

## EFFECT OF SOME TRACE ELEMENT DEFICIENCIES ON THE REPRODUCTIVE PERFORMANCE OF COWS IN NEW VALLEY GOVERNORATE

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**Received:** 21 September 2020; **Accepted:** 15 October 2020

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### ABSTRACT

Minerals play an important role in improving reproductive efficiency in all animals. It is very important for animal production and reproduction. Deficiency of minerals may lead to disorders affecting growth, production and reproductive health of animals. Different trace elements (selenium, cobalt, iodine, iron, zinc, copper and manganese) can influence reproductive performance of animals. Reproductive failure may be occurred by deficiencies of one or more trace minerals and by imbalances. A total number of 230 cows from New Valley governorate (Kharga, Dakhla and Paris) were used in this study. About 35 hybrids cattle were suffered from silent heat, inactive ovaries and post parturient reproductive troubles. Animals were clinically and gynecologically examined, blood samples were collected for carrying out some related analyses. Results explained that 22 of the examined animals showed clear clinical signs of copper deficiency (hypocupremia) and had a poor body condition, score and anemia, Also, 13 of these hypocupremic cows had a mixed selenium, cobalt and iodine deficiency and suffered from ovarian inactivity in comparison with control cows.

**Keywords:** Nutritional deficiency, Parameters, New Valley.

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### INTRODUCTION

Minerals are constitutional components of body and play important role in activities of enzyme, hormone, as take part in its structure in body fluids and tissues, it regulate cell replication and differentiation. After protein and energy, minerals are the important nutrients required and should be given priority in order to optimize reproduction in dairy cattle (Bindari *et al.*, 2013). Mineral

imbalances, deficiencies and toxicity of certain minerals may lead to reproductive disorders as minerals play an important role in health and reproduction of the livestock (Sharma *et al.*, 2007). Minerals are required in reproductive process because of their role in maintenance, metabolism and growth (Hadiya *et al.*, 2010). The availability of minerals to cattle depends upon the production system, feeding practices, and environment (Singh and Bohra, 2005). Beside energy and protein, deficiency of these elements such as calcium, phosphorus, zinc, iron and copper etc. in blood have been reported to be a predisposing factor for the occurrence of retention of placenta and repeat breeding in dairy cows (Kumar, 2014; Sheetal *et al.*, 2014). Nutritional deficiencies and

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reproductive disorders are the principal problems that affect buffalo productivity main stumbling block facing buffalo production, especially in animals kept in small owner farms and exposed to mismanagement as well as some stress conditions such as parasitism, malnutrition, pollution and bad hygiene (Sharm, 2003, Ahmed, 2007). Copper deficiency is one of the most widespread mineral deficiencies. It affects grazing cattle as there are extensive copper deficient areas throughout the world which have reverse effects on the harvest and livestock (Underwood and Suttle, 1999). Copper plays an essential role as a micronutrient. So, Copper deficiency has a severe effect on growth and reproduction in domestic animals (Abba *et al.*, 2000). Copper is essential for the transportation and absorption of iron which necessary for hemoglobin synthesis, also it is important for erythrocyte production (Tuormaa, 2000). Copper is also necessary for melanin synthesis and interaction of copper and estrogen are also observed (Hidiroglou, 1979). Involvement of copper and zinc in the activity of super oxide dismutase helps in regulating the progesterone production by luteal cells (Sales *et al.*, 2011). Copper deficiency affects various physiological functions that may be important in immunological defense to pathogenic challenge (Stabel *et al.*, 1993). Trace elements helps in improving the reproductive performance of cattle (Kumar *et al.*, 2011; Grace and Knowles, 2012). Reports suggested that trace elements deficiency greatly influenced the ovarian activity in ruminants (Boland, 2003). Minerals are also involved in the synthesis of hormone essential for reproduction. Their deficiency will affect the production of both steroidal (Boland, 2003) and thyroid hormone (Abdollahi *et al.*, 2011). Reproductive failure may be produced by deficiencies of one or more minerals or by their imbalances. Copper exerts its role as a cofactor in the activity of several enzymes and reactive proteins ceruloplasmin (Suttle, 2010). When the

level of copper is below physiological needs problems like early fetal resorption, embryonic deaths and increased chances of retention of placenta develops. In dairy cattle they may show delayed or depressed estrous, impaired ovarian function and infertility. Adequate serum copper level of dairy cow has positive effect on reproductive health leading to fewer days to first service, fewer services per conception and fewer days to open. Copper deficiency with cobalt is having dangerous effect on the reproductive performance leading to delay in onset of puberty, early embryonic death, low conception rate and higher chances of retention of placenta (Nix, 2002). If rations contain antagonists such as elevated S, Fe, or Mo, replacing 35 percent of supplemental copper with organic copper sources improved Cu availability. The following mineral percentage may be useful in maintaining copper levels in blood: Zn: Cu 4:1, Cu: Mo 6:1 and Fe: Cu 40:1 (Hutjens, 2000). The aim of this study is to understand the relationship between some trace element deficiency and its effect on reproductive performance of cows in New Valley governorate to approach the suitable treatment, prevention and condole to this problem which is critically affect the economy of our country.

## MATERIALS AND METHODS

### 1. Animals

- A total number of 230 cows from New Valley governorate (Kharga, Dakhla and Paris) were used in this study. About 35 hybrids cattle were suffered from silent heat, inactive ovaries and post parturient reproductive troubles. Animals were clinically and gynecologically examined and blood samples were collected for carrying out some related analyses.
- Eleven healthy animals used as control group were included, while other animals constituted the problem group and have initial symptoms of silent

heat, inactive ovary and post parturient reproductive troubles.

## 2. Samples

- Five ml of blood samples were collected from the jugular vein of each animal, each blood sample divided into two portions. The 1st portion (2ml) was anti-coagulated by (EDTA) and was used for hemogram investigation (Feldman *et al.*, 2000). The 2nd portion (3ml) were allowed to clot, and then centrifuged at 3000 rpm for 10 minutes for serum separation. Eleven healthy animals assigned as Control Group to which other animals were compared. Minerals content in the serum was determined by atomic absorption spectroscopy using Hitachi Z-500 equipment. The value reported for copper, selenium cobalt and iodine

content in the plasma was the mean value obtained from 3 measurements.

## 3. Statistical analyses

Statistical differences were calculated according to the Student t-test with significance level at  $P < 0.05$ . All results were analyzed using the procedure of (SAS, 2004).

## RESULTS

Results explained that (22) of the examined Animals showed clear clinical signs of copper deficiency (hypocuprosis) and had a poor body condition, score anemia, Also, (13) of these hypocupremic cows had a mixed mineral deficiency selenium, cobalt and iodine deficiency and all animals suffered from mineral deficiency had silent heat, inactive ovary, post parturient reproductive Troubles in comparison with Control cows.

**Table 1:** Number of clinically and gynecologically affected cows

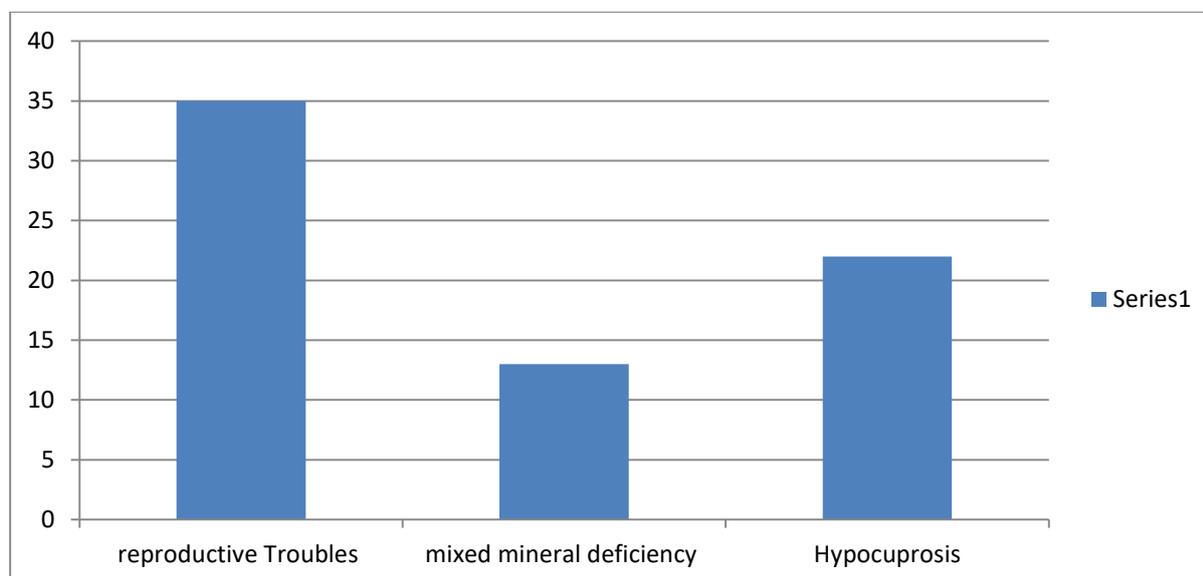
Total cow	Trouble in fertility.	Mixed mineral d.	Hypocuprosis
230	35	13	22

**Table 2:** The effect of hypocuprosis on the blood picture of cows.

Parameters	Control	Hypocuprosis
Erythrogram		
Red cell count(106/ $\mu$ L3)	5.71 $\pm$ 0.14	4.76 $\pm$ 0.08**
Hemoglobin content (g/dl)	13.90 $\pm$ 0.21	11.01 $\pm$ 0.28**
Packed cell volume (%)	35.76 $\pm$ 0.15	33.51 $\pm$ 0.7*
Leukogram		
Total cell count (103/ $\mu$ L3)	6.47 $\pm$ 0.28	5.77 $\pm$ 0.31
Lymphocytes (%)	62.14 $\pm$ 1.86	59.17 $\pm$ 0.98
Neutrophils (%)	38.27 $\pm$ 1.72	35.22 $\pm$ 1.61
Esinophils (%)	1.74 $\pm$ 0.55	1.65 $\pm$ 0.73
Basophils (%)	0.24 $\pm$ 0.12	0.21 $\pm$ 0.10
Monocytes (%)	1.23 $\pm$ 0.61	1.22 $\pm$ 0.48

**Table 3:** Trace mineral concentrations in cattle serum

Concentration	Control	Hypocuprosis
Copper ( $\mu$ g/dl)	>0.7	< 0.5
Selenium (ug/dl)	>200	<60
Iodine (ug/dl)	>15	<5
Cobalt (ug/dl)	> 0.02	<0.005

**Figure 1:** Number of clinically and gynecologically affected cows

## DISCUSSION

Results explained that 22 of the examined Animals showed clear clinical signs of copper deficiency (hypocuprosis) (table 3) and had a poor body condition, score and anemia, (table 1) Also, 13 of these hypocupremic cows suffered from ovarian inactivity In comparison with control cows.

Trace elements helps in improving the reproductive performance of cattle (Kumar *et al.*, 2011; Grace and Knowles, 2012), so that animal must be supplied with a sufficient amount of minerals to meet its needs for production and fertility. Reports suggested that minerals deficiency greatly influence the ovarian activity in ruminants (Boland, 2003), so that in New Valley governorate cows graze on a poor grass which grow in poor land with trace element especially cu. Minerals are also involved in the synthesis of hormones essential for reproduction. Their deficiency will affect the production of both steroidal (Boland, 2003) and thyroid hormone (Abdollahi *et al.*, 2011). Reproductive failure may be induced by deficiencies of single or combined minerals or by their imbalances. This study will focus on the mechanism by which various minerals act and their daily requirements by the dairy cattle.

Copper exerts its role as a cofactor in the activity of various enzymes and reactive proteins ceruloplasmin (Suttle, 2010). Copper is essential for the absorption and transport of iron which is necessary for hemoglobin synthesis, hence needed for erythrocyte production (Tuormaa, 2000).

Involvement of copper and zinc in the activity of super oxide dismutase helps in regulating the progesterone production by luteal cells (Sales *et al.*, 2011). When the level of Cu was below physiological needs problems like early embryonic deaths, fetal resorption, necrosis and increased chances of returned placenta developed. In dairy

cows they may showed suppressed estrous, impaired ovarian function and infertility. Adequate serum copper levels of dairy cow have positive effect on reproductive health, fewer services per conception and fewer days to open. Deficiency of copper along with cobalt was having deleterious effect on the reproductive performance leading to delay in onset of puberty, low conception rate, early embryonic death and higher chances of retention of placenta (Nix, 2002).

Lower nutrient and energy intake leads to negative energy balance and this leads to an increase in fat mobilization leading to fatty liver syndrome and ketosis. It has been showed that plasma calcium concentration of 5 mg/ml reduce abomasal motility by 70% and the strength of the contraction by 50%. Low calcium concentrations also prevent insulin production, further exacerbating this situation (Goff, 1999).

Iodine deficiency impaired reproduction, so iodine supplementation has been recommended when necessary to insure that cows consume 15-20 mg of iodine each day. Recently, excessive iodine intakes have been associated with various health problems including abortion and decreased resistance to infection and disease. Signs of subclinical iodine deficiency in breeding females include suppressed estrus, abortions, still births, increased frequency of retained placentas and extended gestation periods (Hess *et al.*, 2008).

## CONCLUSIONS

More research is needed to increase our information about the effects of nutritional factors affecting fertility and health. Moreover, a lot of work is needed to explain the contents of all feeds of New Valley, in relation to soil conditions and season.

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### تأثير نقص بعض العناصر المعدنية النادرة على الكفاءة التناسلية للابقار بمحافظة الوادي الجديد

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تلعب التغذية دورًا مهمًا في تعزيز الكفاءة التناسلية في جميع الحيوانات. وتعد المعادن وخصوصا العناصر المعدنية النادرة من العناصر الغذائية المهمة جدًا للحفاظ على صحة الحيوان. قد يؤدي نقص العناصر المعدنية النادرة إلى اضطراب هيكلية أو فسيولوجي أو مناعي يؤثر على نمو الحيوانات وإنتاجيتها وكفاءتها التناسلية. يمكن أن تؤثر العناصر المعدنية النادرة المختلفة مثل (السيلينيوم ، والكوبالت ، والنحاس ، والمنجنيز ، واليود ، والحديد ، والزنك) على الكفاءة التناسلية للحيوانات المجتررة. قد يحدث الفشل التناسلي بسبب نقص عنصر أو أكثر من هذه العناصر من خلال عدم الاتزان في تركيب العلائق. في هذه الدراسة تم تضمين ٣٥ بقرة هجينة تعاني من الشيع الصامت وعدم نشاط المبيض ومشاكل تناسلية بعد الولادة من بين (٢٣٠) بقرة في محافظة الوادي الجديد (في قرى مراكز الداخلة والخارجة وباريس). تم فحص الحيوانات اكلينيكية وتناسليا وتم جمع عينات الدم منها لإجراء بعض التحليلات ذات الصلة. أوضحت النتائج أن (٢٢) من الحيوانات التي تم فحصها ظهرت عليها علامات اكلينيكية واضحة على نقص النحاس (نقص السكر في الدم) ولديها حالة جسدية سيئة ، وكذلك فقر الدم ، كما تم تسجيل عدد (١٣) من هذه الأبقار تعاني من نقص السيلينيوم والكوبالت واليود وكذلك من خمول المبيض بالمقارنة مع أبقار المجموعه الضابطة.