

姜璐瑶, 张迎锐, 贾思潼, 等. 东佛里生奶绵羊精液冷冻前后代谢组学比较分析 [J]. 畜牧与兽医, 2024, 56 (8): 7-14.

JIANG L Y, ZHANG Y R, JIA S T, et al. Comparative analysis of metabolomics of semen before and after freezing in East Friensian dairy sheep [J]. Animal Husbandry & Veterinary Medicine, 2024, 56 (8): 7-14.

东佛里生奶绵羊精液冷冻前后代谢组学比较分析

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摘要: 旨在通过比较东佛里生奶绵羊精液冷冻前后代谢组学的差异, 进一步探究精子冷冻损伤潜在机制, 为优化奶绵羊精液冷冻稀释液配方提供一定的理论基础。用假阴道法采集精液混匀后分为 12 组, 其中 6 组作为冻前组, 6 组作为冻后组。利用液相色谱质谱 (LC-MS) 联用的非靶向代谢组学技术检测分析差异代谢物, 并基于京都基因与基因组百科全书 (KEGG) 数据库对差异代谢物进行代谢通路富集分析。结果显示: 东佛里生奶绵羊精液中共检测到 4 113 种代谢物; 与冻前组相比, 冻后组中 70 种代谢物发生了显著变化, 主要为脂质和类脂分子, 如甘油磷脂、鞘脂、异戊烯醇脂; 根据差异代谢物在代谢通路上的富集程度筛选出 2 条代谢通路, 分别为嘌呤代谢通路、癌症中的胆碱代谢通路。综上所述, 精液冷冻过程显著影响了精子膜结构、脂类氧化分解以及腺苷代谢过程, 从而导致精子受到损伤, 精液品质下降。

关键词: 东佛里生奶绵羊; 精液冷冻; 非靶向代谢组学; 液相色谱质谱联用; 差异代谢物; 代谢通路

中图分类号: S813

文献标志码: A

文章编号: 0529-5130(2024)08-0007-08

Comparative analysis of metabolomics of semen before and after freezing in East Friensian dairy sheep

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Abstract: By comparing the differences in metabolomics of East Friensian dairy sheep semen before and after freezing, the potential mechanism of sperm freezing injury was further explored, which provided a theoretical basis for optimizing the formula of frozen diluent of dairy sheep semen. Semen collected by artificial vagina was divided into 12 groups, 6 of which were semen pre-freezing groups and 6 were semen post-freezing groups. The differential metabolites were detected and analyzed by liquid chromatography-mass spectrometry (LC-MS) coupled with non-targeted metabolomics, and the metabolic pathway enrichment analysis was carried out based on the KEGG database. The results showed that a total of 4 113 metabolites were detected in the semen of the East Friensian dairy sheep. Compared with the semen pre-freezing groups, 70 metabolites changed significantly in the semen post-freezing groups, the metabolites being mainly lipids and lipid-like molecules, such as glycerophospholipids, sphingolipids, and prenol lipids. In addition, according to the enrichment degree of differential metabolites in the metabolic pathways, two metabolic pathways were selected, namely purine metabolism and choline metabolism in cancer. In conclusion, the freezing process significantly affected the sperm membrane structure, the oxidative decomposition of lipids and the adenosine metabolism process, which led to the sperm damage and the decline of semen quality after freezing.

Keywords: East Friensian dairy sheep; semen freezing; untargeted metabolomics; LC-MS; differential metabolites; metabolic pathways