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PRODUCTIVE PERFORMANCE OF SUCKLING CALVES FED DIETS SUPPLEMENTED WITH ZINC METHIONINE.

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ABSTRACT

Twenty newly born suckling Friesian calves were divided into four similar groups (5 calves each) after fed one week on colostrums and fed on ration supplementation with the same level of zinc methionine as their dams (Shakweer *et al.*, 2005) (0.00, 40, 80 and 120mg zinc/head/day NRC (1988) during their 120 days sulking period to study the effect of zinc methionine supplementation on nutrient digestibility , feed efficiency , and calves performance . Rumen and blood parameters were also investigated .Calves were individually fed on rations consisted of starter , berseem hay and assigned whole milk. Results indicated that addition of zinc methionine increased ($P<0.05$) the digestibility of all nutrients which was reflected on the nutritive values (as TDN ,DCP) . Addition of 40mg zinc methionine /h/d showed higher calves daily gain than that of the other levels or that of the control group . Concerning rumen parameters , results showed that although higher total protein, pH and volatile fatty acids (TVFA's) were increased by increasing the level of zn methionine supplementation in the ration , yet ammonia-N was decreased .

Generally, it cold be concluded that addition of 40mg zinc methionine /h/d improved nutrient digestibility, feed efficiency and Friesian suckling calves daily gain

Keywords : Friesian calves– zinc methionine – feed intake and efficiency – digestibility- ruminal and blood parameters.

INTRODUCTION

Zinc methionine is a compound composed of zinc and methionine .The additive is resistant to degradation by rumen microbes White *et al.*, (1994) .Zinc methionine was absorbed to the similar to the same extent as zinc oxide, but zinc methionine appears to be metabolized differently after absorption with lower urinary excretion and slower decline rate in plasma zinc Spears (1989). Zinc is needed for the functions of over 100 enzymes, and essential for DNA, RNA, protein synthesis and as such, cell division . White *et al.*, (1994) and Puchala *et al.*, (1999). Consequently, as the participation of zinc is central involved in most events relating to cell division and nucleic acid synthesis , including many other enzymatic pathways, and its presence is most important during periods of rapid cellular development i.e., during organogenesis and fetal growth . So, the time of conception and the following pregnancy , represents the most vital period for assuring an optimum zinc status Bryce-Smith (1989) and Sandsteed (1985) .Studies with pregnant cows had found that zinc deficiency will lead the offspring to be born with gross congenital malformations of the body . Hurley (1969) showed that Inadequate zinc during prenatal period had been particularly linked with lower calves birth weight and Bryce-Smith (1989) and Johanson *et al.*, (1988) found that supplementing 360mg of zn /animal daily as zinc methionine in a

70% concentrate pellets increased daily gain by 10.7% , decreased medical treatments per calf by 5.8%, and also decreased calves mortality .

The objective of this study was to investigate the effect of adding different levels of zinc methionine to the ration of pregnant Friesian dairy cows (at the last three months of pregnancy) on the birth weight of their calves its daily gain from suckling to weaning period , and digestibility of the fed ration .Rumen and blood parameters were also investigated .

MATERIAL AND METHODS

This study was conducted during years 2003-2004 in Karada Animal Production Research Station belonging to .Animal Production Reaserch Institute. Agricultural Research Centre Giza, Egypt . Twenty newly born Friesian calves taken from 20 dams at the last three monthes of pregnancy which their rations were supplemented with 0.00, 40 , 80 and 120mg zinc methionine Shakweer *et al.*, (2005) Calves were removed from their dams after having their colostrums in the first week. Calves in all groups were fed the daily allowances of whole milk, starter and berseem hay (3^{ed} cut)during the suckling period (120 days) as recommended by Ghoneim (1964). Calves were divided into four groups, (five calves in each group) and fed on ration supplemented with the same level of zinc methionine as their dams (0.00 , 40, 80 and 120mg zinc methionine /calf/day) NRC (1988) Feed additives (zinc mrthionine which content 80.5% methionine hydroxy analogue , 15.10% zinc sulfate). Calves were fed on the following tested ration : 1- The control group was fed starter + berseem hay without zinc methionine supplementation. 2- The 1^{st} tested group fed control ration + 40mg zinc methionine /calf/day .3- The 2^{nd} tested group fed control ration + 80mg zinc methionine /calf/day. 4- The 3^{rd} tested group fed control ration + 120mg zinc methionine /calf/day .The calves were fed twice daily at 8 a.m. and 4 p.m. starter and berseem hay from the second week of the experiment until weaning at 16 weeks of age. Body weight was recorded weekly from birth to the end of the trial the chemical composition of whole milk, starter and berseem hay are shown in table (1). Four digestibility trials were conducted at the end of the suckling period (at 15 weeks old) using three calves in each group to determine the digestibility of the different nutrients of the exprimental rations using acid insoluble ash technique (A.I.A) according to Van keulen and Young (1977). Proximate analysis of feedstuffs and faeces samples were carried out according to the methods of A.O.A.C. (1995) . At the end of the digestion trials , rumen liquor samples were collected by stomach tube at (just before morning feeding, 3.00 and 6.00 hrs after feeding). Samples were strained in four folds of cheese cloth. pH value was determined immediately using digital pH meter.Ammonia-N was determined according to the modified semi-micro kijeldehl digestion method A.O.A.C.(1995). TVFA's was determined according to Eadie *et al.*,(1967). Total protozoal counts were determined according to the methods described by EL-Saifi (1969).

Blood plasma were taken from each animal at the end of the collection period of each digestion trial before feeding. Blood samples were taken from

jugular vein and allowed to flow into acid washed heparinzied tubes.Blood samples were immediately centrifuged at 4000 rpm for 20 minuets.Blood plasma was used for determination of total protein , albumin, urea, and zinc. Total protein was determined according to Weichselbaum (1946). Albumin was determined colorimetrically according to Drupt (1974).Urea was determined according to Fawcett and Scitt (1960). Zinc was determined according to Makino *et al.*, (1982).

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

RESULTS AND DISSCUTION

Chemical composition of the used feedstuffs Experimental rations:

Results in table (1) showed that the chemical composition of the used feedstuffs was within the normal published values by Ghoneim (1964).

Table (1): Chemical analysis of the feed ingredients and the Experimental rations (DM basis%)

	DM	OM	CP	EE	CF	Ash	NFE
*Starter	92.61	91.66	17.65	4.69	5.92	8.34	63.40
Berseem hay(3^{ed}cut)	89.88	87.28	12.65	2.57	31.09	12.72	40.97
Whole milk	12.82	94.15	26.44	30.27	0.00	5.85	37.44
Calculated expremental ration							
Ration 1 (control)	91.49	89.87	15.60	3.82	16.21	10.13	54.23
Ration 2	91.50	89.93	15.67	3.85	15.69	10.07	54.53
Ration 3	91.53	89.94	15.68	3.85	15.84	10.05	54.57
Ration 4	91.53	89.94	15.68	3.85	15.84	10.05	54.57

***Starter composed of : 40% ground maize, 11% decorticated cotton seed meal, 16% linseed cake, 15% rice bran, 15% wheat bran, 2% lime stone, and 1% sodium chloride.**

Digestibility coefficients and feeding values:

The data in table (2) indicated that the addition of different levels of zinc methionine to the tested ration fed to the Friesian calves significantly ($P<0.05$) increased digestibility of all nutrients compared to those of the control group. However , there were no significant differences ($P<0.05$) between 80 and 120 mg levels of zinc methionine, concerning the digestibility coefficients of all nutrients , but the same levels significantly increased ($P<0.05$) the digestibility of DM and OM compared with only 40 mg zinc methionine level. However, the 40 mg zinc methionine level slightly increased the digestibility of CP and NFE compared to either 80 and 120 mg zinc mthionine levels.

Table (2): Digestion coefficients and nutritive values ofration fed to suckling calves and supplemented with different levels of zinc methionine .

Item	control ration (1)	Experimental rations		
		Ration(1)+ 40mg/calf/day	Ration(1)+ 80mg/ calf/day	Ration(1)+ 120mg/ calf/day
Digestibility %				
DM	59.26^{c}	66.20^{b}	67.50^{a}	68.16^{a}
OM	62.82^{c}	69.48^{b}	70.87^{a}	71.28^{a}
CP	57.93^{b}	67.61^{a}	65.85^{a}	67.49^{a}
CF	51.03.^{b}	58.98^{a}	59.79^{a}	60.26^{a}
EE	61.09^{b}	66.27^{ab}	70.69^{a}	70.90^{a}
NFE	67.81^{b}	77.07^{a}	76.40^{a}	75.29^{a}
Nutritive values %				
TDN	59.45^{b}	67.72^{a}	67.60^{a}	67.34^{a}
DCP	9.08^{b}	10.60^{a}	10.33^{a}	10.58^{a}

a,b,c : means in the same raw followed by different superscripts are siginificantly (P<0.05) different

This might be attributed to the increase of protein and energy utilization as increased improvement of rumen parameters Valdes *et al.*, (2000) and Salem (2003). These data are in harmony with those of Mousa and El-sheikh (2004) who found significantly increased (P<0.05) digestibility of CP, CF, EE and NFE with the addition of different concentrations of zinc sulfate to the rations of buffalo-calves. Durand and Kawashima (1980) concluded also that the addition of 50 mg zinc/kg DMI to rations would optimize microbial metabolism and consequently led to improvement of the digeostibilities of OM, DM, CP, CF, EE and NFE. This was reflected on the nutritive values as TDN% and DCP % which significantly (P<0.05) increased by different levels of zinc methionine addition compared to that of the control group (Table 2) . Generally , the improvement of feeding values in the tested rations which contained different levels of zinc methionine was revealed higher digestibility coefficients in these rations than control ration .

Rumen parameters:

Ruminal pH values of suckling calves as affected by different levels of zinc mthionine were shown in table (3) whict revealed that ruminal pH values of suckling calves were affected significantly by the different levels of zinc mthionine addition compared to that of the control group. Arelovich *et al.*, (2000) who found that pH after feeding with 2.00 hrs was linearly decreased, but at 6.00 hrs pH was linearly increased (P<0.05) by adding zinc sulfate. On the other hand, feeding calves on protected protein diets resulted in increased (P<0.05) pH value of rumen liquor of calves at pre-weaning ages as compared to that of the control diet as stated by Abdel hamid *et al.*, (2003). However, Bharadwaj *et al.*,(2000) and Demeterova *et al.*,(2002) reported that there were slight decrease in rumen pH when protected amino acid was given to animals.

Data concerning ammonia-N values are presented in table (3) which indicated that ammonia-N was reduced (P<0.05) with different levels of zinc mthionine addition to rations at all sampling times of Friesian suckling calves compared to that of the control group. Howevere, ruminal ammonia was linearly decreased (P<0.01) by adding zinc sulfate as found by Arelovich *et al.*,(2000). This might be due to zinc sulfate addition to the ration of animals depress urease activity directly or it might inhibit growth and reduce the population of ureolytic bacteria as stated by Arelovich *et al.*, (2000).

Ruminal TVFA's values obtained in this study were significantly (P<0.05) increased with different levels of zinc methionine addition to Friesian suckling calves compared to the control group. Also Arelovich *et al.*,(2000) reported that the molar proportion of propionate was increased linearly (P<0.02) by adding zinc sulfate to heifer rations and Aly *et al.*,(2005) indicated that the increase of TVFA's with added protected amino acid may be due to the increase of the apparent digestibility of organic matter. Data concerning protozoal counts are presented in table (3) revealed that non significantly differences with all levels of zinc methionine addition compared to that of the control group. The sampling time (0.00, 3 and 6hrs.) showed that the pH values decreased after the zero time feeding meanwhile , ammonia –N and TVFA's were increased at 3hrs post feeding and then began to decreased again at 6hrs post feeding.

Table (3): The effect of different levels of zinc mthionine supplement on ruminal pH, NH_3, TVFA's values and protozoal count.

Parameters	Time	control ration (1)	Experimental rations		
			Ration(1)+ 40mg/ calf/day	Ration(1)+ 80mg/ calf/day	Ration(1)+ 120mg/calf/day
pH	0	6.89^{b}	7.03^{ab}	6.92^{b}	7.26^{a}
	3	5.99^{c}	6.28^{b}	6.49^{ab}	6.76^{a}
	6	5.69^{b}	6.03^{a}	5.81^{ab}	6.14^{a}
Ammonia_N (mg/100ml RL)	0	23.67^{a}	19.13^{b}	18.70^{bc}	18.30^{c}
	3	30.33^{a}	27.13^{b}	25.33^{c}	24.67^{c}
	6	18.03^{a}	15.73^{b}	15.30^{b}	15.07^{b}
TVFA's (meq/100ml RL)	0	5.05^{b}	5.63^{ab}	5.80^{ab}	6.07^{a}
	3	7.66^{b}	8.10^{ab}	8.29^{a}	8.43^{a}
	6	5.82^{b}	6.49^{ab}	6.70^{ab}	7.00^{a}
Protozoal count ($X10^5$/ml)	0	1.32	1.48	1.35	1.070
	3	1.54	1.74	1.69	1.490
	6	0.327	0.373	0.473	0.457

a,b,c : means in the same raw followed by different superscripts are siginificantly (P<0.05) different

Blood parameters

Data of table (4) show that addition of the different levels of zinc

methionine to tested rations increased total protein, globulin and zinc in plasma, but decreased plasma urea of Friesian calves by increasing the levels of zinc methionine addition compared to those for the control group . The increase in plasma protein may be due to increased protein synthesis as a result of the elevation of the anabolic hormone secretion .EL-Masry and Habeeb (1989) and the increase in plasma globulin by zinc supplementation might be a reflection of the rise in total protein as reported by .EL-Masry and Yousef (1998). These results are in accordance with those of Malcolm-Callis et al ., (2000) who they found that zinc fed at 30mg/kg DMI by beef steers significantly increased serum globulin and Mousa and EL-Sheikh (2004) showed that zinc addition at level of 40mg/kgDMI increased total protein , globulin and zinc in plasma , but it decreased plasma urea of buffalo-calves compared with 80 and 120mg zinc levels and that of the control group.

Table (4): Effect of different levels of zinc methionine supplement on some blood parameters .

Parameters		crontrol ration (1)	Experimental rations		
			Ration(1)+ 40mg/ calf/day	Ration(1)+ 80mg/ calf/day	Ration(1)+ 120mg/calf/day
Total protein	g/dl	7.41^{c}	7.80^{bc}	8.10^{ab}	8.40^{a}
Albumin	g/dl	4.00^{a}	3.63^{ab}	3.47^{b}	3.33^{b}
Globulin	g/dl	3.41^{d}	4.17^{c}	4.63^{b}	5.07^{a}
Urea	mg/dl	29.88^{a}	27.50^{b}	26.67^{b}	26.33^{b}
Zinc	mg/dl	0.79^{b}	0.91^{a}	0.93^{a}	0.96^{a}

a,b,c : means in the same raw followed by different superscripts are siginificantly (P<0.05) different

Growth performance

Data in table (5) revealed that zinc methionine addition at the level of 40mg/kgDMI during pregnant Friesian cows (the calves dams) period significantly increased birth weight of their calves compared to other levels of zinc methionine (80 and 120mg) and control group Shakweer *et al.*, (2005). On the other hand , the calves continued to be fed on the same different levels of zinc methionine after calving .Data in table (5) revlealed that zinc methionine addition at level of 40mg /calf/day significantly (P<0.05) increased final weight (weaning weight) compared to the other levels of zinc methionine and that of the control group .The daily gain of Friesian calves given 40mg zinc methionine supplementation was higher than that of the other zinc levels and the control group . On the other hand ,This improved growth performance due to zinc supplementation not only due to its importance through acting as a component and activator to more than 200 metalloenzumes and hormones Riodran and Vallee (1976) but also can improves acid –base balance Halhn and Baker (1988) and digestive enzymes activities Iznboldina (1994) , Propionate concentration and ruminal protozoa numbers Froetschel, *et al.*, (1990) efficiency of dietary protein utilization and nutrients metabolism Banerjee,(1988). The present results are in agreement with those of Goetsch *et al.*, (1990) who found that the daily gain was higher (P<0.05) with

supplemented ration (4g daily of zinc/animal) than that without zinc supplementation by beef steers . Mousa and EL-Sheikh(2004) found that the addition of zinc at different concentration increased daily gain of buffalo-calves when compared with the control group.

Table (5) :Feed intake and feed efficiency of Friesian calves given different levels of zinc methionine supplement.

Item	control ration (1)	Experimental rations		
		Ration(1)+ 40mg/ calf/day	Ration(1)+ 40mg/ calf/day	Ration(1)+ 40mg/ calf/day
No . of animal	5	5	5	5
Duration /days	120	120	120	120
Initial weight , kg	28.3	40.33	33.33	31.67
Final weight, kg	92.33^{c}	130^{a}	118.33^{b}	116.67^{b}
Total gain , kg	64^{c}	89.67^{a}	85.00^{b}	85.0^{b}
Average daily gain,g/head/day	0.533^{c}	0.747	0.710^{b}	0.709^{b}
Average daily feed intake	1300	1450	1400	1400
Stater DM,g/head/day	899	950	910	910
Hay DM,g/head /day	2199	2400	2310	2310
Total DM intake , g/head/day	1307	1625	1561	1556
Total TDN g/head/day	199.7	254	239	244
Total DCP g/head/day	4.13	3.21	3.25	3.26
Feed efficiency :	2.45	2.18	2.20	2.19
Kg DM /kg ,gain	0.375	0.341	0.337	0.344
Kg TDN /kg ,gain				
Kg DCP/kg ,gain				

a,b,c : means in the same raw followed by different superscripts are siginificantly (P<0.05) different.

Feed intake as / kg DM,TDN and DCP /head are shown in table (5) .The highest intake was recorded with 40mg zinc methionine supplementation /calf/day compared to that of the other levels and the control group. On the other hand , there was an improvement in feed conversion as kg DM, kg TDN and kg DCP/kg gain by addition of different levels of zinc methionine to the ration of Friesian calves . The best feed conversion as kg DM, kg TDN and kg DCP required for each kg gain was obtained with 40mg zinc methionine addition level followed by 80 and 120mg zinc methionine levels ,respectively than that of the control group with no significant differences among them . The present results are in agreement with those of Malcolm-Callis *et al.*, (2000) who they found that feed efficiency was increased with supplemental of zinc . and Mousa and EL-Sheikh,(2004) found that feed intake and feed efficiency were increased with addition of 40mg zinc sulfate /kg DMI for buffalo-calves compared to that of the control group.

CONLUSION

From all the above results, It could be concluded that addition of 40mg zinc methionine /calf /day gave the best results concerning feed digestibility, nutritive feed value ,feed efficiency and performance of Friesian calves .

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الأداء الانتاجى للعجول الفريزيان الرضيعة المغذاة على علائق مضاف إليها نسب مختلفة من زنك المثيونين

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استخدم فى هذة الدراسة عشرون عجل فريزيان مولودة من أبقار مغذاة من الشهر الثالث قبل الولادة على علائق مضاف اليها نسب مختلفة من زنك الستيونين (صفر ، ٤٠، ٨٠، ١٢٠ ملجم زنك مثيونين وقسمت العجول الى اربعة مجاميع (٥ عجول فى كل مجموعة) وغذيت على باديء ودريس برسيم الى جانب كميات اللبن المقررة لها وتم اضافة زنك المثيونين بنفس المستويات التى غذيت عليها أمهاتها Shakweer *et al.*, (2005)(صفر ، ٤٠، ٨٠، ١٢٠ ملجم زنك مثيونين / راس فى اليوم على النحو التالى مجموعة (١) مجموعة الكنترول ، مجموعة (٢) غذيت على عليقة الكنترول +٤٠ملجم زنك مثيونين /راس فى اليوم ، ، مجموعة (٣) عليقة الكنترول + ٨٠ملجم زنك مثيونين /راس فى اليوم ، اما المجموعة (٤) عليقة الكنترول +١٢٠ملجم زنك مثيونين /راس فى وكانت النتائج كالاتى :-

١- إضافة زنك المثيونين بمستوياتة المختلفة أدى إلى تحسن في معاملات الهضم والقيمة الغذائية للعليقة المغذاة كما أدى إلى زيادة وزن الميلاد للعجول المولودة من أمهات غذيت على نفس المستويات من اضافة زنك امثيونين قبل الولادة

٢- أدت إضافة زنك المثيونين لزيادة معدلات النمو والكفاءة التحويلية للعجول من الميلاد وحتى الفطام مقارنة بمجموعة الكنترول كما وجد ان اضافة ٤٠ ملجم زنك مثيونين / راس / يوم قد اعطى افضل نتائج للنمو والكفاءة التحويلية مقارنة ببقية المستويات ومجموعة المقارنة . اما بالنسبة لمقاييس الكرش والدم فقد ادت اضافة زنك المثيونين الى انخفاض تركيز امونيا الكرش وادت كذلك الى ارتفاع تركيز بروتين الدم والجلوبيولين بينما انخفض تركيز الالبيومين ويوريا الدم

وتوصي الدراسة: بان اضافة ٤٠ ملجم زنك مثيونين /كجم مادة جافة ماكولة فى عليقة الابقار خلال الـ ٣ شهور الاخيرة من الحمل ادى الى زيادة وزن العجول عند الميلاد كما ادى لزيادة معدل النمو اليومى والكفاءة التحويلية لهذة العجول .وان اضافة ٤٠، ٨٠، ١٢٠ ملجم زنك مثيونين ادى لتحسين فى المركبات المهضومة للعلائق وكذلك قياسات سائل الكرش وبعض قياسات الدم للعجول الرضيعة بالمقارنة بمجموعة الكنترول .