Metabolic Profiling in Exercise under Different Oxygen Conditions and COVID-19 Influence

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Introduction. Hypoxia was characterized by low oxygen levels. During exercise, the body transitions from oxidative to anaerobic metabolism, closely tied to cardiorespiratory fitness (CRF) and oxygen utilization. Pathogenic disruptions, such as those induced by COVID-19, can disturb these abilities, leading to metabolic changes and physiological consequences. **Objective.** This study aims to characterize the molecular-level metabolic profiles of individuals under various cardiorespiratory conditions influenced by oxygen availability and potential COVID-19 sequelae, using a metabolomic approach. **Material and methods.** Blood samples were collected from convalescent COVID-19 individuals before and after intermittent training on bicycles under normobaric hypoxia using individual facemasks. Metabolites were extracted via liquid-liquid Matyash procedure, and the total metabolome was analyzed using LC-MS/MS. Raw data processing and metabolite identification were performed using MZMine 3 software. Statistical analyses were conducted using GraphPad Prism 9, R programming language, and MetaboAnalyst website. **Results and Discussion.** Training conditions induced metabolic profile alterations, with distinct pathways enhanced in each scenario. Fatty acid oxidation was amplified in hypoxia compared to normoxia, while amino acid catabolic pathways were also influenced. Although glycolysis was modulated, its impact was less pronounced compared to other metabolites. **Conclusion.** Moderate intensity training under normoxia and hypoxia elicited unique metabolic shifts in energetic pathways, highlighting the importance of understanding underlying mechanisms. These findings elucidate biomolecular nuances driven by different oxygen conditions, providing insights into potential therapeutic interventions and optimizing exercise regimes in various physiological contexts.

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