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Effects of pre- and postpartum feeding fish meal on blood metabolites in early lactating Iranian Holstein cows

A. Heravi Moussavi, M. Danesh Mesgaran, T. Vafa, A. Soleimani
Department of Animal Science and Excellence Centre for Animal Science, Ferdowsi University of Mashhad, Mashhad, Khorasan Razavi, Islamic Republic of Iran
Email:bbheravi@yahoo.com

Introduction The transition phase, typically defined as 3 wk before to 3 wk after parturition, is viewed as a critical time in the lactation cycle of a dairy cow. During early lactation dry matter intake (DMI) lags behind the nutrient requirements for milk yield. So, the onset of lactation in the dairy cow is characterized by a dramatic increase in the nutrient demands for milk synthesis. Fish meal (FM) is used in dairy cow ration as a source of RUP in some countries. Greater rumen escape of FM protein is known to increase efficiency of protein utilization in lactating cows. Moreover, FM has an excellent profile of amino acids and is a good source for the 2 most limiting amino acids for milk synthesis, lysine and methionine. Fish meal also contains oil (8 – 10% of DM) with relatively high concentrations of two polyunsaturated fatty acids (PUFA) of the n-3 family, eicosapentaenoic acid (EPA, C20:5) and docosahexaenoic acid (DHA, C22:6), which can be supplied only by the diet because EPA and DHA cannot be synthesized de novo in mammalian systems. Of the available feedstuffs that are high in undegradable protein, fish meal often is effective in improving milk production. Meanwhile, reports on the effect of fish meal on blood metabolites in pre- and postpartum cows are rare and needs more investigation. The objective of this experiment was to compare diets with or without fish meal from transition period up to 35 days in milk (DIM) and their effects on blood metabolites in early lactation Iranian Holstein cows.

Materials and methods From approximately 3 weeks before calving to 35 days after calving, ten multiparous Holstein cows were blocked by parity, expected calving date, and previous 305-d milk production and were randomly assigned within block to 1 of 2 diets containing none (n=5) or 3.5% and 1.95% Kilka fish meal during the prepartum and postpartum periods, respectively. Diets were formulated to be isoenergetic and to provide similar amounts of net energy lactation (NEL) and non-fibrous carbohydrate (NFC) using the Cornell Net Carbohydrate and Protein System. Using vacutainer tubes, blood samples were collected weekly after calving via venipuncture of coccygeal vessels before the morning feeding to monitor serum metabolites. The data were analyzed using the MIXED procedure of SAS (2001) for a completely randomized design with repeated measures.

Results The effect of experimental diets on some blood metabolites during the first 35 DIM are shown in Table 1. The blood metabolites were all similar among the groups. Except for cholesterol, the effect of time was not significant. In contrast with our study, another study showed that feeding fish oil to dairy cows from prepartum to early lactation reduced plasma concentration of glucose (Mattos *et al*., 2004). Serum urea nitrogen (SUN) was similar among the diets in agreement with other report (Heravi Moussavi *et al*., 2007a). Dietary CP content is the most important nutritional factor influencing blood and milk urea nitrogen. It seems because of adjusting the diets to have close amount of metabolizable protein in the current study, SUN was similar among the diets. Results of the current study based on the similar serum triglycerides (TG) level showed that the diets had no apparent impact on fat metabolism. The diet had no effect on serum cholesterol in consistent with another recent report (Heravi Moussavi *et al*., 2007b). The effect of time was significant ($P < 0.001$) and cholesterol concentrations increased after parturition. Feeding fat to dairy cattle sometimes increased plasma cholesterol, and the increase is independent of the degree of fatty acid saturation, although some other study reported no difference.

Table 1 Serum metabolite concentration during the first five weeks postpartum in cows fed diets containing none (Control) or 3.5 and 1.95% fish meal during prepartum and postpartum periods (Supplemented)

	Diets		SED	*Treat. P*	*Time P*
Parameter	Control	Supplemented		Value	Value
Glucose, mg/dl	51.0	51.52	2.31	0.87	0.12
Serum urea nitrogen (SUN), mg/dl	15.13	14.0	0.9	0.66	0.18
Triglycerides, mg/dl	27.84	29.52	4.37	0.79	0.38
Cholesterol, mg/dl	155.10	145.66	7.0	0.37	<0.01

Conclusions The results of this study demonstrate that adding fish meal to the diet did not exert general metabolic effects as plasma concentrations of glucose, SUN, cholesterol as well as serum TG were similar among dietary groups.

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