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EFFECT OF ZINC OR/AND MANGANESE METHIONINE SUPPLEMENTS ON PERFORMANCE OF LACTATING BUFFALOES .

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ABSTRACT

This study was conducted to investigate the effect of adding chelated zinc methionine or / and manganese methionine on the digestibility coefficients, nutritive value, some ruminal and blood parameters, milk yield and composition of lactating buffaloes.**.** Sixteen lactating buffaloes at the last three months of pregnancy were divided into four similar groups . Animals were fed according to Ghoneim (1964) Feeding standard. The lactating buffaloes were fed on the following rations: The control group was fed concentrate feed mixture, berseem hay (*Trifolium alexandrinum*) and rice straw without minerals supplementation. .The 1st tested group was fed the control ration + 40mg zinc methionine /kg DMI). The 2nd tested group was fed control ration + 40mg manganese methionine /kg DMI). The 3rd group was fed the control ration + 40mg zinc methionine + 40mg manganese methionine /kg DMI). All groups were fed from about three months before the expected calving date up to 105 days of lactation . Results indicated that the addition of both chelated zinc and manganese methionine improved DM, OM, CP, CF, EE and NFE digestibilities and feeding values (TDN and DCP) . Also , chelated zinc , manganese and zinc plus manganese supplements tended to reduce ammonia –N ,but increase TVFA's , improved feed conversion and increase milk yield. Moreover, chelated zinc methionine and manganese methionine supplementation increase serum total protein, albumin and globulin, but reduced the concentration of urea in blood serum. From the obtained results. It could be concluded that Zn-Met plus Mn-Met supplementation could be economically and successfully used for lactating buffaloes to improve digestibility's, feeding values, feed efficiency, milk production and economical efficiency .

Keywords: Lactating buffaloes – zinc – manganese – feed intake – digestibility – ruminal and blood parameters – milk yield and composition.

INTRODUCTION

Heavy metal salts have been used routinely to precipitate soluble proteins in laboratory procedures (Cohn *et al.,* 1950). The mechanism involves a crosslinking of peptide as metal ions bind with sulfhydryl groups (Haurowitz, 1950). The use of amino acid complex minerals in mineral supplements compared to inorganic forms is still controversial. Limited research has been done concerning the biological availability of organic and inorganic mineral sources. The majority of bioavailable zinc when supplemented in relatively high levels is stored in body organs such as liver, kidney and pancreas with minor storage in bone, muscle and skin (Ott *et al.,* 1966). Zinc is known to be essential for the function and /or structure of several enzymes as dehydrogenases, peptidases, phosphatases, atransphosphorylase, carboxypeptidase and it was found to be an essential component of both DNA and RNA polymerases (Miles and Henry, 1999). It is also vital for a variety of hormonal activities including growth hormone, glucagons, insulin, as well as sex hormones. Manganese is an important trace mineral in biological systems, acting as an enzyme component and activator (Leach and Harris, 1997).

Manganese is poorly absorbed (1% or lees) from ruminant diet (Bruwaene *et al.,* 1984). Dietary factors that may influence manganese bioavailability have received little attention, probably because manganese deficiency is not considered to be a major problem in ruminants. Limited evidence suggests that high dietary calcium and phosphorus may reduce manganese bioavailability (Hidiroglow, 1979). It has been suggested that manganese may act as a cofactor for mevalonate kinase and faresyl pyrophosphate synthase, enzymeo involved in the production of squalene, aprecursor of cholesterol (Curran and Azarnoff, 1961 and Davis *et al.,* 1990). Many studies have shown improved growth, milk yield, reproductive performance and/ or immune respone in ruminants fed diets containing organic trace mineral (Spears 1996; Socha and Johanson, 1998 and Gunter *et al.,* 1999). Studies with pregnant cows had found that zinc deficiency would lead the offspring to be born with gross congenital malformation of the body. Zinc has been shown to reduce ruminal degradability of feed protein and diets that contain soya protein treated with zinc and promotes greater quantities of ruminal escape protein (Kincaid *et al.,* 1997). The depression in urea degradadation is greater with supplemental zinc than that with supplemental manganese (Arelovich, 1998). Improved bioavailability of zinc methionine may stimulate weight gain and feed conversion ratio in cattle (Kessler *et al.,* 2003).

The objective of this study was to investigate the effect of zinc-methionine or/and manganese-methionine supplementation on digestibility, rumen fermentation, blood plasma constituents, milk yield and composition of lactating buffaloes.

MATERIALS AND METHODS

This study was carried out at the Animal Production Research Station of Sids, Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture, Egypt. The experiment was planned to investigate the effect of Zinc or / and Manganese methionine supplementation on productive performance, milk yield, milk composition, digestion coefficients, rumen parameters and blood parameters of lactating buffaloes. Sixteen lactating buffaloes in at the last three months of pregnancy were divided into four similar groups (four animals each) balanced for live body weight, milk yield and age. The lactating buffaloes were fed on the following rations. The control group was fed concentrate feed mixture (CFM) + berseem hay + rice straw) without supplementation. The 1^{st} tested group was fed control ration +40mg zinc methionine /kg DMI . The 2^{nd} tested group was fed control ration +40mg manganese methionine /kg DMI . The 3^{rd} tested group was fed control ration + 40mg zinc + 40mg manganese methionine /kg DMI according to Ghoneim (1964) feeding standard. Feed additives zinc methionine (Biomet

Zn as commercial name) contained (10% zinc sulfate, 13.4% protein, 22.8% methionine, and 60% ash) while manganese methionine (Bioplex Mn as commercial name) contained (10% manganese sulfate , 15.9% protein, 27.2% methionine, and 60% ash). They were mixed manually with some ground amounts of CFM. Feeding experiments was started for three month before the expected calving date and continued up to 105 days of lactation period . Each group was given (during prepartum) a maintenance ration plus productive requirements which can cover and equivalent to produce 2kg milk yield with 7% fat. After parturition buffaloes were fed according to Ghoneim(1964) feeding standard. Buffaloes were hand milked twice daily (6.0 am and 5.0 pm) during the experimental period (105 days) while milk yields were recorded individually for each milking. Actual milk yield was converted into 7 % FCM using the formula given by Reafat and Saleh, (1962) as follows: 7 % FCM = 0.265 milk yield + 10.5 Fat yields. Feed conversion was calculated as the amount of DM, TDN and DCP required for 1kg of 7 % FCM . Milk samples were collected individually twice every week; samples of milk were used to determine protein, fat, total solids and ash contents. Fat percentage in milk was determined by the standard Gerber's method described by Ling, (1963). Four digestibility trials were carried out at the end of the feeding trial for four days using three buffaloes from each group to determine the nutrient digestibilities and nutritive value of the experimental rations using acid insoluble ash (AIA) technique according to Van Keulen and Young (1977). Faces samples were daily collected from the rectum for four successive days from each animal . Chemical composition of the feed and feces samples were analyzed according to A.O.A.C. (1995) procedures . Rumen liquor samples were collected by stomach tube at three times (just before morning feeding, 3.00 and 6.00 hrs after feeding). Samples were strained through four folds of cheese cloth. Ruminal pH was determined immediately using a digital pH meter. Ammonia-N was determined according to the modified semi-micro kijeldehl digestion method A.O.A,C. (1995). Total volatile fatty acids (TVFA's) was determined according to Eadie,*et al.*,(1967). Blood samples were taken from three buffaloes from each group at the end of the collection period before feeding from the jugular vein and allowed to flow into acid washed heparinzied tubes. Blood samples were centrifuged immediately at 4000 rpm for 20 minuets. Blood plasma was used for determination of total protein, albumin, urea, and zinc content . Total protein was determined according to Weichselboum (1946). Albumin was determined colorimetrically according to Drupt (1974). Urea was determined according to Fawcett and Scott (1960). Zinc was determined according to Makino *et al.* (1982). The Economic efficiency (%) was calculated as a percentage of price of daily milk yield (L.E) to average daily feed cost (L.E.).

The obtained data were statistically analyzed by general linear, model using ANOVA procedures of SAS (1985). The significant differences among means of treatments were tested using Duncan multiple range test (Duncan 1955).

RESULTS AND DISCUSSION

Chemical composition of feedstuffs

Data of table (1) show that the chemical composition of the ingredients used to formulate the experimental rations were within the normal values published by A.P.R.I. (1997).

Table (1): Chemical composition of tested feedstuffs and calculated composition of experimental rations:

Item	DM	OM	CP	EE	CF	NFE	Ash
CF M*	90.95	92.70	16.51	3.10	12.74	60.35	7.30
Berseem hay (3rd cut)	89.40	88.18	12.40	2.32	27.82	45.64	11.82
Rice straw	91.00	84.10	3.05	1.91	37.72	41.42	15.90
Calculated experimental rations:							
Ration 1 (control)	90.52	88.94	11.47	2.53	24.21	50.73	11.06
Ration 2	90.54	88.94	11.47	2.54	24.25	50.68	11.06
Ration 3	90.54	88.94	11.47	2.54	24.25	50.68	11.06
Ration 4	90.51	88.95	11.49	2.54	24.18	50.74	11.05

*** Concentrate feed Mixture contained: 30%yellow corn, 42% undecorticated cotton seed meal, 20% wheat bran, 5% molasses, 2% limestone, 1% common salt**

Nutrient digestibitities and feeding values

Results of digestibility and nutritive values are presented in table (2) Addition of Zn-Met plus Mn-Met significantly ($p<0.05$) increased the digestion coefficients of OM,CP,EE,CF and NFE than those of Mn-Met , Zn-Met supplementation and control group. While the differences of the digestion coefficients of DM were insignificant among zinc-Met or Mn-Met and Zn-Met plus Mn-Met supplemented groups .The digestion coefficients of DM , EE and NFE showed insignificant differences between the Zn-Met and Mn-Met supplemented groups The digestion coefficient of OM, CP and CF of Zn-Met supplemented group was significantly ($p<0.05$) higher than that of Mn-Met addition group . Zn-Met or Zn-Met plus Mn-Met supplementation significantly ($p<0.05$) increased the digestibility coefficients of CP compared to the Mn-Met supplementation and control group . The higher apparent digestibility coefficient with zinc supplemented rations may be due to the improvement of their absorption.

These results are in line with those obtained by Mousa and EL-Sheikh, (2004) who found that the apparent digestibility of DM,OM,CP,CF;EE and NFE were slightly increased by different levels of zinc sulfate supplementation to the ration of lactating buffaloes . Shakweer *et al*., (2005) , Shakweer and El-Nahas, (2005) and Shakweer *et al*., (2006) found that the addition of different levels of zinc methionine to the ration of Friesian dairy cows , suckling calves and Friesian growing calves increased the digestibilities of DM, OM,CP and CF compared with those of the control group. Basiuoni *et al,* (2009) found that the apparent digestibility of DM, OM, CP, CF, EE and NFE were significantly increased by different levels (5g or 10 g/head /day) of Zn-Met supplementation to the ration of lactating Frisian cows.

Table (2): Effect of zinc or/and manganese methionine supplementation on nutrients digestibility and nutritive values by lactating buffaloes:

Items	Experimental groups				SE ±
	Control	40 mg Zn-Met/ kg DMI	40 mg Mn-Met / kg DMI	40 mg Zn-Met + 40 mg Mn-Met / kg DMI	
Digestibility coefficients %					
DM	65.25[b]	69.3[a]	68.8[a]	70.19[a]	0.60
OM	68.66[d]	71.64[b]	70.34[c]	73.13[a]	0.51
CP	62.82[d]	73.09[b]	68.28[c]	74.93[a]	0.42
EE	68.57[b]	69.17[b]	68.83[b]	70.22[a]	0.23
CF	62.84[d]	65.39[b]	63.70[c]	68.19[a]	0.62
NFE	74.10[c]	75.50[b]	75.34[b]	76.11[a]	0.23
Nutritive value %					
TDN	63.93[d]	65.73[b]	64.68[c]	66.96[a]	0.25
DCP	7.21[d]	8.38[b]	7.83[c]	8.61[a]	0.31

a, b, c and d: values in the some row with different superscripts differ significantly (P≤0.05).

The nutritive values as TDN and DCP were significantly (p<0.05)higher for Zn-Met plus Mn-Met addition than those of the other treatments .While the Zn-Met supplementation significantly increased DCP than those of the Mn-Met addition . These results are in agreement with those obtained by Shakweer *et al*., (2005) and Shakweer *et al*., (2006) who found that TDN and DCP were significantly (p<0.05) increased by different levels of zinc methionine supplementation to the ration of lactating Frisian cows and growing Friesian calves. Mousa and EL-Sheikh, (2004) found that TDN and DCP were significantly (P<0.05) increased by the addition of the highest level of zinc sulfate. Basiuoni *et al,* (2009) found that TDN and DCP were significantly (p<0.05) increased by different levels of Zn-Met supplementation to the ration of lactating Frisian cows . Mandal *et al.,* (2007) found that Zn supplementation (20 or 135 mg/kg DMI) had no effect on the digestibility of DM and CP. The improvement in digestibility coefficients could be illustrated on the basis that zinc or/ and manganese methionine can play indirect role to stimulate anaerobic fermentation of organic matter that improve the utilization efficiency of nutrients and direct role to improve digestion in abomasums.

Ruminal parameters:

Results obtained in table (3) reveled the minimum pH values were observed at 3hrs post feeding and tended to increase after 6hrs. This trend was observed with control group and Mn-Met addition while the opposite trend was showen with Mn-Met and Zn-Met plus Mn-Met supplemented group. These results are in hormony with those found by Shakweer *et al*., (2005) and Shakweer *et al*., (2006) who found that the average pH values were not affected by the different levels (40, 80, 120 mg/kg DMI) of zinc methionine supplementation to the ration of the lactating Friesian cows and growing Friesian calves. On the other hand, Basiuoni *et al*, (2009) found that the mean of rumen pH value slightly decreased with Zn-Met supplementation groups than control with different levels (5g, 10 g) of Zn-Met supplementation to the ration of lactating Friesian cows. The maximum NH_3-N values were observed at 3hrs post feeding and tended to decrease at 6hrs . The trend was observed with all supplemented groups and control group . Ammonia-N values at 3hrs post feeding was significantly higher for control group than those for all supplementation group , but the lowest values were those for the Zn-Met plus Mn-Met or Zn-Met groups. The decrease ruminal ammonia –N concentration with Zn-met, Mn-Met and Zn-Met plus Mn-Met supplementation may be due to improve the rumen microbes activity utilizing Ammonia-N to produce microbial protein. These results are in line with those obtained by Basiuoni *et al,* (2009) who found that the rumen NH_3-N concentration was reduced ($p<0.05$) with different levels (5g or 10 g) of zinc methionine supplementation compared to the control group of lactating Friesian cows. . Shakweer *et al*., (2005) and Shakweer *et al*., (2006) found that the ammonia-N in ruminal fluid was decreased with different levels of zinc methionine compared with that of the control group at 3hr post feeding of the growing Friesian calves .

Table (3): Effect of zinc or/and manganese methionine supplementation and sampling time on ruminal pH, ammonia-N and TVFA's concentration of lactating buffaloes

Parameter	Time	Experimental groups				SE ±
		Control	40 mg Zn-Met/ kgDMI	40 mg Mn-Met / kgDMI	40 mg Zn-Met + 40 mg Mn-Met / kgDMI	
pH	0	7.13	7.08	7.10	7.11	0.01
	3	6.57^{b}	6.71^{a}	6.64^{ab}	6.74^{a}	0.02
	6	6.78^{a}	6.67^{ab}	6.70^{ab}	6.59^{b}	0.03
NH_3-N (mg/100ml RL)	0	19.20	18.72	19.12	17.78	0.31
	3	29.02^{a}	26.45^{b}	27.60^{ab}	25.94^{b}	0.42
	6	24.40^{a}	21.64^{b}	23.38^{a}	20.29^{b}	0.52
TVFA's (meq /100ml RL)	0	6.53	6.92	6.77	7.07	0.20
	3	8.83	9.29	9.09	9.48	0.16
	6	6.26^{b}	6.94^{ab}	6.37^{ab}	7.15^{a}	0.15

a, b and c: values in the same row with different superscripts differ significantly ($P\leq0.05$).

The level of ruminal total VFA's reached to maximum level at 3hrs post feeding and started to decrease afterwards . The trend was observed in all experimental groups. These results suggest that the anaerobic fermentation of protected amino acid were more efficient and faster yielding more total VFA's than control ration. These results in accordance with the finding of Basiuoni *et al,* (2009) who found that the concentrations of TVFA's in rumen liquor were significantly ($p<0.05$) higher with different levels (5g, 10 g) of zinc methionine supplementation than that of control group of lactating Frisian cows. Shakweer *et al*., (2005) and Shakweer *et al*., (2006) found that the TVFA's was increased with all different levels (40, 80, 120 mg/kg DMI) of Zn-Met supplementation compared with that of the control group. Spears *et al.,* (2004) found that the Znic methionine addition increased molar proportion of propionate and reduced molar proportions of butyrate and valerate compared to the other treatments (ZnSO4 or ZnGly) and control group for steers.

Milk yield and composition:

Addition of Zn-Met plus Mn-Met supplements significantly increased the actual and 7% fat corrected milk yield of lactating buffaloes compared to those the different groups. Also, supplemented groups apperent to higher miljk yield than those of control group. The increase in milk yield with Zn-Met plus Mn-Met , Mn-Met and Zn-Met supplementation may be due to one or more reasons , higher both of nutrients digestibility and TVFA's concentration and lower ammonia nitrogen concentration in the rumen . Also, apparent increase in the efficiency of nitrogen utilization as well as an increased conversion and availability of nutrients for milk synthesis. Addition of Zn-Met plus Mn-Met, Mn-Met and Zn-Met supplementation led to significant increase ($P<0.05$) in milk fat yield , milk protein yield and yield of milk SNF . The increase of milk fat yield with Zn-Met supplementation may be due to that methionine in particular might facilitate the transfer of blood lipids to milk by furnishing methyl group for synthesis of choline and phosphatidylcholine , which represents an important link between methionine and lipid metabolism in ruminant (Seymour *et al*., 1990). The increase in milk protein yield with Zn-Met supplementation may be due to milk protein response to post ruminal supply of limiting amino acids were much lower on low protein (≤ 14% cp) compared with high protein rations (Rulquin and Verite , 1993) .Also, higher DCP content with Zn-Met supplementation .

Table (4): Effect of zinc or/and manganese methionine supplementation on actual daily milk yield , 7% fat correct milk yield and milk composition of lactating buffaloes.

	Experimental groups				SE ±
	Control	40 mg Zn-Met/ kgDMI	40 mg Mn-Met / kgDMI	40 mg Zn-Met + 40 mg Mn-Met / kgDMI	
Daily milk yield , kg/day	5.61[c]	6.84[b]	7.16[b]	7.89[a]	0.23
7% fat correct milk yield , kg/day	5.43[c]	6.92[b]	7.09[ab]	7.78[a]	0.24
Milk composition (%)					
Fat	6.75	7.15	6.93	6.89	-
Protein	4.39	4.58	4.56	4.66	-
Lactose	4.34	4.35	4.31	4.33	-
Solids non fat	10.12	10.20	10.17	10.25	-

a, b and c: values in the some row with different superscripts differ significantly (P≤0.05).

These results are in line with those obtained by Basiuoni *et al*, (2009) who found that the different levels (5g or 10 g) of zinc methionine supplementation significantly ($p<0.05$) increased the actual milk yield , yield of milk fat , yield of milk protein and yield of milk SNF of Friesian cows compared to the control group. Mousa and EL-Sheikh, (2004) indicated that addition of 80 and 120 mg zinc sulfate to ration did not affect actual milk yield and 7% fat corrected milk of lactating buffaloes. Compbell *et al.*, (1999) and Salama et al., (2003) who reported that milk yield did not differ between treatment by zinc in lactating cows or goats . Shakweer *et al*., (2005) found that the different levels (40, 80, 120 mg/kg DMI) of zinc methionine supplementation increased the actual milk yield and 4% fat corrected milk of dairy Friesian cows compared to the control group.

Blood parameters

The effect of Zn-Met , Mn-Met and Zn-Met plus Mn-Met supplementation on blood plasma constituents (total protein , albumin , urea, zinc and manganese concentration) of lactating buffaloes are shown in table (5). The Zn-Met plus Mn-Met supplementation led to significant (P<0.05) increase in concentration of plasma total protein compared to other groups , while Mn-Met addition had the lowest values. Concentration of plasma albumin significantly increased (P<0.05) with Zn-Met plus Mn-Met and Zn-Met supplementation compared to that the Mn-Met and control group. Concentration of plasma globulin significantly (P<0.05) increased with Zn-Met plus Mn-Met supplementation compared to that of Mn-Met , Zn-Met and control group. However, concentration of plasma urea significantly (P<0.05) increased with control group compared to that of Zn-Met , Mn-Met supplementation, while Mn-Met addition had the lowest values compared to that of Zn-Met, Mn-Met supplementation and control group . The Zn-Met plus Mn-Met supplementation led to significant (P<0.05) increase in zinc and manganese concentration in blood plasma compared to that of Zn-Met , Mn-Met supplementation and control group. These results are in line with those obtained by Mousa and EL-Sheikh, (2004) who indicated that addition of 80 and 120 mg zinc sulfate improved total protein and globulin, while it decreased albumin and urea concentration in blood serum of lactating buffaloes.. Spears and Kegley, (2002) stated that there were no differences in plasma Zn concentrations with zinc methionine- or zinc oxid addition to rations heifers and beef steers. Shakweer *et al*., (2005) and Shakweer *et al*., (2006) found normal concentrations of total protein, globulin and zinc with different levels of zinc methionine supplementation.. However, albumin and urea concentrations in blood serum of lactating Friesian cows and growing Friesian calves were decreased. Kincaid *et al.,* (1997) reported that addition of zinc methionine to rations of 6 wk old calves for 6wk increased the concentrations of zinc, albumin and α_2-macroglobulin in the serum**.**

Table (5): Effect of zinc or/and manganese methionine supplementation on blood plasma constituents of lactating buffaloes:

Items	**Experimental groups**				**SE ±**
	control	**40 mg Zn-Met/ kg DMI**	**40 mg Mn-Met / kg DMI**	**40 mg Zn-Met + 40 mg Mn-Met / kg DMI**	
Total Protein g/dl	8.25^{d}	9.54^{b}	9.15^{c}	9.88^{a}	0.114
Albumin g/dl	4.45^{c}	4.95^{a}	4.63^{b}	5.02^{a}	0.034
Globulin g/dl	3.80^{c}	4.59^{b}	4.52^{b}	4.86^{a}	0.074
Urea mg/dl	36.76^{a}	32.60^{b}	31.22^{b}	24.92^{c}	0.803
Zn mg/dl	0.66^{d}	0.80^{b}	0.69^{c}	0.89^{a}	0.017
Mn mg/dl	0.23^{b}	0.19^{c}	0.25^{b}	0.28^{a}	0.007

a, b, c and d: values in the some row with different superscripts differ significantly (P<0.05).

Feed intake and feed conversion :

The effect of Zn-Met, Mn-Met and Zn-Met plus Mn-Met supplementation on feed intake and feed conversion of lactating buffaloes are shown in table (6).There were no significant differences in daily feed intake of concentrate feed mixture , berseem hay rice straw and total DM among the different experimental groups because the amounts of the previous times were estimated according to milk yield . Addition of Zn-Met plus Mn-Met resulted in the highest feed intake of TDN and DCP (13.34 and 1.67 , respectively) than those of Zn-Met, Mn-Met and control , being (13.11 and 1.67) , (12.90 and 1.56) and (12.61 and 1.41) , respectively. These esults are in accordance with those obtained by Bach *et al.*, (2000); Krober *et al*.,(2000) and Younge *et al.*, (2001) who reported that there was no improvement in dry matter intake when protected amino acids was given to animals. Addition of Zn-Met plus Mn-Met ,Zn-Met, Mn-Met and supplementation improved feed conversion expressed as the quantities of DM, TDN and DCP required to produce one kg 7% FCM compared to that control group. However, Zn-Met plus Mn-Met supplementation increased significantly (P<0.05) compared to other addition and control group. The quantities of DM. TDN and DCP per/ kg 7% FCM for control group were significantly higher (P<0.05) than those of Zn-Met plus Mn-Met , Mn-Met , Zn-Met supplementation .

Table (6): Effect of zinc or/and manganese methionine supplementation on daily feed intake and feed conversion of lactating buffaloes .

Items	Experimental groups				
	Control	40 mg Zn-Met/ kg DM	40 mg Mn-Met / kg DMI	40 mg Zn-Met + 40 mg Mn-Met /kg DMI	SE ±
Av. Body weight (Kg)	561.25	568.75	568.75	562.5	
Daily Feed Intake (Kg/head/day):					
Concentrate Mixture	8.43	8.5	8.5	8.48	
Berseem hay	5.65	5.73	5.73	5.65	
Rice straw	5.65	5.73	5.73	5.65	
Total Daily Nutrients Intake, (Kg/ head):					
DM	19.73	19.95	19.95	19.78	
TDN	12.61	13.11	12.90	13.24	
DCP	1.41	1.67	1.56	1.70	
Av. Milk yield daily (kg)	5.61^{c}	6.84^{b}	7.16^{b}	7.89^{a}	0.23
Daily 7% FCM yield (Kg)	5.43^{c}	6.92^{b}	7.09^{ab}	7.78^{a}	0.24
Feed conversion :					
kg DM/ kg 7% FCM	3.65^{a}	2.90^{b}	2.86^{b}	2.62^{c}	0.26
kg TDN/ kg 7% FCM	2.34^{a}	1.91^{b}	1.85^{b}	1.75^{c}	0.15
kg DCP/ kg 7% FCM	0.261^{a}	0.240^{ab}	$0.220.^{b}$	0.221^{b}	0.01

a, b and c: values in the some row with different superscripts differ significantly (P≤0.05)

These results are in accordance with those obtained by Miller *et al*., (1989) , Olson *et al.*, (1999) and Salama *et al.*, (2003) who reported that dry matter intake7 kg milk was not affect by zinc addition to lactating cows or goats. Spears *et al.,* (2004) showed that supplementation of Zinc methionine significantly (P<0.05) improved the feed conversion of lambs as feed (DM) compared to control and ZnSO4 groups. Mousa and EL-Sheikh, (2004) indicated that the addition of zinc to tested rations did not affect feed intake as (DM, TDN and DCP) and feed efficiency when 40 mg zinc sulfate was added to lactating buffaloes ration. Shakweer *et al*., (2005) showed that the feed intake as (DM, TDN and DCP) was increased with all different zinc methionine supplementation (40, 80, 120 mg/kg DMI) compared to that of the un-supplemented control group. Daily nutrients intake was improved with addition of 80 and 120mg zinc methionine compared to either control or control plus 40mg zinc. Also it was found that feed efficiency was increased with added of 40 and 80mg zinc methionine levels compared to either 120mg zinc methionine level or the control group in Friesian dairy cows.

Economic efficiency

Data presented in table (7) showed that the animals fed Zn-Met plus Mn-Met was the best group for give the highest milk yield with the lowest feed cost . Animals fed Mn- Met was better than that fed Zn-Met , which the lowest efficiency was obtained with those fed control ration. The feed cost to give one kg 7% FCM recorded 1.94 , 2.11, 2.14 and 2.65 L.E. with groups fed the previous treatments, respectively. Regarding the relative feed cost , the groups fed both Zn or Mn methionine supplementation tended to higher relative feed cost but animals fed the Zn plus Mn methionine supplementation was the lowest relative feed cost, as show in table (7).

Table (7): Economical evaluation of the tested group of lactating buffaloes.

Items	Experimental groups			
	Control	40 mg Zn-Met/ kgDMI	40 mg Mn-Met / kgDMI	40 mg Zn-Met + 40 mg Mn-Met / kgDMI
Intake as fed (Kg/ head/day):				
Concentrate Mixture	8.43	8.50	8.50	8.48
Berseem hay	5.65	5.73	5.73	5.65
Rice straw	5.65	5.73	5.73	5.65
Zn-Met* (Biomet Zn) (g/head/day)	---	5.3	----	5.3
Mn-Met*(Bioplex Mn) (g/head/day)	---	---	8.0	8.0
7% FCM yield (Kg/head/day)[1]	5.43	6.92	7.09	7.78
Cost of feed consumed (L.E/day)	14.40	14.83	14.96	15.13
Cost of Kg 7% FCM (L.E/day)[2]	2.65	2.14	2.11	1.94
Relative feed cost /Kg7% FCM	100	80.75	79.62	73.21

[1] adjusted 7% FCM yield.

[2] Cost of Kg 7% FCM (L.E/day) = Cost of feed consumed / average daily 7% FCM yield.

Calculation on based of the following price in Egyptian pound (L.E.) per ton at 2008 , the price of one ton (L.E) of concentrate mixture, berseem hay and rice straw were 1075, 845 and 101respectivly; the price of one Kg from Biomet Zn and Bioplex Mn were 50 L.E. , the price of one kg of milk was 3.5 L.E .

*** Biomet Zn Bioplex Mn as commercial name**

Conclusion:

From the obtained results, It could be concluded that Zn-Met plus Mn-Met supplementation could be economically and successfully used for lactating buffaloes to improve digestibility's, feeding values, feed efficiency , milk production and economical efficiency .

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تــاثير إضــافة الزنــك و/ أو المنجنيــز ميثيــونين علــى الأداء الانتــاجى للجــاموس الحلاب

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أجريت هذا البحث بهدف مقارنة تأثير إضافة الزنك و المنجنيز ميثيونين او مخلوط منهما على معاملات الهضم والقيمة الغذائية ومحصول اللبن وبعض مقاييس الكرش والدم، حيث أستخدم 16 جاموسة فى الثلاثة شهور الاخيرة من الحمل . وتمت باضافة الزنك و / أو المنجنيز المثيونين حتى 105 يوم من موسم الحليب.

قسمت الحيونات الى أربعة مجاميع على النحو التالى: 1- مجموعة الكنترول غذيت على علف مركز + دريس برسيم + قش ارز بدون اضافة الزنك او المنجنيز 2- مجموعة مختبرة غذيت على عليقة الكنترول + 40ملحم الزنك مثيونين /كجم مادة جافة ماكولة 3- مجموعة مختبرة غذيت على عليقة الكنترول + 40ملحم منجنيز مثيونين /كجم مادة جافة ماكولة . 4- مجموعة مختبرة غذيت على عليقة الكنترول +(40 ملحم زنك مثيونين +40ملحم منجنيز مثيونين) /كجم مادة جافة ماكولة وكانت النتائج كالاتى:

إضافة الزنك ومنجنيز مثيونين معا أدى إلى تحسن فى معاملات الهضم والقيمة الغذائية للعليقة الماكولة وكذلك محصول اللبن مقارنة بالمعاملات الاخرى و مجموعة الكنترول بينما اضافة زنك المثيونين الى العليقة ادى الى تحسن فى معاملات الهضم والقيمة الغذائية مقارنة باضافة المنجنيز ميثيونين. كما ادت اضافة إضافة الزنك ومنجنيز مثيونين معا الى زيادة المحصول اليومى من اللبن مقارنة بالمعاملات الاخرى و مجموعة الكنترول بينما ادت اضافة المنجنيز الى زيادة فى معدل الانتاج اليومى مقارنة بالزنك ميثيونين أما بالنسبة لمقاييس الكرش فقد ادت اضافة الزنك والمنجنيز المثيونين الى انخفاض تركيز امونيا الكرش وزيادة تركيز الاحماض الدهنية اما بالنسبة لمقاييس الدم ادت الى ارتفاع تركيز بروتين الدم والجلوبيولين و الالبيومين بينما انخفض تركيز يوريا الدم . كما وجد ان اضافة الزنك مثيونين والمنجنيز ميثيونين معا يمكن استخدامها بصورة اقتصادية فى تغذية الجاموس الحلاب اضافة الزنك مع المنجنيز مثيونين الى العلائق ادى الى تحسن فى معاملات هضم جميع المركبات الغذائية وكذلك القيمة الغذائية معبرا عنها بمجموع المركبات الكلية المهضومة والبروتين المهضوم . كما اظهرت النتائج ان الزنك المثيونين افضل من المنجنيز المثيونين فى تاثيرة على معاملات الهضم والقيمة الغذائية . هذا وقد ادت هذة الاضافات الى زيادة ملحوظة فى انتاج اللبن الفعلي او اللبن المعدل الدهن 7% حيث سجلت قيم انتاج اللبن 7.89 ، 7.16 ، 6.84 ، 5.61 كجم لبن / يوم للمجموعات التى تغذت على كل من الزنك والمنجنيز مثيونين معا ، المنجنيز مثيونين ، الزنك مثيونين ، الكنترول على التوالى وفى نفس السياق كانت قيم انتاج اللبن المعدل 7% دهن تساوى 7.78 ، 7.09، 6.91 ، 5.43 لنفس المعملات السابقة على التوالى. وظهر نفس الايماء السابق مع الكفاءة الغذائية محسوبة على اساس كمية الماكول لكل 1 كجم لبن معدل الدهن 7% وانعكس ذلك ايضا على الكفاءة الاقتصادية حيث اعطت المعاملات الغذائية المضاف اليها الاضافات المخلبية اقل تكاليف غذائية لانتاج كجم لبن.

وتوصى الدراسة : بأن إضافة الزنك و المنجنيز مثيونين معا يمكن استخدامها بصورة اقتصادية وبنجاح فى تغذية الجاموس الحلاب لتحسين الهضم و القيم الغذائية ، الكفاءة الغذائية ، انتاج اللبن والكفاءة الاقتصادية.

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