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Omega-3 Polyunsaturated Fatty Acids, Coenzyme Q10 or Glutathione Effects on Rat Gut MicrobiomeBIOME

Background: Despite major advances of neonatal intensive care diagnostic and therapeutic interventions, necrotizing enterocolitis (NEC) continues to have a devastating impact on preterm babies. Preterm infants frequently experience intermittent hypoxia (IH) episodes, rendering them susceptible to oxidative stress diseases of the neonate, including necrotizing enterocolitis (NEC). We tested the hypothesis that early supplementation with antioxidants and/or omega 3 polyunsaturated fatty acids (n-3 PUFAs) promote gut biodiversity and mitigates IH-induced gut injury. Objective: To test the hypothesis that supplementation with fatty acids and/or antioxidants promotes gut microbiome diversity and mitigates IH-induced inflammation in the terminal ileum. Methods: Newborn rats were exposed to brief IH episodes (12%) during hyperoxia (50% O2) from the first day of life (P0) until P14 during which they received daily oral supplementation with: 1) omega-3 polyunsaturated fatty acids (n-3 PUFAs) in fish oil; 2) Coenzyme Q10 (CoQ10) in olive oil; 3) glutathione nanoparticles; 4) n-3 PUFAs+CoQ10; or 5) olive oil (placebo control). At P14, pups were placed in RA until P21. Control littermates remained in RA from birth to P21 with all treatments identical. At P21, stool samples were assessed for microbiome; and terminal ileum for histopathology, morphometric analyses, total antioxidant capacity, lipid peroxidation, nuclear factor kappa B (NFkB), toll-like receptor (TLR)4, and transforming growth factor (TGF)β1. Results: Single treatment with CoQ10 and n-3 PUFA was associated with high abundance of Firmicutes phyla. However, the largest increase, occurred with CoQ10+PUFA treatment in both RA and IH. The most impressive increase in antioxidant capacity occurred with combination CoQ10+PUFA. Most significant reduction of NEC biomarkers occurred with CoQ10+PUFA. Conclusion: CoQ10+PUFA synergism increased the nonpathogenic microbiome and reduced NEC biomarkers.

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