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Effect of using extruded linseed on colostrum production, composition, some blood parameters and overall health in Holstein dairy cows

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ABSTRACT

This study was for investigating to the effect of dietary supplementation of extruded linseed on colostrum production, colostrum composition and some blood parameters of Holstein calves. The Average of lactation period of 20 transition cows was same. They were divided in two groups. First group was control and the second group was treatment. Diets were designed have similar composition of protein and energy. Experimental diet was including based diet in addition of 500 g/kg DM extruded linseed per head and control diet group was including based diet without extruded linseed. After calving each cow colostrum samples were obtained, also blood samples were gathering in day of birth (d 0), 7 and 14 days after birth. Data were analyzed by GLM proc. Data showed that the colostrum production was higher in treatment group (6.85L) than control group (5.66L), Fat, Lactose, protein and SNF were greater in control group, and also SCC was greater in control group due to mastitis. Cows fed extruded linseed had difference results in blood parameters, but there was not any significant between blood parameters in groups. Vitamin A (Vit A) was greater in d 0 (4.12 mg/dl) and d 7 (9.21mg/dl) after birth, Vit E was greater on d 7 (0.82 mg/dl), and Vit D was higher just in day of birth (33.2 mg/dl) in treatment group. Cows fed extruded linseed had higher IgM than IgG. Also IgG was higher in d 0 (8.57 g/ml) and d 7 (9.20 g/ml) after birth and IgG was greater in d 14 (9.78 g/ml). Result of this study showed that using of extruded linseed could affect on colostrum production, composition, some blood parameters and overall health in Holstein dairy cows.

Keywords: Extruded Linseed, Dairy Cow, Colostrum, Vitamins, Immunoglobulin.

INTRODUCION

It is well recognized that calves are highly susceptible to microorganisms and subsequently death, a response that may reflect deficiencies in both innate and adaptive immune responses (Roy, J.H.B, 1990). The high mortality rate of calves was due to the high incidence and poor survival of septicemia calves (Lofstedt, J., Dohoo, I.R., Duizer, G, 1999). Colostrum is essential material for calves due to have protein, lactose, fat, vitamins (A, B, D, E), and minerals, IgG, IgM and IgA (Halliday et al., 1978; Butler, 1983). Scientist had found that in the new born calves the absorption of colostrum immunoglobulin were influenced by the two major factors ; the age of calf when it receives its first feed of colostrum and the amount of immunoglobulin presented to the calf (Kruse, 1970; Selman, 1973). The efficiency of absorption appears to be maximal shortly after birth and declines steadily thereafter with cessation of absorption occurring at about 20 hours postpartum (Selman, 1973). However in some calves this closure can occur as early as 12 hours postpartum (Stott GH et al., 1979). The quantity of immunoglobulins presented to the newborn calf is dependent on the volume of colostrums offered and the immunoglobulin concentration of that colostrum. Calves with low serum concentrations of absorbed colostral immunoglobulins are very susceptible to infectious disease (Fer H, 1971; McGutre et al., 1976; Naylor JM et al., 1977). Linseed is an excellent source of α- linolenic acid (18:3 n-3), a member of the n-3 (omega-3) fatty acids (FA), (Sinclair, A.J., Attar-Bashi, N.M., Li, D., 2002).

The oil fraction of flax seed isapproximately0.55omega-3α-linolenicacid (Mustafa, A.F., Mckinnon, J.J., Christensen, D.A., He,T., 2002). Omega-3 fatty acids are known to be able to decrease the risks of cardiovascular diseases, hypertension and arthritis as well as having important impacts on the development of the nervous system (Parodi,P.W1997Sinclair, A.J., Attar-Bashi, N.M., Li, D., 2002) and it is essential fatty acid (FA) that is not synthesized in humans (Petit, H.V., Cortes, C., 2010).Flaxseed is also known to increase concentrations of PUFA in milk, but usually theydonotexceed3to4%oftotalfattyacids (Kennelly ,J .J, 1996).Feeding flax seed generally results in the lowest omega-6 to omega-3F A ratio in milk fat (Petit, H.V, 2002), which may improve milk FA profile and result in better human health. In general, untreated whole flaxseed is readily eaten by dairy cows, and feeding up to150g/kg DM as flaxseed had no effect on dry matter intake of early (Petit, H.V., 2002) and late lactation (Martin, C., Rouel, J., Jouany, J. P., Doreau, M., Chilliard, Y., 2008) dairy cows. Feeding flaxseed in the diet could contribute to increased milk production protein and ALA concentrations in milk by dairy cows (Petit, H. V., Dewhurst, R. J., Proulx, J. G., Khalid, M., Haresign, W., Twagiramungu, H., 2001; Da Silva, D. C, Santos, G. T. D., Branco, A. F., Damasceno. J. C., Kazama, R., Matsushita, M., Horst, J.A., Dos Santos, W.B.R., Petit, H.V., 2007). Linseed and extruded linseed have positive influences on dairy cows, but no study about effect of extruded linseed on other functional immune responses and overall health in calves, so this study was investigated the effects of using extruded linseed on colostrum production, composition, some blood parameters and overall health in Holstein dairy cows.

MATERIAL AND METHODS

Cows, Diets and Experimental design

The experiment was conducted at the dairy farm from October to December 2012 in Esfahan-Iran. Cows were housed in tie stalls and fed individually. We randomly selected 20 multi parous Holstein cows during the dry period (initial body weight (BW): 600 ± 5 Kg). Cows were blocked for similar expected calving dates and randomly allotted to either a control diet (no extruded linseed) or an experimental diet containing extruded linseed. Diets were designed to have similar concentration of crude protein (CP), ether extract (EE) and net energy for lactation (NE_L). Diets were designed to have similar concentration of crude protein (CP), ether extract (EE) and net energy for lactation (NE_L) as shown on (Table 1). Cows were fed twice daily at 07:00 and 15:00 h. Treatment group cows received 500 g/kg DM extruded linseed daily from 21days before calving until calving. New born calves received colostrum until 3 days and after that they received starter diet.

Table 1. Ingredients and chemical composition of the experimental diets fed to dairy cows

Ingredients , (% DM)	Experimental diet	Control diet
Alfalfa hay (chopped)	2.70	2.70
Corn silage	4.40	4.40
Barley grain	1.76	1.76
Corn grain	1.32	1.32
Fish meal	0.27	0.27
Soybean meal	0.81	0.81
Canola meal	0.36	0.36
Cotton seed	0.27	0.65
Extruded linseed	0.44	0
Megalac	0	0.07
Magnesium oxide	0.04	0.04
Calcium carbonate	0.17	0.17
Dicalsium phosphate	0.06	0.06
Magnesium sulfate	0.10	0.10
Ammonium chloride	0.07	0.07
Vitamin and Mineral premix	0.20	0.20
Chemical composition (g/kg DM)[1]	12.97	12.98
Cp	15.64	15.61
NE_L ,[2] Mcal/kg	1.52	1.51
NDF,	36.48	37.64
PeNDF	27.30	28.41
Crude protein	15.64	15.61

[1] *Concentrate mixtures were calculated using the chemical analyses provided in NRC (2001).*
[2] *Calculated using published values of feed ingredient NRC (2001).*

Sample collection and analyzes

After calving, colostrum production determined by special pails (kg) and after that colostrum samples were obtained for determine colostrum composition .Colostrums compositions analyzed separately in veterinary laboratory in the farm to determine fat, somatic cell count (SCC), lactose, protein and solids non fat (SNF) by Combifoss system. Combifoss TM combines the proven technology of Fossomatic TM FC and MilkoScan TM. Fossomatic FC is based on the flowcytometry technology. This technique is based on counting and characterizing particles and cells. MilkoScan TM FT+ is based on Fourier Transform Infrared (FTIR). It works with the mid-infrared region of the spectrum from 3-10 µm corresponding to 1000-5000 cm (Combifoss TM FT+; Foss Electric, Hillerod, Denmark). Blood samples were collected from all calves one hour after birth, 7 and 14 days after birth. Blood samples were withdrawn from the jugular vein into Vacutainer tubes containing EDTA. Immediately after obtaining plasma samples, they analyzed separately to determine blood parameters in veterinary laboratory in the farm for determine vitamin A, vitamin D and vitamin E (lot; 20323, ids, CA, USA), and also immunoglobulin M and immunoglobulin G by ELISA method. Calves were weighted one hour after birth and in all of period of experiment they controlled daily to determine level of overall health of them and their with stand in diseases. All information about overall health of calves was recorded separately in center of statistics and information (SI) in the farm during the experiment.

Data analysis

Data were collected and analyzed using the general linear model procedure of SAS (2001). Differences between means were analyzed by Duncan's multiple ranges test and P value less than 0.05 was considered as significant.

RESULTS AND DISCUSSION

Colostrum composition and production

There were not any significant between parameters of colostrums. Cows fed extruded linseed had higher colostrum production than those fed based diet without extruded linseed, but they had lower fat percentage than control group. Protein, lactose and SNF concentration were higher in control group. SCC was also greater in control group due to mastitis in that group.

Table 2. Effect of extruded linseed on colostrum composition and production ($P< 0.05$)

Item	Treatment *	Control **	SEM	P-value
Colostrum yield (kg)	6.86	6.21	1.18	0.71
Fat concentration (%)	1.54	1.58	0.30	0.92
Protein concentration (%)	5.40	6.31	0.55	0.25
Lactose concentration (%)	1.14	1.26	0.40	0.84
SCC (n/dl)	568	1478.5	614.50	0.30
SNF (%)	7.73	8.64	0.75	0.40

* *Treatment group with based diet in addition of extruded linseed.* ** *Control group with based diet without extruded linseed.*

In contrast, supplementation of linseed oil decreased milk yield of dairy cows (Brown et al., 2008; Martin et al., 2008) Indeed, the decrease in milk production reported in some previous studies was associated with a depression in DMI and diet digestibility due to disturbances in rumen function caused by a high level of LSO intake (i.e., >5% of DMI). Discrepancies among studies on effect of linseed supplementation on milk yield of dairy cows might be due to the form of oil, added level, and different duration of the experiment. Benchaar et al (2012) show that linseed oil can be safely supplemented up to 4% in forage-based diets of dairy cows to enrich milk with potential health beneficial FA (i.e., n-3 FA) without causing any detrimental effects on rumen function, digestion, and milk production. They showed that feeding increasing levels of line seed oil linearly decreased milk fat content of short- and medium-chain FA (8:0 to 16:0), and increased the proportion of most 18 car-bon FA in milk fat. These effects are consistent with the reduction in de novo FA synthesis due to feeding unsaturated oils, which occurs as a result of greater uptake and secretion of dietary or ruminally derived FA (Palmquist et al., 1993).

Eddie et al (2004) concluded that the fatty acid composition of milk can be manipulated by dietary means to increase the potentially beneficial supply of α-linolenic and conjugated linoleic acids, and total MUFAs and PUFAs to the human diet. Fatty acids which are potentially harmful to human health including, myristic and palmitic acids, can also be concomitantly reduced. Although substantial amounts of dietary α-linolenic acid can be incorporated into milk from protected linseed sources.

Benchaar et al (2012) showed that Milk fat content was not affected by line seed oil supplementation, whereas milk protein content decreased linearly with increasing amounts of line seed oil in the diet.

Santschi et al (2008) showed that the type of fat supplement consumed had no effect on the quantity of milk produced, nor its composition or yields of its main constituents. They also showed that proportions of short chain FA in milk were not affected by treatment, both in colostrum and milk, whereas medium chain FA were higher in colostrum of cows from the palm oil and line seed oil groups.Petit and Benchaar (2007) used transition cows to compare fat supplements based on whole linseed, acommercial product containing mainly palmitic andoleic acids, and micronized soybeans, and found no treatment effect on either milk composition or production.

Blood parameters
From day of birth to 14 days after birth increased Vit A in treatment and control group that this increase was greater on d 0 and d 7 in treatment group and on d 14 in control group. Vit E percentage was higher on d 0 and 14 days after birth in control group than treatment group, and also increased Vit E on d 7 in treatment group than control group. Cows fed extruded linseed had higher Vit D on d 0 than control group and it was higher on d 7 and d 14 in control group than treatment group. Cows fed extruded linseed had higher IgM than IgG. IgG proportions was higher on d 0 and d 7 in control group and IgM proportions was higher in d 0 and 7 days after birth in treatment group.

Table 3. Effect of extruded linseed on blood parameters (P< 0.05)

	Treatment * (day)			Control ** (day)			SEM			P-value		
Blood Parameters	0	7	14	0	7	14	0	7	14	0	7	14
Vit A	4.12	9.21	10.27	4.02	8.56	10.46	0.76	0.92	1.48	0.93	0.62	0.93
Vit E	0.58	0.82	0.57	0.63	0.66	0.66	0.13	0.13	0.11	0.78	0.39	0.57
Vit D	33.2	30.77	31.55	31.72	34.03	44.06	2.85	3.74	6.18	0.71	0.54	0.17
IgG	8.57	9.20	9.78	8.91	9.40	9.63	0.50	0.31	0.31	0.37	0.65	0.72
IgM	1.89	1.80	1.80	1.67	1.77	1.95	0.11	0.08	0.13	0.17	0.84	0.41

** Treatment group with based diet in addition of extruded linseed. ** Control group with based diet without extruded linseed.*

5% soybean oil in dietary intake of colostrum produced by Hangtal (2008) was also observed. According to studies Allredetal (2006) who reported that supplementation with fatty acids are polyunsaturated fats like soybean oil had no adverse effect on milk production. Linseed reported no effect on milk fat percentage but decreased milk protein. Akraim (2007) showed that that cows fed Linseed had lower milk fat and milk protein. Feeding. Linseed or polyunsaturated fats in dairy calves from birth to 4 weeks before the expected delivery of specified fat in colostrum fat nutrient source is created. By preliminary report kosmeljetal (2001) showed that the effect of nutritional supplementation in reducing the number of somatic cells in goat sector α-Linoleic acid feeding period it is effective.

Table 4. Birth weight of new born calves was greater in treatment group

Item	Treatment	Control	SEM	p-value
birth weight (kg)	38.74	37.68	2.13	0.73
Weigh cut Milk (kg)	95.00 [b]	108.10 [a]	3.27	0.01
Age cut milk (day)	88.70	88.00	1.11	0.67

Fatty acids, lactose and non fat solid of colostrum hadn’t any influence by extruded linseed, cows fed base diet without extruded linseed had higher level of solid non fat than cows fed extruded linseed. Somatic cell count were higher in cows fed ration without extruded linseed than other group, but there was not any significant between them (p>0.05). Calf body weight in time of the birth were higher in cows fed base diet with extruded linseed than cows fed base diet without extruded linseed. Proteins were greater in colostrum of cows fed ration without extruded linseed, but there was not any significant between them (p>0.05). Vitamin A was greater in serum of cows fed ration including extruded linseed than cows fed base diet without extruded linseed, but there was not any significant between them (p>0.05). Vitamin D was greater just in day of birth, but there was not any significant between them (p>0.05). Cows fed extruded linseed had higher IgM than IgG. Immunoglobulin M was higher in d 0 (8.57 g/ml) and d 7 (9.20 g/ml) after birth and IgG was greater in d 14 (9.78 g/ml). Learch et al (2012) showed that the effects of oilseed supplementation depended on oilseed nature (rapeseed or linseed) and form (extruded seeds, cold- pressed fat-rich meal, or whole unprocessed seeds) in interaction with the type of basal diet (grass silage and hay or pasture) and the concentrate composition and percentage in the ration. Bork et al (2010) showed that feeding flaxseed at 0.85 kg/cow per day (DM basis) altered the fatty acid profile of milk, but milk yield, milk com-position, and reproductive performance of dairy cows were not affected. Larsen et al (2012) concluded that up to 6.8% of oilseed supplementation can be fed without production problems and, in many cases, with positive production responses, including an improved milk fatty acid profile. Suksombat et al (2014) indicated that supplementation of whole linseed to lactating dairy cows had no effect on milk yield and milk composition.

CONCLUSION

Findings of the present study indicate that using extruded linseed could affect on colostrum production, composition blood parameters and overall health on Holstein dairy cows. We observed that vitamin A was greater in serum of cows that fed with extruded linseed than cows fed base diet. We found that vitamin D was greater just in day of birth. Also we found that cows fed extruded linseed had higher IgM than IgG and IgM was higher in d 0 after birth. further studies are needed to explore and more detail explanation.

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