Effect of adding different levels of zinc to the diets on performance and growth of local female goat

Moayed Abd Alsahib Towaje[*], Ahmed Hussein Kuttar[**] and Hassan Abd Hassan[**]
[*]College of Veterinary Medicine/ Green University of Al-Qasim
[**]Agriculture Research Directorate/ Ministry of Technology and Science

Abstract

This study was carried out at the Abu Ghraib sheep and goat breeding station to study the effect of adding different levels of zinc (0, 15, 20 and 25 mg/kg. DM) which type of radians: concentrate diets 25% or alfalfa hay 75% in the performance of local goat females and some carcass characteristics of goat females. The animals were divided into four groups (T1) fed free of additives and T2 fed 15 mg zinc/kg.DM and T3 and T4 groups fed 20 and 25 mg/kg.DM of zinc. The results showed no significant effect of adding zinc to the diet on the total feed intake for all nutrients except the dry matter intake (g/ kg) that were increasing significant ($P<0.01$) For all groups of adding zinc, Also the results showed that there were increase significant ($P<0.01$) in some of the studied traits (total and daily weight and feed conversion ratio as well as the final weight of local goat females). The results also showed increase significant ($P<0.01$) in some of the carcass characteristics (slaughter weight, empty body weight, warm carcass weight and the percentage of conversion based on body weight) compared with the T1 group.

Keywords: zinc, performance and growth, local female goat.
e-mail: Moayyed_Towaj@yahoo.com, Ahmed.Hussein430@yahoo.com, Hassan_Abd@yahoo.com
Received: 7-10-2018 Accepted: 4-11-2018

تأثير إضافة مستويات مختلفة من الزنك إلى العلائق على أداء إناث الماعز المحلي

مؤيد عبد الصاحب تويج*، أحمد حسين خطار وحسن عبد حسن****

***كلية الطب البيطري/ جامعة القاسم الخضراء**

****دائرة البحوث الزراعية/ وزارة العلوم والتكنولوجيا**

الخلاصة

أجريت الدراسة في محطة تربية الأغنام والماعز في أبي غريب/ دائرة البحوث الزراعية لدراسة تأثير إضافة مستويات مختلفة من عنصر الزنك بنسب (0، 15، 20 و25 ملغم/ كغم مادة جافة) إلى العليقة المتكونة من العلف المركز 25% ودريس الجت 75% في أداء نمو إناث الماعز المحلي وبعض صفات الذبيحة، وزعت الحيوانات على أربع مجاميع متساوية، وكل مجموعة تضم أربعة حيوانات وهي مجموعة السيطرة T_1 غذيت على عليقة خالية من الإضافات ومجموعة T_2 غذيت على عليقة تحتوي 15 ملغم من الزنك/ كغم مادة جافة والمجموعتين T3 و T4 غذيت على علف يحتوي على 20 و25 ملغم من الزنك. أظهرت النتائج عدم وجود تأثير معنوي لإضافة الزنك إلى العليقة على كمية المتناول الكلي واليومي من العلف ولجميع العناصر الغذائية باستثناء كمية المادة الجافة المتناولة (غم/ كغم) حيث كانت الزيادة عالية المعنوية ($P<0.01$) لجميع مجموعات إضافة الزنك، وكذلك بينت النتائج وجود زيادة عالية المعنوية ($P<0.01$) في بعض الصفات الإنتاجية المدروسة (معدلات الزيادات الوزنية الكلية واليومية وكفاءة التحويل الغذائي بالإضافة إلى الوزن النهائي لإناث الماعز المحلي)، كما ولوحظ من النتائج أيضا وجود زيادة عالية المعنوية ($P<0.01$) أيضا في بعض صفات الذبيحة (وزن الذبيحة، وزن الجسم الفارغ، وزن الذبيحة الحار، نسبة التصافي على أساس وزن الجسم الفارغ) بالمقارنة بمجموعة السيطرة T1.

الكلمات المفتاحية: الزنك، الأداء والنمو، إناث الماعز المحلي.

Introduction

The importance of rare essential minerals in livestock productivity has been realized for several decades (1), and in improved farming systems, the addition of minerals to the animals feeds have increased livestock production as measured by increased body weight and positive performance (2). Recently the importance of trace mineral nutrition has improved the immunological efficiency of the cattle attention. Research supporting these efforts has focused on multiple areas of immunity (3), including specific and unspecified branches of the immune system. The three most important elements that have received the most attention include iron, selenium and zinc (4), and we will focus on the recently adopted zinc element as food additives in ruminant diets. The aim of this study was add the zinc in different levels to alfalfa hay 75% and concentrate 25% of the local goat females diet to study its effect on the rates of total and daily weight gains and the efficiency of food conversion and some of the carcass characteristics of local females goats.

Material and Methods

- **Experiment Aim:** To determine the effect of adding different levels of zinc in the diet on feed intake, weights gains and the efficiency of feed conversion, study of some of the carcass characteristics of local females goats.
- **Experiment Plan:** This experiment was conducted in the field of sheep and goats at the Abu Ghraib plant/ General Authority for Agricultural Research to study the possibility of using different levels (0, 15, 20 and 25 mg/kg.DM) of zinc element and its effect on the growth performance of local goat females which started at 7/5/2016 and continued for 62 days. animals weight 23 ± 0.75 kg and 6-7 months old the animals were randomly divided into four group equal treatments, each involving four animals and two replicates/ group. All experimental animals were fed on concentrated at 2.5% of body weight Where the amount of feed per week can be adjusted per transaction Experiment based on the new weight of each animal. Ingredient and chemical of experimental diets presented in tables 1, 2, 3 and 4.
- **Style of conducting the experiment:** The animals feed groups for 14 day as preliminary period and fed the concentrate once daily. The animals were weighted for three consecutive days at 8 am after cutting the feed for 12 hours to fixing their initial weights. The animals were fed once daily at 8 am (5) while concentrate diets was served free at 12 o'clock, As the quantity adjusts. The feed consumed daily on the basis of the consumption of animals in each treatment. The concentrated diets and alfalfa hay remaining weighted at the morning to the amount of feed intake. And the duration of the experiment did not notice any cases or digestive disorders.
- **Growth Experiment:**

A. Daily and total weights (g/ kg)
B. Initial and final weights (kg)
C. Calculation of food conversion efficiency Daily feed intake(g)/ Daily weight gain (g)

- **Slaughter animals and study some carcass characteristics:** Two females after the end of study from each groups starved for 12 hours before slaughter. All females were weighed for the final weight before the slaughter date. After the random selection of the eight females killed in the slaughter of the station, the characteristics of the carcass were studied, which included the percentage of the dissolution, the weight of the carcass, the final weight of the carcass, the area of the ocular muscle, the thickness of the subcutaneous fat layer. The area of the ocular muscle and the thickness of the subcutaneous fat layer was measured after the left part of the sacral was cut between the lower edge of 12 ribs of the carcasses. The area of the ocular muscle was measured using trace paper to draw the area of the ocular muscle by a

device used to measure irregular areas. Measured by the plane meter, and the measurement of the layer of fat above the 12 ribs of the left side of the whole carcass by the Vernia instrument. For the calculation of the filtration rate and the conversion efficiency, they were calculated based on the final weight of the local goat females.

Table (1) Ingredients of concentrate%.

Ingredients	**%**
Barley	22
Wheat bran	23
Soybean Meal	13
yellow corn	40
Minerals and vitamins	1
Salt	1
Crud protein*	14.52
ME(MJ/Kg DM)**	11.18

*Calculate from the chemical analysis table for Iraqi feed materials (on DM% basis)(6)

**ME (MJ/ Kg DM)= 0.012 × 0.031 CP × EE + 0.005 × CF + 0.014 × NFE (7)

Table (2) The chemical composition of the ingredient of groups of the diets%.

groups / Ingredient	T1	T2	T3	T4
Barley	22	22	22	22
Wheat bran	23	23	23	23
Soybean Meal	13	13	13	13
Zinc mg/kg.DM	-	0.15	0.20	0.25
yellow corn	40	40	40	40
Minerals and vitamins	1	1	1	1
Salt	1	1	1	1
Total	100%	100%	100%	100%

T1: (control) without any adding, T2: diet adding zinc with 15 mg/kg.DM, T3: diet adding zinc with 20 mg/kg.DM, T4: diet adding zinc with 25 mg/kg.DM

Table (3) The chemical composition of the ingredient of the diet%.

Items / Ingredient	DM	OM	Ash	CP	CF	EE	NFE	ME (MJ/ Kg DM)*
Barley	90.431	86.896	3.535	12.678	8.410	3.059	62.749	11.2965
Soybean Meal	89.122	84.125	4.997	47.455	7.575	2.237	26.858	10.1860
yellow corn	89.196	86.245	2.951	10.092	3.879	3.890	69.000	12.0963
Wheat bran	89.151	84.479	4.672	18.114	10.998	3.563	51.804	10.5361
alfalfa hay	90.415	80.841	9.574	14.312	18.094	1.95	46.125	09.684

*ME (MJ/ Kg DM)= 0.012 × CP + 0.031 × EE + 0.005 × CF + 0.014 × NFE (7)

Table (4) The Chemical composition (%) and metabolizable energy (MJ/ kg.DM) of the groups diets

Items / Groups	DM	OM	Ash	CP	CF	EE	NFE	ME (MJ/Kg DM)
T1	90.948	80.417	10.530	12.046	20.850	1.222	46.298	8.4104
T2	90.958	81.218	09.740	11.068	18.360	1.121	50.568	8.8780
T3	89.912	81.404	08.508	10.010	19.116	1.163	51.112	8.8133
T4	91.804	81.568	10.2353	11.582	20.095	1.187	48.596	8.6438

T1: (control) without any adding, T2: diet adding zinc with 15 mg/kg.DM, T3: diet adding zinc with 20 mg/kg.DM, T4: diet adding zinc with 25 mg/kg.DM

- **Statistical analysis:** Statistical analysis of all experimental data was performed using the statistical program available SAS (8) to find the difference between transactions using full random design (C.R.D Completely Randomized Design) The significant exam between the mean of the coefficients were tested using the Duncan (9) test to compare the averages of the multistage coefficients according to the following mathematical model:

Yij= μ +ti+£ij
Yij= measured viewing value
μ= The general mean of the studied objective
ti=Effect of treatment i
£ij= The random error, which is distributed naturally at an average of zero and a variation of $£^2$ e

- **Chemical analysis:** Experimental diets were analyzed to determine dry matter, ash nitrogen and Ether extract according to the (10).

Results and Discussion

- **Quantity of feed intake:** Table (5) shows the effect of adding different levels of zinc to diets in the daily and total intake of nutrients, The results showed that there was no significant effect of adding different levels of zinc in the total amount of nutrients (organic matter, total nitrogen, acid detergent fiber, nuteral detergent fiber, cellulose, hemicellulose and lignin). The daily intake of dry matter for females goat feeding zinc levels (0.15, 20 and 25 mg/kg.DM) Was 1186 g/ day compared to the daily intake of dry matter without zinc added (1140 g/ day), These results agree with (11), as different levels of zinc have improved animal appetite by increasing nutrient digestibility and thus improved daily intake of dry matter, especially for alfalfa hay (roughages). In the same, (12) refer that addition of 20 (mg/kg.DM) of zinc to the diets resulted in increased daily intake of feed and a significant increase in dry matter intake. This may be due to the fact that the use of supplements or dietary supplements has improved environmental conditions of rumen and this is reflected in the positively on the daily intake of nutrient (13).

Table (5) Effect of adding different levels (0.15, 20 and 25 mg/kg.DM) of zinc to alfalfa hay and concentrate in the daily intake of different nutrients (g/ day)

Groups / Intake	T1	T2	T3	T4	Levels of significant
Dry matter intake (g/ kg body weight)	106±1.47 b	112±2.61 a	114±2.77 a	117±2.78 a	**
Organic matter intake (g/ kg body weight)	103.6±0.03	104±021	106±0.06	107±0. 0.06	N.S
Nitrogen intake (g/ kg body weight)	2.69±0.12	2.78±0.15	2.76±0.15	2.74±0.15	N.S
Metabolizable energy intake (MJ/ kg body weight)	1.22±0.04	1.23±0.04	1.25±0.05	1.24±0.05	N.S
Nuteral detergent fiber (mg/ kg body weight)	34.40±0.06	35.67±0.46	37.82±0.67	38.80±1.45	N.S
Acid detergent fiber (mg/ kg body weight)	18.45±0.48	22.14±0.51	23.34±0.61	25.78±0.63	N.S
Hemisylolose (mg/ kg body weight)	16.32±0.16	17.44±0.17	17.58±0.17	18.33±0.19	N.S
Cellulose (mg/ kg body weight)	7.78±0.82	8.34±0.85	9.78±0.89	9.90±0.29	N.S
Lignin (mg/ kg body weight)	10.67±0.25	11.33±0.27	11.81±1.23	11.84±1.23	N.S

T1: (control) without any adding, T2: diet adding zinc with 15 mg/kg.DM, T3: diet adding zinc with 20 mg/kg.DM, T4: diet adding zinc with 25 mg/kg.DM, N.S indicates no significant.

- **Body weight and efficiency of food conversion:** Table (6) shows The effect of the adding zinc to the diet in the daily and total weight gain and conversion food efficiency may be due to the differences in the behavior of rumen microbial populations to different levels of zinc (0.15, 20 and 25 mg/kg.DM) through its increasing of disintegration on lignin, hemicellulose and cellulose, with increase microbial activity of protein composition, Food in the gastrointestinal tract (14), The role of microorganisms in increasing digestibility, which helps maintain the

microbial balance within the rumen and increase the efficiency of food metabolism and thus increase the response to growth. These results agree with the results of (15). when added at levels of zinc to feed ruminants refused increased the daily weight, crude protein intake and crude fiber and significantly improved conversion feed efficiency. This improvement may be due to an increase in the animal's palatable taste of the zinc supplement, in addition to the fact that the bulk of the animal needs have been processed from the intensive diet, or may be due to the adaptation of the microorganisms to the different treatments of zinc, especially T2 and T4, For microbial protein in rumen (16).

Table (6) Effect of the adding of different levels (0.15, 20 and 25 mg/kg.DM) of zinc to the alfalfa hay and concentrate in the final weight and daily increases and the efficiency of food conversion

Groups / Weight gain	T1	T2	T3	T4	Levels of significant
Initial weight (kg)	17.45±0.03	17.23±0.03	17.80±0.03	17.40±0.03	N.S
final weight (kg)	27.75±0.23 b	28.44±0.48 ab	29.84±0.61 a	28.55±0.49 ab	**
Total weight increase (kg)	9.82±0.03 b	11.21±0.03 a	12.04±1.12 a	11.15±03 a	**
Average daily weight gain (g/d)	155±0.17 b	177±0.38 a	191±0.42 a	176±0.38 a	**
Food conversion efficiency (kg dry matter/ kg Increase weight)	6.83±0.41 a	6.32±0.36 a	5.96±0.17 b	6.64±0.38 a	**

T1: (control) without any adding, T2: diet adding zinc with 15 mg/kg.DM, T3: diet adding zinc with 20 mg/kg.DM, T4: diet adding zinc with 25 mg/kg.DM,** indicates significant differences at the probability level (P <0.01), N.S indicates no significant.

- **Weight and carcass Characteristics:** Table (7) shows the significant effect of adding the zinc to alfalfa hay and concentrate on the slaughter weight, the conversion feed efficiency and the carcass characteristics by increasing of experimental treatments containing the zinc element (15, 20 and 25 mg/kg.DM) compared with T1,This is due to the fact that zinc has increased the activity of microorganisms in the rumen, which in turn increases the efficiency of the use of dry matter (15), increasing the effectiveness of beneficial bacteria (17). Food conversion efficiency and role The best qualities of the studied carcass are obtained (18, 19) indicated that the addition of dietary supplements of the mineral elements (zinc) resulted in better metabolism of nutrients, especially those related to energy and protein, thus obtaining the highest weight of the carcass and improving its qualities (conversion feed efficiency and carcass weight) compared with T1.

Table (7) The effect of adding different levels (0.15, 20 and 25 mg/kg.DM) of zinc to the diet of alfalfa hay and concentrate in weight is slaughter, empty body weight, warm carcass weight and the percentage of conversion based on body weight, empty body weight

Groups / Hems	T1	T2	T3	T4	Levels of significant
slaughter weight empty (kg)	28.50±3.23 b	28.51±3.23 b	31.70±4.00 a	31.61±4.00 a	**
empty Body weight (kg)	24.75±1.43 b	24.80±1.45 ab	26.30±2.77 a	26.50±2.96 a	**
hot carcass weight (kg)	11.85±0.51 b	12.38±0.98 a	13.68±1.33 a	13.28±1.29 a	**
cold carcass weight (kg)	11.52±1.007 b	11.32±1.002 b	13.00±1.381 a	12.51±1.202 a	**
Conversion feed based on empty body weight %	46.54±0.034 b	49.91±0.036 a	52.01±1.35 a	50.16±1.17 a	**
Conversion feed based on live weight%	41.57±0.230 b	43.42±0.384 a	43.15±0.382 a	42.01±0.237 a	**

T1: (control) without any adding, T2: diet adding zinc with 15 mg/kg.DM, T3: diet adding zinc with 20 mg/kg.DM, T4: diet adding zinc with 25 mg/kg.DM,****** indicates significant differences at the probability level (P <0.01).

References

1. Hambidge, K. M.; Casey, C. E. & Krebs, N. F. (1986). Zinc. In: Mertz, W. D., editor. Trace elements in human and animal nutrition. Vol. 2. Orlando, USA: Academic Press, PP. 1-138.
2. Favier, A. E. (1992). The role of zinc in reproduction. Biol. Trace Elem. Res., 32 (1-3): 363-382.
3. Suttle, N. F. (2010). Mineral nutrition of livestock. 4th ed., CABI is a trading name of CAB International.
4. Moeini, M. M.; Kiani, A.; Karami, H. & Mikaeili, E. (2011). The effect of selenium administration on the selenium, copper, iron and zinc status of pregnant heifers and their newborn calves. J. Agr. Sci. Technol., 13:53-59.
5. Hassan, S. A.; Al-Ani, A. N. & Al-Jassim, R. A. (1996). Improving nitrogen content and digestibility of dried date pulp for ruminants feed b ammonia treatment. IPA. J. Agric. Rec., 6: 167- 180.
6. Kazem, K. A.; Abdulla, E. & Abdul Ahad, S. (1978). Chemical composition and value Food for Iraqi feed materials. Bulletin issued by the Nutrition Department of the directorate of Public Livestock of the Ministry of Agriculture and Agrarian Reform, Republic of Iraq.
7. MAFF. (1975). Ministry of Agriculture, Fisheries and Food Department of Agriculture and Fisheries for Scotland energy allowances and feed system for ruminants, Technical Bulletin, P. 33.
8. SAS. (2012). Statistical Analysis System. Users Guide. Statistical. Version 9th ed. SAS. Inst. Inc. Cary. N.C. USA.
9. Duncan, D. B. (1955). The new multiple range and multiple F-test. Biometrics, 11:1-42.
10. A.O.A.C. (2005). (Association of Official Analytical Chemists). Official of analysis. 18th Ed. AOAC International, Gaithersburg, Maryland, USA.
11. Kundu, M. S.; Kumar De, A.; Jeyakumar, S.; Sunder, J.; Kundu, A. & Sujatha, T. (2014). Effect of zinc supplementation on reproductive performance of Teressa goat. Vet. World, 7(6):380-383.
12. Dork, E. A.; Spear, J. W.; Brown, T. T. & Quereshi, M. A. (1993). Influence of dietary zinc and dexamrth- asone on immune response and resistance to pusteurella hemolytic challenge in growing lambs. J. Nutri. Res., 13:1213-1216.
13. Aboul-Fotouh, G. E.; Abd El-Maksoud, A. M. S. & Hassouna, M. M. E. (1992). Evaluation of urea treatment and zinc supplementation on in sheep diets.1. digestibility coefficients and nutritive values. J. Agric. Sci., Mansoura Univ., 17: 2881-2887.
14. Hilal, E. Y.; Elkhairey, M. A. E. & Osman, A. O. A. (2016). The role of zinc, manganse and copper in rumen metabolism and immune function: A review article. Open J. Anim. Sci., 6 (4): 304- 324.
15. Ballantine, H. T.; Socha, M. T.; Tomlinson, D. D. A.; Johnson, A. B.; Fielding, A. S.; Shearer, J. K. & Van Amstel, S. R. (2002). Effects of feeding complexed Zinc, manganese, copper, and cobalt to late gestation and lactating dairy cows on claw integrity, reproduction, and lactation performance. The Prof. Anim. Sci., 18(3): 211-218.
16. Ahola, J. K.; Baker, D. S.; Burns, P. D.; Mortimer, R. G.; Enns, R. M.; Whittier, J. C.; Geary, T. W. & Engle, T. E. (2004). Effect of copper, zinc, and manganese supplementation and source on reproduction, mineral status, and performance in grazing beef cattle over a two-year period. J. Anim. Sci., 82: 2375-2383.
17. Hassan, A. A. & Mohamed, S. F. (2012). Chemical composition and digestibility of urea-calcium hydroxide treated barley straw, date palm frond and corn cobs with and without molasses. Al-Anbar. J. Vet. Sci., 5 (1): 103-115.
18. Hassan, S. A.; Sadq, S. M. & Hassan, K. M. (2008). Evaluation of Fungal or Chemical Treatments for Barley Straw in Ruminants Feeding 1-Chemical composition, in vitro, in vivo digestibility and voluntary intake. Jordan J. Agric. Sci., 8 (2): 232-241.
19. Spears, J. W. (2000). Micronutrients and immune function in Cattle. Proc. Nutr. Soci., 59: 587- 594.