Effects of application of vitamin-mineral supplement in milk on performances of Holstein suckling calves

S Delir[1], H Mohammadzadeh[2*], A Taghizadeh[3], H Paya[4]

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[1]Graduated Student of Animal Nutrition, Department of Animal Science, Faculty of Agriculture, University of Tabriz

[2]Assistant Perofessor, Department of Animal Science, Faculty of Agriculture, University of Tabriz

[3]Perofessor, Department of Animal Science, Faculty of Agriculture, University of Tabriz

[4]Assistant Perofessor, Department of Animal Science, Faculty of Agriculture, University of Tabriz

*****Corresponding author E-mail: hamidmhz@tabrizu.ac.ir

Abstract

Introduction: Considering the breeding calves are one of the most important management programs in dairy farms and calves in the coming years are the main farm profit, proper nutrition is important for their well-being. Calves do not eat enough solid feed in the first few weeks of life due to the lack of complete rumen development. Therefore, milk or milk replacer in this period is the most important source of energy and protein and other essential nutrients for the growth and health of calves. However, milk is a poor source of some minerals and vitamins for suckling calves. **Aim**: The objective of this experiment was to determine the effects of vitamin-mineral supplementation in milk on performances of Holstein suckling calves. **Material and method:** At day of birth, thirty Holstein suckling calves were randomly assigned to 3 treatments with 10 calves in each group from 3 through to 60 days of age. The experiment performed at 4 periods. Treatments were: (1) CON (no additives), (2) LMV (addition of 15 grams of mineral-vitamin supplement per liter of milk) and (3) HMV (addition of 25 grams of mineral-vitamin supplement per liter of milk). Whole milk was fed to calves at two meals at 09:00 and 17:00. In all treatments same starter (20% protein and 3.3 Mcal/kg metabolizable energy) were fed to calves. Calves had free access to starter and water from the beginning of the experiment. Data were analyzed by mixed procedures of SAS (9.1) software. **Results:** Treatments had no effect on body weight changes and daily weight gain of calves ($P>0.05$). Calves on HMV treatment, consumed less starter than CON calves but showed better feed conversion ratio ($P<0.05$). Also, the time spent for starter intake in the CON group was higher than the LMV and HMV calves ($P<0.05$). Dry matter digestibility increased ($P<0.05$) in LMV and HMV in compared to CON group. Blood metabolite analysis showed that total protein concentration was significantly higher in CON when compared with HMV ($P<0.05$). **Conclusion:** Improvement in the nutrients digestibility and feed conversion ratio in calves on LMV and HMV treatments, resulted in lower starter intake but same final weight and daily weight gain of the suckling calves.

Keywords: Blood parameters, Chelate minerals, Efficiency of dietary, Probiotics, Starter intake, Vitamins

Introduction

Considering the breeding calves are one of the most important management programs in dairy farms and calves in the coming years are the main farm profit, proper nutrition is important for their well-being. Calves do not eat enough solid feed in the first few weeks of life due to the lack of complete rumen development. Therefore, milk or milk replacer in this period is the most important source of energy and protein and other essential nutrients for the growth and health of calves (Asadi et al. 2018). Wnuk et al. (2003) reported that there is a shortage of macro-minerals (such as calcium, phosphorus, magnesium, sodium, and potassium) and all micro-minerals (except of Zn) in whole milk. Also, the concentration of niacin (B3), pantothenic acid (B5), vitamin B6, vitamin C, folate, vitamin E and vitamin K is low in milk. Considering very low starter intake in early suckling period, suckling calves cannot get all the vitamins and minerals in sufficient amount from liquid diet. Because milk replacer usually is enriched with vitamin and minerals, then calves on raw milk are more susceptible to mineral and vitamin deficiencies when compared with calves on milk replacer. On the other hand, the level of vitamin B production in newborn calves is not sufficient due to the incomplete development of the digestive tract (rumen and digestion). The deficiency of these vitamins and minerals cause problems in the growth and health of infant calves.

Salles et al. (2014) reported that selenium supplementation to diet (SeR) and milk (SeA) of infant calves (Jersey × Holstein) increased blood concentration of Se in the SeR and SeA. As well as, they observed that dry matter intake tended to be higher in SeR-treated animals than in SeA-treated animals at 30 days of age. Feed conversion tended to be more efficient in Se-supplemented animals compared to the control. Selenium-supplemented calves showed a tendency to have better feed conversion rates than control animals with an intake of 2 kg of food per kg of weight gain. These growth parameters indicate of an improvement in the development of the animals.

Additionally, Sani et al. (2012) with addition of hormone (growing hormone, insulin-like growth factors I and II, prolactin, glucagon and insulin), vitamins and minerals (minerals: consisting of selenium, zinc and vitamins A, D and E) in colostrum and milk of pre-weaning Holstein calves did not observed any significantly effects on dry matter intake, average daily gain and feed conversion ratio. However, treatments did not differ in BW gain and weaning BW. The albumin to globulin ratios were not affected by treatments in that study.

However, Kamada et al. (2007) showed that Se supplementation (3.0 ppm) to colostrum increased IgG amount in blood plasma of newborn calves, without any distinctive effects on blood plasma albumin.

Nonnecheet al. (2010) reported that the substitute nutrition of fat soluble vitamins and minerals by infant calves in three treatments (uncultivated calves (0.11 kg / day), low growth calves (0.58 kg / day) and high growth calves (1.16 kg / day) during 7 weeks caused a significant difference in body weight, so that at the end of the course the tests, uncultivated, low growth and high growth calves weight were 51.4 ± 0.7, 78.6 ± 2.6 and 111.6 ± 1.9 kg, respectively.

In another investigation, Dehghan-Banadaky et al. (2015) studied the effects of complete vitamin and mineral supplementation in milk on growth and health of Holstein bull calves. In that study, vitamin and mineral (VTM) supplementation did not improve average daily gain. Vitamin and mineral supplementation in milk did not affect the concentration of circulating IgG1 or expression of serum amyloid A or haptoglobin in calves. However, VTM supplementation did not affect mineral concentrations in blood of calves. This accumulation indicates that these minerals were supplied in excess in treated diets. VTM supplementation did not affect growth performance or expression of inflammatory acute phase proteins during lipopolysaccharide challenge. They concluded that fetal deposits of minerals and vitamins after birth may be sufficient to sustain the calf at least for a short period.

Also, Mecitogluet al. (2017) did not find any significant difference in the weight gain of Holstein calves by applying vitamins and minerals (7.5g) supplementation. Teixeira et al.(2014) also showed no significant difference in the daily gain of Holstein slaughtered calves with 60 mg zinc, 10 mg manganese, 5 mg selenium and 15 mg copper.

Due to the lack of some vitamins and minerals in milk and low starter intake of suckling calves in early suckling period, it is essential to supply enough vitamins and minerals for these animals to achieve the best performance. In this experiment, the mineral vitamin supplement in milk had all the fat-soluble vitamins, B vitamins and chelated minerals (especially iron, zinc, copper and manganese).

It also contains probiotics and prebiotics which may prevents the growth of pathogens in intestine. Thus the objective of this study was to evaluate the effects of milk mineral-vitamin supplement on performance and blood metabolites of Holstein suckling calves.

Material and Methods

Experimental design, animals and treatments

Thirty neonate Holstein suckling calves (BW=36.76±5.8 kg) in the calf-raising facilities of the Moghan Agro-Industrial and Animal Husbandry Company (Pars-Abad, Iran) were used in this experiment. Calves were separated from their dams at birth and were transferred to individual hutches bedded with clean wheat straw until weaning. The hutches had a roofed area to protect the calf from direct sunlight and rainfall and had a rear window. The mineral-vitamin supplement (Roumak Extra) was prepared from Soha Aghrin Tech Co (Tehran, Iran). This product is a milk soluble supplement that contains all the fat soluble vitamins and B vitamins and chelated minerals especially iron, zinc, copper and manganese. Also, this supplement contains probiotics and prebiotics. Thirty Calves were assigned randomly to one of 3 treatments: CON (no additives); LMV supplement (15 gr mineral-vitamin supplement per milk liter); HMV supplement (25 gr mineral-vitamin supplement per milk liter). Calves received pooled colostrum at 10% of body weight (BW) as 3 times daily for 3 d and whole milk from 4 d until weaning. This study was lasted two months. Calves fed 4 kg per day in the first 4 weeks, 5 kg per day at weeks 5 and 6 and 4 kg per day at weeks 7 and 8 according to the intake of milk program was step down method (Khan et al. 2007). Calves received whole milk twice daily at 09:00 and 17:00 h, with adlibitum access to a starter concentrate (20% protein and 3.3 Mcal/kg metabolizable energy) (Table 1) and fresh water from 3 d. Calves in this study were generally healthy with no mobility and mortality during the study.

All calves were weighed every 14 d until 60 d of age (weaning day). Orts were removed, and fresh starter was offered daily at 10:00 h. Offered starter concentrate and starter orts were recorded daily for individual calves and then daily feed intake was determined. Calves were weaned of milk abruptly when they consumed 1 kg of the calf starter for 3 consecutive days. The length of starter eating behavior was recorded every 5 min for 8 hours (Chapinal et al. 2007).

Table 1: Items and chemical composition of the starter

Item (%)	Content
Barley grain	27.50
Corn grain	40.10
Soybean meal	30.50
Oyster powder	1.40
Salt	0.20
Vitamin and mineral premix	0.30
Chemical composition	
Crude protein(DM)	20
Metabolizable energy (Mcal/kg)	3.3
Ca	75
P	5

Feed and feces sampling and analysis

Feed samples (500 gr) were randomly collected on every two weeks. Feces samples (200 gr) were taken from the rectal at the end day of each experimental period (28, 42 and 60 days). The feed and feces samples were individually placed in plastic bags and then were immediately frozen at -10°C. Feces of all calves were monitored daily and animals with enteritis were recorded and treated. The feed and feces samples were placed in an oven at 60 °C for 72 h (AOAC 2005). Acid-insoluble ash was used as an internal marker to calculate the digestibility of dry matter (DM) and crude protein (CP) (Van Keulen and Young 1977) based on the relative amounts of these nutrients and acid-insoluble ash in the feed, feed refusal and feces.

Blood sampling and analysis

Blood samples were taken from the jugular vein after birth and 30 min before the morning feeding of milk at the end of each period in 10ml heparinic vacuum tubes. Blood samples were placed on ice immediately after collection and centrifuged at 3000 × g for 15 min to harvest plasma. The plasma was stored at -20°C until analysis. Concentrations of glucose, albumin, blood urea nitrogen, total protein and beta hydroxy butyrate in the blood were measured using spectrophotometer (state faz-2100, USA) and commercially available Pars-Azmoon company laboratory kits.

Statistical analyses

Data for starter intake, nutritional behavior, weight gain, digestibility of dry matter and crude protein and blood parameters were analyzed using randomize completely design (with 3 treatments and 10 replicates per treatment) and mixed procedures of SAS (Statistical Analysis Software, Version 9.1, SAS Institute, Inc., Cary, NC). A level of $P<0.05$ was used as the criterion for statistical significance.

Result and Discussion

There were significant difference in daily total dry matter (milk plus starter) and daily starter intake in 3^{rd} and 4^{th} experimental periods. So that total dry matter intake and starter consumption in the CON and LMV groups was higher than the HMV (Table 2). The spend time for starter consumption in the CON group was higher than the LMV and it was higher in LMV when compared to HMV ($P<0.05$). Lower starter intake in the HMV and LMV treatments was probably due to the adequate supply of vitamins and minerals in these treatments that act as antioxidants or coenzyme and cofactors (Shi et al. 2011). Thus, feed efficiency may improve in supplement received animals despite low starter consumption. Lee et al. (2007) and Dominguez et al. (2009) showed that lambs receiving selenium in ration did not significantly differences from the control group in feed intake. But Shi et al. (2011) showed the addition of selenium in the diet increased feed intake in goats. This difference in the results may be due to the higher selenium content in basal diet, resulting difference in absorption of selenium. Also Erickson et al. (1999) and Pradose et al. (2017) reported that different concentrations of phosphorus, calcium, copper, manganese and zinc feeding in calved did not have any significant differences on dry matter intake. In the study by Sani et al. (2012), which used vitamins and minerals (including selenium and zinc and vitamins A, D and E) and hormone (including growth hormone, insulin-like growth factors 1 and 2, prolactin, glucagon and insulin) in colostrum and milk, results showed that the calves were fed the hormone and vitamins had lower dry matter intake compared to the control group.

Table 2- Total starter intake during whole experimental period, daily starter intake (kg) and behavior of starter intake of calves tested in different experimental periods

	Experimental treatments				
	Daily dry matter intake (from milk and starter, kg)				
Period	CON	LMV	HMV	SEM	P value
1	0.54	0.55	0.54	0.01	0.7618
2	0.84	0.82	0.74	0.09	0.3041
3	1.53[a]	1.51[a]	1.33[b]	0.11	0.0307
4	2.02[a]	1.96[a]	1.70[b]	0.14	0.0016
	Daily intake of starter (kg)				
1	0.04	0.03	0.04	0.02	0.6529
2	0.33[a]	0.31[a]	0.23[b]	0.07	0.0414
3	0.89[a]	0.88[a]	0.68[b]	0.12	0.0328
4	1.52[a]	1.48[a]	1.20[b]	0.23	0.0123
	spend time for starter intake (min/8 h)				
1	14.80[a]	7.48[c]	12.04[b]	2.37	0.0024
2	34.36[a]	26.70[b]	16.84[c]	2.90	0.0001
3	42.54[a]	28.70[b]	20.41[c]	4.16	0.0009
4	36.19[a]	28.40[b]	17.73[c]	3.08	0.0001

CON: Milk without mineral-vitamin supplementation

LMV: Supplementation of 15 grams mineral-vitamin per liter of milk

HMV: Supplementation of 25 grams mineral-vitamin per liter of milk

Different Latin letters mean a significant difference between treatments in a period

Although feed intake was numerically lower in HMV than in the CON, but there were no significant differences (P>0.05) between treatments in calves weight and daily weight gain (Table 3). Therefore, the increase in nutritional efficiency in HMV and LMV may be due to improved health status (Williams et al. 1991). Better feed conversion ratios were observed in HMV treatment when compared with CON and LMV groups in 2nd and 4th periods (P>0.05). Improvement in the performance is a cumulative effect of better nutritional efficiency and probably due to higher microbial protein supply (Williams et al. 1991). The reasons for variation and sometimes inconsistency in findings considering the effect of vitamin-mineral supplementations on feed intake and growth performance in different studies can be due to several factors. One of the important factors is the type of supplement and the amount of supplement (Emami et al. 2015). Researchs have shown that different forms of supplementation at different concentrations can have different effects on growth performance through differences in absorption rate of the gastrointestinal tract (Moonsie-Shageer and Mowat, 1993; NRC 2005). They reported that mineral chelates are absorbed in the small intestine by amino acids through amino acid carriers, therefore, have higher absorption rate than other types of minerals such as carbonate, chloride, phosphate, and sulfate. Another effective factor is the type of animal, its body weight and its stage of production. In the study (Van Bibber-Krueger et al. 2016), the use of chromium-yeast supplementation in the diet improved feed conversion efficiency in low weight calves. .Whereas in the heavy calves there was no difference between the chrome consumer calves and the control group. Some studies (Sani et al. 2012; Dehghan-Banadaky et al. 2015; Teixeira et al. 2014; Salles et al. 2013) those used different amount of vitamins and minerals in the diet did not find any significant difference in weight gain of calves. Whereas, Nonneche et al. (2010) and Mecitoglu et al. (2017) and reported that by feeding of milk replacer containing soluble vitamins and minerals in Holstein suckling calves, weight gain significantly was increased (P<0.05).

Table 3- Weight, daily weight gain (kg) of calves tested in different experimental periods

	Experimental treatments				
	Weight (kg)				
Period	CON	LMV	HMV	SEM	P value
1	40.08	38.76	39.19	2.20	43.29
2	47.07	46.27	46.35	2.61	0.7652
3	58.20	56.37	56.61	3.84	0.5441
4	72.97	73.27	71.10	4.30	0.4922
	Daily weight gain (kg)				
1	0.22	0.20	0.14	0.08	0.1076
2	0.47	0.50	0.48	0.11	0.7958
3	0.65	0.71	0.60	0.12	0.1553
4	0.98	0.99	0.96	0.14	0.9047
	Feed conversion ration				
1	2.47[b]	2.64[b]	3.89[a]	0.29	0.0024
2	1.79[a]	1.66[ab]	1.54[b]	0.17	0.0427
3	2.30	2.16	2.16	0.23	0.1322
4	2.02[a]	2.03[a]	1.75[b]	0.15	0.0162

CON: Milk without mineral-vitamin supplementation
LMV: Supplementation of 15 grams mineral-vitamin per liter of milk
HMV: Supplementation of 25 grams mineral-vitamin per liter of milk
Different Latin letters mean a significant difference between treatments in a period

Digestibility of dry matter in LMV and HMV treatments was more than CON treatment ($P<0.05$) in all experimental periods (Table 4). A possible reason for the increased digestibility of DM in the LMV and HMV may be due to supply of required micronutrients to the rumen microorganisms (Galvao et al. 2005). Then, improved digestibility of nutrients in this study may was due to supplying adequate minerals and vitamins for rumen microorganisms. Wang et al. (2009) reported that the addition of minerals improved the fermentation pattern and activity of microorganisms particular cellular bacteria in rumen, which ultimately increased the apparent digestibility of nutrients. Salama Ahmad et al. (2003) reported digestibility of dry matter and crude protein was higher in suckling goats supplemented with zinc methionine (6 g/day). They mentioned that one possible reason to same nutrient digestibility in starters with zinc methionine and without zinc methionine is that the zinc requirements for rumen microbes were supplied from a basic diet. However, Asadi et al. (2018) reported that injection or feeding of selenium and vitamin E at 0.005 mg/kg live weight (0.1 mg/20 kg live weight) in the Dalagh lamb did not showed significant difference in digestibility's of crude protein, organic matter and dry matter intake. These researchers also reported that the digestibility of dietary nutrients was affected by changes in principle dietary components, not Se and vitamin E concentration.

Table 4- Dry matter and crude protein digestibility of calves tested in different experimental periods (%)

	Experimental treatments				
	Dry Matter				
Period	CON	LMV	HMV	SEM	P value
1	ND	ND	ND	ND	ND
2	80.19[b]	82.55[a]	83.87[a]	1.89	0.0038
3	81.66[b]	83.23[ab]	84.50[a]	1.76	0.0064
4	79.98[b]	82.36[a]	83.22[a]	2.32	0.0156
	Crude protein				
1	ND	ND	ND	ND	ND
2	80.65	81.32	81.46	1.35	0.7221
3	81.53	81.41	83.97	2.10	0.1403
4	80.79	82.09	82.82	2.08	0.3440

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LMV: Supplementation of 15 grams mineral-vitamin per liter of milk
HMV: Supplementation of 25 grams mineral-vitamin per liter of milk
Different latin letters mean a significant difference between treatments in a period
ND: Not determined

There was no significantly different in glucose concentration between treatments (Table 5). No effect of supplement on blood glucose concentration in the present experiment could be due to the appropriate level of blood glucose and as well as the lower sensitivity of ruminants to insulin regulation of blood glucose (Haldar et al. 2009).Variance in blood glucose concentrations depends on factors such as age, milk and solid feed intake (Warner 1991; Williams et al. 1994). Winter (1985) reported that increasing of plasma glucose concentration improves energy status in the livestock. In addition, providing more glucose causes decreasing of gluconeogenesis from the amino acid sources, resulting low catabolism and ultimately lower the concentration of blood urea nitrogen. Blood glucose concentration usually alters with variance in diet and physiological age, reflecting a change in energy metabolism, that provide glucose from entered intestinal intact glucose from the dietary energy sources, compared to provided glucose from volatile fatty acids resulted from ruminal fermentation of carbohydrate. Mohri et al. (2011), Dominguez-Varaet al. (2009) and Alimohamadi et al. (2013) also reported a lack of observation of the effect of selenium supplementation on lamb blood glucose concentrations.

Total protein concentration (Table 5) was significantly different in all periods ($P<0.05$).Total protein concentration in all periods in CON treatment was higher than the other treatments. The concentration of protein in the plasma indicates the status of anabolism and catabolism of protein (Kitchelong et al. 1995). Thus, the level of plasma protein at any time resulted from hormonal balance, nutritional status, water balance and other factors affecting animal health (Kitchelong et al. 1995). Reducing feed intake reduces the total protein in the serum (Srikandakumar et al. 2003). Thomas et al. (2018) with using 0.3 mg/kg zinc and 1 mg/kg copper showed that total protein and globulin level in 10 days in calves of second treatment was higher than that of control treatment calves. Chrystian et al. (2018) with supplementation of metaphilactic minerals (zinc, copper, selenium and manganese) showed that the level of total protein and globulin in supplemented lambs was higher than that of control treatment lambs.

Albumin concentration (Table 5) in the plasma was significantly higher in HMV in comparison with the other treatments in the second period ($P<0.05$). Albumin is one of the most effective proteins in the transfer of toxic substances from the body to the liver cells and also acts as an antioxidant (Aliarabi et al. 2014). Albumin transfers vitamins, minerals, unsaturated fatty acids, hormones and other compounds into the immune system (Aliarabi et al. 2014). Sani et al. (2012) did not observe any significant difference between the calves fed with vitamins and minerals with calves in the control group in terms of albumin levels.

Blood urea nitrogen concentration was significantly higher ($P<0.05$) in periods 2 and 4in CON group than the other treatments (Table 5). It should be noted that the synergism of energy and protein metabolism in the rumen affect blood urea nitrogen. The high serum urea may be due to unbalanced energy and protein in the diet or tension, since during the stress cortisol increases serum that may increase the decomposition of amino acids (Peixoto and Osorio 2007). Therefore, changes in blood urea concentrations indicate the interaction of energy and protein in the diet (Darezereshkipoor et al. 2013). In a study by Quigley et al. (2006), with increasing age in calves, the concentration of blood urea nitrogen decreased up to the age of weaning, whereas it’s concentration from the age of weaning until the three weeks after weaning was increased. In a study, using minerals (zinc, copper, selenium and manganese) in lambs caused fluctuations in the level of urea serum, which indicates a high sensitivity to metabolic disorders (Peixoto and Osorio 2007).

Table 5- The concentration of blood glucose, albumin, total protein, beta hydroxy butyrate and urea nitrogen in tested calves (mg/dl) in different experimental periods

	Experimental treatments				
	Glucose				
Period	CON	LMV	HMV	SEM	P value
1	ND	ND	ND	ND	ND
2	ND	ND	ND	ND	ND
3	ND	ND	ND	ND	ND
4	90.57	95.16	93.18	13.69	0.7742
	Albumin				
1	4.91	4.94	4.95	0.46	0.9871
2	4.11[ab]	3.99[b]	4.37[a]	0.28	0.0315
3	5.77	5.73	5.62	0.33	0.5768
4	4.35	4.50	4.35	0.41	0.6478
	Total protein				
1	5.34[a]	4.65[b]	5.31[a]	0.34	0.0006
2	6.29[a]	5.84[b]	5.74[b]	0.45	0.0385
3	6.70[a]	6.50[a]	5.49[b]	0.96	0.0244
4	6.56[a]	5.88[b]	5.80[b]	0.34	0.0001
	Urea nitrogen				
1	39.14	36.97	38.01	3.91	0.5728
2	35.29[a]	35.20[a]	32.46[b]	1.53	0.0011
3	31.89	30.70	31.26	2.49	0.5969
4	35.17[a]	33.68[ab]	31.78[b]	2.44	0.0206
	Beta hydroxy butyrate				
1	ND	ND	ND	ND	ND
2	ND	ND	ND	ND	ND
3	0.17	0.15	0.23	0.07	0.0668
4	0.27	0.25	0.33	0.07	0.0668

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HMV: Supplementation of 25 grams mineral-vitamin per liter of milk

Different Latin letters mean a significant difference between treatments in a period

ND: Not determined

There were no significantly different (P>0.05) between treatments in blood beta hydroxy butyrate (BHBA) concentration (Table 5). With weaning and increasing of feed intake (starter ration), BHBA concentration and other ketone bodies are increased in the plasma (Hill et al. 2007). Stivens and Stitler (1966) showed that BHBA increases with age in relation to increased feed intake and development and activities rumen argued for conversion of BHBA to butyrate. In fact, as Hill et al. (2009) showed that BHBA concentration as an indicator of the size of epithelial metabolic activities in the rumen, because butyric acid absorb and pass through the rumen wall to makeup of BHBA. The same concentration of plasma BHBA in all of treatments may be due to the fact that the concentration of energy in test diets was equal resulting of available energy was similar (Darezereshkipoor et al. 2014).

Conclusion

Improvement in the nutrients digestibility and feed conversion ratio in calves fed mineral-vitamin supplement in milk resulted in lower starter intake, better feed conversion ratio and similar final weight and daily weight gain of the suckling calves.

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تاثیر کاربرد مکمل ویتامینی-معدنی در شیر بر عملکرد گوساله‌های شیرخوار هلشتاین

شبنم دلیر[۱]، حمید محمدزاده[۲*]، اکبر تقی زاده[۳] و حمید پایا[۴]

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[۱]دانش آموخته کارشناسی ارشد تغذیه دام، دانشکده کشاورزی، دانشگاه تبریز

[۲]استادیار گروه علوم دامی، دانشکده کشاورزی، دانشگاه تبریز

[۳]استاد گروه علوم دامی، دانشکده کشاورزی، دانشگاه تبریز

[۴]استادیار گروه علوم دامی، دانشکده کشاورزی، دانشگاه تبریز

مسئول مکاتبه: Email: hamidmhz@tabrizu.ac.ir

چکیده

زمینه مطالعاتی: با توجه به اینکه گوساله‌های شیرخوار آینده صنعت گاو شیری هستند، توجه به رشد و سلامت آنها اهمیت زیادی دارد. گوساله‌های شیرخوار در چند هفته اول زندگی به دلیل عدم توسعه کامل شکمبه قادر به مصرف کافی خوراک جامد نبوده و لذا در این دوره شیر یا جایگزین شیر، مهم‌ترین منابع تامین انرژی و پروتئین و دیگر مواد مغذی برای رشد و سلامتی و عملکرد مناسب گوساله می‌باشند. اما کمبود برخی ویتامین‌ها و مواد معدنی در شیر، باعث بروز مشکلاتی در رشد و سلامتی گوساله‌های شیرخوار می‌شود. **هدف**: هدف این آزمایش تعیین تاثیرات مکمل ویتامینی-معدنی در شیر بر روی عملکرد گوساله‌های شیرخوار هلشتاین می‌باشد. **مواد و روش‌ها**: ۳۰ راس گوساله شیرخوار هلشتاین به طور تصادفی به ۳ تیمار اختصاص یافتند. تیمارها شامل: ۱) CON (بدون افزودنی) ۲) LMV (اضافه کردن ۱۵ گرم مکمل معدنی-ویتامینی به ازای هر لیتر شیر) ۳) HMV (اضافه کردن ۲۵ گرم مکمل معدنی-ویتامینی به ازای هر لیتر شیر). شیر کامل در دو وعده ۹:۰۰ صبح و ۱۷:۰۰ بعد از ظهر توسط گوساله‌ها تغذیه شد. در همه تیمارها استارتر (۲۰ درصد پروتئین و ۳/۳ Mcal/kg انرژی قابل متابولیسم) توسط گوساله‌ها مصرف شد. گوساله‌ها به صورت آزادانه به آب دسترسی داشتند. داده‌ها با نرم‌افزار آماری SAS (۹/۱) با رویه Mixed آنالیز شدند. **نتایج**: وزن بدن و افزایش وزن روزانه گوساله‌ها تحت تاثیر مکمل ویتامینی-معدنی قرار نگرفت (P>۰/۰۵). گوساله‌های تیمار HMV استارتر کمتری نسبت به گوساله‌های گروه شاهد مصرف کردند اما ضریب تبدیل بهتری داشتند (P<۰/۰۵). همچنین زمان مصرف استارتر در گروه شاهد بیشتر از تیمارهای LMV و آن هم بیشتر از تیمار HMV شد (P<۰/۰۵). قابلیت هضم ماده خشک در LMV و HMV (P<۰/۰۵) در مقایسه با CON بیشتر شد. غلظت پروتئین تام خون در همه دوره‌ها در تیمار شاهد بیشتر از HMV بود (P<۰/۰۵). **نتیجه‌گیری نهایی**: بر اساس نتایج این پژوهش، بهبود قابلیت هضم و ضریب تبدیل در گوساله‌های دریافت کننده مکل معدنی-ویتامینی در شیر منجر به کاهش مصرف استارتر شده و درنتیجه وزن نهائی گوساله‌ها مشابه بود.

واژگان کلیدی: پارامترهای خونی، وزن بدن، مواد معدنی کیلاته، پروبیوتیک، مصرف استارتر، ویتامین‌ها