Animal Reproduction

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Physiology of reproduction in male and semen technology

Impact of diets enriched with omega-3 fatty acids or antioxidants on Belgian blue bull semen

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Improving bull semen quality and quantity is an important issue for artificial insemination (AI) centers. Spermatogenesis is influenced by many factors, including genetics and nutrition. The objective of the study was to evaluate the impact on blood and semen parameters of enriching the diet of Belgian blue bulls with 1. Omega-3 fatty acids: concentrate enriched with extruded linseed (Linamix, Dumoulin) providing an omega-3 concentration of 14g/kg instead of 3.7 and extra vitamin E to prevent lipid peroxidation (160mg/kg instead of 50) = O3 diet; 2. Antioxidants :concentrate supplemented with 47mg/kg beta-carotene, 200mg/kg encapsulated grape extracts rich in polyphenols (Nor-Grape BP-0, Nor-Feed), 600 mg/kg melon extracts rich in superoxide dismutase (Melofeed, Lallemand) and 1mg/kg selenium instead of 0.8 = AX diet; 3. in comparison with the basic concentrate without enrichment = CT diet. After at least one month of receiving the CT diet, 24 Belgian blue bulls (1 to 9 years old) housed in the AI center of Inovéo (Ciney, Belgium) were randomly assigned to 3 groups. Each group received successively the three diets (basic diet + 1.25kg concentrate per 100 kg BW per day) for a period of 4 months in a different order. At the end of each 4-month period, specific analysis were conducted on semen (volume, concentration and computer assisted sperm analysis for motility and morphological parameters; fatty acid profiles analysis using gas chromatography) and blood samples (concentration in selenium, vitamin A and vitamin E). Statistical analysis was performed using a mixed model for repeated measurements with diet, period of the year and their interaction as fixed effects. A majority of the measured parameters was influenced by the period of sampling. As expected, blood concentrations in selenium and vitamin A were on average higher with the AX diet ($p=0.0011$ and 0.034, respectively), while the vitamin E concentrations were higher with the O3 diet by comparison with the two other diets ($p<0.0001$). A higher semen concentration was found with the AX diet by comparison with the CT diet (mean: 1.45 vs 1.28 billion spz/ml; $p=0.037$). The proportion of motile spz also tended to be higher for the AX by comparison to the CT regime (mean: 60.6 vs 56.1%; $p=0.098$). No significant difference was observed for the semen parameters between the AX and the O3 diet or between the O3 and the CT diet. The diet did not significantly influence the other measured sperm characteristics, including the proportion of progressive spermatozoa. The proportion of saturated, monounsaturated or polyunsaturated fatty acids in sperm cells was similar between diets. However, the O3 diet significantly increased the proportion of docosahexaenoic acid (DHA; $p=0.0001$) and its precursor alpha-linolenic acid (ALA; $p=0.0009$) by comparison with the two other diets. A high DHA content in sperm membranes usually correlates with a better sperm quality, which was not demonstrated in the present study. In conclusion, the diet enriched in linseed increased the DHA content of the sperm, while supplementing the diet with a cocktail of natural antioxidants had a positive impact on semen concentration and motility.

Keywords: belgian blue bull, semen, antioxidants