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EFFECT OF SELENIUM ENRICHED YEAST SUPPLEMENTATION ON THE PRODUCTIVE PERFORMANCE OF LACTATING BUFFALOES

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SUMMARY

Two experiments, a preliminary with goats and a second with lactating buffaloes, were carried out in this study. In the first experiment, six Baladi castrated male goats were ranked in a 3x3 Latin square design experiment with 30 days interval periods to study the effect of adding selenium enriched yeast in two levels on the ruminal environment. The control diet consisted of 60% CFM, 20% berseem clover and 20% rice straw. The two experimental diets contain control diet plus 2.5 g/h/d of selenium enriched yeast with 2.5 mg selenium content (low level) or 4.5 g/h/d of selenium enriched yeast with 4.5 mg selenium content (high level). Ruminal fluid samples were collected 4 hours after the morning meal. It was found that ruminal fluid from animals fed low level of selenium enriched yeast had higher rumen total nitrogen ($P<0.05$), and total volatile fatty acid ($P>0.05$) content as to compared other treatments. Ruminal fluid from animals fed selenium enriched yeast had higher ($P<0.05$) non protein nitrogen content and pH value than control. However, true protein nitrogen and ammonia nitrogen were not affected by selenium enriched yeast supplementation.

In the second experiment, fifteen lactating buffaloes at 7 days post partum were divided randomly into three groups (5 animals each) to study the effect of adding selenium enriched yeast in two levels on the digestibility of nutrients, milk yield and milk composition using complete random block design experiment with 90 days period. The control group fed basal diet consisting of 60% CFM, 20% berseem clover and 20% rice straw, treatment I (low level) and treatment II (high level) were; control ration plus 10 or 20 g/head/day selenium enriched yeast, which contained 10 or 20 mg/head/day selenium, respectively. Grab and blood serum samples were collected in the last day every month at 4 hours after the morning meal, while milk samples were collected every two weeks for chemical analysis.

Selenium enriched yeast supplementation improved ($P<0.05$) the digestibility of nutrients as compared to the control. Supplementation of low level of selenium enriched yeast to buffaloes rations increased ($P<0.05$) milk yield, 4% FCM yield, milk protein and not fat solids contents as effect of the high level of selenium enriched yeast as compared to the control. Other milk constituents were not affected by treatments. Feed efficiency (milk yield/DMI and FCM/DMI) was higher ($P<0.05$) for animals fed selenium enriched yeast than animals fed control diet. Blood serum glucose was higher ($P<0.05$) in animals fed ration supplemented with selenium enriched yeast as compared to the control, other blood serum parameters were not affected by selenium supplementation. It could be concluded that selenium enriched yeast

supplementation improved rumen activity, milk yield, milk protein content and digestibility of nutrients, however the individual effect of yeast and selenium could not differentiate.

Keywords: *selenium enriched yeast, rumen activity, digestibility, buffaloes, milk production, blood serum parameters.*

INTRODUCTION

Selenium (Se) is an important trace element for human health, necessary for the formation and function of at least 13 proteins and a component of glutathione peroxidase enzyme, mainly in the form of selenocysteine (Rayman, 2004). Its anti-carcinogenic effect, especially in the case of prostate cancer and some gastric cancers has been reported (Ip and Lisk, 1994). Selenium deficiency in cattle has been described to be involved in the pathogenesis of postnatal maladjustment syndrome (Cawley, 1987 and Guyot *et al.*, 2004), neonatal diarrhoea (Cawley, 1987 and Zust *et al.*, 1996), pneumonia in calves (Hall, 1987), myopathies (skeletal and cardiac muscles, congenital myopathy of the tongue) (Hidiroglou and Jenkins, 1968), fertility problems (Corah and Ives, 1991) and udder health (Smith *et al.*, 1997) in both beef and dairy herds. The maximum tolerable level of Se is 2 mg/kg live body weight for the major livestock species (NRC, 1980). Selenium can be supplemented to cattle diets in either inorganic (usually sodium salts of selenite or selenate) or organic forms (Se-yeast). Cattle fed Se-yeast usually have higher concentrations of Se in whole blood, serum or plasma and milk than do those fed inorganic Se (Ortman and Pehrson, 1999 and Gunter *et al.*, 2003). Whether the typically higher concentrations of Se in blood when cows are fed Se-yeast reflect improved Se status (i.e., improved disease resistance) compared with cows fed inorganic Se. Selenium enriched yeast is produced by growing specific strains of yeast *(Saccharomyces cervisiae)* in a Se-enriched media. Based on these findings and the increasing use of organic forms of Se for supplementation to livestock, El-Batal and Fadel (2002) produced an edible yeast having high levels of organic intracellular selenium, mainly selenomethionine (Rayman, 2004) in a less-toxic form (Kim and Mahan, 2001), which is useful as a dietary supplement.

This study was conducted to evaluate the effects of selenium enriched yeast with two levels on some production traits of lactating buffaloes and on rumen parameters of goats.

MATERIALS AND METHODS

This study was conducted at a private farm, in Om Dinar, Embaba, Giza, Egypt, and Dairy Science Department, National Research Center, Dokki, Giza, Egypt.

Microorganisms

Selenium enriched yeast *(Saccharomyces cerevisiae F-25* with high selenium content) was obtained from Microbial Chemistry Lab. National Research Center, Dokki, Giza, Egypt. The cultures were maintained on Malt agar medium.

Preparation of selenium enriched yeast in shaking flasks

Cane molasses medium composed of (g/l): molasses, 100 (42% sucrose 2.0; orthophosphoric acid, 2.0 and sodium selenite, 0.05 (pH 5.5). The medium (50 ml in 250 ml Erlenmeyer flask) was autoclaved at 121°C for 15 min. The yeast culture was harvested by centrifugation at 3000 rpm for 15 minutes. The yeast yield was washed 5 times with distilled water. The obtained yeast cells were dried at air flow 18 °C till standard weight. Total count of yeast live cells was determined using agar plat count (El-Batal and Fadel, 2002) and selenium content was determined according to (Whetter and Ullrey, 1978). Fermentation was performed in 220 (rpm) shaking at 32°C for 72 h inoculation. The employed yeast cells have $4.2x10^{10}$ live cells/g as well as containing 1000 µg selenium/g dry cells.

Animals and diets

Six Baladi castrated male goats (4 years old ; average live weight 29 kg) were divided into three groups to study the effect of selenized yeast supplementation level to goats ration on rumen activity using 3x3 Latin square design for 30 days interval experimental periods. The control diet used consisted of 60% concentrate feed mixture (CFM), 20% berseem clover and 20% rice straw. The two experimental diets used were: control diet plus 2.5 g/h/d of selenium enriched yeast, which contains 2.5 mg selenium (low level) or 4.5 g/h/d of selenium enriched yeast contains 4.5 mg selenium (high level). Selenium content in the control, T_1 and T_2 diets were 0.38, 2.88 and 4.88 mg/kg, respectively (Table, 1).

Fifteen lactating buffaloes (7±1 years old, average body weight 589±10 kg and 5±1 number of lactation) 7 days post partum were divided to three groups according to milk production and lactation to study the effect of the level of selenium enriched yeast supplementation on the some production traits using complete random block design experiment with 90 days period. Experimental rations were; control (60% CFM: 20% berseem clover: 20% rice straw), control ration plus 10 and 20 g/head/day selenium enriched yeast, which contained 10 and 20 mg/head/day selenium (selenium enriched yeast) for treatments 1 and 2, respectively. Selenium content in the control, T_1 and T_2 diets were 0.38, 10.38 and 20.38 mg/kg, respectively (Table, 1).

The CFM consisted of 35% yellow corn, 25 % wheat bran, 22% decorticated cotton seed meal, 15% rice bran, 1.5% ground limestone and 1.5% common salt. The chemical composition of ingredients is shown in Table (1). The offered feeds were assessed to cover the requirements for each animal (A.R.C. 1983). The CFM for each animal was offered individually once daily at 8.00 am, while berseem clover and rice straw were offered at 10.00 am and 4.00 pm. Dry matter intake was measured during the last refusals of the previous day. Water was available to animals at all times.

Selenium determination procedure

Samples of feeds, milk and blood were analyzed for selenium concentration using a fluorometric method described by Muniz-Naveiro *et al.* (2007). Se was determined by HG-AFS. Hydride generation was carried out by adding 5ml min−1 NaBH4 (0.8% (w/v)) in 1% (w/v) NaOH. An Ar flow of 250 ml min−1 was used to carry the Se-hydrides to the gas–liquid separator. An H2 stream (50 ml min−1) was used to obtain a good diffusion flame. In order to dry the Se-hydride a permapure system was used with

a 2.5 l min−1 N2 flow. The primary current of the discharge hollow cathode lamp was set at 20mA and the boosted current at 25 mA.

Analysis of feed samples

Samples of ingredients and rations were analyzed for dry matter (DM), ash, crude fiber (CF), organic matter (OM) and ether extract (EE) according to methods of A.O.A.C. (1995), while nitrogen-free extract (NFE) was calculated.

Rumen fluid analysis

At the end of each period, rumen fluid samples were collected from each goat at 4 hours after the morning feeding by a stomach tube. The samples were strained through two layers of cheese cloth and then stored in glass bottles (10 ml) with 3 drops of toluene and a thin layer of paraffin oil just to cover the surface to stop microbial activity and to prevent volatilization and stored at –18°C till analysis. Ruminal pH was determined using a digital pH-meter, total nitrogen (TN), non-protein-nitrogen (NPN) and NH_3-N were determined according to A.O.A.C. (1995). True protein nitrogen (True-PN) was calculated by difference. Total volatile fatty acids (TVFA's) were determined by Gas chromatography method.

Digestibility trial

Simultaneously three apparent digestibility trials were carried out on three buffaloes of each group and repeated each 30 days of the experimental period. Grab sample method was used and silica (4 mol HCl insoluble ash) as internal marker was applied for determining the apparent digestibility. Feces grab samples were collected at 8.00 a.m. for three successive days from each animal. Solution of 10% H_2SO_4 were added to the representative samples then dried in oven at 70°C for 24 hours. The dried feces samples from each animal were mixed and stored at -18°C for chemical analysis. The digestibility coefficient was calculated according to the following formula according to Gallups *et al.*, (1945) and Forbes and Garrigus (1948):

$$Digestibility = 100 - \left[100 \, x \, \frac{\%\ indicator\ in\ feed}{\%\ indicator\ in\ feces} \, x \, \frac{\%\ nutrient\ in\ feces}{\%\ nutrient\ in\ feed} \right]$$

Sampling and analysis of milk

Individual milk samples were collected every two weeks of the experimental period (90 days). The buffaloes were hand-milked (twice daily), milk yield was recorded and pH of milk was determined (Ling, 1963). Milk samples were also analyzed for fat, total solids (TS), total protein (TP), ash (Ling, 1963) and lactose (Barnett and Abd El-Tawab, 1957). Solids-not-fat (SNF) was calculated by difference.

Sampling and analysis of Blood serum

Blood samples were collected from the jugular vein of each animal (buffaloes) at the last day of each period (4 hours after morning feeding). The collected blood samples were centrifuged at 4000 r.p.m. for 20 minutes to separate the serum. The obtained serum was stored at –18°C till analysis. Blood serum was analyzed for total protein (Armstrong and Carr, 1964), albumin (Doumas *et al.* 1971), urea (Patton and Crouch, 1977), glucose (Siest

et al., 1981), and serum AST and ALT activities (Reitman and Frankel, 1957). Globulin and albumin/globulin ratio were calculated.

Statistical analysis

Data obtained from this study were statistically analyzed according to procedures outlined by Snedecor and Cochran (1982). The procedure was;

1- Latin square design for rumen liquor data using the following general linear model procedure:

$$Y_{ijkl} = \mu + R_i + C_j + T_k + e_{ijkl}.$$

Where Y_{ijkl} is the parameter under analysis of the ijkl goat, μ is the overall mean, R_i is the effect due to the period, C_j is the effect due to the animals on the parameter under analysis, T_k is the effect due to treatment, e_{ijk} is the experimental error for ijk on the observation.

2- Complete random block design was applied for milk, blood and digestibility data using the following general linear model procedure:

$$Y_{ijk} = \mu + R_i + T_k + e_{ijk}.$$

Where Y_{ijk} is the parameter under analysis of the ijk goat, μ is the overall mean, R_i is the effect due to the lactation period, T_k is the effect due to treatment, e_{ijk} is the experimental error for ijk on the observation.

The Duncan's multiple range test (Duncan, 1955) was used to test the significance between means.

RESULTS AND DISCUSSION

Rumen fluid parameters

Effects of treatments on characteristics of ruminal fermentation are shown in Table (2). Ruminal fluid pH values were significantly higher ($P<0.05$) in selenium enriched yeast treated groups than control. All values were above pH 6.0 which indicated a better digestion of cellulolytic materials (Mertens, 1978). Also, TVFA's value was slightly increased with animals fed low amount of selenium enriched yeast while high amount slightly decreased the amount of TVFAs as compared to the control group. The major effect of yeast on ruminal fermentation included an increase of VFA's and propionate concentration (Lila *et al.*, 2004). Also, selenium was identified as a part of cellular glutathione peroxidase, which provided evidence for selenium involvement in other metabolic processes of rumen microorganisms (Heider and Bock, 1993).

Ruminal fluid total nitrogen was significantly increased ($P<0.05$) with animals fed low selenium enriched yeast as compared to other treatments, ruminal true protein nitrogen was decreased ($P>0.05$) in the group fed high amount of selenium enriched yeast as compared to other treatments. These results may be due to negative effect of higher selenium consumed in high selenized yeast group. These results are in agreement with Kholif and Khorshed (2006). It is important to note that, the highest values of rumen total nitrogen and TVFA's which observed with animals fed with low amount of selenium enriched yeast as compared to other treatments led to conclude the highest improvements of rumen environment and microflora activity which produced more microbial protein. Hieder and Bock (1993)

Table (1) : Chemical composition of concentrate feed mixture (CFM), rice straw (RS) and berseem clover (BC) (% Dry matter basis) and calculated rations.

Item	Ingredients %			Calculated rations		
	CFM	RS	BC	Control	T_1	T_2
Dry matter	90.03	93.39	82.90	89.27	89.27	89.27
Organic matter	90.00	86.77	86.30	88.61	88.61	88.61
Ash	10.00	13.23	13.70	11.39	11.39	11.39
Crude protein	14.67	3.96	11.10	11.81	11.81	11.81
Ether extract	3.33	4.55	2.90	3.49	3.49	3.49
Crude fiber	13.00	35.5	31.50	21.2	21.2	21.2
NFE	59.00	42.76	40.80	52.00	52.00	52.00
Selenium (mg/kg)[1]	--	--	--	0.38	2.88	4.88
Selenium (mg/kg)[2]	--	--	--	0.38	10.38	20.38

NFE = Nitrogen-free-extract, [1]for goats rations; [2]for buffaloes rations

Table (2): Rumen fluid parameters of goats with selenium enriched yeast supplemented rations.

Item	Control	Low selenium enriched yeast	High selenium enriched yeast	±SE
pH	6.30^b	6.39^a	6.38^a	0.036
TVFA's (m.eq/100ml)	6.65	6.99	6.32	0.125
Total nitrogen (mg/100ml)	146.71^b	152.63^a	147.30^b	0.315
Non protein nitrogen (mg/100ml)	59.36^b	65.35^a	62.14^a	0.425
True protein nitrogen (mg/100ml)	87.35	87.28	85.16	0.146
Ammonia nitrogen (mg/100ml)	30.96	28.66	29.65	0.355

Table (3): Digestibility coefficients of nutrients as affected by supplementing lactating buffalo's rations with selenium enriched yeast.

Item	Control	Low selenium enriched yeast	High selenium enriched yeast	±SE
DM	52.95^b	60.08^a	58.49^a	0.120
OM	57.18^b	61.82^a	59.48^b	0.143
CP	52.27^b	63.22^a	60.60^a	0.352
EE	60.11	60.67	60.24	0.253
CF	57.21^b	62.40^a	60.65^{ab}	0.206
NFE	59.64	61.99	60.82	0.356

^{a,b,c} means with different superscripts are significant ($P<0.05$) difference.

suggested that selenium was identified as a part of cellular glutathione peroxidase, which provided evidence for selenium involvement in other microbial metabolic process. It has been suggested that increased bacterial flora in animals fed *S. cerevisiae* is central to the action of yeast in the rumen and increased bacterial population leads to an increase in both the degradation of fiber in the rumen and the flow of microbial protein from the rumen (Wallace and Newbold, 1992).

Ruminal non protein nitrogen was increased ($P<0.05$) while, ruminal ammonia-N was slightly decreased by selenium enriched yeast supplementation. These results may be due to ammonia-N absorption to ruminal wall or higher utilization of ammonia-N for microbial protein formation. Ammonia-N concentration was not modified by the addition of selenium enriched yeast which was similar to the results of Mutsvangwa *et al.* (1992) in lactating dairy cows fed yeast (10 g/d) moreover, Heider and Bock, (1993) noted that selenium was improved metabolic processes of microorganisms. Values of ammonia-N seemed to be sufficient to cover the microbial demands for microbial protein synthesis as obtained from the reports of previous investigators (Erdmann *et al.*, 1986).

Digestibility of nutrients

Data of Table (3) showed that apparent digestibility of dry matter and crude protein were significantly increased ($P<0.05$) in animals fed ration supplemented with selenium enriched yeast compared with control. Also, digestibility of organic matter and crude fiber were significantly increased ($P<0.05$) with animals fed low amount of selenium enriched yeast followed by high amount of selenium enriched yeast and then control. Digestibility of ether extract and nitrogen free extract followed the same trend, however, the effect of selenium enriched yeast failed to be significant. Similar results were obtained by El-Ashry *et al.*, (2001) with yeast and Kholif and Khorshed (2006) with selenium enriched yeast. The improvements of crude fiber digestibility may be due to the increase of the numbers of rumen total viable bacteria and cellulolytic bacteria with animals fed yeast (Lila *et al.*, 2004 and Newbold *et al.*, 1995). Williams and Newbold (1990) suggested that yeast culture alter the site of digestion and that total tract digestibility.

Dry matter intake

Dry matter intake (Table, 4) did not differ among treatments, being 17.50, 17.84 and 17.59 kg/head/d in control, low and high selenized yeast, respectively. The animals of low selenized yeast treated group consumed slightly higher amount of dry matter than other treatments. Values of grams consumed/kg metabolic body size (MBS) were similar among treatments being 146.32, 149.04 and 147.32 g/MBS in control, low and high selenized yeast, respectively. These results are in agreement with Kholif and Khorshed (2006). Weiss and Hogan (2005) observed that dry matter intake or dry matter as a percentage of body weight were not affected by either source or level of selenium supplemented to dairy cows ration.

Blood serum metabolites

Data in Table (4) showed blood serum parameters as affected by selenized yeast supplementation to goat rations. Diets

Table (4): Blood serum parameters as affected by supplementing lactating buffalo's rations with selenium enriched yeast.

Item	Control	Low selenium enriched yeast	High selenium enriched yeast	±SE
Total protein (gm/dl)	7.00	7.26	7.14	0.113
Albumin (gm/dl)	3.81	3.82	3.65	0.090
Globulin (gm/dl)	3.19	3.45	3.49	0.203
A/G ratio	1.31	1.17	1.14	0.153
Urea (mg/dl)	50.12	45.65	46.85	0.500
ALT (U/l)	40.64	42.37	35.63	0.503
AST (U/l)	13.19	16.19	13.57	0.243
Glucose (mg/dl)	63.99^{b}	74.35^{a}	73.72^{a}	0.440
Selenium (µg/L)	41^{c}	118^{b}	212^{a}	2.65

^{a,b,c,} means with different superscripts are significant (P<0.05) difference.

Table (5): Milk yield and composition as affected by supplementing lactating buffaloes rations with selenium enriched yeast.

Item	Control	Low selenium enriched yeast	High selenium enriched yeast	±SE
No. of animals	5	5	5	
Live body weight	589	590	588	1.125
Metabolic body size ($W^{0.75}$)	119.6	119.7	119.4	0.09
DM intake (kg/head/day)	17.50	17.84	17.59	1106
g DM/kg $W^{0.75}$	146.32	149.04	147.32	0.125
Milk yield (kg/d)	6.56^{b}	7.94^{a}	7.88^{a}	0.070
4% FCM (kg/d)	9.62^{b}	11.25^{a}	11.13^{a}	0.125
Milk composition %				
Fat (%)	7.11	6.78	6.75	0.12
Total solids (%)	16.27	16.51	16.21	0.10
SNF (%)	9.16^{b}	9.73^{a}	9.46^{ab}	0.09
Protein (%)	4.04^{b}	4.46^{a}	4.19^{ab}	0.063
Lactose (%)	4.23	4.49	4.56	0.047
Ash (%)	0.78	0.76	0.70	0.047
Acidity %	0.17	0.16	0.16	0.010
PH value	6.78	6.80	6.87	0.03
Selenium (µg/L)	46^{c}	132^{b}	210^{a}	3.25
Feed efficiency:				
Milk yield/DMI	0.375^{b}	0.445^{a}	0.448^{a}	0.758
FCM yield/DMI	0.549^{b}	0.631^{a}	0.633^{a}	0.563

^{a,b,c,} means with different superscripts are significant (P<0.05) difference.

containing selenized yeast did not affect serum total protein, albumin and globulin, while, serum A/G ratio and urea nitrogen tended to be lower than control. Blood serum alanine-aminotransferase (ALT) and aspartate-aminotransferase (AST) values were not significantly affected by treatments. There was no indication of adverse effects on cow health associated with the use of selenium enriched yeast. Similar results were obtained by Kholif and Khorshed (2006).

Serum glucose value (P<0.05), which increased with animals fed selenized yeast compared with control. These results may be due to the improvements occurred in metabolic process as a selenium and yeast response. Serum glucose had the same trend of milk yield (Table, 4) which was in accordance with the results of Clark *et al.* (1977) who claimed a positive correlation between blood glucose and milk yield. Blood serum selenium concentration was higher (P<0.05) for animals fed selenium enriched yeast than control also, higher level of selenium enriched yeast diet increased (P<0.05) selenium concentration of blood serum compared with low level diet (Table, 4).

Milk yield and composition

Data of milk and milk constituent yields of the experimental buffaloes are summarized in Table (5). Milk yield was significantly (P<0.05) higher in selenized yeast supplemented groups representing an increase of about 21.03 and 20.12 % for low and high selenized yeast, respectively, than buffaloes receiving control. Also, 4% FCM was significantly (P<0.05) higher in selenized yeast supplemented groups representing an increase of about 16.94 and 15.70 % for low and high selenized yeast, respectively, than buffaloes receiving control.

Milk protein and solids not fat contents were highest (P<0.05) in low followed by high selenized yeast and then control. Selenium is an important trace element for human health, necessary for the formation and function of at least 13 proteins and a component of glutathione peroxidase enzyme, mainly in the form of selenocysteine (Rayman, 2004). From these data we can conclude the positive effect of selenium on the metabolic process in the mammary gland, which led to the increase of milk protein and solids not fat synthesis. Also, milk lactose content was insignificantly higher in animals fed selenized yeast compared with control. The higher milk yield with the animals fed selenized yeast supplemented ration might be attributed to the positive effect of yeast on the rumen microflora and digestibility of organic matter and its nutrients as shown in Table (3). These results also may probably be attributed to the higher of blood serum glucose and albumin concentration of animals fed yeast supplemented ration as shown in Table (4). It led to an increase in milk lactose synthesis and consequently milk production being increase. Similar results were obtained by Kholif and Khorshed (2006).

Milk fat content was insignificantly decreased with selenized yeast treated groups compared with control. This decrease may be due to the dilution rate of higher milk yield of selenized yeast treated groups. However, milk total solid was not affected by treatments. Milk ash content was slightly lower in animals fed high

selenized yeast than other treatments. Milk pH value was higher and milk acidity was lower in animals fed selenium enriched yeast than control. Weiss and Hogan (2005) observed that milk yield or milk composition was not affected by selenium source or level supplemented to dairy cows ration. Generally, feed efficiency calculated as milk yield / DMI and 4% FCM / DMI were significantly improved ($P<0.05$) with animals fed selenized yeast supplemented ration compared with control.

Selenium concentration of milk was higher ($P<0.05$) for animals fed selenium enriched yeast than control also, higher level of selenium enriched yeast diet increased ($P<0.05$) selenium concentration of milk compared with low level diet (Table, 5). The concentrations of Se in colostrum and milk were 1.5 to 2.0 times greater ($P<0.01$) for cows fed Se-yeast than for cows fed selenate (Weiss and Hogan, 2005). From a summary of ten previous studies, Weiss (2005) reported that the concentration of Se in milk from cows fed Se-yeast was 1.9 times greater than for milk from cows fed selenite or selenate. Also, Juniper *et al.* (2006) found significant positive linear effects of increasing dietary selenium derived from selenized yeast on selenium concentrations in the milk, blood, urine, and feces.

Researchers found evidence for selenium as cancer-protective agent (Ip and Lisk, 1994). Therefore, selenium must be provided to human and animals as a part of nutritional intake. If high-Se products are to be produced for human nutrition, it is important to be able to develop feeding systems that produce milk with consistent and predictable Se concentrations.

CONCLUSION

Supplementing the daily ration of buffaloes with selenized yeast (10 g/head/day selenized yeast - contained 10 mg/head/day organic selenium) improved rumen fermentation and nutrients digestibility coefficients. Also, it improved feed efficiency, milk production and composition with no deleterious effect on general health of treated animals. Lactating buffaloes have a positive response to organic selenium supplementation, however the individual effect of yeast and/or selenium did not differentiate except the higher level of selenium in milk.

REFERENCES

A.O.A.C. (1995). Official Methods of Analysis. 16th Ed. Vol. 1, "Agricultural, Chemicals, Contaminats, Drugs". Washington, D. C., USA.

A.R.C. (1983) . The Nutrient Requirement of Livestock. no.2 Ruminants Tech . Rev. and summaries Agric. Res. Council , London, UK.

Armstrong, W. D. and C. W. Carr (1964). Physiological Chemistry: Laboratory Directions, 3rd ed. PP. 75, Bures Publishing Co. Minneapolis, Minnesota, USA.

Barnett A. J. G. and G. Abd El-Tawab (1957). Determination of lactose in milk and cheese. J. Sci. Food Agric., 8: 437.

Cawley, G.D., (1987). Selenium and weak calf syndrome. Vet. Rec. 120, 47.

Clark, J. H.; H. R. Derring and M. R. Bennink (1977). Milk production, nitrogen utilization and glucose synthesis in lactating cows infused postruminal with sodium caseinate and glucose. J. Nutrition, 107: 631.

Corah, L.R., Ives, S., (1991). The effects of essential trace minerals on reproduction in beef cattle. Vet. Clin. North Am., Food Anim. Pract. 7, 41–57.

Doumas, B., W. Wabson and H. Biggs (1971). Albumin standards and measurement of serum with bromocresol green. Clin. Chem. Acta, 31: 87.

Duncan, D.B. (1955). Multiple range and multiple F tests. Biometrics, 11: 1.

El-Ashry M. A., A. M. Kholif, H. A. El-Alamy, H. M. El-Sayed and T. A. El-Hamamsy (2001). Effect of different yeast cultures supplementation to diet on the productive performance of lactating buffaloes. Egypt. J. Nutr. & Feeds, 4: 21-34.

El-Batal, A. L. and M. Fadel (2002). Production of high selenium yeast in pilot scale batch fermentation. Egypt. J. Biomed. Vol. 9, April, :87-98.

Erdmann R. A.; G. H. S. Proctor and J. H. Vandersall (1986). Rumen ammonia concentration on In situ rate and extent of digestion of feed stuffs. J. Dairy Sci., 69: 2312.

Forbes R. M. and W. P. Garrigus (1948). Application of a lignin ratio technique to the determination of the nutrient intake of grazing animals. J. Anim. Sci., 7: 373-382.

Gallup, W. D.; C. S. Hobbs and H. M. Briggs (1945). The use of silica as a reference substance in digestion trials with ruminants. J. Anim. Sci., 4: 68-71.

Gunter, S. A., P. A. Beck, and J. M. Phillips. (2003). Effects of supplementary selenium source on the performance and blood measurements in beef cows and their calves. J. Anim. Sci. 81:856–864.

Guyot, H., Aliaoui, H., Rollin, F., (2004). Trace elements deficiencies in the pathogenesis of respiratory distress syndrome in the mature newborn calf. Proceedings: XXIII World Buiatrics Congress. Quebec, Canada, p. 20.

Guyot H., P. Spring, S. Andrieu, F. Rollin (2007). Comparative responses to sodium selenite and organic selenium supplements in Belgian Blue cows and calves. Livestock Science 11,1. 259–263.

Hall, T.J., (1987). Effect of selenium on calf pneumonia. Vet. Rec. 121, 599.

Heider, J. and A. Bock (1993). Selenium metabolism in microorganisms. Adv. Microb. Physiol. 25: 71-109.

Hidiroglou, M., Jenkins, K.J. (1968). Factors affecting the development of nutritional muscular dystrophy in northern Ontario. Can. J. Anim. Sci. 48, 7–14.

Ip, C. and D. J. Lisk (1994). Characterization of tissue selenium profiles and anticarcinogenic response in rat fed natural source of selenium rich product. Carsinogenesis.15:573-576.

Juniper D. T., R. H. Phipps, A. K. Jones and G. Bertin (2006). Selenium Supplementation of Lactating Dairy Cows: Effect on Selenium

Concentration in Blood, Milk, Urine, and Feces. J. Dairy Sci. 89:3544-3551.

Kholif, S. M. And M.M. Khorshed (2006). Effect of yeast or selenized yeast supplementation to rations on the productive performance of lactating buffaloes. Egyptian J. Nutr. And Feeds, 9 (2) :193-205.

Kim,Y.Y. and D.C., Mahan (2001). Comparative effects of high dietary levels of organic and inorganic Se on Se toxicity of growing finishing pigs. J. Anim. Sci. 79, 942–948.

Lila Z. A., N. Mohammed, T. Yasui, Y. Kurokawa, S. Kanda and H. Itabashi (2004). Effects of a twin strain of Saccharomyces cerevisiae live cells on mixed Ruminal microorganism fermentation in vitro. J. Anim. Sci. 82:1847-1854.

Ling E. R. (1963). "Text Book of Dairy Chemistry" Vol. II. Practical, 3rd ed Chapman and Hall, L.T.D., London, UK.

Mertens, D. R. (1978). Effect of buffers upon fiber digestion. Invited paper at Regulation of Acid-Base Balance Symposium, 8:9, PP. 65, Arizona Inn, Tucson, Arizona.

Muniz-Naveiro O., R. Dominguez-Gonzalez, A. Bermejo-Barrera, P. Bermejo-Barrera, J. A. Cocho, J. M. Fraga (2007). Selenium speciation in cow milk obtained after supplementation with different selenium forms to the cow feed using liquid chromatography coupled with hydride generation-atomic fluorescence spectrometry. Talanta, 71: 1587–1593.

Mutsvangwa, T., I. E. Edwards, J. H. Topps and G. F. M. Paterson. (1992). The effect of dietary inclusion of yeast culture (Yea-Sacc) on patterns of rumen fermentation, food intake and growth of intensively fed bulls. Anim. Prod. 55:35–41.

Newbold, C. J., R. J. Wallace and F. M. McIntosh. (1995). Different strains of *Saccharomyces cerevisiae* differ in their effects on ruminal bacterial numbers in-vitro and in sheep. J. Anim. Sci. 73:1811–1818.

NRC, (1980). Mineral Tolerance of Domestic Animals. National Academy Press, Washington, DC.

Ortman, K., and B. Pehrson. (1999). Effect of selenate as a feed supplement in dairy cows in comparison to selenite and selenium yeast. J. Anim. Sci. 77:3365–3370.

Patton C.J. and S. R. Crouch (1977). Spectrophotometric and kinetics investigation of the berthelot reaction for the determination of ammonia. Anal. Chem.., 49: 469.

Rayman, M. P. (2004). The use of high-selenium yeast to raise selenium status: How does it measure up? Br. J. Nutr. 92:557–573.

Reitman, S. and S. Frankel (1957). Colorimetric method for the determination of serum glutamic-oxaloacetic and glutamic – pyrovate transaminase. An. J. clin. Path., 28: 56.

Siest G., J. Henny and F. Schiele (1981). Interpretation des examens de laboratoire. Karger ed. 206.

Smith, L.K., J.S. Hogan, W.P. Weiss (1997). Dietary vitamin E and selenium affect mastitis and milk quality. J. Anim. Sci. 75, 1659–1665.

Snedecor, G. W. and W. G. Cochran (1982). Statistical Methods. 7th ed. Iowa State Unvi. Press, Ames, Iowa, USA.

Wallace R. J., and C. J. Newbold (1992). Probiotics for ruminants. Page 317 in Probiotics: The Scientific Basis. R. Fuller, ed. Chapman and Hall, London, U.K.

Weiss, W. P. (2005). Selenium sources for dairy cattle. Pages 61–71 in Proc. Tri-State Dairy Nutr. Conf., Ft. Wayne, IN. Dept. of Anim. Sci., The Ohio State Univ., Columbus.

Weiss W. P. and J. S. Hogan (2005). Effect of selenium source on selenium status, neutrophil function, and response to intramammary endotoxin challenge of dairy cows. J. Dairy Sci. 88:4366-4374.

Zust, J., B. Hrovatin, and B. Simundic (1996). Assessment of selenium and vitamin E in dairy herds and clinical disease in calves. Vet. Rec. 139, 391–394.

تأثير مستوى إضافة الخميرة المدعمة بالسيلينيوم إلى العليقه على الأداء الإنتاجي للجاموس الحلاب

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أجريت تجربتين فى هذه الدراسة ففى التجربة الأولى تم استخدام ستة ذكور ماعز بلدى مخصية لدراسة تأثيرمستوى إضافة الخميرة المدعمة بالسيلينيوم على نشاط الكرش باستخدام نظام المربع اللاتينى 3x3 حيث تغذت الحيوانات على العلائق التالية:

1- المجموعة الأولى (المقارنة): 60% علف مركز +20% برسيم أخضر+20% قش أرز.
2- المجموعة الثانية: عليقه المقارنة + 2.5 جم خميرة مدعمة بالسيلينيوم (2.5ملجم) / رأس/يوم.
3- المجموعة الثالثة: عليقه المقارنة + 4.5 جم خميرة مدعمة بالسيلينيوم (4.5ملجم) / رأس/يوم.

وقد أشارت النتائج إلى حدوث ارتفاع فى تركيز كل من النيتروجين الكلى معنويا (على مستوى 5%) فى الكرش مع المستوى الأقل من الخميرة المدعمة بالسيلينيوم عن باقى المعاملات. كما أن الحيوانات المغذاة على الخميرة المدعمة بالسيلينيوم ارتفع بها النيتروجين الغير بروتينى و pH معنويا (على مستوى 5%) مقارنة بالمجموعة الأولى.

وفى التجربة الثانية تم استخدام 15 جاموسة حلابة لدراسة تأثير إضافة الخميرة المدعمة بالسيلينيوم على الأداء الإنتاجي للجاموس الحلاب. حيث قسمت الحيوانات الى ثلاثة مجموعات باستخدام نظام القطاعات العشوائية حيث تغذت الحيوانات على العلائق التالية:

1- المجموعة الأولى (المقارنة): علف مركز60% + برسيم أخضر20% + قش أرز20%.
2- المجموعة الثانية: عليقه المقارنة +10 جم خميرة مدعمة بالسيلينيوم (10ملجم) / رأس/يوم.
3- المجموعة الثالثة: عليقه المقارنة +20 جم خميرة مدعمة بالسيلينيوم (20ملجم)/ رأس/يوم.

وكانت أهم النتائج المتحصل عليها كما يلى:

1- ارتفع معامل الهضم معنويا (على مستوى 5%) لكل من المادة الجافة و العضوية والبروتين الخام والألياف الخام للجواميس التى تغذت على المستوى الأقل من الخميرة المدعمة بالسيلينيوم مقارنة بالمجموعة الأولى.
2- ارتفع إنتاج اللبن واللبن المعدل نسبة الدهن 4% معنويا (على مستوى 5%) ونتيجة لذلك ارتفع محصول كل مكونات اللبن بإضافة الخميرة المدعمة بالسيلينيوم بمستوييها مقارنة بالمجموعة الأولى. كما ارتفعت نسبة بروتين اللبن و الجوامد اللادهنية معنويا (على مستوى 5%) بإضافة المستوى الأقل من خميرة السيلينيوم تبعتها إضافة المستوى الأعلى من خميرة السيلينيوم مقارنة بالمجموعة الأولى.
3- ارتفع معدل الاستفادة من الغذاء معنويا (على مستوى 5%) بإضافة كلا المستويين من خميرة السيلينيوم.
4- ارتفع جلوكوز الدم معنويا (على مستوى 5%) بإضافة كلا المستويين من خميرة السيلينيوم لعلائق الجاموس الحلاب.

ومن هذه النتائج يتضح ان اضافة خميرة السيلينيوم بمستوى 4.5 جم / رأس / يوم للجاموس الحلاب قد حسن من معاملات الهضم وإنتاج اللبن وتركيبه. وبرغم وجود السيلينيوم غير العضوى فى العلائق، إلا أن إضافة السيلينيوم العضوى فى صورة خميرة السيلينيوم إلى علائق الجاموس الحلاب قد اثر ايجابيا على أداء الجاموس الحلاب ولذلك يوصى بإضافة خميرة السيلينيوم لتدعيم نقص الاستفادة من السيلينيوم فى أغذية الحيوانات الحلابة دون التأثير على صحة الحيوان.