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Research Article

The performance of Holstein calves in response to fat supplementation in starter period

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ABSTRACT

To evaluate the effect of adding calcium salt of soybean oil on the performance and growth of suckling calves, 18 Holstein calves, after the birth with weight average 3.94 ± 42.43 kg were randomized into three groups. The experimental allotments including: 1) the starter without calcium salt of soybean oil (control), 2) starter with 0.3% calcium salt of soybean oil and 3) starter containing 0.5% calcium salt of soybean oil. These allotments were compared in the form of a randomly plan in the range of 5 to 60 days.The using of calcium salt of soybean oil significantly affected the dry matter intake during the test period so that the calcium salt increases the amount of 0.5 percent in starter, compared to the control allotments and 0.3 percent, the dry matter intake significantly increased ($P<0.05$).The results of this experiment showed that the use of different levels of calcium salts of soybean oil have not significant effects on body size (height from the withers, the height of the buttocks, waist circumference and body length) in the different periods of test. The waist circumference was affected in the fourth period of measurement by experimental allotments ($P<0.05$).The daily gain of calves weight and feed efficiency showed no significant difference between the experimental allotments. The concentrations of plasma metabolites (glucose, urea nitrogen, cholesterol, triglyceride and total protein) were not affected by in any time of the measurement by the experimental allotments ($P<0.05$).The test results not showed that using the calcium salt of soybean oil have any significant effects on the growth and performance of Holstein suckling calves.

Keywords: suckling calves, calcium salts of fatty acids, performance

INTRODUCTION

The future of each unit of breeding the dairy cows depends on the success rate in the breeding programs of the calves. The calves breeding is the most important and vital breeding of common activity in the cattle. Fats are the rich compounds of the energy, and when protected give to the calves, will increase the digestibility of nutrients. Studies show that due to high consumption of corn and soybean meal in starter concentrate suckling calves, the ratio of fatty acids, omega-6 to the omega-3 is high in their diet. This high ratio can affect the growth and health of calves (Hvt et al., 2006).It has been shown that supplements of starter with linoleic acid sources and linolenic acid increase the daily gain of average weight and feed efficiency in dairy calves (Hill et al.,2007).Generally, the starter fed to dairy calves were poor in terms of fat and almost empty of Arachidonic acid (C20:4), EPA acid (C20:5) and Dihomo Gamma linoleic acid(C20:6).Moreover, as the calves are older and rumen develope, rumen microbes probably will produce the essential fatty acids. The starter diet containing corn, soybean and oat are common in the United States and contains low levels of linoleic acid and linolenic acid and have the linoleic acid to linolenic acid ratio greater than 15 to 1.This ratio is

beyond the optimal ratio 10 to 1 for the pigs (Los mechanical and Nobel, 1999) and the ratio is of 6 to 1 for a human baby (Klein, 2002).

Since the Linoleic acid and Linolenic acid in the calves' starter diet is low and improvement in the average of daily weight gain and feed efficiency have been observed with adding the linoleic acid and linolenic acid to the calves' starter diet (Hill et al., 2007). So it is assumed that the calves respond favorably to the use of supplements containing these fatty acids.The target of this study was investigate the effect of calcium salt of soybean oil in starter diet on growth, performance, some physical measurements and blood metabolites of Holstein calves.

MATERIAL AND METHODS

In this experiment, 18 Holstein dairy calves (average weight of 42.43 ± 3.94 kg) immediately after birth were randomly assigned to the treatments in dairy farm of Nishabour of Iran. The calves were transferred immediately after birth in individual boxes with a roofed space (1.8 × 1.5 × 2.1 meters, the length, width and height respectively) and alameda (2.7 × 1.5 m, length and width, respectively) with a concrete floor. Experimental rations are including: 1) the starter without calcium salt of soybean oil (control), 2) the starter containing 0.3 percent (dry material of starter) calcium salt of soybean oil and 3) the starter containing 0.5 percent calcium salt of soybean oil, according to Forum National Research (2001) are set, and were evaluated using the computer model (Table 1).The calves after birth were fed in the first 12 hours with colostrum (10% of body weight), and then until the end of the experiment were fed with fresh cow's milk, two meals a day and at the rate of 10% of body weight. Flaming the individual stations every week and were disinfected with disinfectant liquid once in month. Horn burning of the calves was carried out after two weeks. 3 days old calves had access to fresh water and starter concentrate. The test was performed in a period of 60 days, from birth until the age of 2 months. Sampling was performed periodic and on the days of birth (zero), 15, 30, 45 and 60. Feeding was carried out at ten o'clock in the morning and sampling was done at the 12 o'clock. The calves permanently access to the starter concentrate and the starter concentrate was provided only in each day. Weight (12 pm), body length and height of the withers and height of the buttocks (using oblique) and waist and chest circumference (using standard meters) was measured every 15 days. Each calf-vein blood samples were obtained on days zero (start of the experiment), 30 (mid case) and 60 (end of study) to determine blood metabolites (glucose, urea nitrogen, triglyceride, cholesterol, total protein. Samples by needle and laboratory tubes coated with anti-coagulant (EDTA) at a rate of 10 ml were collected by centrifugation at 3000 rpm and then centrifuged for 10 minutes. Plasma collected for glucose, urea nitrogen, triglyceride, cholesterol, total protein was stored at -20 ° C. data of the experiment were performed in a form of "completely random analysis plan. For performance aspect, such as the dry matter intake, daily weight gain, feed conversion and feed efficiency, primary weight of calves were used as covariates. The results were analyzed by procedure GLM in SAS software version 1.9.to compare the average of treatments, have used from the average of Least-squares and Duncan test at 5% error.

RESULTS AND DISCUSSION

The dry matter intake in the sampling days was similar ($P<0.05$) but in the whole experiment period, dry matter intake in the allotments 3 was significantly higher than other two allotments ($P<0.05$).According Sajys et al (2008) dairy cows feed using zero levels, 2, 4 and 6% calcium salts of fatty acids was not significantly changed. Some studies, demonstrate the lack of the calcium salts effect on dry matter intake of food are due to non-availability of fatty acids of calcium salts in the rumen environment, due to low solubility and high melting point (Connell et al., 1990).Studies have shown that the use of calcium salts of unsaturated fatty acids in the allotment can increase feed palatability and decrease the dust feed, and so increase the food consumption (Thompson et al,

1980).Also Drakly et al (2002) reported that the use of calcium salts of fatty acids have no significantly effect on feed intake in four periods of 21 days on fattening calves. But in whole periods, the feed intake significantly increased due to increasing the calcium salts of fatty acids in the allotment (P< 0.05). Using the supplementation of calcium salt of soybean oil had no effect on daily weight gain (gr) of calves and the ratio of weight gain to the feed intake (feed conversion factor), in the days of sampling and testing period (P<0.05). Table 2. Dry matter intake (grams per day), daily weight gain (gr) and feed efficiency of calves fed with experimental allotment in different periods.

Studies have shown that respond to the fat using in the allotment of ruminants and changes in the feed conversion ratio are dependent on the total fat consumption, basic allotment composition, fat source, the level of calcium in the allotment, the type of concentrate material used in the ration and rumenliquid PH.

Also some studies have reported that feed conversion ratio depends on the fat adding to feed intake efficiency, and energy of rations containing fat and simultaneous releasing of protein and energy in the rumen. (Atheist and Leeson, 1985). According to the results, the experimental rations have no significantly effect on body size (height from the withers, the height of the buttocks, waist circumference and body length) in different periods of test (Table 3).The chest circumference were affected by experimental rations in the fourth period of measurement (0.05> P).The calves that are the control rations receiver have significantly lowest level of the chest (89.16 cm) and calves receiving rations containing 0.5 percent calcium salt of soybean oil (93.66 cm), have the maximum size of chest. Watkins and et all (2001) reported that adding fatty acids to the rations increased bone formation and cellular development in the livestock and poultry. Hill et al. (2007) also reported that the addition of various sources of essential fatty acids to the allotment, will affect the body size of dairy calves.In plasma metabolites density investigation, density of glucose, blood urea nitrogen and triglyceride levels were not affected by experimental rations in any time of the measurement (P0.05).Chnydr et al. (1987) observed a slight increase in plasma triglyceride levels, due to the fed of fatty acid calcium salt,. These researchers reported that the increase in fat passes into the small intestine and then increase intestinal absorption in the rations including fatty acids protected with calcium, leads to increase fat and fatty acids in the blood. Triglycerides are necessary to transport the fatty acids in the blood, therefore slightly increased the plasma triglyceride levels of blood. The results are according to the tests by Sanchez et al. (2001) and Borjee (1995).The cholesterol plasma density of blood at the beginning of the study period in the ration containing 0.3% of calcium salt of soybean oil was significantly lower compared to the control ration containing 0.5% of calcium salt of soybean oil (P<0.05). but was not found significant difference between experimental rations in viewpoint of plasma cholesterol of blood in the middle and end of the experiment (P>0.05). Table 3. Physical size characteristics (cm) of calves fed with experimental rations in different periods.

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Table 1: Composition of experimental diets of calves

	Experimental rations*		
Feed matter	1	2	3
Alfalfa leaf	10	10	10
Barleycorn	27.6	27.6	27.6
Corn	14.5	14.5	14.5
Soybean meal	15.9	16.2	15.7
Cottonseed meal	7.3	7.3	7.3
Full cottonseed	3.4	3.4	3.4
Wheat bran	12.6	12.6	12.6
Wheat residue	2.1	2.1	2.1
Yasmino-Max	4.5	4.5	4.5
Calcium salt of soybean oil	0.3	0	0.5
salt	0.15	0.15	0.15
D-calcium phosphate	0.19	0.19	0.19
Sodium bentonite	0.19	0.19	0.19
Mineral and vitamin supplements	1.27	1.27	1.27
Chemical composition of experimental rations			
Dry material	92.20	92.71	92.41
Crude protein	22.10	22.73	22.95
Soluble fiber in acid detergent	8.07	8.35	8.75
Soluble fiber, neutral detergent	21.60	20.91	21.00

Dry matter	92.33	91.50	91.89
Calcium	1.30	1.35	1.32
Phosphorus	0.50	0.54	0.59

*Experimental allotments 1) the starter without the calcium salt of soybean oil (control), 2) the starter containing 0.3 percent calcium soybean oil and 3) the starter containing 0.5 percent calcium soybean oil.

Table 2: Effects of experimental rations on the dry matter intake (grams per day), daily weight gain (g) and feed efficiency in calves

P-value	SEM	Experimental rations*			period
		3	2	1	
					Dry matter intake (grams per day)
0.578	19.582	92.02	84.76	84.52	Days 0-15
0.443	59.929	360.95	225.36	263.10	Days 15-30
0.308	80.212	503.80	325.60	309.50	Days 30-45
0.858	117.642	590.80	495.20	458.30	Days 45-60
0.098	33.302	386.91[a]	282.74[b]	278.87[b]	Whole period
					daily weight gain (g)
0.873	78.180	138.70	214.90	166.10	Days 0-15
0.206	81.796	369.10	223.80	144.60	Days 15-30
0.169	107.457	867.90	766.70	719.00	Days 30-45
0.538	55.120	989.29	875.00	954.76	Days 45-60
0.238	32.092	551.81	485.42	463.06	Whole period
					feed efficiency
0.613	0.938	0.78	0.58	0.46	Days 0-15
0.574	0.404	0.99	0.44	0.64	Days 15-30
0.734	0.126	0.61	0.44	0.55	Days 30-45
0.849	0.127	0.61	0.59	0.47	Days 45-60
0.182	0.043	0.71	0.58	0.58	Whole period

*The experimental rations; 1) The starter without calcium salt of soybean oil (control), 2) The starter containing 0.3 percent calcium soybean oil and 3) The starter containing 0.5 percent calcium soybean oil.

Table 3: Effects of experimenta lrations on the height from the withers, height of the buttocks, body length, waist circumference, Chest in calves

P-value	SEM	Experimental rations*			period
		3	2	1	
					height from the withers
0.507	1.586	80.66	78.66	78.17	Days 0-15
0.637	1.128	82.33	82.33	81.00	Days 15-30
0.834	1.116	84.66	84.00	83.66	Days 30-45
0.439	0.927	87.50	86.00	86.00	Days 45-60
0.551	1.850	90.66	90.16	89.00	Whole period
					height of the buttocks
0.652	1.528	83.83	83.66	82.00	Days 0-15
0.543	1.031	86.67	86.50	85.16	Days 15-30
0.983	0.903	88.34	87.17	86.66	Days 30-45
0.471	0.941	91.16	90.50	89.90	Days 45-60
0.399	1.106	95.16	94.33	93.00	Whole period
					body length

0.531	1.130	71.83	70.83	72.66	Days 0-15
0.809	0.904	73.83	73.50	74.33	Days 15-30
0.462	0.747	76.83	75.50	76.00	Days 30-45
0.338	1.926	79.66	78.66	79.66	Days 45-60
0.584	1.146	85.16	83.50	84.00	Whole period
					waist circumference
0.192	1.259	79.00	76.66	75.67	Days 0-15
0.167	1.486	84.00	80.83	80.00	Days 15-30
0.281	1.396	88.16	85.83	85.00	Days 30-45
0.299	1.902	95.83	93.33	91.50	Days 45-60
0.622	1.255	103.50	102.83	100.50	Whole period
					Chest
0.473	0.891	80.83	79.66	79.33	Days 0-15
0.387	0.948	83.16	82.83	81.33	Days 15-30
0.162	0.837	86.83	85.16	84.50	Days 30-45
0.080	1.347	93.66^{a}	90.33^{ab}	89.16^{b}	Days 45-60
0.757	1.183	98.66	97.66	97.50	Whole period

*The experimental rations; 1) The starter without calcium salt of soybean oil (control), 2) The starter containing 0.3 percent calcium soybean oil and 3) The starter containing 0.5 percent calcium soybean oil.