POLAR BEARS (*URSUS MARITIMUS*) UNDER HUMAN CARE ADOPT AN ENERGY CONSERVATION STRATEGY IN THE FACE OF LIMITED ENERGY AVAILABILITY

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Abstract

Many mammals experience changes in energy expenditure and nutritional intake associated with seasonal availability of resources. Periods of fasting in mammals are reflected through changes in mass, body temperature, and blood biochemistry. The polar bear (*Ursus maritimus*) is an apex predator and sentinel species in the Arctic, where changes due to rapid warming will impair the ability of ice-obligate species to acquire food. Negative effects on polar bears will likely be exacerbated by the rapid increases in temperature and establishing reliable metrics of polar bear health is increasingly important. We used a combination of simulated seasonal adjusted calorie supply, animal training, voluntary blood draws, and body temperature analysis to study the physiological effects of seasonal variability in food intake on four polar bears under human care. When placed in an energy deficit, adult polar bears lost mass at 0.7–1.0 kg/day, a rate similar to observations in the wild. A gradual decline in body temperature was observed from June to October, which is consistent with observations on wild bears and likely represents a physiological adjustment to food deprivation and energy conservation. Bears exhibited changes in blood biochemistry consistent with fasting. For instance, urea:creatinine ratios declined to values consistent with fasting bears in the wild. Identifying the conditions under which polar bears adopt a physiological energy conservation strategy will improve our ability to understand and predict the responses of wild polar bears to rapid sea ice loss and reduced foraging. We found that polar bears under human care adopt an energy conservation strategy analogous to polar bears in the wild in the face of restricted energy availability.