* (2014) indicated that Se + Vit E +Cu injection markedly reduced Somatic Cells Count as compared to other experimental treatments.

Balicka-Ramisz and Jastrzębski (2014) showed that cows fed a diet containing suboptimal concentrations of Se (<0.05 ppm in the dry matter) showed an increase in blood glutathione peroxidase activity, which contributed to the decline in the number of somatic cells in milk. Oltramari *et al*. (2014) concluded that se reduced Somatic Cells Count and improved mammary gland health.

The decrease in Somatic Cells Count can be explained by the better response of neutrophils to infectious agents that cause mastitis in the cows supplied with organic Se

(Ibeagha *et al.,* 2009). According to Ortman and Peharson (1999) there is greater Se absorption in the organic form, such as selenomethionine and selenocysteine, compared with inorganic sources, such as sodium selenite and selenate (91 and 81%, respectively).

Selenium reduced Somatic Cells Count and improved mammary gland health and this may be explained by the preventive function of neutrophils and the antioxidant action of Se. According to Sordillo and Aitken (2009) when there is evidence of infection, neutrophils and macrophages migrate from the blood stream to the mammary gland tissue in order to fight infection. The phagocytosis of the infectious agents for the defense cells causes an accentuated increase in the production of cellular oxygen, which is highly toxic. When there are appropriate amounts of Se circulating, these toxic metabolites are neutralised by antioxidant enzymes, mainly GSH-Px, elevating the phagocytic capacity of the organism. On the other hand, Se deficiency results in oxygen accumulation that can cause lesions or even cell lysis.

The Se+Vit E treatment group resulted in low Somatic Cells Count of milk. These findings might be due to an increase in the activity of polymorphonuclear neutrophils (PMN), immune potency and resistance of the animal against infectious diseases. Also, Se is a constructional part of glutathione peroxidase structure and along with vit E acts as an important biological antioxidant, which prevents the activity of free radicals leading to the udder health and milk quality (Erskine *et al*., 1990; Erskine *et al*., 1989).

Table (4): Descriptive statistics (mean±S.E.) **and test of significance for milk production and constitution parameters of different groups.**

Treatment / Parameters	G1	G2	G3	G4
Milk production	18.13±1.08	19.81±0.54	20.56±1.06	20.2±0.45
Milk fat	3.67±0.19	3.5±0.2	3.7±0.1	3.71±0.1
Milk protein	2.3±0.1^{b}	2.37±0.08a^{b}	2.6±0.09^{a}	2.46±0.09^{ab}
Milk Lactose	4.42±0.11	4.45±0.09	4.66±0.09	4.53±0.02
Milk Total solid	11.24±0.42	11.24±0.26	11.57±0.14	11.55±0.19
Milk Solids not fat	7.57±0.25	7.74±0.11	7.87±0.12	7.84±0.1
Somatic cell count	312.3±17.96^{a}	208.35±8.13^{ab}	170.31±83.01^{ab}	157±53.04^{b}

G1 =control G2 = injection 10 ml viteselen
G3 = injection 20 ml viteselen G4 =organic selenium
Identical letters within each row indicates insignificant difference at p≤0.05.

Blood parameters

Glutathione peroxides

Table (5) showed that treatments had significant effect on glutathione peroxidase where all treatments were significantly higher than control, and G3 and G4 were the highest significantly. The significant effect of treatment with Se or Se+Vit. E was in accordance with the previous results on cows, sheep, lambs or goats by Milad *et al.* (2001) who reported that GSH-Px activity was significantly higher in the treated group (P<0.01; P<0.001, respectively) than in the control group. Se and vitamin E improved glutathione peroxidase (GSH-Px) activity in blood and increases plasma concentrations of total antioxidant capacity and Se in dairy cattle (Calamari *et al.,* 2011) and goats (Katamoto *et al.,* 1998). Malbe *et al.* (2002) found that glutathione peroxidase activity increased significantly (P<.001) for selenium supplemented cows in comparison with activity in non-supplemented cows. Hamam and Hala Abou-Zeina (2007) injection of both vitamin E plus Se, in Baladi ewes, increased significantly the concentrations of natural antioxidants (αtocopherol and glutathione peroxidase) in blood of sheep. Faixová *et al.* (2007) showed that lambs of the second group fed additional Se had greater activity of blood glutathione peroxidase (GPx) (P<0.001). Results confirmed the positive correlation between blood Se content and the activity of this selenoenzyme. Liu *et al.* (2008) found that the activity of GSH-Px in blood was significantly increased (p<0.05) (p<0.05) when HSe, LSeVE and HSeVE were fed.

Trávníček *et al.* (2008) the average activity of GSH-Px in the whole blood of ewes of group E1 (1 147.4±181.5 U/g Hb) and E2 (1 056.1±267.5 U/g Hb) was 1.6 and 1.5 times higher, respectively, than in the control group (697.9±179.3 U/g Hb) (P<0.001). Illek *et al.,* (2009) revealed that the activity of the selenoenzyme glutathione peroxidase is often considered to reflect the selenium concentration in whole blood.

Levels of GSHPx in the SY supplemented groups were significantly higher already in the fourth week of the study (1 wks prepartum) (P < 0.01) and in the SS supplemented group the GSH-Px values were significantly higher than those in the negative control group (NC) only 9 weeks from the start of supplementation. Antunović *et al.* (2009) carried out trial with lambs fed different dietary supplementation of selenium (inorganic and organic sources) resulting in significantly higher activity of the blood GSH-Px enzyme, compared to the control group without addition of selenium.

Ebrahimi *et al.* (2011) reported that the glutathione peroxidase activity of calves was significantly greater in the Sel-Plex group (p<0.01) than that in the control group. Pop *et al.* (2011) reported that the average activity of glutathione-peroxidase GSH-Px in the experimental group was significantly higher (6.28±0.81 mole/ml) than that measured in comparison with the reference group (2.48 ± 0.48 mole / ml).

Antunović *et al.* (2014) showed significant higher GSH-Px activity (P<0.01) in the lambs blood of experimental groups (Exp.-I and Exp.-II) compared to the control group. Azimi *et al.* (2015) indicated that there was significant difference among treatments for serum glutathione peroxidase level. The lowest glutathione peroxidase level was related to the control group and the highest level was for calves received vitamin E plus selenium. Administration of vitamin E and selenium alone increased antioxidant enzyme levels significantly as compared to the control group.

Plasma total proteins, albumen and globulin concentrations

Table (5) revealed that Se supplementation either with Vit. E or in organic form had no significant effect on plasma total protein, albumin and globulin concentrations although their levels tended to be lower in the control than in all treatments groups except G3 which showed lower level of albumin than control group. This result was in accordance with that of Hamam and Hala Abou-Zeina (2007), Slavik *et al.*(2008) and Shinde *et al.* (2009) who found that plasma proteins were not affected by Se supplementation. Also, Arthur *et al.* (1988), Singh *et al.* (2002) and Kumar *et al.* (2009) reported that supplementation of Se had no significant effect on serum globulin levels. The insignificantly higher plasma proteins concentrations in Se treated groups than the control group was in accordance with Mudgal *et al*. (2008) who found that the level of globulin was significantly ($P<0.01$) increased in groups supplemented with 0.3 ppm selenium (Se).

Plasma Urea:

Results illustrated in Table (5) revealed that plasma urea concentration was significantly higher in G4 (organic Se) than in G2 (injection 10 ml viteselen), while no significant differences were found between other groups. The insignificant effect of inorganic Se treatment was in accordance with that of Tahmasbi *et al.* (2012) who found that treated dairy cows by injection of selenium-vitamin E had no significant effect on their plasma urea. Meanwhile, Slavik *et al.* (2008) found that the group of cows received an inorganic Se supplement (sodium selenite) showed an increase in their blood urea level. These contradicting results may be due to protein level in diets as Canfield *et al.* (1990) concluded that feeding high rumen degradable protein to the cows will result in high blood urea nitrogen concentration.

Plasma Glucose:

Se supplementation either with Vit. E or in organic form did not affect significantly plasma glucose concentration as shown in Table (5). However, plasma glucose concentration tended to be higher in G4 (organic Se) than in the other three groups. These results were in agreement with that of Calamari *et al.* (2011) and Tahmasbi *et al.,* (2012) who found that dairy cows treated by sodium selenite or organic Se as well as injection of selenium-vitamin E had no significant effect on their plasma glucose.

Plasma total cholesterol and triglycerides:

Tables (5) showed that Se supplementation either in inorganic form with Vit. E or in organic form did not affect significantly plasma cholesterol and triglycerides concentrations. However, the highest values of Plasma total cholesterol were recorded by G4 followed by G3, G1 and G2, respectively and that for triglycerides were shown in G3, G1, G2 and G4, respectively. These results are in accordance with that of Tahmasbi *et al.* (2012) who found that in dairy cows feed of diet contains vitamin E and/or selenium (Se) supplementation did not affect plasma total cholesterol and triglycerides. Also, the insignificant effect of treatment with Se or Se+Vit. E on triglycerides was in accordance with the previous work on cows, sheep, lambs or goats by Shinde *et al.* (2009), Soliman *et al.* (2012), Falkowska *et al.* (2000), Antunović *et al.* (2014) and Ziaei, (2015) who reported that selenium supplementation had no significant effect on blood triglycerides.

Plasma ALT and AST

Table (5) indicated that Se or Se+Vit. E treatment did not affect plasma ALT and AST activities in all groups in summer. The result was in accordance with that of Das *et al.* (2012) and Antunović *et al.* (2014) who found that enzyme activity (ALT and AST) in the blood of lambs did not significantly differ depending on the dietary supplementation with selenium.

Table (5): Descriptive statistics (mean±S.E.) and test of significance for blood plasma and physiological parameters of different groups.

Parameter	G1	G2	G3	G4
GSH-Px	4.02 ± 0.98^{b}	5.88 ± 0.53^{ab}	6.72 ± 0.16^{a}	6.57 ± 0.19^{a}
Total protein	5.72±0.25	6.03±0.18	6.06±0.2	5.9±0.15
Albumin	3.49±0.24	3.53±0.05	3.33±0.22	3.46±0.12
Globulin	2.23±0.14	2.5±0.22	2.73±0.08	2.44±0.19
Urea	20.29 ± 1.18^{ab}	18.21 ± 1.49^{b}	20.96 ± 0.8^{a}	24 ± 2.53^{a}
Glucose	30.31±1.48	30.77±1.34	30.3±2.03	31.3±1.12
cholesterol	133±11.82	132.01±21.07	134.62±8.51	136.72±3.04
Triglyceride	28.71±3.06	27.73±2.23	29.93±1.32	26.94±2.02
ALT	12.85±1.78	13.25±1.3	13.94±0.79	14.25±1.4
AST	26.75±1.38	25.05±2.06	26.31±1.92	25.15±1.22

GSH-Px=Glutathione peroxides ALT=alanine aminotransferase
AST= aspartate aminotransferase G1 =control
G2 = injection 10 ml viteselen G3 = injection 20 ml viteselen
G4 =organic selenium
Identical letters within each row indicate insignificant difference at $p\leq0.05$.

Physiological Parameters

Rectal temperature

Tables (6) indicated that Se supplementation either with Vit. E or in organic form did not affect significantly rectal temperature. Similar results had been found by El-Shahat and Abdel-Monem (2011) who showed that there was no significant difference in rectal temperature of experimental animal.

Respiration rate

Table (6) indicated that Se treatment either as inorganic or organic forms with or without vit. E did not affect respiration rate. This result was similar to that reported by El-Shahat and Abdel-Monem (2011) who showed that there was no significant difference in respiratory rates of experimental animal.

Table (5): Descriptive statistics (mean±S.E.) and test of significance for rectal temperature and respiration rate of different groups.

Parameter	G1	G2	G3	G4
Rectal temperature	38.48±0.1	38.38±0.08	38.48±0.13	38.42±0.06
Respiration rate at noon	53.4±2.3	51.8±3.43	50±2.41	52.6±3.72

S.E. = Standard error G1 =control
G2 = injection 10 ml viteselen G3= injection 20 ml viteselen
G4 =organic selenium dt = Duncan's Multiple Range Test

Conclusions:

Selenium treatment as organic or in-organic forms has no significant role in thermoregulation of dairy cows under summer conditions. It also had no significant effect on kidney or liver functions as well as plasma metabolites. However, it has a significant role against mastitis by decreasing somatic cell count through stimulating the immune system.

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Effect of selenium and vitamin E supplementation as a nutritional treatment for some physiological and productive traits of Holstein dairy cows under Egyptian summer conditions

تأثير اضافة السيلينيوم وفيتامين E كمعاملات غذائية على بعض الصفات الفسيولوجية والانتاجية لابقار الهولشتين الحلابة تحت ظروف فصل الصيف فى مصر

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المستخلص

أجريت هذه الدراسة فى شركة سند للانتاج الحيوانى ، محافظة دمياط ، مصر. خلال فترة صيف 2013 م من يوليو إلى سبتمبر. أستخدم فى هذه الدراسة 20 بقرة حلابة من سلالة الهولشتين فريزيان تمتع بصحة جيدة وخالية من الأمراض والمتماثلة فى العمر (3 سنوات) ومتوسط الوزن (500كجم±25 كجم) وعدد أيام الحليب (80يوم ±10)، جميع الحيوانات فى موسم الحليب الثانى. تم توزيع الحيوانات فى التجربة عشوائياً الى أربع مجموعات (5 حيوانات/مجموعة).

المجموعة الاولى: مجموعة المقارنة (الضابطة) تم حقنها على فترات اسبوعية بمعدل 10 مل محلول فسيولوجي.

المجموعة الثانية: تم حقنها فى العضل كل اسبوعين بمعدل 10مل فيتسلين.

المجموعة الثالثة: تم حقنها فى العضل كل اسبوعين بمعدل 20مل فيتسلين.

المجموعة الرابعة: تم إضافة السيلينوم العضوى الى الغذاء بمعدل 3ملجم/كجم ماده جافة.

القياسات الإنتاجية (إنتاج اللبن ومكوناته ، النسبة المئوية للدهن، البروتين، اللاكتوز، الجوامد الصلبة الكلية، الجوامد الصلبة الغير دهنية وعدد الخلايا الجسدية). مكونات بلازما الدم (انزيم جلوتاثيون بيروكسيديز، البروتينات الكلية ، اليوريا، الانين امينو ترانسفريز، إسبارتات امينو ترانسفريز، الجلوكوز، الكوليسترول والدهون الثلاثية). القياسات الفسيولوجية (درجة حرارة المستقيم ومعدل التنفس). جميع القياسات تم تقديرها خلال التجربة (مدة التجربة 60 يوم).

أوضحت النتائج ان المعاملة بالسلينيوم سواء العضوى او غير العضوى مع إضافة فيتامين (E) أو بدون إضافته لم يكن له تأثيراً كبيراً على القياسات الانتاجية، قياسات الدم او القياسات الفسيولوجية بإستثناء عدد الخلايا الجسدية وانزيم الجلوتاثيون بيروكسيديز. ويخلص الدراسة الى أن التأثير الرئيسى للسيلينوم هو تقليل عدد الخلايا الجسدية بسبب تأثيره على المناعة، وفى الوقت نفسه لم يكن له أى دور فى التخفيف من الإجهاد الحرارى فى ظل ظروف الصيف فى المنطقة الشمالية (الدلتا) من مصر.