Changes in diet composition affect energy metabolism at several biological scales in Japanese quail

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Changes in diet composition can affect energy metabolism and animals' capacity to deal with thermal challenges. In particular, the quantity and functional type of fatty acids in food can influence both metabolism and thermoregulation in endotherms. To better understand how changes in fatty acids circulating levels could affect energy metabolism in birds, we experimentally manipulated diet composition in Japanese quail by supplementing the food with saturated or unsaturated fatty acids. As a positive control, we included a diet with DNP, a chemical mitochondrial uncoupler. We measured changes in circulating fatty acids over time and metabolism at whole-individual and cellular levels at the end of the experiment. Since mitochondria mainly drive energy production and oxygen consumption in individuals, we also examined how diet influenced the link between individual and mitochondrial metabolism. Specifically, we assessed resting metabolic rate and shivering activity of pectoral muscle under cold stress, and then mitochondrial respiration in blood and liver. Our results showed that circulating fatty acid proportions changed over time according to diet. Surprisingly, fatty acid supplementation did not increase mitochondrial metabolism in either tissue. Ongoing analysis of data obtained at the individual level will provide further insight into effects of diet on birds' metabolism. The results of this study will allow us to better characterize ability of birds to respond to environmental constraints, such as acute thermal variations, at several biological scales.