قسم : الصحة ومراقبة الأغذية ·
كلية : الطب البيطرى ـ جامعة القاهرة·
رئيس القسم: أ. د· /عبدالرحمن عشوب ·

دور بعض الأملاح المعدنية في تغذية عجول الجاموس وعلاقتها بالانتاج
٢ـ أثر اضافة أكسيد الزنك

أحمد عطية ، صبرى عوض الله ، عصام يوسف ، مها هادى

أجريت هذه التجربة على عدد ٧ ذكور جاموس صغير تمت اضافة أكسيد الزنك الى علائقها لدراسة أثر هذا المعدل على الحالة الصحية والانتاجية لهذه الحيوانات وقد استمرت التجربة لفترة ٩٠يوما على مدى التجربة تناولت الحيوانات عليقتين أساسيتين الأولى كانت مكونة من البرسيم بالاضافة الى المركزات التجارية المخلوطة ، والعليقة الثانية كانت من الدريس والمركزات التجارية المخلوطة والدراوة· قسمت ايضا الحيوانات الى ثلاث مجموعات : الأولى تمت تغذيتها على العلائق الأساسية فقط في حين أُضيف الى العلائق الأساسية لكل من المجموعتين الثانية والثالثة ٢٥٠مجم /١٠٠٠ مجم أكسيد زنك على الترتيب ، وقد تم خلط أكسيد الزنك بالمركزات التجارية، وعلى مدى التجربة تم تسجيل الزيادة في أوزان الحيوانات المستخدمة ، كذلك تم تحليل أمصال لتقرير مستوى كل من الزنك والنحاس والكالسيوم والفوسفور والماغنسيوم وكانت النتائج كالآتي:

١ـ سجلت المجموعة الثالثة والتي أُضيف الى غذائها أكسيد الزنك بمقدار ١٠٠٠مجم يوميا أعلى زيادة معنوية في الوزن ·
٢ـ لم تكن هناك زيادة معنوية في مستوى الزنك في مصل الحيوان·
٣ـ النسبة المرتفعة للزنك صاحبها نقص في مستوى النحاس في الدم وكانت هناك علاقة سلبية قوية بينهما في كل من المجموعة الثانية (ر= ٦٣ر٠) والثالثة (ر =-٤٠ر٠)·
٤ـ وجد ارتباط ايجابي بين مستوى الزنك والمنجنيز في كل من المجموعتين الثانية والثالثة (ر= ١٨ر٠) ، (ر= ٣٦ر٠) على الترتيب ·
٥ـ ايضا لوحظ ارتباط ايجابي قوى بين مستوى الزنك والكالسيوم في المجموعة الثانية (ر= ٧٣ ر٠)·
٦ـ وجد ارتباط سلبي بين مستوى الزنك والفوسفور في كل من المجموعة الثانية (ر=٦٦ر٠) في حين كان الارتباط ايجابي في المجموعة الثالثة (ر=٣٤)·

Dept. of Hygeine,
Fac. of Vet. Med., Cairo University,
Head of Dept. prof. Dr. M.A. Ashoub.

ROLE OF SOME MICROELEMENTS IN NUTRITION OF WATER BUFFALO AND ITS RELATION TO PRODUCTION
II- Effect Of Zinc Supplementation

(With 10 Tables)

By
A.N. ATTIA, S.A. AWADALLA, E.Y. ESMAIL and M.M. HADY

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SUMMARY

7 male buffaloe calves were used to study the influence of addition of zinc oxide to the commonly fed rations for 90 days on their health and body weight gain. During the experimental period the calves received, for about one month a basal ration composed of green barseem, commercial concentrate mixture and wheat bran, then turned on diet composed of barseem hay, comercial concentrate mixutre and green corn. The calves were alloted into three groups. Group one received no supplemental zinc, while calves of group II and II recveived 250 mg and 1000 mg zinc oxide plus the basal ration. During the experiment body weight gain of the calves was estimated, and blood was analysed for zinc, copper, manganese, calcium, phosphorus and magnesium levels. The following results were obtained:

1- The highest significant body weight gain was recorded in the calves of Group III.

2- High dietary zinc supplementation depressed the serum copper levels while manganese levels , recorded. Also a strong positive correlation between serum zinc calcium levels was found.

INTRODUCTION

Zinc is an essential nutrient for animals, functioning largely or entirely on enzymatic systems and being involved in protein synthesis, carbohydrate metabolism and many other biochemical reactions. Many workers showed that zinc involved in formation and function of many enzymes such as blood carbonic anhydrase, blood serum alkaline phosphatase and blood serum Lactic dehydrogenase (VALLEE, 1959, MILLER et al. 1965 and SCHWARZ and KIRCHGESSNER, 1975).

Many investigations had been conducted to study the effect of zinc nutrition on animal growth. However it was concluded that in zinc deficient animals specially calves, reduced growth rate was common symptom. (MILLER et al 1963; CLARK et al. 1970, PRICE and HUMPHRIES, 1980).

However, OTT et al. (1965) showed that in zinc deficient calves not only the growth rate and feed efficiency was affected but also, the rumen function. Our aim in the pressent

study is to investigate the influence of different levels of supplemental zinc on buffalo calves performance and its relationship with copper, manganese, calcium and phosphorus and magnesium.

MATERIAL and METHODS

Seven male-buffalo-calves aging 6-9 months were used in this experiment. Each was kept in a seperate pen at calf disease research centre, Faculty of Veterinary Medicine, Cairo University, Giza, Egypt. Calves were alloted into three groups, Group I (control) received basal ration (1) composed of green barseem, commercial concentrate mixture and wheat bran for one month and continue for the rest of experimental period on another basal ration. (2) composed of barseem hay, commercial concentrate mixture and green corn. The amount of the ingredients of the basal ration and its chemical composition are shown in Table (1). The basal ration was estimated to cover the uffalo-calves requirements according to RANJHAN and PATHAK (1979). Group II and III was fed on the same basal rations plus 250 and 1000 mg zinc oxide daily.

The zinc content of the basal ration was estimated using Atomic absorption spectrophotometer, Data illustrated in Table (2). Dietary zinc supply for calves are shown in Table (3). Blood sample were collected at 15 days before and at 15, 30, 60 and 90 days after supplementation. Collected serum samples were analysed for zinc, copper, manganese, calcium, phosphorus and magnesium as in the preceeding work of copper supplementation.

Food samples were taken and analysed as described in the preceeding publication and also body weight gain was recorded as the same manner in copper supplementation. Obtained data were statistically analysed according to SARHAN (1962).

RESULTS

The obtained results are shown in Tables (1, 2, 3, 4, 5, 6, 7 and 8).

DISCUSSION

The data concerning the body weight development and the average daily body weight gain of the calves in the different groups are presented in Table (4). From the tabulated data, one can observe that the highest daily body weight gain was recorded in calves of group III. The analysis of varience of the data, demonstrated significant difference ($P < 0.05$) regarding the average daily body weight gain, between calves of group I and those of group III. It is clear that zinc supplementation during the experimental period, increase the body weight gain of calves, such increase was greater at the higher level of zinc supplementation. these results are in accordance with the study of BESSON, et al. (1962);MILLER, et al. (1965), OTT, et al. (1965), PIERY, et al. (1986); Price and HUMPHRIES (1981). The growth promoting effect of supplemented zinc might be attributed, firstly, to the increase of zinc content of the basal ration and secondly, to the improving effect of zinc supplementation on rumen digestion (OTT, et al., 1965).

The data shown in Table (5), present the change which tookplace in the serum zinc levels. Non significant differences betwen average serum zinc levels in different groups of calves was found ($P > 0.05$). These results are in agreement with those recorded by many workers (MILLER et al., 1965; PERRY, et al., 1968; TOWERS, et al., 1981; KIRCHGESSNER

and WEGAND, 1982). In spite of the higher serum zinc levels recorded in the present work, they were all within normal levels recorded by other Egyptian workers (FAHMY et al., 1979).

The results concerning the changes in the average serum copper levels in buffalo-calves during experiment are illustrated in Table (6). Generally, the recorded serum copper level were all within normal limits for such element as stated by OMRAN (1979). There were negative correlation between the serum zinc and copper levels in groups II and III.

Such depressing effect of high dietary zinc intake on serum copper level might be due to a decrease in liver copper content following zinc supplementation (OTT et al., 1966; MILLS, 1973). The exhausted liver copper stores may be replinished in part through withdrawal of a part of blood copper leading to reduction in its level in blood. Moreover, an increased rate of copper excretion in such circumstances might be expected.

The data illustrated in Table (7) present the alteration in the average serum manganese levels in buffalo-calves during experiment. All the recorded serum manganese levels comes within normal ranges estimated by HADY (1984). Serum manganese levels did not significantly affected by the zinc supplementation in the different groups ($P > 0.05$). There was a positive correlation between serum zinc and manganese levels.

Data concerning the average serum calcium levels in different groups during the experiment are presented in Table (8). From the tabulated data, it is demonstrated that, the greatest increase in the serum calcium level was recorded on the day- 60 following zinc supplementation. Non significant negative correlation was traced between the serum level of zinc and calcium in group II, while a significant positive correlation was demonstrated in group III, this finding agree with those reported by PERRY et al., 1968 and SMITH et al. 1984. Such increase in serum calcium level from day 16 up to the end of the experiment, might be attributed to the increase in the serum calcium level in the ration, and not to the zinc supplementation.

Table (9) presents, the average phosphorus level in different groups during experiment.

Statistical analysis, revealed that zinc supplementation did not significantly affect the average serum phosphorus levels in the different groups ($P > 0.05$), while a negative correlation was found between serum levels of both zinc and phosphorus in groups II and III. A further explanation to the negative correlation between the hgih zinc intake and serum copper level was established by THOMPSON, et al. (1959), who reported that posphorus absorption was reduced subsequent to zinc supplementation in diet of lambs.

Regarding serum magnesium level changes in buffalo-calves during experiment they are presented in Table (10). The data observed insignificant negative correlation between the serum zinc and mgnesium levels in group II, while a positive correlation was traced in group III.

The present work concluded that, addition of one gram of zinc oxide to rations composed of barseem hay, green corn and commercial concentrate mixture, increased the body weight gain of yearling buffalo-calves compared to that reported in controls. In other words it could be concluded that the Egyptian feeding struffs most commonly incorporated in buffalo ration, do not fulfill the complete needs of zinc for animals, and these elements should be supplemented to calves during their growth periods for improving meat production.

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Table (1): Ingredients, amounts and chemical composition of each feed stuffs of the basal ration fed to calves during experiment II and III

Type of basal ration	Ingredients	Amount in (kg)	Chemical composition % on DM basis						
			Moisture	Dry matter	Crude protein	Ether extract	Crude fiber	Nitrogen free extract	Ash
Basal ration (1)	- Green berseem*	13.2	80.6	19.4	2.42	0.73	5.73	9.15	1.80
	- Commercial concentrate mixture **.	4.00	8.4	91.6	15.70	6.20	18.4	43.95	7.35
	- Wheat bran.	0.250	8.5	91.5	20.13	4.67	10.41	50.16	6.13
Basal ration (2)	- Berseem hay.	2.50	11.5	88.5	12.42	3.66	31.7	30.80	9.93
	- Commercial concentrate mixture**.	4.00	8.5	92.5	18.45	6.80	17.73	42.87	6.62
	- Green corn (darawah*)	3.00	81.6	18.4	0.52	1.10	6.61	7.94	2.23

Table (2): Average content of trace elements in the feed stuffs used (on dry matter basis)

Ingredients of the basal ration	Type of basal ration	Calcium %	Phosphous %	Magnesium %	Copper mg/Kg	Zinc mg/Kg	Manganese mg/Kg
Green barseem	I	1.5	0.46	0.49	12.67	44.23	99.25
Commercial concentrate mixture		0.12	1.80	0.58	25.00	53.94	47.50
Wheat bran		0.17	1.40	0.56	14.00	61.81	94.75
Barseem hay	II	0.97	0.27	0.73	15.16	6.60	46.35
Commercial concentrate mixture		0.72	1.15	1.83	10.65	44.52	57.62
Green corn darawah		2.94	0.92	0.85	8.70	32.38	53.64

Table (3): Amount of Zinc oxide supplemented and total zic in mg received by each calf in different groups.

Groups	Type of basal ration	Amount of zinc mg/Kg DM. of basal ration	Zinc oxide supplied in mg daily	Calculated zinc supplied mg/daily	Total amount of zinc mg/Kg DM	Total zinc mg received per calf daily
Control	1	50.38	-	-	50.38	326.96
1	2	41.47	-	-	41.47	269.55
II	1	50.38	250 mg	200.75	81.31	527.70
	2	41.47	250 mg	200.75	72.35	470.28
III	1	50.38	1000mg	803.00	174.00	1129.26
	2	41.47	1000mg	803.00	165.00	1072.50

Table (4): Averae daily dry matter intake, body weight development and body weight gain of different groups of calves during experiment II

Group	Number of animals in each group	Average daily dry matter intke (kg)	Total zinc intake (mg) reeived per calf per day	Average intial body weight.		Average final body weight		Total averae	Average daily
				Kg	%	Kg	%	gain in	gain in
I	2	6.49	326.96	200	100	241	120.5	41	0.455
		6.50	269.55						
II	3	6.49	527.70	198	100	328	120.2	40	0.445
		6.50	470.28						
III	2	6.49	1129.26	187	100	261	139.57	74	0.822*
		6.50	1072.50						

* f Differ significantly in group II ($p < 0.05$).

Table (5): Average serum zinc levels (Mg/100 ml, %) in buffalo-calves During experiment II.

Time of	Group I		Group II		Group III	
	Mg/100 ml	%	Mg/100 ml	%	Mg/100 ml	%
Prelimenary period.	39.95	100	92.89	100	94.50	100
After zinc supplements ation						
15 days	93.95	100	138.75*	149.37	118.19	125.0
30 days	108.11	115.07	122.40	131.76	147.91	156.5
60 days	80.00	85.15	125.33	134.92	150.00	158.73
90 days	75.86	80.74	86.99	93.65	96.28	101.88

- Non-significant difference in average serum zinc levels in between groups (P/__ 0.05).

* : Significant difference in average serum zinc levels at day 15- after zinc supplementation (P/__ 0.05).

Table (6): Average serum copper levels (Mg/100 ml, %) in buffalo-calves during experiment II.

Time of	Group I		Group II		Group III	
	Mg/100 ml	%	Mg/100 ml	%	Mg/100 ml	%
Prelimenary period.	143.14	100	153.22	100	190.85	100
After zinc supplements ation						
15 days	148.84	103.98	104.10	69.94	112.54	58.97
30 days	139.17	97.23	107.71	70.29	115.97	60.76
60 days	122.71	85.73	140.80	91.89	152.20	79.75
90 days	120.06	83.88	128.86	84.10	132.78	69.57

Table (7): Average serum manganese levels (Mg/100 ml, %) in buffalo-calves during experiment II.

Time of	Group I		Group II		Group III	
	Mg/100 ml	%	Mg/100 ml	%	Mg/100 ml	%
Prelimenary period.	5.47	100	7.32	100	6.67	100
After zinc supplements ation						
15 days	5.17	94.52	5.08	69.39	6.15	92.20
30 days	5.46	99.82	6.10	83.33	5.45	81.71
60 days	6.43	117.55	5.71	78.01	7.14	107.05
90 days	2.86	52.29	2.86	39.07	4.28	64.17

- Non-significant difference in average serum copper levels in between groups (P/__ 0.05).

Table (8): Average serum calcium levels (Mg/100 ml, %) in buffalo-calves during experiment II.

Time of	Group I		Group II		Group III	
	Mg/100 ml	%	Mg/100 ml	%	Mg/100 ml	%
Prelimenary period.	9.42	100	8.30	100	6.97	100
After zinc supplements ation						
15 days	7.67	81.42	7.34	88.43	7.13	102.29
30 days	13.50	142.86	8.92	104.83	12.60	180.70
60 days	13.79	146.39	14.25	171.69	13.32	191.10
90 days	10.57	112.21	11.59	139.64	10.91	156.57

- Non-significant difference in average serum copper levels in between groups (P/__ 0.05).

Table (9): Average serum phosphorus levels (Mg/100 ml, %) in buffalo-calves during experiment II.

Time of sampling	Group I		Group II		Group III	
	Mg/100 ml	% %	Mg/100 ml	%	Mg/100 ml	%
Prelimenary period.	7.92	100	7.65	100	9.37	100
After zinc supplements ation						
15 days	7.31	92.29	6.75	88.24	5.40	57.63
30 days	8.15	102.90	6.30	82.35	7.75	82.71
60 days	6.00	75.76	7.13	93.20	6.30	67.24
90 days	6.90	87.12	7.20	94.12	6.24	66.59

- Non-significant difference in average serum copper levels in between groups (P/__ 0.05).

Table (10): Average serum magnesium levels (Mg/100 ml, %) in buffalo-calves during experiment II.

Time of sampling	Group I		Group II		Group III	
	Mg/100 ml	%	Mg/100 ml	%	Mg/100 ml	%
Prelimenary period.	4.66	100	5.32	100	5.39	100
After zinc supplements ation						
15 days	4.23	90.77	4.03	75.75	4.95	91.84
30 days	4.90	105.15	4.28	80.45	5.02	93.14
60 days	4.99	107.10	5.00	93.98	5.69	124.12
90 days	4.54	97.42	5.33	100.18	4.91	91.10

- Non-significant difference in average serum copper levels in between groups (P/__ 0.05).