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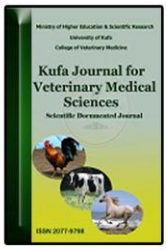

Clinical and biochemical studies on zinc deficiency (hypozincemia) of goat and sheep

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Abstract:

Clinical, and some biochemical parameters have been studied in local sheep and goat affected naturally with hypozincemia in Al-Najaf province, Iraq. The study was conducted on 25 local Iraqi sheep and 15 goat, the age of these animals were between 1-2 year old. Twenty clinical healthy sheep of the same ages were used as control. Affected sheep and goat showed signs of alopecia (36.36% , 27.27%) abnormal skin (rough, thickened, wrinkled, cracked and dandruff) (45.45% , 27.27%), paleness of mucous membranes (63.63% , 36.36%), loss of appetite (63.63% , 36.36%), decreased growth rate (36.36% , 18.18%), swelling of joints (18.18% , 9.09%) and pica (9.09% , 9.09%) respectively. No significant difference has been detected in body temperature, whereas respiratory and heart rates were significantly increased in affected animals in comparison with control. The biochemical results revealed significant decrease in serum zinc and alkaline phosphatase level in diseased animals than in control one.

Key words: zinc deficiency, goat and sheep, clinical and biochemical studies.

دراسة سريرية وكيموحيوية لنقص الزنك في الاغنام والماعز

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الخلاصة:

اجريت دراسة سريرية وكيموحيوية على 25 راسا من الاغنام المحلية و15 راسا من الماعز المحلي بعمر 1-2 سنة كانت تعاني من اصابة طبيعية لنقص الزنك في مدينة النجف الاشرف في العراق . استعملت مجموعة سيطرة من الاغنام بعدد(10) راس والماعز بعدد(3) راس وبنفس العمر .اظهرت الاغنام والماعز المصابة علامات سريرية تمثلت بالحاصة بنسبة (36.36% ، 27.27%) وافات جلدية (خشونة الجلد ،تثخنه، مع تجعده وتشققه وظهور النخالية)بنسبة (45.45% ، 27.27%) شحوب الاغشية المخاطية بنسبة (63.63% ، 36.36%) فقدان الشهية بنسبة (63.63% ، 36.36%) نقصان معدل النمو بنسبة (36.36%،18.18%) تورم المفاصل بنسبة (18.18%،9.09%) وانحراف الشهية بنسبة (9.09%،9.09%) على التوالي. لم يلحظ هناك اي فرق معنوي في درجات الحرارة ،في حين ظهرت هناك زيادة واضحة في ضربات القلب ومعدل التنفس في الحيوانات المصابة مقارنة بمجموعة السيطرة. اظهرت النتائج الكيموحيوية انخفاض معنوي في مستوى الزنك وانزيم الفوسفاتيز القاعدي في الحيوانات المصابة مقارنة بمجموعة السيطرة.

مفاتيح البحث : نقص الزنك ،الأغنام والماعز ،دراسة سريرية وكيموحيوية.

Introduction:

Zinc is essential microelements that influence metabolism, the immune system and overall health condition (1). It has a wide spectrum of biological activities and its deficiency has been related to various dysfunctions and alterations of normal cell metabolism (2). It is an integral component of a wide range of metalloenzymes and acts as a cofactor for RNA and DNA polymerases (3).

Mineral deficiency or imbalance observed in nearly everywhere in the world causes significant losses in terms of both production and economy (4,5,6) . It is reported that the losses caused by trace elements are as important as the losses caused by infectious and parasitic diseases (7).

Zinc is a component of 300 enzyme (8), it's vital to the activities of a variety hormones such as glucagon , insulin , growth hormones, and sex hormones (9).
Zinc is also essential for the biosynthesis of fatty acids and participates in both the inflammatory and immune responses and also involved in the metabolism of vitamin A (10).

The objective of the current work is to present the clinical, and biochemical features of clinical hypozincemia in local breed of sheep and goat in Al-Najaf province, Iraq.

Materials and Methods:

Twenty five sheep and fifteen goats of local breeds (1-2 years) of both sexes were examined in al Najaf province . Seven sheeps and four goats were found to be affected with hypozincemia and constitutes the basis for the present study. Additionally, 10 normal sheep and 3 normal goat were used as control.

The animals were examined clinically for systemic reaction , body condition, behavior ,appetite, coat of the animal ,mucous membrane and any other abnormalities.

Blood samples were taken from the jugular vein without anticoagulant for trace element and biochemical analysis.
The samples were kept for 15 minute at room temperature and then centrifuged to obtain serum for zinc analysis , and alkaline phosphatase.

The zinc value were determined using the Atomic absorption spectrophotometer (Shimadso aa-6300.co al qiffaf.lab and science. Equipment) while the alkaline phosphatase(ALP) were determined by the spectrophotometer using the commercial kit (Biolabo sa 02160, Maizy France).

Results:

Table 1: Clinical signs of sheep and goat affected with zinc deficiency (n=11)

Clinical sings	No. of cases sheep	No. of cases goat	% of cases sheep	% of cases goat
loss of appetite	7	4	63.63%	36.36%
Pale mucous membranes	7	4	63.63%	36.36%
Abnormal skin	5	3	45.45%	27.27%
Decreased growth rate	4	2	36.36%	18.18%
Swelling of joints	2	1	18.18%	9.09%
Pica	1	1	9.09%	9.09%

Diseased animals with hypozincemia showed signs of alopecia in different body regions 62% , abnormal skin 54% (rough skin, thickened, wrinkled, cracked and with dandruff), paleness of mucus membranes 29% ,intermittent diarrhea 16% and loss of appetite 66% , decreased growth rate 12% , swelling of joints and wool eating (pica) 20% .

The body temperature was normal , whereas respiratory and heart rates were increased above normal.

Results of biochemical changes indicated a decrease in zinc values in diseased animal than the control , in which the level in affected sheep was 39.16±1 (µg/ml) and in the affected goat was 33.6±2 (µg/ml) while in the control group was 81.63±6 (µg/ml) for sheep and 79.53±6 (µg/ml) for goat.

Alkaline phosphatase in diseased sheep was 195±2.68(U/L) and in goat was 180±4.56(U/L) while in control was 260±11.32 (U/L) .

Discussion:

Mineral supplementation in rations for sheep and goat is important not only for animals but also for farmer who could benefit a greater productivity of his animals and a better financial gain if the trace element status in animals would be appropriate (11). Once the animals are deficient, their products (meat, milk and wool) are also deficient. Meat and milk are consumed by people who need a sufficient intake of oligo-elements to their health (12).

Among factor that predispose to zinc deficiency are increase calcium and phosphorus (decreases zinc absorption) , diet rich in legume (high calcium) or high phosphorus grain supplement (corn-soybean , corn-oat-barley) with no added minerals. Some legumes contain less zinc than grasses grown on the same soil and zinc concentration decreases with aging of the plant (13). Elevation of soil pH above 6.5 and use of fertilizers like nitrogen and phosphorus (14). Several factors may affect the availability of zinc to ruminants and cause secondary zinc deficiency. These include the consumption of immature grass, feeding of late-cut hay, and the presence of excessive dietary sulphur. Moreover, the contamination of silage with soil at harvesting time can also affect the digestibility of zinc (5).

Sheep and goat have a small, zinc storage unit, therefore clinical signs and laboratory abnormalities associated with zinc deficiency occur rapidly after removal of zinc from diets and return to normal after supplementation because sheep are able to absorb zinc very efficiently at low intake (15) , therefore, optimal zinc in nutrition is required (16). The young rapidly growing lamb achieves its high requirement from the ewes milk which is rich in zinc (17).

Diseased sheep and goat showed different clinical signs which were also mentioned by others (9,18,13,12,5).

In this study ,the serum value of zinc and alkaline phosphatase were significantly lower in diseased animal than in control. This finding indicate clearly that the condition in sick animals is hypozincemia.

In ruminants, concentrations of Zn in plasma are reduced during a Zn deficiency. Cattle consuming diets severely deficient in Zn (1.2 ppm dietary Zn) have depressed concentrations of Zn in plasma within 36 h (19). Sheep deficient in Zn had serum Zn values of 44 µg/mL, and serum Zn increased to 78 µg/mL when they were given a ZnO supplement (20). (21) surveyed 11 dairy goatherds in Florida and found plasma Zn was lower in goats with seasonal dermatosis .(22) reported that goats fed 4 ppm Zn had 62 µg of Zn/mL of plasma and showed signs of Zn deficiency.

The skin alopecia and abnormality belong to the zinc integral component of a wide range of metalloenzymes and acts as a cofactor for RNA and DNA polymerases (23). Its presence is of particular

importance in rapidly-dividing cells, including those of the epidermis (24).

Zinc deficiency results in failure of keratinization, which leads to parakeratosis, loss and failure of growth of hair, lesions of coronary bands, retarded testicular development and cessation of spermatogenesis (25). This probably reflects the importance of zinc in protein synthesis (26). The lesions of the arteriolar walls of the dermis have also been reported (27).

In the present study, loss of appetite was the main clinical sign exhibited by the zinc deficient sheep and goat .In human the zinc deficiency cause reduced ability to taste and smell foods(28) .it have been showed that changes in appetite are associated with changes in concentration of amino acids derived neurotransmitters in the brain .

Also it cause avoiding carbohydrate and seeking protein and fats in rats (29) . So zinc deficiency may reduce appetite by impairing taste. Also the sense of taste is mediated through the salivary zinc dependant polypeptide, gustin .and thus it well reduce the taste and appetite (30).

The reduced appetite could be the cause for pale mucous membrane , decreased body weight and poor growth .This suggestion supported by the finding feeding 3000 ppm zinc enhance the growth and health in nursing pig (31).

Studies in various species, including rodents, domestic fowl, calves and lambs have found that dietary zinc deficiency significantly reduces red blood cells (18) and carbonic anhydrase activity which may impair respiratory functions (32). This might be the cause of the increased respiratory rate which was detected in diseased sheep and goat in our study. Rapid respiration may occur due to hypoxia (anemic hypoxia), caused by decreased Hemoglobin concentration, affecting oxygen transportation to body tissues(18). Therefore, the body may receive inadequate supply of oxygen which result in panting in animals (5).

The pale mucous membrane is a major sign of anemia in zinc deficient animals which might be due to impairment of cell replication and protein synthesis and thus the generation of blood cells (33,34).

The extent that marginal or subclinical zinc deficiency exists is unknown, but is likely more widespread and based on zinc supplementation studies, subclinical zinc deficiency can result in impaired reproduction and decreased weight gains (35).

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