EFFECT OF DIFFERENT LEVELS OF ZINC AND PROTEIN ON THE PERFORMANCE OF GROWING LAMBS

By

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B.Sc. (Animal Production), Fac. Agric., Cairo Univ., Egypt, (2001).

THESIS
Submitted in Partial Fulfillment of the Requirements for the Degree of

MASTER OF SCIENCE

In

Agricultural Sciences
(Animal Production)

Department of Animal Production
Faculty of Agriculture
Cairo University
EGYPT

2007

SUPERVISION SHEET

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M.Sc. Thesis

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Title of Thesis: Effect of different levels of zinc and protein on the performance of growing lambs.
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Branch: Animal Nutrition **Approval**: 22 /10 /2007

ABSTRACT

The effect of different levels of dietary crude protein and zinc on growth performance, digestion coefficients, carcass characteristics, blood components and economical efficiency were evaluated. Thirty growing male Farafra lambs (four months of age and 22.19 kg weight) were used in growth trial for 6 months and distributed randomly into six feeding groups. The first three feeding groups were fed on rations containing 14 % CP without Zn supplementation, 20 mg Zn or 30 mg Zn, while the other groups were fed on rations contained 10 % CP without Zn supplementation, 20 mg Zn or 30 mg Zn (as $ZnSO_4$). Reduction of dietary crude protein level (from 14 to 10% CP) significantly ($P<0.05$) reduced digestion coefficients of DM, CP, CF, and DCP, NB, total protein and its fractions (albumin and globulin), urea, and ALT activity. However, the reduction of dietary crude protein did not significantly affect digestion coefficients of OM, EE, NFE, and TDN, final body weight, total body weight gain, ADG, DMI, feed conversion, slaughter weight, empty body weight, hot carcass weight, dressing percentage, serum Zn concentration, AST and alkaline phosphatase activity. While, it increased, significantly ($P<0.05$), serum creatinine concentration and economic efficiency. Zinc supplementation by 20 or 30 mg/d increased digestibility of DM, OM, CF, CP, EE, NFE TDN, DCP and N balance, final live body weight, total gain and average daily gain, feed conversion, slaughter weight, empty body weight, hot carcass weight, dressing percentage, serum zinc concentration, total protein, albumin and globulin, AST and ALT, but did not significantly affect DMI, TDN intake, creatinine concentration and alkaline phosphatase, and significantly ($p<0.05$) decreased serum urea concentration.

Generally, supplementation of Zn to ration containing 10%CP reduced significantly the negative effects resulted from reducing protein content in lambs' rations. Lambs fed ration containing 10 % CP supplemented with either 20 or 30 mg Zn/h/d resumed good growth performance, improved nutrient digestion coefficients and nutritive values, carcass traits and economical efficiency nearly or slightly more than those fed ration containing 14% CP without Zn supplementation.

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ACKNOWLEDGEMENT

Sincere gratitude and appreciation are due to ***Dr. Sabbah Mahmoud Allam****, professor of Animal Nutrition, Animal Production Department, Faculty of Agriculture, Cairo University, for supervising this work, proposed the topic and work plan of this study.*

I am deeply grateful to ***Dr. Ali Mohammed Ali****, associate professor of Animal Nutrition, Animal Production Department, Faculty of Agriculture, Cairo University, for supervising this work and his continuous help in statistical analysis, guiding, encouragement and reading the manuscript. I appreciate his efforts to extend and broaden my understanding of life sciences; this work could not be finished without his greatest efforts.*

I would also like to express my deep gratitude to ***Dr. Faten Fahmy Abou-Ammou*** *Chief Researcher, Animal Production Research Institute, Ministry of Agriculture, for supervising this work and provided me with all facilities needed for this study.*

Sincere thanks are due to my parents, my husband and my sisters ***Enas****,* ***Dina****,* ***Doha****,* ***Manar****, and* ***Omneia*** *for their love, patience, encouragement and confidence throughout this study.*

Thank is accorded to my colleagues of husbandry lab, Sheep and Goats Research Division, Animal Production Research Institute, Ministry of Agriculture, ***Dr. Tarek Abd Al-Khalik, Dr. youssif Hafiz, Misses Amera Galal*** *and* ***Misses Rasmeia****.*

Cordial thanks for the staff member of Sheep and Goats branch, Malawi Station for Animal Production Research, Ministry of Agriculture; especially to ***Dr Mohammed Hider*** *for many help in growth trail of this study.*

Sincere thanks are due to my parents, my husband and my sisters ***Enas****,* ***Dena****,* ***Doha****,* ***Manar****, and* ***Omneia*** *for their love, patience, encouragement and confidence throughout this study.*

INTRODUCTION

Protein is a critical nutrient particularly for young rapidly growing animals. Optimal use of protein is a vital target in any practical feeding system, since protein supplements are much more expensive than energy feeds, so wasteful usage of it will increase the cost of production.

Riodran and Vallee (1976) indicated that zinc is a very important element because it acts as an activator for up to 200 metalloenzymes and hormones and it is essential for multitude of body functions. Zinc requirement for lambs is estimated to be 20-33 mg/kg DM (NRC, 1985). Kirchgessner and Heindle (1993) indicated that feeding zinc to ruminants generally improved growth performance. Moreover, zinc supplementation improved both nitrogen and energy metabolism that are cause an increase in somatotropin hormones and insulin as growth factors (Kirchgensser and Heindle, 1993). Zinc increases the activity of zinc metalloenzymes such as RNA and DNA polymerases and thymidine kinase, which are responsible for the growth, development of skeleton and synthesis of body protein (Underwood, 1981and Freeman, 1983). Zinc supplementation increases the availability of zinc to meet animal's requirement, specially if rations are containing wheat bran, cotton seeds meal or yellow corn which are rich in phytic acid content that bind with zinc forming unavailable zinc- phytate complex. In addition, zinc supplementation reduces ruminal protein degradation, increases propionate concentration and ruminal protozoa number (Froetschel *et al*., 1990).

Therefore, the present investigation was conducted to study the effect of zinc supplementation on metabolism and growth performance of growing lambs fed rations of different crude protein content.

REVIEW OF LITERATURE

1. Zinc supplementation

Zinc is a shiny bluish-white, soft metal with an atomic number of 30 and an atomic weight of 65.37. The metal is found naturally in ores mainly in the sulfide form. In 1877, evidence provided that zinc had a biological function (O'Dell, 1983). Zinc researches with animals were not published until 1934, where it was reported that zinc was required for rats' growth as cited in Lamand, 1984 and McDowell, 2003.

Researches indicating the importance of zinc in a domesticated animal species did not appear in the literature until 1955, when it was reported that zinc supplementation prevented a condition called parakeratosis in swine, two years later zinc was found to prevent skin lesions and poor feathering in chicks (O'Dell, 1983). In ruminants, the idea of zinc deficiency was slower to surface. Chesters (1983) was able to produce clinical zinc deficiency signs in calves when calves were fed a purified diet low in zinc. After their research, zinc deficiency in cattle was later reported under field conditions by three groups of researchers (Lamand, 1984).

a. Function of zinc

Zinc is found in all body organs and it is needed for normal hair, skin, feather, and bone growth. Zinc is linked to wound healing, where zinc is involved in the synthesis of collagen in the bone and skin. Zinc plays a role in immunity, fertility, and nearly 200 zinc metalloenzymes. These metalloenzymes include carbonic anhydrase, which is required to transfer carbon dioxide in the red blood cells, carboxypeptidase (a