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YIELD, COMPOSITION AND SOME PROPERTIES OF MILK AND SOFT CHEESE AS AFFECTED BY UTILIZATION OF ZINC METHIONINE IN COWS FEEDING.

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ABSTRACT

Twelve lactating Friesian cows with body weight of 450 to 550 kg and 2nd to 5th lactation season were used after 8weeks of calving in a complete switch-back design with three treatments and three successive experimented periods; each period consisted of 28days. The first 14 days of each period were considered as transition period followed by 14days as test period.

Cows in the first group were fed control ration (G1) consisted of 35% concentrated feed mixture, 40% fresh berseem and 25% rice straw without or with supplementation with 5g zinc methionine/head /days (G2) or with 10g zinc methionine/ head /days (G3).The attained results revealed an increase in milk yield, total solids, fat total protein, casein nitrogen and whey protein nitrogen contents in milk (G2) and solid not-fat, lactose, non-casein nitrogen, non-protein nitrogen, total volatile fatty acid and ash contents in milk (G3). On the other hand, zinc increased in (G2) and (G3) compared with the control. Minerals contents of milk were not affected by zinc methionine supplementation. Clotting time was decreased while curd tension and curd syneresis increased in milk of (G3) treatment, whereas cheese yield, total solids, fat, recovery of fat and protein in (G3) and (G2) were also increased. The organoleptic properties were insignificantly from the different treatments.
keywords: Friesian cows, zinc methionine, milk, soft cheese,

INTRODUCTION

Zinc has been recognized for several decades as indispensable for normal growth and health in animals (NRC, 2001). The recommended level of zinc in diets of lactating dairy cows has been increased recently (NRC, 1988, 2001). It is an essential component of over 300 enzymes covering all six classes of enzymes (Dibley, 2001). Zinc has biological roles that are characterized by catalytic, structural and regulatory functions. The metabolic action of these systems includes carbohydrate and energy metabolism, protein synthesis, nucleic acid metabolism, epithelial tissue integrity, cell repair and division, vitamin A transport and utilization and vitamin E absorption (Miller et al., 1988; Hunt and Groff, 1990; Dibley, 2001 and NRC 2001). On the other hand, it was reported that methionine is the first limiting amino acid for increasing milk yield and milk protein production (Schwab et al., 1992). Supplying this amino acid may improve microbial protein synthesis and therefore, improve milk production without adding excess nitrogen to the environment.

The objective of this study was to investigate impact of using zinc methionine in cows feeding on the yield and some properties of milk and the resultant soft cheese made from such milk.

MATERIAL AND METHODS

This study was carried out at Animal Production Research Station (Sakha), Animal Production Research Institute, Agricultural Research Center.

Twelve lactating Friesian cows in the 2^{nd} to 5^{th} of lactation, weighing 450-500 kg were used after 8weeks of calving in a complete Switch- back design with three treatments with three successive experimental periods as described by Lucas (1956). Cows in the first group were fed control ration (G1) consisted of 35% concentrate feed mixture +40%fresh berseem +52% rice straw without supplementation or supplemented with 5g zinc methionine/ head/ day (G2), 10g zinc methionine/head/day (G3).

Milk samples from the consecutive evening and morning milk were taken from each cows at 4^{th} weeks of each period and mixed in proportion of milk yield.

Individually morning and evening milk yield were recorded daily.

Fat and total solids were measured according to Ling (1963).

Total nitrogen content (TN) was determined using semi-microkjldahl as recommended by Rowland (1938).

Non casein nitrogen (NCN) and non protein nitrogen (NPN) were determined in the collected filtrate after precipitation of casein and protein respectively.

Casein nitrogen (CN) and whey protein nitrogen (WPN) were quantified by the difference as reported by Rowland (1938) as follows:-

CN=TN – NCN

Casein%= CN x 6.38

Whey protein = (NCN-NPN) x 6.38

Total protein = TN x 6.38

Lactose content was determined according to Barnett and Abdel-Tawab (1957).

Ash content was measured according to AOAC (1990).

The method of Kosikowski (1978) was used for determination of total volatile fatty acids (TVFA).

Rennet coagulation time (RCT) was determined according to Berridge (1952).

Curd tension was measured at room temperature (25-30C) according to Chandrasekhar *et al.* (1957).

Whey syneresis was measured according to Mehanna and Mehanna (1989).

Determination of calcium, magnesium and zinc was done using Atomic absorption, whereas sodium and potassium by using Flam photometer according toAOAC (1990).

Phosphorus was determined as given by Allen (1940).

Soft cheese was made as given by Fahmi and Shrara (1950).

Yield of fresh cheese (Kg/100Kg) was calculated. All cheese samples were analyzed for total solids (TS), fat and TN as given by Ling (1963).

Organolyptic properties were assessed as recommended by Naguib *et al.* (1974).

Statistical analysis:-

Analysis of variance and Duncan's test as well as average and standard error were carried out using SPSS computer program (SPSS, 1999).

RESULTS AND DISCUSSION

The effects of zinc methionine supplementation on milk yield (Kg/day) of cow's milk during the different experimental periods are shown in Table (1). Zinc methionine supplementation led to significant increase (P< 0.05) in the yield compared with the control. The recorded means were 14.20, 16.74 and 16.15 kg/ day for G1, G2 and G3, respectively. However the differences between G2 and G3 were insignificant. These results agree with those given by Seymour et al. (1990), Durand et al. (1992), Misciattelli et al. (2003) and Kellogg et al. (1989).

Zinc methionine supplementation led to significantly increase (P< 0.05) in the content of total solids (TS) and solid not- fat (SNF) during the different experimental period (Table 1). The mean content of TS for G1, G2 and G3 were 11.53, 12.27 and 12.20 % whereas those of SNF were 7.96, 8.50 and 8.54 %, respectively. Similar results were given by Kudrna et al. (1998), Nichols et al. (1998), Bharadwaj and Sengupta (1999), Shibano et al. (2000), Ali (2005) and Girard et al. (2005).

Lactose content significantly increased (P< 0.05) with zinc methionine supplementation as shown in Table (1). The recorded means for G1, G2 and G3 were 4.17, 4.34 and 4.47 %, respectively. These results are in accordance with those obtained by Sevi et al. (1998), Nicholas et al. (1998), Fahey et al. (2002) and Ali (2005).

Ash content also significantly increased (P<0.05) by the applied treatments. The mean values for G1, G2 and G3 were 0.71, 0.73 and 0.75 %, respectively. These results agree with those obtained by Gaafar (1994), who found that zinc content in milk increased with increasing dietary zinc intake.

On the other hand, total volatile fatty acids as affected by zinc methionine supplementation significantly increased (P< 0.05) and 3.66 to 3.88 and 3.88,were recorded for G1,G2 andG3, respectively.

Table (1): Milk yields (Kg/day) and milk composition as affected by zinc methionine supplementation of Friesian cows (Average of three replicates)

Property	G1	G2	G3*
Milk yield (kg/day)	14.20+0.07b	16.74+0.04a	16.15+0.03a
TS (%)	11.53+0.211c	12.27+0.111a	12.20+0.056ab
Fat (%)	3.58+0.102c	3.77+0.112a	3.66+0.156b
SNF (%)	7.96+0.012b	8.50+ 0.010ab	8.54+0.015a
Lactose (%)	4.17+0.131c	4.34+0.023b	4.47+0.135a
Ash (%)	0.71+0.01c	0.73+0.01ab	0.75+0.2a
TVFA**	3.66+0.02b	3.88+0.01a	3.88+0.01a

G1, G2 and G3 represent the control and 5g and 10g zinc methionine respectively.

** Expressed as ml 0.1N Na OH/ 10g milk.

a, b and c: values in the same row with different superscripts differed significantly

Nitrogen distribution (%) as affected by zinc methionine supplementation is shown in Table (2). TP increased by the applied treatments. The recorded values were 3.08, 3.43 and 3.33% for G1, G2 and G3, respectively.

Casein nitrogen (CN) of milk significantly increased (P< 0.05). The mean values for G1, G2 and G3 were 0.348, 0.358 and 0.355%, respectively. The corresponding non-casein nitrogen (NCN) contents were 0.136, 0.126 and 0.130 %, respectively.

Table (2) shows non-protein nitrogen (NPN) content of the experimental groups in different periods. G2 showed the highest values followed by G1, while G3 had the lowest values. These values were significantly different (P<0.05).

Concerning whey protein nitrogen (WPN), the values showed that G3 had the highest WPN content (0.091%), whereas G1 had the lowest value (0.087%). The differences in this respect due to the applied treatments were significant.

In general, the recorded nitrogen distributions agree with the finding of several authors (Keys et al., 1984; baker et al., 1998 and Noftsger et al., 2005).

Table (2): Nitrogen distribution (%) of milk as affected by zinc methionine supplementation treatments (Average of three replicates).

Property	G1	G2	G3
TP	3.08±0.02c	3.43±0.05a	3.33±0.03b
CN	0.348±0.012c	0.358±0.025a	0.355±0.065b
NCN	0.136±0.023a	0.126±0.015c	0.130±0.231b
NPN	0.032±0.02b	0.036±0.052a	0.029±0.064c
WPN	0.087±0.03c	0.090±0.02b	0.091±0.04a

*** See legend to Table (1) for details.**

Concerning the minerals content, the values of Ca were the highest in G3 being 934mg/liter. This was also true with respect of Mg and zinc content. In spite of G2 treatment had the highest values of K and Na the differences between G2 and G3 were significant in this respect. However, it may be of interest to note the important role of the applied treatments on increasing the minerals of milk (Table 3).

Table (3): Minerals content per liter of milk as affected by zinc methionine supplementation treatments (Average of three replicates).

Property	G1	G2	G3
Ca (mg)	930±0.123	932±0.235	934±0.243
Mg (mg)	118.3±0.153ab	116±0.124c	119±0.265a
K (mg)	1156.6±0.100b	1160±0.053a	1153±0.065c
Na (mg)	400±0.010a	395±0.034b	393.3±0.056c
P (mg)	950±0.030	955±0.065	950±0.054
Zinc (ug)	2430±0.234c	2483±0.124ab	2486±0.0154a

***See legend to Table (1) for details.**

Although the differences in milk clotting time were insignificant, the recoded values (Table 4) around 7 min. The values were 7.08, 7.07 and 7.02 min. for milk belonging to G1, G2 and G3, respectively. The corresponding curd tension values (g) were 18.67, 19.00 and 19.05, in order.

It seems from curd syneresis data that G3 caused a significant increase in curd syneresis at any time given.

Table (4): Clotting time (min), curd tension (g) and curd syneresis (ml/15g) of milk as affected by zinc methionine supplementation.

Property	G1	G2	G3
Clotting time(min.)	7.08+0.114	7.07+0.125	7.02+0.154
Curd tension (g)	18.67+0.326c	19.00+0.245ab	19.05+0.215a
Curd syneresis after			
Zero min	12.30+0.105c	12.40+0.105b	12.50+0.112a
10 min	12.45+0.086c	12.55+0.062b	12.61+0.235a
30 min	12.77+0.154b	12.66+0.225c	13.15+0.165a
60 min	13.09+0.035c	13.76+0.032a	13.71+0.045b

* See legend to Table (1) for details.

Yield of the resultant soft cheese (Table 5) significantly increased from 24.6% in the control to 25.0% and 25.5% in G2 and G3, in order. This might be due the increase in TS and fat content. The recorded values of TS were 36.55, 36.87 and 36.96% whereas, those of fat were 17.33, 17.43 and 17.48% for G1, G2 and G3 respectively.

Recovery of fat (RF) and recovery of protein (RP) in the resultant soft cheese followed the same trend of the prevention results.

Table (5): Cheese yield, TS, fat content and recovery of fat (RF) and recovery of protein (RP) in the resultant cheese and its sensory evaluation as affected by the applied treatments

Property	G1	G2	G3
Cheese yield (%)	24.6+0.456c	25.0+0.542b	25.5+0.198a
TS (%)	36.55+0.210c	36.87+0.215ab	36.96+0.312a
Fat (%)	17.33+0.05c	17.43+0.12ab	17.48+0.0a
RF (%)	91.85+0.254c	93.27+0.325b	94.67+0.247a
RP (%)	79.83+0.123c	82.32+0.325b	83.28+0.165a
Sensory scores			
Flavour (60)	52.26+1.120	51.62+2.150	51.63+3.214
Body&texture (30)	26.63+1.170	25.86+1.121	25.92+1.150
Saltiness (5)	4.23+0.120	4.56+0.054	4.60+0.065
Appearance (5)	4.38+0.240	4.45+0.124	4.36+0.145
Total (100)	87.50+1.245	86.49+2.051	86.56+1.536

* See legend to Table (1) for details.

Table (5) shows that the cheese from G1 had the lowest value of RF being 91.85% and the value was the highest (94.67%) in cheese from G3.

The recovery of protein (RP) was the lowest also (79.83%) in cheese from G1, whereas G2 and G3 had the values of 82.32% and 83.28%, in order.

The organoleptic evaluation revealed that the flavour of soft cheese was not affected by the applied treatments. The differences in this respect were mostly insignificant. The body and texture, saltiness and appearance were not affected by the applied treatments since the scoring points given were insignificantly different.

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تأثير إضافة مثيونين الزنك إلى عليقة الأبقار على معدل انتاج اللبن و التركيب الكيماوي و بعض خواص اللبن و الجبن المصنع منة.

حامد السيد حاتم

قسم كيمياء الألبان - معهد بحوث الإنتاج الحيواني-الدقي – الجيزة

أجريت هذه الدراسة على ١٢بقرة حلابة في مواسم الحليب ما بين الثاني و الخامس و ذلك بعد ٨ أسابيع من الولادة حيث وزعت هذه الأبقار على ثلاث معاملات خلال ثلاث فترات كل منها ٢٨يوم و ١٤يوم الأولى فترة انتقالية يليها ١٤يوم يتم خلالها أخذ العينات طبقا لتصميم الكامل لثلاث معاملات و ثلاث فترات تجريبية .غذيت الأبقار على العليقة الأساسية التي تتكون من ٣٥%مخلوط علف مركز +٤٠% برسيم +٢٥% قش أرز بدون إضافة(المجموعة الأولى) أو إضافة ٥جم زنك مثيونين/بقرة/يوم (المجموعة الثانية)أو إضافة ١٠جم زنك مثيونين/بقرة/يوم (المجموعة الثالثة) و تم تقدير محصول اللبن الناتج و تركيبة الكيمائي و بعض الخواص الريولوجية كما تم تصنيع جبن أبيض من اللبن الناتج وحساب تصافى الجبن و تقدير بعض مكوناتة

وأوضحت النتائج المتحصل عليها ما يلي-:

- أدت إضافة الزنك مثيونين إلى حدوث زيادة معنوية على مستوى (٠,٠٥.) في إنتاج اللبن الفعلي بمعدل ١٦,١٥&١٦,٧٤ مقارنة بالكنترول ١٤,٢٠كيلوجرام/يوم وحدثت زيادة معنوية على مستوى (٠,٠٥) لكل من الدهن و الجوامد الصلبة الكلية في المجموعة الثانية بينما كانت الزيادة في المحتوى الجوامد الصلبة اللادهنية و اللاكتوز والرماد في المجموعة الثالثة.
- كذلك أدت إضافة الزنك مثيونين إلى حدوث زيادة معنوية علي مستوى (٠,٠٥) في المحتوى الكلى من البروتين والكازين النيتروجينى و النيتروجين غير البروتينى في المجموعة الثانية بينما أدت إلى زيادة المحتوى من النيتروجين الكازينى ونيتروجين بروتين الشرش في المجموعة الثالثة.
- أدت إضافة الزنك مثيونين إلى زيادة المحتوى من الزنك في لبن المجموعة الثانية و الثالثة ٢٤٨٦&٢٤٨٣ مقارنة بالكنترول ٢٤٣٠ ميكروجرلم وكانت الزيادة غير معنوية و كذلك باقي المعادن.
- أدت إضافة الزنك مثيونين إلى خفض وقت تجبن اللبن مقارنة بالكنترول و كذلك زيادة قوة الجذب الخثرى و قوة طرد الشر ش.
- بينما أدت إضافة الزنك مثتونين إلى زيادة تصافى الجبن الأبيض الطري المصنع من لبن الكنترول ٢٤,٦%إلى ٢٥% في حالة لبن المجموعة الثانية إلى ٢٥,٥% في حالة لبن المجموعة الثالثة. كانت درجات التحكيم للجبن الناتج للخواص الحسية للمنتج غير معنوية فى كل المعاملات.

من النتائج المتحصل عليها ينصح باستخدام الزنك مثيونين بنسبة ٥جم/بقرة/يوم للأبقار الحلابة حيث أنة أدى إلى زيادة إنتاج اللبن وكذلك أدى الى تحسين فى التركيب الكيماوى للبن.