Effects of timing and duration of fish oil supplementation of pregnant ewes on maternal and offspring performance up to weaning

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Introduction Long chain polyunsaturated fatty acids (PUFA) of the n-6 and n-3 series are essential for development of the nervous and immune systems in growing foetuses. Pregnant ewe rations are often undersupplied with these fatty acids, and there is evidence of improved neonatal vigour (Capper *et al*., 2006) and reduced lamb mortality (Annett *et al*., 2009) when diets are supplemented with long chain PUFA (fish oil) during the period of rapid foetal growth in late pregnancy. However, fish oil supplementation prior to lambing has also been shown to reduce colostrum production (Annett *et al*., 2008) which could offset the developmental benefits for lamb survival within extensive, easier-care sheep systems. Foetal brain development reaches its peak between 6-10 weeks pre-lambing (Turley *et al*., 1996); therefore fish oil supplementation earlier in pregnancy could provide a suitable compromise, as suggested by Pickard *et al*. (2008). The objectives of the current study were to investigate the effects of fish oil supplementation at different stages of pregnancy and for different periods of time on ewe and lamb performance.

Materials and methods One hundred and twenty six multiparous ewes (live weight 75 ± 11.1 kg; body condition score 2.9 ± 0.5) of mixed breeds (Lleyn X, Belclare X and Texel X) were housed on day 84 following a synchronised mating to Suffolk, Texel, Highlander and Primera sires. Half the ewes were individually housed while the remainder were housed according to litter size in groups of 3-4. At housing, ewes were allocated to one of six treatments (n = 21) balanced for condition score, ewe breed, sire breed and litter size. All ewes were offered precision chop grass silage plus protein balancer (228 g CP/kg DM), the quantities being adjusted weekly depending on stage of pregnancy and litter size. In addition, ewes were offered 20 g/d crude herring oil (United Fish Industries Ltd, Killybegs, Ireland), using milled barley as a carrier, which commenced 3, 6 or 9 weeks pre-lambing and continued for a period of either 3 or 6 weeks, as follows: 9/3 (T1); 6/3 (T2); 3/3 (T3); 9/6 (T4), 6/6 (T5) or 0/0 (Control, T6). A protected fat supplement (Maxfat-CS®, Trouw Nutrition, Belfast) was offered to ewes not receiving fish oil to ensure diets were iso-lipidic. Silage was offered daily at 0930 h while supplements were offered in two equal size feeds at 0930 h and 1600 h. Intakes of silage and supplement were recorded daily. Ewe live weight and body condition scores were measured fortnightly pre-lambing, within 24 h lambing, 6 weeks post-lambing and at weaning. Lambs were tagged and weighed at birth, 6 weeks of age and at weaning. Lambing difficulty was scored on a four-point scale where 1 = no assistance and 4 = manual delivery with difficulties. Lamb viability was scored on a 3-point scale (1 = up & sucked; 3 = helped to suck). Data were analysed as 6 treatments using Residual Maximum Likelihood (REML) analysis with contrasts used to make factorial comparisons. Covariates were included for ewe breed, sire breed, litter size, lamb age and sex, where appropriate. Lambing difficulty data were analysed using regression analysis.

Results There were no significant treatment interactions so only the main effects are presented. Neither fish oil supplementation *per se*, stage of gestation when supplementation commenced or the duration of the supplementation period had any significant effects on silage dry-matter intake, lamb mortality, lamb viability, the incidence of lambing difficulties or lamb growth rate up to weaning. However, commencing fish oil supplementation at 9 weeks rather than 6 weeks pre-lambing led to a 0.5 kg increase in mean lamb birth weight, regardless of the duration of the supplementation period.

Table 1 Effects of fish oil supplementation strategy on ewe and lamb performance

Treatment	9/3	6/3	3/3	9/6	6/6	0/0	s.e.d	F	S	D
Silage DM intake (kg/d)	0.93	0.91	0.92	0.93	0.90	0.92	0.032	NS	NS	NS
Prop. lambs born dead	0.07	0.07	0.08	0.05	0.07	0.03	0.058	NS	NS	NS
Mean lamb birth wt (kg)	4.7	4.3	4.8	4.8	4.3	4.5	0.23	NS	*	NS
Lamb viability score	1.02	1.00	1.00	1.00	1.00	1.03	0.023	NS	NS	NS
Prop. ewes assisted	0.62	0.72	0.75	0.71	0.68	0.59	0.104	NS	NS	NS
Prop. lambs died birth to wean	0.07	0.12	0.13	0.05	0.14	0.06	0.077	NS	NS	NS
Birth to weaning LWG (g/d)	251	265	275	267	276	264	12.3	NS	NS	NS

D, duration of supplementation; DM, dry-matter; F, fish oil supplementation; LWG, live weight gain; S, start time of supplementation ; Treatments are denoted in the format A/B where A = Start of fish oil supplementation (weeks pre-lambing) and B = Duration of supplementation period (weeks)

Conclusion The results of this study suggest that supplementing ewes with crude fish oil during mid and late pregnancy has limited benefits for lamb viability and weaned lamb output, irrespective of the timing or duration of the supplementation period.

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