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Biomarkers of Body Composition and Athletic Performance in Human Serum

Resting metabolic status is the underlying factor that determines both body composition and athletic performance, and, can be studied by measuring markers of cellular metabolism (biomarkers) in blood. However, studies aimed at measurement of biomarkers in blood as they relate to body composition or athletic performance have yet to be reported. The traditional chemistry screen (containing 20 analytes) is commonly used on blood to identify adverse health conditions related to the liver, kidney, and, cardiovascular systems, and, to measure glucose, triglycerides, and total cholesterol. In addition, mass spectrometry-based metabolite profiling has been shown to identify more than 350 serum metabolites. Therefore, in the present study we used the traditional chemistry screen and mass spectrometry-based metabolite profiling with the goal of identifying biomarkers that are significantly linearly associated with lean and fat mass (measured by dual-energy X-ray absorptiometry), and, with aerobic capacity (VO$_2$ max) and muscle strength (double leg press 1 repetition maximum, normalized to lean mass, DLP/lean). Use of the traditional chemistry screen identified significant linear associations between creatinine and lean mass (adjusted $R^2 = 0.77$); with both alkaline phosphatase and aspartate aminotransferase (AST) and fat mass (adjusted $R^2 = 0.51$); between AST and VO$_2$ max (adjusted $R^2 = 0.50$); and, between magnesium and DLP/lean (adjusted $R^2 = 0.23$). Use of mass spectrometry-based metabolite profiling identified significant linear associations between the tyrosine catabolic product 4-hydroxypyruvate and lean mass (adjusted $R^2 = 0.8$); between cortisone and fat mass (adjusted $R^2 = 0.37$); between the Vitamin B$_6$ catabolic product 4-pyridoxic acid and VO$_2$ max (adjusted $R^2 = 0.50$); and, between the branched chain amino acid valine and DLP/lean (adjusted $R^2 = 0.21$). In conclusion, we report for the first time, biomarkers that are significantly associated with both body composition and athletic performance.

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