EFFECT OF VITAMIN E AND SELENIUM SUPPLEMENT ON PREGNANT COWS AND THEIR CALVES

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SUMMARY

The present study was designed to investigate the effect of selenium and/ or vitamin E on pregnant cows and their calves. Thirty- two healthy pregnant cows were used in this investigation. They were divided into four equal groups. The first group was considered as control without treatment, the second group was injected intramuscular with selenium as sodium selenite (5mg/ 100kg B.W), the third group, was administered orally with vitamin E (400mg/ 100kg B.W), while the fourth group was injected with selenium and administered orally with vitamin E too. One dose weekly for three successive weeks was used. The blood samples were collected from the pregnant cows and their neonatal calves for determination the levels of selenium, vitamin E, total immunoglobulins and total proteins. The obtained result revealed that selenium and/ or vitamin E induced improvement in the immune status of the newly born calves and also, their levels in these calves. It could be concluded that selenium and vitamin E have synergistic effect, so, it is better to give them together to pregnant cows, when used as prophylaxis from diseases caused by vitamin E deficiency.

INTRODUCTION

Selenium and vitamin E have been recognised for several years as nutrients critical for optimal livestock growth, productivity and health, **(Metre et al., 2001)**. The biochemical role of selenium was demonstrated by **Rotruch et al. (1973)** to be as a component of the enzyme glutathione peroxidase. Gluathione peroxidase functions in cellular oxidation- reduction reactions to protect the cell from oxidative damage from free radicals and peroxides **(Flohe et al., 1973)**. Vitamin E (α- tocopherol) also functions as an antioxidant and protects the cell against oxidative damage: however, it is lipid soluble and primarily associated with the cell membranes. The complementary functions of selenium and vitamin E have been hypothesized, where, supplementation with one can reduce, but not eliminate the requirement for the other **(Hoekstra, 1975 &**

Maas. 1983). The action of vitamin E and selenium appear to be synergistic **(Frye 1991)**.

Selenium and vitamin E also, have important roles in immune system function and resistance to diseases **(Dhur et al., 1999)**. Where, the offspring of the native breed of cows which supplemented with selenium and vitamin E during the prepartum period, had greater concentration of immunoglobulins **(Nagwa et al., 2000)**. Newly born calves take maternal antibodies from colostrum during the first 24 hour of life **(Selman et al., 1970)**. Therefore, it is desirable to increase the cow's colostrum antibody content. Cows given selenium and vitamin E produced more colostrum, and more immunoglobulins than in untreated cows **(Lacetera et al., 1996)**. Two routes exist for transfer of selenium from the dam to the calf: placental transfer and milk. The placental transfer of selenium has already been demonstrated in cattle, because the maternal supplementation of cows in late gestation increases selenium reserve in the liver of the foetus or new born **(Abd el-Rahman and Kincaid 1995)**. The amount of selenium consumed by cows during the non lactating period has been shown to affect selenium concentration in serum of their new born calves. **(Awadeh et al.,1998)**. While vitamin E crosses the placental barrier much less readily, so, the newly born calves have adequate serum selenium level and lower serum α- tocopherol levels than their dams **(Scott 1978)**.

In the present study, selenium and vitamin E were administered - alone or in combination- in excess to pregnant cows aiming to investigate their influence on their levels in these cows and their neonatal calves until weaning and on the immune status of both.

MATERIALS AND METHODS

A) Animals: The study was carried out on a farm in Wadi El-Moolak, Ismailia governorate. The selection of the pregnant cows was depend on the health status. They were healthy, without reproductive problems and in the same reproductive cycle. The cows were free from external and internal parasites. Cows in this farm grazed in berseem pastures (Trifolium alexandrinum L.) from January to May, while , from June to December, these animals were tied in open sheds and fed on ration consisted of concentrates and rice straw. Green corn (Darawa), when was available, was offered to these animals during this period.

Thirty- Two pregnant cows (3-5 years old), in the last month of pregnancy, were divided into four equal groups of 8:

1) cows in the first group (gC) served as control and received the basic feed, which covers the dietary needs of a pregnant and lactating cow.

2) cows in the second group (gSe) received the basic feed and additionally intramuscular selenium injection of 5mg. selenium/ 100kg B.W. **(Fatma 1997).**

3) cows in the third group (gE) received the above basic feed supplemented with an additional 400mg/100k.g B.W of vitamin E as a- tocopherol acetate. **(Fatma 1997).**

4) cows in the fourth group (gESe) received the basic feed plus 400mg of vitamin E/ 100kg B.W. and intramuscular selenium injection of 5mg selenium/ 100kg B.W.

The drugs used as one dose weekly for three successive weeks before parturation.

B) Drugs: 1- selenium: was used in this study as an aqueous solution of sodium selenite* (2.5mg selenium/ 1ml solution).

2- vitamin E: was obtained as a viscous oil of vitamin E (Alpha- tocopherol). It is available as soft gelatin capsules (400mg)**

3- selenium and vitamin E preparation: each (1ml) of the preparation contains 1.67mg/ml sodium selenite and 150mg/ml vitamin E.***

C) Blood samples: The first sample was collected (4 weeks before parturation) from cows on the starting day of the experiment, before the supplying with ∝- tocopherol and before the selenium injection. A second sample was taken on the first day of parturation. While blood samples from newly born calves were collected, at 36 hrs. of age, and from the same calves on weaning day.

D) Biochemical studies: Sera were separated from the blood clot by centrifugation and used for selenium, ∝- tocopherol , total protein and total immunoglobulins determination.

Serum selenium was determined by atomic absorption spectrophotometer as described by **Meret and Henkin (1971)*** ∝- tocopherol concentration was determined by the method of **Oser (1979)****. Total Serum proteins was estimated by the method described by **Henry (1968)** and total serum immunoglobulins determined by the sod. sulphite turbidity test according to **Stone and Gitter (1969)** by using spectrophotometer as adopted by **Khalil (1975). The data obtained were statistically analyzed using T.test according to Tamhane and Dunlop, (2000).**

RESULTS

1) Determination of selenium in sera of cows:

The results of selenium determination in the serum samples of cows are presented in table (1). On the starting of the experiment and before α-tocopherol and selenium administration, no statistically significant differences of selenium concentration were noticed among the cows of all groups. On farrowing day, cows in the second and fourth groups that were injected with selenium (gSe and gESe) had significant increase ($P \leq 0.01$) of selenium levels in their sera compared with the control group (gC).

2) Determination of selenium in sera of calves:

Selenium concentration in the representative calves sera are shown in table (1). Calves in the second and fourth groups injected with selenium (gSe and gESe) had significantly increased levels ($P \leq 0.05$ & $P \leq 0.01$) comparing with the control group (gC), either 36 hrs after birth or at the weaning day.

3) Determination of α- tocopherol in sera of cows:

The results of α- tocopherol determination in sera of cows are given in table (2). Serum a-toeoherol concentration did not differ significantly from the control group.

4) Determination of α- tocopherol in sera of calves:

The results of the representative calves serum are shown in table (2). 36 hrs. After birth, calves born to cows supplemented with α- tocopherol in the Third (gE) & fourth groups (gESe) had significantly increased level ($P \leq 0.01$ & $P \leq 0.001$) comparing to the control group (gC).

5) Determination of total immunoglobulins in sera of cows:

The total immunoglobulins concentration in the sera of cows are presented in table (3). On the starting day, the mean concentration differences among all animals were not statistically significant. On farrowing day, cows in the control group (gC) had the lowest mean of immunoglobulins values. While, cows of the fourth group (gESe) that received both α- tocopherol and selenium had significantly increased levels ($P \leq 0.01$) of total immunoglobulins, compared to the control group (gC).

6) Determination of total immunoglobulins in sera of calves:

Calves born to cows of third (gE) and fourth (gESc) groups always had significantly increased levels ($P \leq 0.05$ & $P \leq 0.001$) of serum immunoglobulins, compared to calves of the control group (gC), either 36hrs. after birth or at the weaning day.

7) Determination of serum total proteins in sera of cows and their calves: are presented in table (4).

DISCUSSION

Selenium is an essential element in the diet of animals and has a variety of roles; it is an antioxidant that works in conjunction with vitamin E to prevent and repair cell damage in the body, is involved in immune function and is necessary for growth and fertility. **(plant 2003).**

The present study investigate the effect of administration of selenium and α- tocopherol acetate in the pregnant cows and their calves. Both elements were given either separately or in combination.

At the beginning of the experiment (zero time), the mean serum concentration values of selenium, a- tocopherol, total proteins, and total immunoglobulins were not significantly different among the four groups of cows.

The intra muscular injection of selenium in pregnant cows increased the serum selenium concentration of the cows and calves. Selenium transfer from pregnant cows to their embryos was demonstrated in cattle **(Abdel-Rahman and Kincaid 1995).** Therefore, selenium that was detected in calves sera 24-36 h. after birth originates from placental transfer and from colostrum uptake. This latter finding is in agreement with the observation made by **Underwood (1971).** that calves absorb selenium from colostrum and milk, and carry it in blood bound to plasma proteins. Also, **Perry et al.,(1978)** recorded that selenium level of calf serum at birth is a reflection of the maternal selenium supplementation. **Rock et al., (2001)** mentioned that pregnant ewes which fed on additional selenium had increased concentration of selenium in whole blood and serum.

On the other hand, these results show a significant increase in total immunoglobulins in selenium injected cows than non- injected control ones. These data agree with the results obtained by **Hayek et al., (1989) in sows, Bednarek et al., (1994)** in calves. **Mllad and Kovac (1999) in ewes and Hassan et al., (2001)** in horses. Similar results obtained by **Awadeh et al., (1998)** who found that selenium supplementation increase colostral immunoglobulins concentrations in

cows and serum immunoglobulins concentrations in their calves. Also, **Arthur et al., (2003)** reported that selenium supplementation increase the level of serum immunoglobulins and the production of secondary antibodies to antigen.

On the farrowing day, a decrease of α- tocopherol was noticed in all cows, in contrast, calves of all groups always had high α- tocopherol concentration levels, which were more prominent in calves from cows of (gE) and (gESe). This α- tocopherol was obviously, taken from colostrum and milk, where, it was drained from plasma. This explains the decreased α- tocopherol concentration in cow's serum on the farrowing day and confirms the observations made by **Malm et al., (1976)** who reported that the α- tocopherol concentration in colostrum could be 6-36 times greater in sows which were supplied with extra α- tocopherol during pregnancy.

The combined use of α- tocopherol and selenium proved to be more beneficial for cows and calves than their separate administration. This agreed with **Lacetera et al., (1996)** who reported that cows treated with selenium and α- tocopherol acetate 3 weeks before calving had higher glutathione peroxidase values at calving and during the first 12 weeks of lactation. Also, in their calves, the glutathione peroxidase values were significantly high at birth and 4 weeks of age. Also, **Ikewchi et al., (1997)** reported that the serum selenium and vitamin E, levels in dams and their calves, fed selenium & vitamin E were significantly higher than those in control. On the other hand, our results showed that, highest immunoglobulins concentrations was detected in cows that received both α- tocopherol and selenium (gESe). The influence of extra α- tocopherol and selenium administration to cows was reflected in their calves on the farrowing and weaning days. Where, calves of cows in (gESe) group had the highest immunoglobulins concentration, which was statistically significantly different from that in the other groups. Our results agreed with **Megahed and Daghash (1999)** who observed increase of total immunoglobulins concentration in newly born calves after injection of vitamin E and selenium, in cows during late gestation. This could be attributed to the effect of selenium and vitamin E which increased absorption of globulin and essential protein digested products which was eventually reflected on the obtained parameters **(Abbas 2002)**. Also, the present results revealed that the total protein significantly increased in cows which received both selenium and α- tocopherol acetate, and this increase was detected in their calves, (Table 4). These results run parallel with those obtained by **Fatma (1997)** who reported that the increased protein level of the treated groups can be attributed to the increase in globulin level, also, **Metry et al., (1998)** in calves and lastly **Shahira & Mona (2006)** in lambs. The sex of calves had no effect on the values of any of the parameters examined, since males and females reacted very similarly.

In conclusion, this study indicate that selenium supplementation was less effective than el-

ther α- tocopherol supplementation alone or the combined supplementation of selenium and α-tocopherol. The administration of extra- α- tocopherol by the pregnant cows in combination with the injection of selenium regularly during pregnancy, proved to be very beneficial for cows and their calves. Where it improves their health status during the crucial period of pregnancy and weaning. And it is also an important factor in calf immunity. So, it is better and advisable to give selenium and vitamin E together to pregnant cows, when used as a mean of prophylaxis from diseases caused by vitamin E deficiency and not selenium alone.

Table (1): *Selenium levels (μg/dl) in the serum of cows and calves.*

	G1 (gC)	G2 (gSe)	G3 (gE)	G4 (gESe)
Cows at last month of pregnancy	5.18 ± 0.21	5.41 ± 0.33	5.61 ± 0.18	5.48 ± 0.37
Cows on day of farrowing	5.22 ± 0.41	6.81 ± 0.28**	5.01 ± 0.21	6.93 ± 0.28**
Calves 36 hrs. postpartum.	5.17 ± 0.13	6.21 ± 0.22**	5.18 ± 0.31	6.14 ± 0.35*
Calves on weaning day.	5.15 ± 0.18	6.31 ± 0.44*	5.11 ± 0.1	6.33 ± 0.48*

Table (2): *α-tocopherol levels (μg/dl) in the serum of cows and calves.*

	G1 (gC)	G2 (gSe)	G3 (gE)	G4 (gESe)
Cows at last month of pregnancy	236.7 ± 5.6	219.6 ± 6.41	234.22 ± 4.12	222.34 ± 7.21
Cows on day of farrowing	198.6 ± 5.15	181.5 ± 6.28	196.4 ± 3.81	184.5 ± 5.31
Calves 36 hrs. postpartum.	223.7 ± 3.41	214.3 ± 2.81	241.5 ± 4.72**	254.2 ± 6.11***
Calves on weaning day.	211.5 ± 3.62	201.7 ± 4.82	212.9 ± 5.22	216.7 ± 4.21

Table (3)*: total immunoglobulins levels (gm/dl) in the serum of cows and calves.*

	G1 (gC)	G2 (gSe)	G3 (gE)	G4 (GESe)
Cows at last month of pregnancy	2.11 ± 0.21	2.01 ± 0.04	2.24 ± 0.11	2.13 ± 0.17
Cows on day of farrowing	2.14 ± 0.16	2.71 ± 0.15	2.31 ± 0.21	2.91 ± 0.11**
Calves 36 hrs. postpartum.	2.17 ± 0.05	2.41 ± 0.21	2.67 ± 0.19*	2.89 ± 0.13***
Calves on weaning day.	2.00 ± 0.07	2.29 ± 0.13	2.58 ± 0.04***	2.78 ± 0.17***

Table(4) *total protein levels (gm/dl) in the serum of cows and calves.*

	G1 (gC)	G2 (gSe)	G3 (gE)	G4 (GESe)
Cows at last month of pregnancy	6.24 ± 0.42	6.21 ± 0.18	6.43 ± 0.26	6.35 ± 0.19
Cows on day ofarrowing	6.16 ± 0.34	6.62 ± 0.51	7.05 ± 0.42	7.84 ± 0.33**
Calves 36 hrs. postpartum.	6.13 ± 0.29	6.48 ± 0.35	7.21 ± 0.22*	7.73 ± 0.41**
Calves on weaning day.	6.11 ± 0.14	6.58 ± 0.28	6.86 ± 0.31*	6.97 ± 0.21**

* Significant at P ≤ 0.05

** Significant at P ≤ 0.01

*** Significant at P ≤ 0.00i

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الملخص العربى

تأثير فيتامين هـ والسيلينيوم على الأبقار العشار ونتاجها

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أجريت هذه الدراسة بهدف معرفة تأثير حقن السلينيوم وفيتامين هـ على الأبقار العشار ونتاجها. حيث تم استخدام عدد ٣٢ بقرة عشار فى الشهر الأخير من الحمل تنتمى لإحدى المزارع الخاصة بمنطقة وادى الملاك- محافظة الإسماعيلية. وقسمت هذه الأبقار إلى أربع مجموعات متساوية كلاً منها يضم عدد ثمانية أبقار: الأولى ضابطة والثانية تم حقنها فى العضل بالسيلينيوم كصوديوم سيلينيت بجرعات ٥ ملجم لكل ١٠٠ كجم من وزن الحيوان والثالثة تم تجريعها عن طريق الفم باستخدام كبسولات فيتامين هـ بجرعات ٤٠٠ ملجم لكل ١٠٠ كجم من وزن الحيوان والمجموعة الرابعة والأخيرة تم إعطائها كلاً من السيلينيوم وفيتامين هـ معاً بنفس الجرعات وتم الحقن والتجريع لهذه الأبقار مرة واحدة أسبوعياً لمدة ثلاث أسابيع متتالية. ثم تم أخذ عينات دم من هذه الأبقار فى بداية التجربة وقبل الحقن أو التجريع ثم أخذ عينات دم أخرى عند الولادة. أيضاً تم أخذ عينات دم من العجول المولودة لهذه الأبقار عند عمر ٣٦ ساعة ثم أخذ عينات دم أخرى عند الفطام. تم قياس مستوى السيلينيوم وفيتامين هـ والجلوبيولينات المناعية الكلية والبروتين الكلى فى مصل كلاً من الأبقار العشار والعجول المولودة لها. من نتائج الدراسة تبين أن السيلينيوم وفيتامين هـ سواءاً كلاً على حدة أو معاً أديا إلى تحسن الحالة المناعية للعجول المولودة- كما تبين أن مستوى كلاً من السيلينيوم وفيتامين هـ فى مصل العجول المولودة هى انعكاس مباشر لمستويهما فى مصل الأبقار الأمهات. نستخلص من هذه الدراسة أن استخدام كلاً من السيلينيوم وفيتامين هـ معاً فى صورة وقائية أثناء الفترة الأخيرة من الحمل فى الأبقار العشار كان له أحسن الأثر فى تحسين الحالة الصحية والمناعية للعجول المولودة وكذلك فى مستوى السيلينيوم وفيتامين هـ فى هذه العجول، لذلك يوصى باستخدامهما معاً.