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Exercise Adaptation and Epigenetic Remodeling: Effects of *Lactobacillus* Supplementation on Exosomal HSPs and PGC-1 α

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INTRODUCTION:

PGC-1 α is an essential gene that regulates oxidative metabolism and mitochondrial biogenesis in skeletal muscle [1]. Physical activity induces metabolic stress through dynamic changes in lactate levels, oxygen availability, and substrate utilization [2]. These changes are linked to molecular adaptations such as the modulation of mitochondrial stress signaling pathways and the activation of heat shock proteins (HSP60, HSP70, and HSP90). Meanwhile, probiotic supplementation may influence metabolism and immune regulation by modulating microbial metabolite production, thereby affecting host metabolic pathways and immune responses. Emerging evidence suggests that both exercise-induced metabolic signals and microbiota-derived metabolites may regulate gene expression through epigenetic mechanisms, including DNA methylation and histone modifications. These processes may contribute to long-term transcriptional reprogramming associated with exercise adaptation, potentially affecting key metabolic regulators.

METHODS:

Circulating exosomes were isolated from plasma samples collected from twelve trained subjects before and after 12 weeks of probiotic supplementation with *Lactobacillus spp.* Exosomal expression of HSP60, HSP70, HSP90, and PGC-1 α was analyzed by Western blot. Genomic DNA was extracted from circulating polymorphonuclear cells isolated from whole blood. MSAP-PCR was used to evaluate methylation pattern changes associated with probiotic supplementation.

RESULTS:

Probiotic supplementation modulated exosomal heat shock proteins and metabolic markers. Changes in PGC-1 α levels suggested modulation of mitochondrial metabolic regulation. Levels of HSP60 increased mildly, while levels of HSP70 remained stable, and levels of HSP90 decreased. HSP60 variations were associated with changes in DNA methylation profiles.

CONCLUSION:

Lactobacillus spp. supplementation may support exercise adaptation by modulating mitochondrial efficiency, heat shock protein signaling, and epigenetic remodeling. The association between exosomal HSP60 and DNA methylation suggests a potential interplay between mitochondrial stress responses and epigenetic regulation. These effects may contribute to long-term metabolic adaptations and performance maintenance in trained individuals.

BIBLIOGRAPHY:

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