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Productive Performance of Lactating Buffaloes Fed Rations Containing some Feed Additives under Summer Season in Egypt.

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ABSTRACT

This study was conducted to compare the effect of supplementing yeast combined with chromium methionine (Cr-Met) or niacin or their mixture into rations of lactating buffaloes on their productive performance over 120 days of an experimental period under summer season conditions. Twelve lactating buffalos with an average 550 Kg live body weight and in their 4th or 5th seasons at mid-lactation, were divided randomly into four similar groups (three buffaloes per group) according to their live body weight and milk yield. Dietary treatments (on DM) were as follows: (T1) control ration that free from feed additives, T2: control ration plus 10g yeast + 5g Cr-Met, T3: control ration plus 10g yeast + 5g niacin and T4: control ration plus 10g yeast + 5g Cr-Met + 5g niacin. The experimental rations were formulated to cover maintenance and production allowance according to Kearl (1982) for dairy cattle. Results indicated that supplementing lactating buffalo rations with different feed additives (T2, T3 and T4) improved the digestibility of most nutrients and feeding values as TDN and DCP than those of control one (T1). No significant differences were found respecting most blood serum constituents among all groups of lactating buffaloes, except globulin concentration was significantly ($P<0.05$) lower with those fed tested rations compared with that of control group. The 7% - FCM yield was significantly ($P<0.05$) higher for all tested rations (T2, T3 and T4) than that of control one (T1). Also, 7% - FCM yield of both tested rations (T3 and T4) was significantly ($P<0.05$) higher than that in tested one (T2), being the highest value was recorded with T4 ration that supplemented with the mixture of additives (yeast - Cr-Met - niacin). The daily 7% - FCM yield was increased by (11.18%) for T2, (15.91%) for T3 and (18.43%) for T4 supplemented rations compared with unsupplemented ration (T1). Milk composition was not affected by any treatments except lactose percentage which was significantly ($P<0.05$) decreased with those fed T2 – ration compared with those fed other experimental rations (T1, T3 and T4). Likewise, feed conversion was significantly ($P<0.05$) improved with all animals fed tested rations (containing feed additives) being the best improvement was occurred with mixture of supplements (yeast plus Cr-Met and niacin). Meanwhile, relative economic efficiency was 5.3, 6.5 and 7.8 % for tested rations T2, T3 and T4, respectively being better than that of control one (T1). Generally, from the obtained results indicated that the supplementation of different feed additives to lactating buffalo rations had positive effects on digestibility, feeding value, some blood serum parameter, milk yield and economic efficiency.

Keywords: lactating Buffaloes, chromium methionine, niacin, yeast, digestibility, blood parameters, milk production, economical efficiency.

INTRODUCTION

Buffaloes are the major source of producing meat and milk in Egypt, and their productive performance is greatly affected by many physiological and environments factors. Heat stress and humidity are considering an environmental two main factors responsible for the reduction in animal production economically during summer season (Pierre *et al*., 2003). Such dysconditions could be led to decrease milk yield between 10 to 35% in mid-lactating dairy cows (Rhoads *et al*., 2009), and 14% in early lactation period (Lacetera *et al*., 1996), as well as affect worsely on milk composition (El-Khashab, 2010). The adverse impact of heat stress on milk production by reduction dry matter intake and decrease the nutrients uptake (McGuire *et al*. 1989) led to a negative energy balance as well as increase the maintenance requirements (Collier *et al*., 2005). Moreover, such stress also adversely affect rumen health and its functions (Baumgard and Rhoads 2012). Furthermore, under heat stress conditions Smith and Teeter (1987) indicated that the increasing mineral excretion led to healthy problems, therefore, cause serious economic losses (Pierre *et al*., 2003). Commonly, some reports indicated that the suitable temperature for milk production of dairy cattle is between - 0.5° and 25°C (West, 2003). On the other hand, buffaloes are more susceptible to heat stress as compared to other farm animals (Das *et al*., 1999) because the dark body color and rarely distributed sweat glands. For these reasons, it's important to reduce the heat stress in order to maintain good health status and high productive efficiency. Ultimately, one of the key management factors of reducing the effectiveness of heat stress on animals performance is the nutritional strategies that can potentially help to maintain animal health and productive efficiency (Collier *et al*., 2006). Some nutritional strategies that can be effectively reduce the damage of heat stress could be induced by reducing the ratio of roughage to concentrate that may led to an increases in dry matter intake yet, the studies indicated that dairy cows fed high concentrate (energy) and low fiber diets during heat stress could be improve DMI and milk yield. Moreover, addition of feed additives for instance, yeast that have been effectively alleviate the heat stress conditions and also to stabilize rumen health and its functions to be in maximal modulation favorably for rumen microorganism. It also altered microbial protein activities in the rumen and total bacterial number particularly the cellulolytic one that increasing the rate of fiber digestion (Offer and Cruive, 1991). On the other hand, many studies with dairy cows (Bruno *et al*. 2009 and Shwartz *et al*., 2009) reported that yeast culture addition increased feed intake during heat stress and milk production. Moreover, niacin supplementation led to increase microbial protein synthesis in the rumen and protozoa numbers as well (Erickson *et al*., 1990), propionate production (Riddell *et al*., 1980), cellulose digestion (Horner *et al.,* 1988a) and improve energy utilization (Zimbelman *et al*., 2010). In some studies, improvement of milk production and persistency in dairy cows were found with rations supplemented with niacin (Madison-Anderson *et al*., 1997), and also increased milk protein percentage (Minor *et al*., 1998). likewise, chromium is an essential element for potentiates insulin action (NRC, 2001), and thus play a vital role in carbohydrates, lipids and proteins metabolism (Vincent, 1999). Chromium supplementation has shown to be effective for alleviating the negative effects of environmental stresses and thereby improving productive performance of farm animals (Amata, 2013), improving immunity (Spears, 2000), increase growth performance in growing and finishing ruminant animals (Amata, 2013), with growing heifers (Spears *et al*., 2012), mature dairy cows (Leiva *et al*., 2014), and lastly increased DMI, and milk yield of dairy cows (McNamara and Valdez 2005). It can also improve metabolic rate by improving thyroid hormones (Burton, 1995). Furthermore, during stress periods, the chromium excretion in the urine usually led to increases the chromium requirements. Therefore, important recommendation with supplemental dietary chromium for animals undergoing environmental stress was recorded by (NRC, 1997).

Therefore, the objectives of this study were to evaluate the effects of supplementing yeast mixed with chromium methionine, or niacin or their mixture into racions of lactating buffaloes on feed intake, nutrients digestibility, milk production and composition, some blood serum parameters status and economic efficiency under summer season conditions.

MATERIALS AND METHODS

This study was conducted at Rewinh buffalo production farm belongs to the Agricultural production sector, Agriculture Research Center, Ministry of Agriculture, Kafr El Shiekh Governorate, Egypt, to evaluate the effect of feeding lactating buffaloes on diets supplemented with yeast mixed with chromium methionine or niacin or its mixture on their productive performance.

Animals and rations:

This study was carried out during summer season (June tell September 2017) and lasted for 120 days. Twelve lactating buffaloes in their 4^{th} or 5^{th} seasons at mid-lactation and weighed in average 550 kg were divided randomly into four similar groups (three buffaloes per group) according to their live body weight and milk yield. Dietary treatments (on DM basis) were as follows: (T1) control ration that unsupplemented with feed additives, T2: control ration plus 10g yeast (Dox-al,DXThepax100R (strain GSH351) containing $5x10^9$ cells/g (European patent n.0111202-European patent n.98116181.3) + 5g chromium methionine (Cr-Met), consisting of Cr-Met complex 3.4% (consists of 0.1% chromium and 0.7% methionine), calcium carbonate 95.1% and mineral oil 1.5%, T3: control ration plus 10g yeast + 5g niacin and T4: control ration plus 10g yeast + 5g Cr-Met + 5g niacin. Feed additives (yeast, Cr-Met and niacin) were mixed with a CFM just before feeding in the morning along the experimental period. Control rations consisted of approximately 60% concentrate feed mixture (CFM) + 20% corn silage (CS) + 20% rice straw (RS) on dry matter basis. The CFM in mash form and consist of 40% corn yellow, 30% wheat bran, 8% soyabeen meal, 19% sunflower meal, 1.8% limestone 1% common salt and 0.2% mineral and vitamins premixes and chemical composition of the ingredients are present in Table (1). The experimental rations were formulated to cover maintenance and milk production allowance according to Kearl (1982) for dairy cattle. In addition, diets were offered twice daily and fresh water was allowed freely. All animals were vaccinated and treated in accordance of the established routine of the livestock and they injected with vitamins AD_3E to cover their requirements. Buffaloes were hand milked twice at 7 am and at 3 pm every day. Feed intake and daily milk yield of each buffalo were recorded daily along the experimental period. Milk samples were collected every two weeks (from consecutive the evening and morning milking in the same day) during the experimental period from each buffalo. The formula that given by Raafat and Saleh (1962) was used to convert the actual milk yield in 7% fat corrected milk as following :

7% - FCM = 0.265 x milk yield + 10.5 x fat yield

Feed conversion was calculated for the experimental rations as the amount of DM and TDN in kg required to produced one kg of 7% - FCM . Economic efficiency of milk production were expressed as the ratio between the price of daily FCM produced and the cost of daily feed consumed .

Digestibility trials:

Four digestibility trials were conducted to determine the digestibility and feeding values of experimental rations, using Acid insoluble Ash (AIA) as a natural marker as described by (Van Keulen and Young, 1977). Fecal grab samples of about 300g were collected from the rectum at the end of the feeding trial twice daily over 5- days period. Blood samples were collected from all animals at the end of digestibility trials before morning feeding from the jugular vein and after collection these samples were immediately centrifuged at 4000 rpm for 20 minutes and serum was separated and stored at -25 ^{0}C until analysis.

Laboratorial Analysis:

The chemical analysis of representative samples of feed and feces were analyzed according to (AOAC, 2000). Blood serum was separated from the whole blood to determine some blood serum parameters using commercial kits of Bio-Merieus, lab, France, following the same steps described by manufactories as the total protein, according to Armstrong and Carr (1964), albumin was analysed according to Doumas (1971) and globulin was calculated by subtracting the albumin value from total protein one. The activities of aspartate aminotransferase (AST) and alanine aminotransferase (ALT) were analysed according to Reitman and Frankal, (1957). Milk samples were analyzed for milk lactose, fat, protein, total solid (TS) and solid non-fat (SNF) concentrations by the Milkoscan system (Foss Electric Hillerod, 133B Milkoscan, Denmark).

Statistical analysis

Statistical analysis was carried out by General Linear Model procedures (GLM) described in SAS User's Guide (SAS, Institute 2003). Differences among treatment means were separated by Duncan's new multiple-range test (Duncan, 1955).

RESULTS AND DISCUSSION

Chemical composition of feedstuffs and experimental rations are presented in Table 1. Results showed that chemical composition of CFM, CS, RS and calculated composition of experimental rations are within the normal ranges which earlier reported in PSAN (1997), and by several other workers (Mostafa *et al.*, 2015 and Abou Elenin *et al.,* 2016).

Digestion coefficients and feeding values:

Data of digestion coefficients and feeding values of experimental rations are presented in Table 2. Data indicated that most nutrient digestibilities were significantly (P<0.05) higher with all tested rations than that in control one, being the differences among the tested rations did not significant differ in respect of most nutrient digestibilities excepted with OM and NFE digestibilities. The results of the present study could be emphasised on the potential beneficial effect of using the experimental feed additives for improving the rations digestibility of lactating buffaloes particularly under the heat stress condition of summer season in Egypt. Results here are similar with those reported by Mostafa *et al.* (2015) who noticed that addition two level of niacin to the rations of Friesian calves had increased the digestibility of dry matter of the consumed diets. Similarly, Kumar and Dass (2005) stated that niacin supplementation in diet of buffaloes had improved the rumen fermentation by decreasing ammonia–N concentration and increasing protein synthesis. On the other hand, the positive effect of supplementation of Cr-Met plus yeast are confirmed by the findings of Deka *et al.* (2015) who revealed that all nutrient digestibilities tended to increased with increasing the level of organic Cr from zero tell 1.5 mg/kg DM with lactating buffaloes. Moreover, Moawd *et al.* (2008) revealed that digestibility of most nutrients of the diets of lambs were significantly (P<0.05) higher with supplementation of organic chromium than those of unsupplemented one.

Table 1. Chemical composition of feed ingredients and calculated composition of the experimental rations.

Items	Chemical composition %						
	DM	OM	CP	CF	EE	NFE	Ash
Ingredients							
CFM*	92.85	91.65	16.40	11.99	2.75	60.51	8.35
CS	27.05	90.28	7.20	29.30	3.40	50.38	9.72
RS	88.02	82.62	4.26	36.64	1.82	39.90	17.38
Experimental rations:							
T1(control)	79.27	89.52	12.13	20.41	2.68	54.30	10.48
T2	78.34	89.55	12.05	20.55	2.70	54.25	10.46
T3	78.20	89.54	12.03	20.58	2.70	54.23	10.46
T4	78.35	89.50	11.95	20.74	2.70	54.11	10.50

***CFM; contained 40% yellow corn, 30% wheat bran, 8% soyabeen meal, 19% sunflower meal, 1.8% limestone 1% common salt and 0.2% mineral and vitamins. CS : Corn silage, RS : Rice straw.**

Table 2. Nutrient digestibilities and feeding values of experimental rations using lactating buffaloes.

Item	Dietary treatments				
	T1	T2	T3	T4	P. value
Digestibility %					
DM	$61.63^{b}\pm0.54$	$63.19^{a}\pm0.06$	$63.53^{a}\pm0.39$	$63.23^{a}\pm0.12$	0.02
OM	$65.96^{b}\pm0.35$	$67.18^{b}\pm0.15$	$67.84^{a}\pm0.24$	$67.90^{a}\pm0.08$	0.001
CP	$60.10^{b}\pm0.57$	$62.11^{a}\pm0.19$	$62.05^{a}\pm0.12$	$62.22^{a}\pm0.40$	0.01
CF	$43.74^{b}\pm0.69$	$46.46^{a}\pm0.50$	$45.12^{ab}\pm0.08$	$45.94^{a}\pm0.20$	0.01
EE	$69.22^{b}\pm0.91$	$72.32^{a}\pm0.45$	$70.65^{ab}\pm0.67$	$72.05^{a}\pm0.44$	0.03
NFE	$75.46^{b}\pm0.38$	$75.90^{b}\pm0.13$	$77.61^{a}\pm0.28$	$77.37^{a}\pm0.19$	0.0008
Feeding values (on DM basis) :					
TDN%	$61.37^{b}\pm0.38$	$62.59^{a}\pm0.16$	$63.13^{a}\pm0.27$	$63.21^{a}\pm0.07$	0.003
DCP%	7.29 ± 0.12	7.48 ± 0.04	7.47 ± 0.03	7.44 ± 0.05	0.21
DE (Mcal/Kg DMI) [A]	$2.71^{b}\pm0.18$	$2.76^{b}\pm0.007$	$2.78^{ab}\pm0.01$	$2.79^{a}\pm0.003$	0.005

[A]: DE (Mcal / Kg DMI) = 0.04409 x TDN%. (NRC, 1989).
a, b and c: Means in the same row with different superscripts are significantly different (P< 0.05).
T1: control, T2:5g Cr-Met +10g yeast, T3 : 5g niacin + 10g yeast and T4 : 5g Cr-Met + 5g niacin + 10g yeast.

Earlier the same effect of organic chromium supplement was found by El- Tahan *et al.* (2005) when fed lactating cows on concentrate feed mixture plus berseem hay. In contrary, Behnam *et al.* (2008) reported that no effect of niacin supplementation into the diets of dairy cows in early lactations on OM digestibility. Also, Kumar *et al.* (2013) proved that no influence of organic Cr addition in the diets of buffaloes calves on nutrient digestibilities under the condition of heat stress.

The feeding values of the experimental rations respecting TDN seemed to be significantly (P<0.05) higher with all tested rations than that of control one. While, the differences among all experimental treatments in respect of DCP values appeared to be statistically insignificant. Otherwise, the value of DE Mcal/kg DM of T4 (Cr-Met + niacin + yeast) was significantly (P<0.05) higher than those of control (T1) and tested ration (T2), but the other tested ones (T2 and T3) were similar to that of control in this item. The results indicated that the positive response of the different feed additives on nutrient digestibilities was reflected on the feeding values of the tested rations and control one. These results are in close agreement with those results of Mostafa *et al*. (2015) and Abou Elenin *et al.* (2016) who reported that a markedly improvement in TDN and DCP values when supplemented calve diets with niacin and thiamin especially with the high – concentrate diet.

Productive performance:

Feed intake and Feed conversion:

The results of daily feed intake that expressed as DM, TDN and DCP for lactating buffaloes are presented in Table 3. The DM intake was significantly (P<0.05) higher with supplemented tested rations compared with the unsupplemented ration (control). Similar trend among the experimented dietary treatments was observed with both TDN and DCP intakes. In fact, feed intake by ruminant animals potentially affecting by the digestion coefficients of rations consumed. For instance, in the present study feed intake (DM, TDN and DCP) significantly (P<0.05) increased as increasing the digestibility values of the tested ration in comparison with that of control one (Table 2). The results indicated that yeast with either Cr-Met or niacin and in combination together increased DM intake by 2.90, 5.19 and 6.11%, respectively than that of unsupplementation group (T1). Similarly, many studies with dairy cows (Bruno *et al.* 2009 and Shwartz *et al.* 2009) revealed that yeast culture addition increased feed intake during heat stress and lactation. Moreover, niacin supplemented under heat stress conditions by 12g in the diet for cows increased DMI by 3.6% relative to that of control ration (Costanzo *et al.,* 1997). On the contrast to the present findings, addition rumen-protected niacin under the mild and heat stress conditions (Rungruang *et al.* 2014) for Holstein cows diets had no effect on DM intake. Similar trend were observed by Horner *et al.* (1988b) and Erickson *et al.* (1992) with cows in early and mid – lactation. Regarding the Cr-Met response in the present study, similar results are obtained by (Hayirli *et al.* 2001, Soltan, 2010 and Khili *et al*. 2011) who reported that DMI increase with cows received Cr-Met supplemented diets during prepartum and postpartum. These data are in harmony with those of (Moonsie-Shageer and Mowat 1993, Barajas *et al.*, 2005, McNamara and Valdez 2005, Kraidees *et al.* 2009 and Soltan *et al.,* 2012). This animals response might be due to the positive metabolic action of chromium that alleviate the negative effect of heat stress (Almeida and Barajas 2002), and thereby improving productive performance of farm animals (Amata, 2013). Yet vice versa, results were obtained by (Kegley *et al.* 1997) who indicated that Cr-Met supplementation did not affect DMI in steers. Also, lack of affect DMI was observed by Moawd *et al*. (2008) when supplemented different level of organic Cr to the diets of fattening lambs.

Table 3. Average feed intake and feed conversion of lactating buffaloes fed the experimental rations.

Items	Experimental rations T1	T2	T3	T4	P value
Initial weight, kg	550	550	550	550	
Daily feed intake,(kg/h/) as DM:					
CFM	7.88	7.97	8.12	8.08	
CS	2.50	2.77	2.86	2.95	
RS	2.71	2.73	2.79	2.86	
Yeast	00	10	10	10	
Cr-Met	00	5	00	5	
Niacin	00	00	5	5	
Total daily intake (kg/h/d) as					
DM	13.09[c]± 0.04	13.47[b]± 0.19	13.77[ab]± 0.06	13.89[a]± 0.02	0.003
TDN	8.04[c]± 0.06	8.43[b]± 0.14	8.69[a]± 0.04	8.78[a]± 0.009	0.0007
DCP	0.95[b]± 0.01	1.01[a]± 0.02	1.03[a]± 0.004	1.03[a]± 0.007	0.003
Feed conversion (kg feed/kg 7% - FCM[1]):					
DM	2.06[a]± 0.007	1.91[b]± 0.03	1.87[bc]± 0.009	1.85[c]± 0.004	٠.0001
TDN	1.27[a]± 0.009	1.19[b]± 0.02	1.18[b]± 0.007	1.17[b]± 0.00	٠.001

[1]Fat corrected milk

a ,b and c means the same row with different superscripts differ (P<0.05).

T_1: control , T_2: 5g Cr-Met +10g yeast, T_3 : 5g niacin +10g yeast and T_4 : 5g Cr-Met + 5g niacin +10g yeast

Also, data in Table 3 indicated that significant (P<0.05) improvement in feed conversion respecting kg DM or TDN per kg 7% - FCM with all tested rations in comparison with control one, being the best one was associated with T4 treatment that supplemented with those of combined additives of (yeast, chromium and niacin). These findings are in agreement with those obtained by Moawd *et al*. (2008) who found that marked improvement in feed conversion when lambs fed diets containing different levels of organic chromium. Also, similar results are recorded by Meherz *et al.* (2004) who concluded that yeast supplementation to the diets of lambs had favorable effect on feed conversion as DM or TDN per kg weight gain. On the other hand, Mostafa *et al*. (2015) indicated that insignificant improvement in feed conversion (DM: gain) when fed growing – fattening calves diets supplemented with 500 or 1000 mg niacin per head daily.

Milk yield and composition :

Milk yield and composition are presented in Table 4. The average milk yield were (6.11, 6.55, 7.11 and 6.99 Kg/h/d) for rations T1, T2, T3 and T4, respectively. Feed additives led to an increase in milk yield by 7.20, 16.37, and 14.40%, for tested rations T2, T3 and T4, respectively in comparison to control one T1. Also, results showed that milk yield was significantly (P<0.05) higher with rations T3 and T4 than that in tested ration T2 and the control one T1, being milk yield also was significantly (P<0.05) higher with ration T2 than that with control group. Similar trend among treatments regarding 7% - FCM yield was observed, where the daily 7% - FCM yield was increased by (11.18 %) for T2, (15.91%) for T3 and (18.43%) for T4 supplemented rations compared with unsupplemented ration (T1). These results might be due to the increases in nutrient digestibilities and feeding values for T2, T3 and T4 than that of control group (T1). Moreover, the beneficial response of lactating buffaloes to niacin addition may be due to that niacin is play a vital role in carbohydrates and lipids metabolism and consequently improves energy utilization via increasing blood glucose percentage as well as increasing microbial protein synthesis and ruminal fluid protozoa number which contributed in increasing the availability of amino acids for casein and lipoprotein synthesis, increased of VFAs and hence all these metabolic processes were responsible for enhanced milk production (Horner *et al.,* 1988b and Zimbelman *et al.,* 2010). Furthermore, niacin supplementation improves dry matter intake and feed efficiency as results of increasing the rate of digesta passage and escape of ruminal undegraded protein and consequently being available in small intestine for enzymatic digestion and absorption and subsequent use by the mammary gland (Riddell *et al.,* 1981 and Muller *et al.,* 1986). These findings are in agreement with those obtained by Muller *et al.* (1986) and Al-Abbasy, (2013) who reported that milk production increased with increasing the level of niacin in the diet of cows in early lactation in summer months. Similar trend was obtained during hot-dry and hot-humid seasons by Das *et al.* (2014) who found that milk yield of lactating buffaloes fed a basal diet plus supplementation of 6g niacin + 10g yeast + 150g mustard oil was higher than those fed the unsupplemented one. However, these findings are in disagreement with those obtained by some workers under summer season in which Small, (2010) and Rungruang *et al.* (2014) indicated that niacin supplementation did not affect actual milk production and 4% FCM of Holstein cows. On the other hand, results in Table (4) that related Cr-Met supplementation are in good agreement with those obtained by Hayirli *et al.,* (2001), Khalili *et al.,* (2011) and Targhibi *et al*. (2012) during early lactation. Moreover, under heat stress conditions in Egypt, Soltan (2010) reported that Cr supplementation into the diets of dairy cows increased milk production up to 12.1% based on untreated one during early lactation. In perspective, supplemental Cr and its positive effect on milk production may be explained by Ohh and Lee (2005) who reported altered insulin sensitivity and increased glucose/insulin ratio in cows after parturition and in addition, Cr supplementation had increased dry matter intake. Earlier, Evans and Bowman (1992) observed comparable conclusion in which chromium functions primarily to potentiate insulin, by facilitating interaction between insulin and insulin receptors. Potentially, Chang *et al.* (1995) decided that supplemental inorganic Cr and niacin together tended to have beneficial effects on performance of stressed calves. They added that niacin may be additionally working as limiting factor at involving inorganic Cr in the diet of calves and its effect on metabolic processes.

Concerning milk composition, results indicated that fat, protein, SNF, TS and ash percents did not significantly affect by rations supplementation with feed additives, while inclusion of combination Cr-Met with yeast in diet T2 led to lower lactose percentage significantly (P<0.05) than that of other rations. Pointedly, milk fat was insignificantly increased by 5 and 4.7% with Cr-Met supplementation in T2 and T4, respectively than that in control one. These results may be due to the higher CF digestibility of both T2 and T4 (5 & 4.7) than that of the other experimental rations that leading to arise the acetate concentration in the rumen which excessively in turn affected positively on fat content. These results are supported by the findings of Hayirli *et al.* (2001) who observed an improvement in milk yield, fat and lactose contents when cows fed Cr-Met-diet during pre/post parturition in first of lactation. On the other hand, results in Table (4) that related to niacin supplementation were similar with those found by Muller *et al.* (1986) who reported that milk composition did not affect by supplemental niacin into the ration of dairy cows during summer period. However, the current results are in contrast with those recorded by Das *et al.* (2014) who confirmed that supplemental niacin cause an increment of fat percent significantly (P<0.01) compared with control group. Regarding milk protein, similar finding were reported with dairy cows in early lactation by Targhibi *et al.* (2012) who found that supplemental Cr–Met did not affect milk fat and protein percents. Also, McNamara and Valdez (2005) and Soltan (2010) stated that no influence of supplementing Cr on milk composition. The results of this study (Table 4) are consistent with the findings of El- Tahan *et al.* (2005) who found insignificant effects of addition different levels of organic chromium to the diets of lactating cows, respecting milk composition (fat, SNF and protein). On the other hand, Masek *et al.* (2008) observed that dietary supplementation with live yeast cells significantly (P<0.05) increased total milk yield but chemical composition of milk was not influenced by treatments with the exception of milk fat that was significant higher in yeast culture group. On the other hand, there are also many reports that showed supplemental niacin had no effect on milk protein percent (Morey *et al.,* 2011 and Yuan *et al.,* 2012). However, the present data contrast with those of Karkoodi and Tamizrad (2009) who reported that milk protein percentages increased with increasing the level of niacin in the diet of cows. Recently, these discrepancies could be also associated with differences in breeds, stage of lactation, type of forage given, and feeding strategy over different studies.

Table 4. Effect of experimental rations on milk yield, and milk composition.

	Experimental groups				
Item	**T1**	**T2**	**T3**	**T4**	**P. value**
Milk yield (Kg/h/d)	6.11[c]±0.07	6.55[b]±0.06	7.11[a]±0.16	6.99[a]±0.08	0.0001
7% - FCM (Kg/h/d)	6.35[c]±0.07	7.06[b]±0.06	7.36[a]±0.16	7.52[a]±0.08	0.0001
Milk composition %					
Fat	7.37±0.26	7.74±0.28	7.35±0.49	7.72±0.38	0.79
Protein	4.30±0.05	4.39±0.05	4.31±0.05	4.32±0.06	0.37
Lactose	5.47[a]±0.04	5.34[b]±0.06	5.53[a]±0.04	5.58[a]±0.02	0.004
Solids not fat	10.39±0.26	10.33±0.29	10.41±0.51	10.40±0.38	0.81
Total solids	17.76±0.08	18.07±0.05	17.72±0.02	18.14±0.07	0.69
Ash	0.62±0.02	0.60±0.003	0.57±0.02	0.56±0.04	0.42

a ,b and c means the same row with different superscripts differ (P<0.05).

T_1: control,T_2: 5g Cr-Met +10g yeast, T_3 : 5g niacin +10g yeast and T_4: 5g Cr-Met+5g niacin +10g yeast.

Blood parameters:

Data of some blood serum parameters are presented in Table 5. Concentrations of total protein and albumin as well as activity AST and ALT were not significant different among all the experimental rations, while, globulin concentration was significantly (P<0.05) lower with all tested rations than that of control one. While, serum A/G ratio was significantly (P<0.05) higher with all tested rations than that of control group. These results are similar with those found with dairy cows during transition period were recorded by Khalili *et al.* (2011) and Targhibi *et al.* (2012) who used Cr supplementation in cows' diet. Earlier comparable results were proven by Al - Saiady *et al.* (2004) who stated that chelated Cr supplementation in Holstein cow diets had no effect on AL concentration but decreased the TP and GL concentration and increased significantly A/G ratio compared with unsupplemented ration. Specifically, Moonsie-Shageer and Mowat (1993) explained that the increase in serum Al of Cr supplementation diet may be due to the increased amino acid synthesis in the liver, in which Cr-Met may enhance amino acid synthesis possibly via insulin and incorporation of several amino acids into protein. Recently, Nejad *et al.* (2016) concluded that feeding diet supplemented with 400 ppb / d of Cr to Holstein steers for 4 months during the late fattening period can improve some blood metabolites and beef quality by increasing PUFA in beef. In general, Cr is one of the essential micronutrients for ruminants and is greatly considered to be a metabolic modifier and eventually the organic source of Cr is a promising form due to its higher bioavailability than inorganic ones (NRC, 1997).

Concerning niacin supplementation, Abou Elenin *et al.* (2016) indicated that concentration of total protein did not affect supplemented diets with either niacin or thiamin and its mixture supplementing for fattening buffaloes calves diets. In contrary, Mostafa *et al.* (2015) reported that total protein and albumin contents in blood serum were significantly (P<0.05) increased with supplementation of niacin and thiamin to the diets of fattening Friesian calves. In recent years, niacin has been widely used as a supplement for diets of high-performing ruminants, particularly dairy cattle (Chang *et al.,* 1995). They added supplemental inorganic Cr and niacin together for its beneficial effects on performance of stressed calves, suggesting that niacin may be a limiting factor for absorption and/or use of inorganic Cr. Furthermore, Mehrez *et al.* (2004) reported that total protein was significantly ($P<0.05$) higher with yeast culture supplementation in the diet of lambs than that of unsupplementated one, while albumin, globulin and liver enzymes (AST & ALT) did not affected by this supplement. They concluded that yeast culture (as a good source of vit. B) supplementation for growing lamb diets had positive response on their growth performance with high concentrate diet than the roughage one. On the other hand, liver functions as AST and ALT activities (Table 5) did not significantly affect by rations supplementation with feed additives in comparison with control one. All blood parameters were found to be within the normal range as reported by El -Kaneko *et al.,* (1997). The results of the serum parameters are considering as an indicators for normal protein metabolism and normal activity for kidney and liver cells of buffaloes.

Table 5. Some serum blood constituents of lactating buffaloes fed on the experimental rations.

Item	Experimental groups				
	T1	T2	T3	T4	P value
Total protein (g/dl)	8.00±0.12	7.37±0.31	7.48±0.29	7.57±0.32	0.43
Albumin (g/dl)	4.36±0.09	4.55±0.36	4.99±0.26	4.86±0.26	0.36
Globulin (g/dl)	3.63^{a}±0.29	2.82^{b}±0.06	2.50^{b}±0.12	2.72^{b}±0.27	0.003
Albumin / Globulin ratio	1.20^{b}±0.02	1.62^{ab}±0.65	2.00^{a}±0.15	1.83^{a}±0.24	0.04
AST (Iu/L)	8.67±2.31	8.34±0.33	9.67±2.6	8.00±0.34	0.75
ALT (Iu/L)	36.67±2.01	34.67±1.85	35.00±1	38.00±2.45	0.16

a ,b and c means the same row with different superscripts differ ($P<0.05$).

Economical efficiency:

Table (6) represents the effect of supplementing lactating buffaloes diets with different feed additives on the economical efficiency. Data showed that diets of lactating buffaloes which including feed additives greatly means an increases their productive performance and in consequent increasing the economical efficiency than the diet free from feed additives (control). The improvement of economical efficiency values being 105.30, 106.50 and 107.80 for T2, T3 and T4, respectively based on control (T1). Results here are matching with those obtained by Mostafa *et al*. (2015) and Abou Elenin *et al*. (2016) when supplemented diets of growing – fattening calves with niacin and thiamin especially with the high – concentrate diet. Also, the results of this study were consistent with the findings of El- Tahan *et al.* (2005) who found favorable effects of addition different levels of organic chromium to the diets of lactating cows, respecting economical efficiency under normal conditions.

Table 6. Effect of feed additives supplementation in diets of lactating buffaloes on their economical efficiency.

Item	Experimental groups			
	T1	T2	T3	T4
Feed intake (kg/head/day) as fed:				
Concentrate feed mixture (CFM)	8.48	8.58	8.75	8.70
Corn silage	9.25	10.25	10.58	10.90
Rice straw	3.08	3.10	3.17	3.25
Feed additive				
Yeast	0	10	10	10
Cr-Met	0	5	0	5
Niacin	0	0	5	5
Economic evaluation:				
7% - FCM yield (kg/h/d)	٦.35	7.06	7.36	7.52
Feed cost (LE/h/d):				
Concentrate Intake	35.62	36.04	36.75	36.54
Corn silage intake	5.09	5.64	5.82	6.00
Rice Straw intake	0.92	0.93	0.95	0.98
Price of additive (LE)	0.00	1.35	1.75	2.10
Total feed cost (LE/h/d)[1]	41.64	43.96	45.27	45.62
Price of 7% FCM yield (L.E./d)	63.50	70.60	73.60	75.20
Feed cost /kg 7% FCM (L.E./d)[2]	6.56	6.33	6.15	6.07
Economic efficiency[3]	1.53	1.61	1.63	1.65
Improvement of economic efficiency (%)	100	105.3	106.5	107.8

[1]Total feed cost (L.E/h./d)= Price of each ration ingredient x its amount consumed. [2]Feed cost of Kg 7% FCM (L.E/d) = Total feed cost /average daily7% FCM yield. [3]Economic efficiency = price of daily 7%- FCM produced / the cost of daily feed consumed. Price of feedstuffs and supplements: 4200 LE/Ton of CFM and 550 LE/Ton of corn silage, 300 LE/ton Rice straw, 100 LE/kg of yeast,70 LE/kg of Cr-Met, 150 LE/kg of Niacin, and price of milk: 10 LE/kg.

CONCLUSION

Under hot-humidity conditions in Egypt, it could be concluded that supplementation of yeast combined with chromium methionine, or niacin or their mixture into rations of lactating buffaloes in mid-lactation had positive effects on digestibility, feeding values and milk production, beside better economic efficiency.

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REFERENCES

Abou Elenin, I.M. Ebtehag, A.A. Abdou, W. Abd Elaziz Riad and M.R.M. Mostafa (2016). Effect of dietary niacin and/or thiamin supplementations on growth fattening performance of buffalo calves. Egypt. J. Nut. and Feeds, 19 (3) : 415-425.

Al-Abbasy, E . GH. (2013). Effect of adding two levels of niacin in milk production and controlling indicators of ketosis in Friesian cows postpartum. British J. of Dairy Sci., 3 (1): 1-4.

Almeida L, and R. Barajas (2002). Effect of Cr-methionine and Zn-methionine supplementation on blood concentration immunoglobulin G and M inflammatory response to phytohemagglutinin in stressed feedlot calves. J. Anim. Sci., 80 (Suppl. 1): 363.

Al-Saiady, M.Y., M.A. Al - Shaikh, S.Y. Al - Mufarrej, T.A. Al - Showeimi, H.H. Mogawer, and A. Dirrar (2004). Effect of chelated chromium supplementation on lactation performance and blood parameters of Holstein cows under heat stress. Anim. Feed Sci., Technol., 117:223-233.

Amata, I. A. (2013). Chromium in Livestock Nutrition: A Review. Glo. Adv. Res. J. Agric. Sci. (ISSN: 2315-5094). 2 (12). 289-306.

AOAC. (2000). Association of Official Analytical chemists. Official Methods of Analysis Washington, D, C., USA.

Armstrong, W.D. and C.W. Carr (1964). Physiological chemistry 3rd ed. P.75. burges publishing Co. Minneapolis /Minnesota.

Barajas, R., B.J. Carvantes, R.D.E. Virgilio, L. Almeide, J.M. Romo, and D.C. Calderan (2005). Influence of chromium methionine on growth performance, of medium stressed bull- calves during the receiving period in the feedlot. Proc., Western section, Am. Soc. Anim. Sci., 56: 430-432.

Baumgard, L.H., and R.P. Rhoads (2012). Ruminant nutrition symposium: Ruminant production and metabolic responses to heat stress. J. Anim. Sci., 90 (6): 1855-1865.

Behnam, G, N. Vahdani and S. Zerehdaran (2008). Effect of niacin on milk production and blood parameters in early lactation of dairy cows. Pak. J. Biol. Sci., 11(12) 1582-1587.

Bruno, R.G.B., H.M. Rutigliano, R.L. Cerri, P.H. Robinson and J.E.P. Santos (2009). Effect of feeding Saccharomyces cerevisiae on performance of dairy cows during summer heat stress. Anim. Feed Sci. Technol. 150:175-186.

Burton, J.L., (1995). Supplemental chromium: its benefits to the bovine immune system. Anim. Feed Sci., and Technol., 53: 17–133.

Chang, X., D.N. Mowat and B.A. Mallard (1995). Supplemental chromium and niacin for stressed feeder calves. Can. J. Anim. Sci., 75: 351–358.

Collier, R.J., G.E. Dahl, and M.J. VanBaale. (2006). Major advances associated with environmental effects on dairy cattle. J. Dairy Sci., 89: 1244-1253.

Collier, R.J., L.H. Baumgard, A.L. Lock and D.E. Bauman (2005). Physiological Limitations: nutrient partitioning. Chapter 16. In: Yields of farmed Species: constraints and opportunities in the 21st Century. Proceedings: 61st Easter School. Nottingham, England. J. Wiseman and R. Bradley, eds. Nottingham University Press, Nottingham, U.K. 351-377.

Costanzo, A.D., J.N. Spain, and D.E. Spiers (1997). Supplementation of nicotinic acid for lactating Holstein cows under heat stress conditions. J. Dairy Sci., 80:1200–1206.

Das, K.S., J.K. Singh, G. Singh, R.C. Upadhyaya, R. Malik and P.S. Oberoi (2014). Heat stress alleviation in lactating buffaloes: Effect on physiological response, metabolic hormone, milk production and composition. Indian J. of Anim. Sci. 84 (3): 275–280.

Das, S.K., R.C. Upadhyaya, and M.L. Madan, (1999). Heat stress in murrah buffalo calves. Livest. Prod. Sci. 61: 71–78.

Deka R.S., V. Mani; M. Kumar; S.S. Zade, R.C. Upadhaya and H. Kaur (2015). Effect of additional chromium supplementation on health status, metabolic responses, and performance traits in periparturient Murrah Buffaloes (Bubalus bubalis). Biol. Trace Elem Res. 163:132–143.

Doumas, B. (1971). Colorimetric determination of albumin. Clin. Chem. Acta, 31: 87.

Duncan, D. B. (1955). Multiple range and multiple F-test Biometrics,11.1.

El-Kaneko, J.J., J.E. Harvey and W.J. Sitelu (1997). Clinical Biochemical of domestic animals 5th ed. Harcourt Barce and Company Asia PTE. LTD. 989-899.

El-Khashab, M. (2010). Physiological and productive responses to amelioration of heat stress in lactating buffaloes under hot summer conditions in Egypt. Available at: http: // www.spsa-egy.org/p=835

El-Tahan A.A.; R.I. Moawd A.A. Abd El-Hamid and K.M. El-Gendy (2005). Effect of chromium picolinate supplementation on productive performance of lactating cows. Egypt. J. Nutri. and Feeds 8 (1) (Sp. Issu.) 555-565.

Erickson, P.S., A.M. Trusk, and M.R. Murphy (1990). Effects of niacin source on epinephrine stimulation of plasma nonesterified fatty acid and glucose concentrations, on diet digestibility and on rumen protozoa numbers in lactating dairy cows. J. Nutr. 120:1648–1653.

Erickson, P.S., M.R. Murphy, and J.H. Clark. (1992). Supplementation of dairy cow diets with calcium salts of long-chain fatty acids and nicotinic acid in early lactation. J. Dairy Sci., 75: 1078–1089.

Evans, G.W., and T.D. Bowman (1992). Chromium picolinate increases membrane fluidity and rate of insulin internalization. J. Inorg. Biochem. 46: 243-250.

Hayirli, A., D.R. Bremmer, S.J. bertics, M.T. Socha and R.R. Grummer (2001). Effect of chromium supplementation on production and metabolic parameters in periparturient dairy cows. J. Dairy Sci., 84:1218-1230.

Horner, J.L., C.E. Coppock, J.R. Moya, J.M. Labore, and J.K. Lanham (1988a). Effects of niacin and whole cottonseed on ruminal fermentation, protein degradability, and nutrient digestibility. J. Dairy Sci., 71:1239–1247.

Horner, J.L., L.M. Windle, C.E. Coppock, J.M. Lahore, J.K. Lanham, and D.H. Nave (1988b). Effects of whole cottonseed, niacin, and niacinamide on *in vitro* rumen fermentation and on lactating Holstein cows. J. Dairy Sci. 71:3334.

Karkoodi, K. and K. Tamizrad (2009). Effect of niacin supplementation on performance and blood parameters of Holstein cows. South African J. of Anim. Sci., 39 (4).

Kearl. L.C. (1982). Nutrient requirements of ruminants in developing countries. International feedstuffs Institute, Utah Agri. Expt. Stat. Utah State Univ., USA.

Kegley E.B., J.W. Spears, and T.T. Brown (1997). Effect of shipping and chromium supplementation on performance, immune response, and disease resistance of steers. J. Anim. Sci., 75:1956–1964.

Khalili, K., A.D. Foroozandeh and M. Toghyani (2011). Lactation performance and serum biochemistry of dairy cows fed supplemental chromium in the transition period. African J. of Biotechnology, 10 (50), 10304-10310.

Kumar, M., K. Harjit and T. Amrish (2013). Assessment of chromium content of feedstuffs, their estimated requirement, and effects of dietary chromium supplementation on nutrient utilization, growth performance, and mineral balance in summer-exposed buffalo calves (*Bubalus bubalis*). Biol. Trace Elem Res. 155: 29–37.

Kumar, R., and R.S. Dass (2005). Effect of niacin supplementation on rumen metabolites in Murrah buffaloes *(*Bubalus bubalis*)*. Asian Aust. J. Anim. Sci., 18: 38–41.

Lacetera, N., U. Bernabucci, B. Ronchi and A. Nardone (1996). Body condition score, metabolic status and milk production of early lactating dairy cows exposed to warm environment. Rivista di Agricoltura Subtropicale Tropicale, 90, 43–55.

Leiva, T., R.F. Cooke, A.C. Aboin, F.L. Drago, R. Gennari, and J.L.M. Vasconcelos. (2014). Effects of excessive energy intake and supplementation with chromium propionate on insulin resistance parameters in non lactating dairy cows. J. Anim. Sci., 92: 775-782.

Madison-Anderson R.J., D.J. Schingoethe, M.J. Brouk, R.J. Baer and M.R. Lentsch (1997). Response of lactating cows to supplemental unsaturated fat and niacin. J. Dairy Sci., 80 (7):1329-1338.

Masek, T., Z. Milkulec, H. Valpotic, L. Kusce, N. Mikulec and N. Antunac (2008). The influence of live yeast cells (*Saccharomyces Cervisiae*) on the performance of grazing dairy sheep in late lactation. Vet. Arhiv., 78:95.

McGuire, M. A., D.K. Beede, M.A. DeLorenzo, C.J. Wilcox, G.B. Huntington, C.K. Reynolds and R.J. Collier. (1989). Effects of thermal stress and level of feed intake on portal plasma flow and net fluxes of metabolites in lactating Holstein cows. J. Anim. Sci. 67:1050–1060.

McNamara J.P., and F. Valdez (2005). Adipose tissue metabolism and production responses to calcium propionate and chromium propionate. J. Dairy Sci., 88:498–507.

Mehrez, A.Z., A.A. Gabr, M.Y. El-Ayek, M.R.M. Mustafa and E.Kh. Hamed (2004). Growth performance of growing lambs fed diets differing in concentrate : roughage ratio and supplemented with a probiotic. Egypt, J. Anim. Prod. Supp. Issue (41) : 267-274.

Minor, D.J., S.L. Trower, B.D. Strang, R.D. Shaver, and R.R., Grummer, (1998). Effects of nonfiber carbohydrate and niacin on periparturient metabolic status and lactation of dairy cows. J. Dairy Sci., 81, 189-200.

Moawd, R.I., A.A. Abu El-Ella, A.A.H. El-Tahan, A.A. Abd El-Hamid and A.A. El-Makass (2008). Influence of chromium picolinate supplementation on productive performance and some blood parameters of fattening lambs. J. Agric. Sci. Mansoura Univ., 33 (5): 3181-3198.

Moonsie-Shageer, S. and D.N. Mowat (1993). Effect of level of supplemental chromium on performance, serum constituents, and immune status of stressed feeder calves. J. Anim. Sci., 71: 232-238.

Morey, S.D., L.K. Mamedova, D.E. Anderson, C.K. Armendariz, E.C. Titgemeyer, and B.J. Bradford. (2011). Effects of encapsulated niacin on metabolism and production of periparturient dairy cows. J. Dairy Sci., 94: 5090–5104.

Mostafa, M.R.M., Ebtehag, I. M. Abou- Elenin, A.A. Abdou, and W. Abd elaziz Riad (2015). Effect of thiamin or niacin supplementation into the rations of growing fattening calves on their productive performance. Egypt. J. Nut., and Feeds, 18 (3), 373-382.

Muller, L.D., A.J. Heinrichs, J.B., Cooper and Y.H. Atkin (1986). Supplemental niacin for lactating cows during summer feeding. J. of Dairy Sci., 69 : 1416–20.

Nejad, J.G., B.H. Lee, B.W. Kim, S.J. Ohh and K. Sung (2016). Effect of chromium supplementation on blood metabolites and fatty acid profile of beef during late fattening period in Holstein steers. Asian Aust. J. Anim. Sci., 29 (3), 378-383.

NRC, (1989). Recommended dietary allowances. 10th edition, Washington, DC: National Academy of Sciences, pp. 241-243.

NRC, (1997) The role of chromium in animal nutrition. National Academy Press, Washington, D.C

NRC, (2001). Nutrient requirements of dairy cattle. 7th ed. Natl. Acad. Sci., Washington, DC.

Offer, N.W., and A. Cruive (1991). Maximizing fiber digestion in the rumen : the role of yeast culture. In Biotechnology in the feed industry, Sixth ann symp Proc. Of Alltech Tech. Publ, Kentucky, U.S.A. page 79.

Ohh S.J., and J.Y. Lee (2005). Dietary chromium-methionine chelate supplementation and animal performance. Asian-Aust. J. Anim. Sci., 18 (6) : 898-907.

Pierre, N.R., B. Cobanov, and G. Schnitkey (2003) Economic losses from heat stress by U.S. livestock industries. J. Dairy Sci., 86: (Suppl.): 52-77.

PSAN, (1997). Practically and Scientifically Animal Nutrition 1st ed. 1997, Animal Production Research Institute, Ministry of Agriculture, Egypt.

Raafat, N.A, and M.S. Saleh (1962). Creating two equations to correct cattle and buffaloes milk yield to unified fat percent. proceeding of the 1th Conf. Anim. Nutri. Minia Univ.p:203.

Reitman, S. and S. Frankel (1957). Colorimetric methods for the determination of serum glutamic – oxaloacetic and glutamic – Pyruvate transminases. Amin. J. Clin., Pathol., 28: 56.

Rhoads, M.L., R.P. Rhoads, M.J. VanBaale, R.J. Collier, S.R. Sanders, W.J. Weber, B.A. Crooker and L.H. Baumgard (2009). Effects of heat stress and plane of nutrition on lactating Holstein cows: I. production, metabolism and aspects of circulating somatotropin. J. of Dairy Sci., 92, 1986–1997.

Riddell, D.O., E.E. Bartley, and A. D. Dayton. (1980). Effect of nicotinic acid on rumen fermentation in vitro and in vivo. J. Dairy Sci. 63: 1429–1436.

Riddell. D.O., E.E. Bartlev. and A.D. Davton (1981). Effect of nicotinic acid 'on microbial protein synthesis in vitro and on dairy cattle growth and milk production. J. Dairy Sci., 64 : 782-791 .

Rungruang, S.J.L., R.P. Collier, L.H. Rhoads, M.J. Baumgard, D.E. Veth, and R.J. Collier (2014). dose-response evaluation of rumen-protected niacin in thermo neutral or heat-stressed lactating Holstein cows. J. Dairy Sci., 97 : 5023–5034.

SAS Institute, (2003). SAS User's Guide: Statistics. Version 8.2, SAS Institute Inc., Cary, NC.

Shwartz, G., M.L. Rhoads, M.J. Van Baale, R.P. Rhoads, and L.H. Baumgard. (2009). Effects of a supplemental yeast culture on heat-stressed lactating Holstein cows. J. Dairy Sci., 92:935-942.

Small, D.J.N. (2010). Effect of feeding supplemental rumen – protected niacin (NiashureTM) on milk yield and milk composition in early lactation Holstein cows. AMSc. Thesis submitted to the graduate faculty of North Carolina state Univ.

Smith, M.O., and R.G. Teeter. (1987). Potassium balance of the 5 to 8-week old broiler exposed to constant heat or cycling high temperature stress and the effects of supplemental potassium chloride on body weight gain and feed efficiency. Poult. Sci., 66: 487–492.

Soltan, M.A. (2010). Effect of dietary chromium supplementation on productive and reproductive performance of early lactating dairy cows under heat stress. J. of Anim. Physiol. and Anim. Nutri. 94 : 264–272.

Soltan, M.A., A.M, Almujalli, M.A. Mandour and M. El-Shinway Abeer (2012). Effect of dietary chromium supplementation on growth performance, rumen fermentation and some blood serum units of fattening dairy calves under heat stress. Paskitan J. of Nutri., 11 (9) : 849-854.

Spears, J.W. (2000). Micronutrients and immune function in cattle. Proceedings of the Nutrition Society. 59 : 587-594.

Spears, J.W., C.S. Whisnant, G.B. Huntington, K.E. Lloyd, R.S. Fry, K. Krafka, A. Lamptey, and J. Hyda (2012). Chromium propionate enhances insulin sensitivity in growing cattle. J. Dairy Sci., 95 : 2037-2045.

Targhibi, M.R. H. Karami Shabankareh and F. .Kafilzadeh (2012). Effects of supplemental chromium on lactation and some blood parameters of dairy cows in late gestation and early lactation Asian J. of Anim. and Veterinary. Advances. 7 (11) : 1205-1211.

Van Keulen, J. and B.A. Young (1977). Evaluation of acid insoluble ash as natural marker in ruminant digestibility studies. J. Anim. Sci., 44: 2982.

Vincent, J.B. (1999). Mechanisms of Chromium Action: Low-Molecular-Weight Chromium Binding Substance. J. of the Am. College of Nutrition. 18:1, 6-12.

West, J. W. (2003). Effects of heat-stress on production in dairy cattle. J. Dairy Sci., 86 : 2131–2144.

Yuan, K., R.D. Shaver, S.J. Bertics, M. Espineira, and R.R. Grummer (2012). Effect of rumen-protected niacin on lipid metabolism, oxidative stress and performance of transition dairy cows. J. Dairy Sci., 95 : 2673 – 2679.

Zimbelman, R.B., L.H. Baumgard, and R.J. Collier (2010). Effects of encapsulated niacin on evaporative heat loss and body temperature in moderately heat-stressed lactating Holstein cows. J. Dairy Sci., 93 : 2387–2394.

الأداء الإنتاجى للجاموس الحلاب المغذاة على علائق تحتوى على بعض الإضافات الغذائية خلال الصيف فى مصر

على أحمد عبده على

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أجريت هذه الدراسة لمقارنة أثر إضافة الخميرة مختلطة مع الكروميوم-مثيونين والنياسين ومخلوطهما على الأداء الإنتاجى للجاموس الحلاب في الصيف. حيث تم تقسيم الحيوانات (اثني عشرمن الجاموس حلاب) بمتوسط وزن ٥٥٠ كجم، في الموسم الرابع أو الخامس في منتصف موسم الحليب، بشكل عشوائي إلى أربع مجموعات متماثلة (ثلاثة لكل مجموعة) وفقًا لوزن الجسم الحي وإنتاج اللبن. كانت المعاملات الغذائية (على أساس DM) على النحو التالي: غذيت المجموعة الأولى (الكنترول): ٦٠% علف مركز+٣٠% سيلاج الذرة + ١٠% قش أرز بدون أضافات بينما المعاملة الثانية: عليقة الكنترول + ١٠جرام خميرة + ٥جرام كروميوم-مثيونين، المعاملة الثالثة: عليقة الكنترول + ١٠جرام خميرة + ٥جرام نياسين، المعاملة الرابعة: عليقة الكنترول + ١٠ جرام خميرة + ٥ جرام كروميوم-مثيونين + ٥جرام نياسين. وتم تغذية الحيوانات بشكل فردي وفقا لمقررات كيرل (١٩٨٢) للماشية الحلابة. وأجريت ٤ تجارب هضم على نفس حيوانات التجربة وذلك لتقدير القيم الهضمية والغذائية لعلائق التجربة. أوضحت النتائج أن الجاموس الحلاب المغذاة على الإضافات الغذائية المختلفة (T2 و T3 و T4) كانت الأعلى فى معاملات هضم لمعظم العناصر الغذائية بالمقارنة بالكنترول. وايضا كانت القيم الغذائية (TDN وDCP) تقريبا أخذت نفس الاتجاه لمعاملات هضم المواد الغذائية. كما لا توجد فروق ذات دلالة إحصائية فى تركيز الدم لكل من البروتين الكلى الألبيومين ونشاط AST وALT بين المعاملات. زاد إنتاج اللبن أو اللبن المعدل ٧% دهن معنويا لجميع العلائق التجريبية على النحو التالى T4 يليه T3 و T2 مقارنة بالكنترول. كما لم تظهر فروق ذات دلالة إحصائية فيما يتعلق بمكونات اللبن ولكن هناك انخفاض معنوي ($P <0.05$) فى نسبة اللاكتوز مع T2 بالمقارنة مع المعاملات الأخرى. وبالمثل ، تحسنت الكفاءة التحويلية بشكل معنوي ($P <0.05$) مع كل الحيوانات التي غذيت على العلائق المختبرة (المحتوية على إضافات غذائية) وكانت افضلها T4. وفي الوقت نفسه كانت الكفاءة الاقتصادية ٥.٣ و ٦.٥ و ٧.٨٪ ، بالنسبة للمعاملات T2 و T3 و T4 على التوالي بشكل أفضل مقارنة مع مجموعة الكنترول (T1). وبشكل عام ، تشير النتائج التي تم الحصول عليها إن الإضافات الغذائية المختلفة المضافة إلى علائق الجاموس الحلاب كان لها تأثيرإيجابى على معاملات الهضم، القيم الغذائية، إنتاج اللبن والكفاءة الاقتصادية دون أى تأثير عكسى على صحة الحيوانات.