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Performance of Lactating Cows Fed Rations Supplemented with Chromium Methionine, Non-protected Niacin and Yeast

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Abstract

THIS STUDY aimed to investigate the impact of adding chromium methionine, non-protected niacin and yeast on the nutrient digestibility, some blood serum parameters and the productive performance of dairy cows. Twenty lactating cows at early lactation with an average LBW of 550.33±11.64 kg were randomly allocated to four groups of five cows each, based on LBW and previous milk yield. All animals were fed individually on a basal ration containing 50% concentrate feed mixture, 25% fresh berseem, and 25% rice straw (on a DM basis) to cover the nutrient requirements, according to NRC (1989). The control group (T1) was un-supplemented. The remaining groups, T2, T3, and T4, were supplemented with 5 g/h/d of chromium methionine (Cr-Met), 10 g/h/d of non-protected niacin, and 10 g/h/d of yeast, respectively. Results revealed that the treatments had no effect on dry matter intake (DMI). Most of the nutrient digestibility, feeding values, milk yield, feed conversion ratio, and economic efficiency were significantly ($P<0.05$) improved in the treated groups. The yeast group, followed by the niacin and Cr-Met groups produced significantly more actual milk and 4%-Fat corrected milk yield per day. Niacin and Cr-Met dietary led to enhanced milk composition. Most of the blood measurements showed no significant differences among groups. Niacin and Cr-Met supplements improved kidney functions. The IgM levels were significantly ($P<0.05$) higher in the supplemented groups. Finally, dairy cows supplemented with additives, especially yeast, showed increased milk production and improved nutrient digestibility, feed conversion, economic efficiency, and immunity without negatively affecting their health.

Keywords: Dairy cows, Cr -Met, Niacin, Yeast, Milk Yield.

Introduction

Feed additives are one of the most successful and effective strategies for increasing gut health, animal productivity and reproduction and minimizing the effects of environmental conditions without harming to animals [1, 2, and 3]. However, some of these additives may have harmful side effects for both animals and humans [4]. As a consequence of this, European Union Legislation has used at 2006 a ban on using some of these additives in the form of antibiotics in animal feed. On the other hand, trace minerals are essential for dairy cows' immunity, metabolism of energy, maintaining the health and functions of the reproductive system and milk production [5, 6]. According to Abdou [7], supplementing lactating buffalo rations with niacin, chromium methionine and yeast improved milk production without harming animals' health. Meanwhile, chromium is essential for lipid, protein and carbohydrate metabolism and immune system activities [8]. Also, chromium play as glucose tolerance factors (GTF), which promote glucose metabolism, enhance insulin sensitivity [9] and alleviate stressors like heat stress, early lactation, etc. [10, 11]. Moreover, chromium might improve the endocrine profile and immune system by reducing cortisol release [11,12]. According to Cao *et al.* [13], trace mineral amino acid complexes are more gut stable and bioavailable compared to inorganic minerals. On the other hand, Doreau and Ottou [14] found that a protozoon is one example of a microflora type that cannot synthesize the B-vitamin such as niacin, but need them. Niacin is useful for several metabolic processes, including lipid metabolism, tissue oxidation and glycolysis and is useful for

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immunity and energy metabolism as a coenzyme [15]. Also, niacin helps rumen fermentation, microbial protein synthesis, and propionic acid production and prevents lactate accumulation [14]. Moreover, yeast as a growth-promoter is a naturally rich source of vitamins and minerals, enzymes, other necessary nutrients, and co-factors, which play a pivotal role in biological oxidation [16]. Yeast supports rumen fermentation conditions, stabilizes rumen pH, and reduces acidosis risk as well as other ruminant digestive issues [17], which improves nutrient digestibility and animal productivity [18]. Yeast activates the immune system by supplying the gut with oligosaccharides in cell wall yeast [19]. So, the main objective of this study was to determine the effect of adding Cr-Met, niacin, and yeast on the nutrient digestibility, productive performance, and some blood parameters and immune measures of dairy cows during early lactation.

Material and Methods

This study was conducted at El-Gemmaiza Animal Production Research Station belonging to Animal Production Research Institute, Agriculture Research Centre, Ministry of Agriculture, Egypt, and registered with serial number 132429. The experiments were performed according to the guidelines of a local ethics committee for animal care and welfare (Number 08/2016 EC).

Experimental animals

Twenty lactating cows with an average weight of 550.33±11.64 kg in their 4th to 5th lactating seasons. Cows were divided at two weeks post calving into four similar groups (five cows each) according to body weight and previous milk production in a complete random block design. The experiment was lasted 150 days through winter season of 2021. All animals were fed individually on a basal ration containing 50% concentrate feed mixture (CFM), 25% fresh berseem (FB), and 25% rice straw (RS) (on DM basis). The groups were as a control group (T1) without supplementation. Other groups (T2, T3, and T4) were supplemented with 5 g/h/d of Cr-Met, 10 g/h/d of niacin and 10 g/h/d of yeast, respectively. Cr-Met consists of 0.1% chromium and 0.7% methionine, 95.1% calcium carbonate, and 1.5% mineral oil. Niacin was 70±2% niacin (ANEVIS, Quali Tech Inc., USA). Yeast (strain GSH351) containing $5x10^9$ cells/g (European patent n.0111202-European patent n.98116181.3). Supplements were mixed daily with a CFM prior to morning feeding. Animals were fed to cover their recommended requirements according to dairy cows requirements [20]. Table 1, shows the chemical composition of the feedstuffs and the calculated composition of the basal ration. CFM and RS were given twice daily, at 8.00 and 16.00, while FB was given once day at 11.00. Fresh and clean water was available all time. Cows were kept under continuous veterinary observation. Cows were manually milked at 8.00 and 16.00 and biweekly; milk yield was recorded at each milking. Milk samples were taken every two weeks from morning and evening milking, mixed in proportion to milk yield and analyzed for fat, protein, lactose, solids non-fat, and total solids using a Milk scan apparatus (model/30 series type 10900 FOSS), and difference method ash was calculated, 4%- Fat corrected milk (4%- FCM)= 0.4 X MY (kg) + 15X fat yield (kg) according to the formula [21] used to convert the actual milk yield (ACMY) to 4%- FCM. Feed conversion (FCR) was determined as the amount of Kg DM, TDN, CP and DCP required for producing one kg 4%-FCM. The economic efficiency of the experimental rations was expressed as the ratio between the daily 4%-FCM production price and the daily feed consumed cost.

TABLE 1. Chemical analysis of feedstuffs and the calculated composition of the basal ration

Items	Chemical composition, % on DM basis						
	DM	OM	CP	CF	EE	NFE	ASH
Concentrate feed mixture*	92.84	91.21	15.85	12.86	2.39	60.11	8.79
Fresh berseem	15.93	88.60	14.12	26.89	2.61	44.98	11.40
Rice straw	91.28	84.95	3.26	35.24	1.75	44.70	15.05
Basal ration	41.99	88.99	12.27	21.96	2.29	52.47	11.01

*The concentrate feed mixture was consisting of 37% yellow corn, 28% of wheat barn, 16% undecorticated cotton seed, 10% sunflower meal, 5% soybean, 2% limestone, 1% common salt and 1% mineral and vitamins premixes.

Digestibility trials

A digestibility trial was undertaken at the end of the experimental period using three cows from each group to assess the digestibility coefficients and feeding values of the experiment rations. Each digestibility trial consisted of 15 days as preliminary period followed by seven days as collection period. Acid insoluble ash was used as a natural marker [22]. Feces samples were taken from the rectum of each cow twice daily with 12 hrs interval during the collection period. Samples of feedstuffs were taken at the beginning, middle and end of the collection period. Nutrient digestibility was calculated according to Schneider and Flat [23]. Total digestible nutrients (TDN) and digestible crude protein (DCP) were calculated to McDonald et al. [24].

Blood samples

The blood samples were taken at 3 hours after the morning feeding from the vein of experimental animals in dry clean glass tubes and left for 30 minutes at room temperature. Blood samples were centrifuged at 4000 rpm per 20 min. to separate the serum and kept at -20^0c until chemical analysis.

Analytical procedure

The samples of CFM, RS, FB, and feces were composted, and the representative samples were then analyzed according to the official methods [25]. Blood serum was separated from the whole blood to determine the levels of total protein (TP), albumin (AL), urea and creatinine by using commercial kits (Spectrum Biotechnology Egypt) a spectrophotometer instrument (Ltd., Lutterworth, UK). The globulin value was calculated by subtracting the AL value from the TP value. The serum immunoglobulin (G and M) concentrations were assayed using the ELISA method. Milk samples were analyzed using a Milkoscan system (Foss Electric Hillerod, 133B Milkoscan, Denmark) for milk fat, protein, lactose, solid non-fat (SNF), and total solid (TS) concentrations**.**

Statistical analyses

The data were statistically analyzed used one way analysis of variance procedure [26] computer programing using the fixed model:

$Y_i = \mu + T_i + ie$ whereas Y_i = the individual observation, μ= Overall mean, T_i = Effect of treatments (i=1, 2, 3, 4), and ie= Random error component assumed to be normally distributed. The Duncan's new multiple-range test [27] was used to test the significant between means.

Results

Digestibility and feeding value of experimental rations:

Table 2, indicates that the dietary supplemented groups recorded significantly ($p<0.05$) higher nutrient digestibility than those of T1 group. While, there were no significant differences in CPD and EED between the T2 and T1 groups. The T4 group had significantly ($p<0.05$) improved CPD than theT1, T2 and T3 groups with insignificant differences between T2 and T3 as well as between T1 and T2 and enhanced DMD and OMD ($P<0.05$) compared with other groups except in the T1 and T2 groups, but had no significant differences among the T3 and T4 groups in this term. Furthermore, the dietary supplement groups significantly improved the CFD, EED, and NFED with the highest values of CF and EE in T3 and NFE in T4. Also, Table 2, shows the feeding values (%) represented by TDN and DCP for dietary supplements were significantly ($p<0.05$) higher than in the control group. The T4 group recorded the highest values, followed by the T3 and T2 groups.

TABLE 2. The digestibility coefficients and nutritive value of lactating cows fed the experimental rations

Item	T1	T2	T3	T4	±SE
Digestibility coefficients %					
Dry matter (DM)	65.58^c	68.31^b	69.01^{ab}	69.92^a	0.33
Organic matter (OM)	68.21^c	70.70^b	71.27^{ab}	72.17^a	0.33
Crud protein (CP)	63.34^c	64.61^{bc}	65.74^b	67.90^a	0.54
Crud fiber (CF)	51.34^b	54.57^a	56.39^a	56.12^a	0.76
Ether extract (EE)	80.41^b	81.97^{ab}	85.31^a	85.30^a	1.22
Nitrogen free extract (NFE)	76.24^b	78.86^a	78.58^a	79.37^a	0.30
Nutritive value (%)					
Total digestible nutrients (TDN)	63.19^c	65.51^b	66.08^{ab}	66.70^a	0.36
Digestible crud protein (DCP)	7.77b	7.93^{ab}	8.07^{ab}	8.33^a	0.12

a, b and c: Means within rows with different superscript are significantly different ($P<0.05$).

T1 – group without supplementation; T2 – group supplemented with 5 g/h/d of Cr-Met; T3–group supplemented with 10 g/h/d of niacin; T4–group supplemented with 10 g/h/d of yeast.

Animal performance

Feed intake

Table 3, shows dietary supplements didn't affect DMI and CPI among the different groups, which ranged from 13.55 to 14.20 and 1.663 to 1.742 kg/head/day, respectively. However, TDNI was higher significantly ($p<0.05$) in T3 and T4 compared to T1 with insignificant differences with T2. In respect of DCPI, T4 recorded significantly ($p<0.05$) the highest intake followed by T3 and T2, but T1 had the lowest intake. No significant difference in DCPI between T3 and T4 and also between T2 and T3.

Milk yield and composition

Results in Table 3, indicated that dietary supplements improved milk yield, which T4 revealed significantly ($p<0.05$) the highest actual and 4% FCM yield followed by T3 and T2, but T1 had the lowest yield. Milk yield in T4 differ significantly with both T1 and T2 as well as between T1 and T2.Whereas, T3 didn't significantly differ from both T2 and T4.

Also, Table 3 showed significant differences in milk composition ($p<0.05$). Fat present was higher significantly in T3 and T4 than that of T1 and T2. Protein and SNF contents were higher significantly in T2 and T3 compared to T1 and T4. Moreover, lactose content was higher significantly in T2 compared to T4, with insignificant difference with both T1 and T3. Also, TS was higher significantly in T3 compared to T1 and T4 and insignificant difference with T2.

Feed conversion ratio

Additive supplements improved feed conversion ratio (Table 3), in which T4 recorded the lowest values of DM, TDN, CP and DCP per kg of 4% FCM, but T1 had the highest values, whereas T2 and T3 showed intermediate values.

TABLE 3. Feed intake, milk yield and composition, and feed conversion ratio of dairy cows fed on the trial rations

Item	Experimental rations				
	T1	T2	T3	T4	±SE
Daily feed intake (Kg/d/ h) on DM.:					
Dry mater intake (DMI)	13.55	13.80	14.20	13.99	0.30
Total digestible nutrients intake TDNI	8.56^{b}	9.04^{ab}	9.38^{a}	9.33^{a}	0.24
Crude protein intake CPI	1.663	1.693	1.742	1.717	0.169
Digestible crude protein intake DCPI	1.053^{c}	1.094^{b}	1.146^{ab}	1.165^{a}	0.025
Milk production:					
Actual milk yield ACMY (Kg/h/d)	10.21^{c}	11.38^{b}	12.02^{ab}	12.62^{a}	0.35
4% - FCM (Kg/h/d)	9.52^{c}	10.68^{b}	11.78^{ab}	12.28^{a}	0.44
Milk composition					
Fat %	3.55^{b}	3.59^{b}	3.87^{a}	3.82^{a}	0.40
Protein %	2.55^{b}	2.80^{a}	2.89^{a}	2.66^{b}	0.21
Lactose %	4.33^{ab}	4.56^{a}	4.26^{ab}	3.95^{b}	0.13
SNF %	7.59^{ab}	7.84^{a}	7.91^{a}	7.28^{b}	0.22
TS %	11.16^{b}	11.44^{ab}	11.78^{a}	11.10^{b}	0.5
Ash %	0.73	0.68	0.70	0.67	0.12
FCR :					
Kg DMI/ Kg 4% FCM	1.42^{a}	1.29^{b}	1.21^{bc}	1.14^{c}	0.04
Kg TDNI/ Kg 4% FCM	0.899^{a}	0.846^{ab}	0.796^{bc}	0.760^{c}	0.030
G CP/ Kg 4% FCM	174.68^{a}	158.52^{ab}	147.88^{ab}	139.82^{b}	7.53
G DCPI/Kg 4% TCM	110.61^{a}	102.43^{ab}	97.28^{ab}	94.87^{b}	3.48

a, b and c: Means within rows with different superscript are significantly different ($P<0.05$).

T1 – group without supplementation; T2 – group supplemented with 5g/h/d of Cr-Met; T3–group supplemented with 10g/h/d of niacin; T4–group supplemented with 10 g/h/d of yeast.

Blood parameters:

Results in Table 4, demonstrate that dietary supplements didn't affect serum TP, Al, Gl, and IgG levels but were significantly ($p<0.05$) higher in serum IgM levels compared to the control group. Moreover, the serum urea and creatinine levels were significantly ($p<0.05$) lower in the niacin group, followed by the Cr-Met group, than those in the control and yeast groups.

TABLE 4. Blood parameters of dairy cows fed the experimental rations

Item	T1	T2	T3	T4	±SE
TP (g/dl)	6.98	7.09	7.07	7.10	0.11
Al (g/dl)	3.69	3.72	3.71	3.72	0.10
Gl (g/dl)	3.07	3.38	3.36	3.38	0.12
Creatinine (mg/dl)	1.04^{a}	0.90^{b}	0.84^{c}	1.03^{a}	0.59
Urea (mg/dl)	41.35^{a}	35.97^{b}	33.61^{c}	40.34^{a}	0.62
IgG (ng mL-1)	766.50	770.56	772.26	777.42	7.35
IgM (µg mL-1)	48.03^{b}	56.16^{a}	56.24^{a}	57.16^{a}	0.90

a, b, c :Means within rows with different superscript are significantly different ($P<0.05$).

T1 – group without supplementation; T2 – group supplemented with 5g/h/d of Cr-Met; T3–group supplemented with 10g/h/d of niacin; T4–group supplemented with 10 g/h/d of yeast.

Economic efficiency

Table 5 illustrates the impact of dietary supplements on economic efficiency, which T4 revealed significantly ($p<0.05$) the highest economic efficiency, followed by T3, and T2 compared to T1. Economic efficiency improved by 109.61, 11.99, and 122.57% for T2, T3 and T4, respectively based on control (T1).

TABLE 5. Impact of dietary supplements on economic efficiency

Item	**Experimental groups**				
	T1	**T2**	**T3**	**T4**	**±SE**
Feed intake	13.55	13.80	14.20	13.99	
CFM	7.33	7.43	7.65	7.53	
Berseem	21.26	21.66	22.28	21.96	
Rice straw	3.71	3.78	3.89	3.83	
Additive cost	0	0.38	2.5	1.5	
Total feed cost[1]	41.24^{c}	42.21^{c}	45.57^{a}	43.40^{b}	1.14
Price of 4% FCM yield (L.E./d)	95.20	106.80	117.80	122.80	
Feed cost /kg 4% FCM (L.E./d)[2]	4.33^{a}	3.95^{b}	3.87^{c}	3.53^{d}	0.34
Economic efficiency[3]	2.31^{d}	2.53^{c}	2.59^{b}	2.83^{a}	1.25
Improvement of economic efficiency (%)	100	109.61^{c}	111.99^{b}	122.57^{a}	2.12

a, b and c: Means within rows with different superscript are significantly different ($P<0.05$).

T1 – group without supplementation; T2 – group supplemented with 5g/h/d of Cr-Met; T3–group supplemented with 10g/h/d of niacin; T4–group supplemented with 10 g/h/d of yeast. [1]Total feed cost (L.E/h./d)= Price of each ration ingredient x its amount consumed. [2]Feed cost of Kg 4% FCM (L.E/d) = Total feed cost /average daily 4% FCM yield. [3]Economic efficiency = price of daily 4%- FCM produced / the cost of daily feed consumed. Price of feedstuffs and supplements: 4800 LE/ton of CFM and 250 LE/ton of berseem fresh, 200 LE/ton rice straw, 150 LE/kg of Cr-Met, 250 LE/kg of niacin, 100 LE/kg of yeast, and 10 LE/kg of 4% FCM.

Discussion

It is evident from several that adding yeast supplements enhances nutrient digestibility by optimizing rumen fermentation conditions and effectively suppressing pathogenic bacteria [17], which supports gut health and immune system activities. Moreover, it supplies vital nutrients that improve the growth and reproduction of cellulolytic bacteria and the fungus responsible for lignin degradation, thereby improving CFD [16, 18]. Additionally, Desnoyers *et al.* [28] found that live yeast supplement positively affect OMD and DMI, resulting in increased energy benefits in diets. Similarly, Ovinge *et al.* [29] demonstrated that introducing yeast to steers rations significantly improved DMD, OMD, CPD, EED, ADFD and NDFD. However, the addition of yeast to dairy cow rations didn't impact nutrient digestibility, as stated by Ferreira *et al.* [30]. Niacin supplementation, on the other hand, increased microflora numbers, enhanced rumen fermentation and improved OMD [14, 31]. Similarly, Luo *et al.* [32] observed that higher niacin levels in high-concentrate rations of finishing male cattle enhanced nutrient digestibility. However, niacin supplementation to ruminant rations had no effect or a negative effect on nutrient digestibility [33, 34]. On the other hand, Cr-Met is a vital element that supports rumen microflora growth and reproduction and rumen fermentation processes, which enhance nutrient digestibility [35]. Moreover, it's necessary for fat and carbohydrate metabolism in ruminants helping to improving CFD [9]. Our findings are similar to those by Deka *et al.* [36], who reported that chromium adding to lactating buffaloe rations improved nutrient digestibility, but didn't affected on it with growing cattle [37]. The findings of nutritive values are similar to those obtained by Kraidees *et al.* [38], Abou-Elenin *et al.* [39] and Ghoniem *et al.* [40], when Cr-yeast, niacin, or yeast were added to the ruminant ration.

Feed intake was similar to the findings of Keshri *et al.* [37], Luo *et al.* [32] and Ovinge *et al.* [29]. On the contrary, giving these feed supplements causes changes in the DMI of dairy ruminant [11, 34, 41].

Enhancing milk yield and feed conversion ratio with yeast supplements may attributed to improving nutrient digestibility and microbial protein, promoting the immune system's function, and providing energy for MY [42, 19]. Similarly, the addition of probiotics to dairy cows increased milk yield [12] and also improved FCR of the steer rations [32]. Moreover, the yeast group increased fat% and reduced milk lactose% as reported by Arambel and Kent [43] that ADF in the ration was probably sufficient to maintain milk fat synthesis, thereby negating any treatment effect. Also, Desnoyers *et al.* [28] reported that yeast dietary improved milk fat% by enhancing microflora population and TVFAs, which leads to improved milk fat content in dairy cows. However, De Ondarza *et al.* [44] stated that yeast supplementation has little or no effect on milk composition in general. Furthermore, Ferreira *et al.* [30] noted that adding live yeast to ruminant rations had no influence on MY and its composition. These discrepancies in the results of these studies may be due to differences in feeding protocol, lactation phase, and overall stress, in addition to the probiotic strain and quantity employed and animal age and species [45]. On the other hand, niacin supplementation had the ability as a coenzyme to enhance MY, milk composition and FCR by promoting DMI, ruminal microflora growth and activity, microbial protein, feed degradation in the rumen, and preventing disorders like metabolic fatty liver and ketosis [46]. Increased milk yield and FCR by adding niacin supplements are in line with those findings of and Gaowa *et al.* [34], Luo *et al.* [32]. Also, according to Dufva *et al*. [47], supplementation of niacin increased the protein and fat content of dairy cattle milk by increasing microbial protein and enhancing fibre degradation which improved acetate production. In contrast to the present results, Chen *et al.* [48] and Wei *et al.* [49], noticed that supplementation with protected or unprotected niacin didn’t affect milk yield. On the other hand, adding chromium enhances gluconeogenesis, glucose metabolism, and insulin regulation, which increases milk production and lactose milk content [9]. Wu *et al.* [50] observed similar results when different levels of Cr addition increased MY, milk lactose%, and improved feed efficiency. Moreover, organic mineral amino acid complexes or organic Cr addition in cow rations improved milk yield [51]. Also, Cr supplements improved FCR by increasing feed intake and nutrients reaching the liver [10]. Improvements in fat, protein, and lactose percentage of milk are consistent with those results obtained by Nikkhah *et al.* [52] after the addition of Cr to dairy cow rations under heat stress. Nevertheless, Bryan *et al.* [53] found that adding Cr supplements had no effect on MY and the percentage of fat, protein, and lactose in dairy cow milk.

The current findings are in line with previous studies on the influence of Cr-Met, niacin, and yeast added to the ruminant rations on the serum TP and their fractions [50, 39, 54]. Moreover, the niacin and Cr-Met groups had significantly lower serum urea and creatinine levels than the other groups, but there was a significant difference between the niacin and Cr-Met groups. This might be due to improving protein metabolism and utilization resulting in lower serum urea and creatinine levels [48]. While the addition of the yeast increased serum urea levels because microflora couldn’t retain urea in the rumen [55].

On the other hand, all supplement groups had improved IgM than the control group, which is consistent with those obtained by Ma *et al.* [54] and Zhang *et al.* [41] which indicates probiotics provide protection against pathogenic infection. Probiotics have multiple mechanisms to promote the immune system by releasing inhibitory chemicals that prevent pathogenic growth, like hydrogen peroxide, organic acids, and bacteriocins [56]. Also, increasing anti-inflammatory agents like IL-10 and TGF-β [57]. Furthermore, it contains mannan-oligosaccharides and B-glucans that compete with harmful bacteria and adhere to receptor defence cells of the digestive system [19], which help reproduction of the T and B cells and regulate immunological responses and cytokine production [58]. Also, adding Cr may have improved immunity by inhibiting cortisol release from the adrenal gland and increasing IgM [59]. Cortisol reduces immune system efficiency by reducing lymphocyte proliferation and activation of lymphocyte factors as well as T-cell factor growth synthesis [60]. Furthermore, a possible explanation can be the indirect antioxidant action by preventing the auto-oxidation of glucose due to lower [61]. Also, Borgs and Mallard [62] found that chromium could enhance the immune system's function by affecting cytokine production and insulin activity. According to Dos Santos *et al.* [63], methionine can effectively eliminate free radicals in mammalian cells, normalize haemacorit, and suppress abnormal activity enzymes. Moreover, niacin has been demonstrated to be important in energy metabolism regulation, methylation, DNA repair, and immunological function [15]. Finally, all blood serum parameters in the present study were within the normal range, indicating that animals had a good nutritional and physiological status. In term of economic efficiency, the findings are consistent with those obtained by [7] who added lactating buffalo rations with a blend of Cr-Met, niacin and yeast. Also, Abou-Elenin *et al.* [39], Ghoniem *et al.* [40], and El-Tahan *et al.* [64] observed a similar effect when adding niacin, yeast and organic chromium to the diets of fattening calves, and lactating buffalo, and cows.

Conclusion

From the results of this study, we concluded that yeast as a natural supplement in dairy cow rations, improves nutrient digestibility, feed intake, milk production, feed conversion, feed and economic efficiency. Whereas, Cr-Met and non-protected niacin supplement was more effective in milk composition and kidney functions.

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Conflict of interest

Authors state no conflict of interest

Data Availability Statement

Data availability statements can take by any form.

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أداء الأبقار الحلابة المغذاه على العلائق المدعمة بالكروميوم ميثيونين والنياسين الغير محمى والخميرة

على احمد عبده ، عبد الغنى حسانين غنيم ، عزت عرفة البلتاجى ، عصام محمد الكتامى و ولاء محمد عبدالوهاب

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اجريت هذه الدراسه بهدف دراسة تأثير إضافة الكروم الميثيونين والنياسين والخميرة على معاملات هضم العناصر الغذائية وبعض قياسات الدم والأداء الإنتاجي لأبقار الحلابة .تم تقسيم عشرين بقرة مرضعة في وقت مبكر من الرضاعة بمتوسط وزن قدره 550.33±11.64 كجم بشكل عشوائي لأربع مجموعات تتكون كل منها من خمسة حيوانات، بناءً على وزن الوزن عند الولادة وإنتاجية الحليب. تم تغذية جميع الحيوانات بشكل فردي على عليقة اساسية تحتوي على العلف المركز والبرسيم وقش الأرز .تم تغذية مجموعة الكنترول (T1) على العليقة الأساسية بدون أي مكملات غذائية .فى حين تم تغذية بقية المجموعات (T2, T3, T4) منفرده على العليقة الأساسية باضافه 5 جرام كروميوم ميثونين، و10 جرام نياسين، و10 جرام خميرة، على التوالي لكل رأس /يوم . أشارت النتائج إلى أن المعاملات لم تؤثر على كلا من الماكول أو مكونات اللبن باستثناء اللاكتوز (٪)، والذي كان أعلى معنويا على مستوى (P<0.05) في مجموعة Cr-Met مقارنة بمجموعة الخميرة. كما تحسنت معظم معاملات هضم العناصر الغذائية، والكفاءة التحويلية ، وإنتاج اللبن معنويا بشكل ملحوظ على مستوى(P<0.05) في المجموعات المختبرة مقارنة بمجموعة الكنترول. كما سجلت مجموعة الخميرة اكبرانتاج من اللبن اليومى أو اللبن المعدل عند مستوى4% دهن اليومى، تليها مجموعتى النياسين والكروميوم- ميثونين . .حسنت كل من مجموعة النياسين والكروميوم ميثيونين مكونات اللبن. كما تلاحظ عدم وجود فروق ذات دلالة إحصائية فى معظم قياسات الدم بين المجموعات.فى حين كانت مستويات اليوريا والكرياتينين في الدم أقل بشكل ملحوظ في المجموعتين T2 و T3مقارنة بمجموعتي T1 و .T4وكانت مستويات الجلوبيولين المناعي M (IgM) في الدم أعلى بكثير في المجموعات المختبره فى حين لم تختلف مستويات الجلوبيولين المناعي G (IgG) في الدم بين المجموعات. كما سجلت مجموعة الخميرة زيادة معنوية فى الكفاءة الغذائية والإقتصادية . بشكل عام، أظهرت أبقار الحلابة المكملة بالاضافات الغذائية عليقة المكملة وخاصة بالخميرة، زيادة في إنتاج الحليب وتحسين هضم العناصر الغذائية والكفاءة التحويلية والإقتصادية والمناعة دون التأثير سلبا على حالتها الصحية

الكلمات الدالة (المفتاحية): الأبقار الحلابة ، الكروميوم مثيونين ، النياسين ، الخميرة ، انتاج اللبن.