NOCTURNAL HYPOTHERMIA IN FASTING QUAIL: EFFECT OF PHOTOPHASE DURATION

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Japanese quail (*Coturnix c. japonica*) react to food deprivation with shallow nocturnal hypothermia, i.e. by lowering their body temperature and metabolism beyond the normally occurring drop during the dark phase (scotophase). This drop then becomes deeper on successive nights of fasting, which suggests that the birds are able to sense the state of their energy reserves (Hohtola *et al.* 1991) and adaptively adjust the level of their body temperature. We wanted to see whether quails are able to utilize a deeper hypothermia when the dark phase is shorter and thus maintain the energetic benefits of hypothermia constant. We used intraperitoneal radiotelemetric transmitters (VM-FH ca. 3.5 grams, Mini-Mitter, Co.) for continuous measurement of body temperature and activity of quails. The transmitters were implanted under isoflurane anesthesia (4% induction, 2% maintenance). Buprenorphine was given for 24 h postoperatively and one week was allowed for recovery before actual experiments. The birds were placed in cages (40x60x40 cm) that were stacked on a metal rack and receivers were placed underneath the cages. Readings of body temperature and activity were taken once a minute. All measurements were done at 22°C. The photoperiods used were (L:D) 12:12, 16:8, and 20:4. All dark phases were symmetrical around midnight. The birds were first maintained on a photoperiod for 8-9 days, after which food (commercial poultry mash, Raisio OY, Finland) was removed for 48 h at 8.00 a.m. (light phase). After food replacement, the measurements were continued for another 4-5 days before switching to a new photoperiod. Water was always available *ad lib.* The birds were weighed at the beginning and end of each fast. The level of hypothermia did not increase with shortening of the dark phase indicating that the birds were not able to compensate for the decreased time by increasing the depth of hypothermia. The nocturnal levels of body temperature were actually slightly higher at short scotophases. Instead, the diurnal body temperature decreased with the change in photoperiod (a slight decrease on the second fast night at 16:8 L:D, a marked decrease on both nights at 20:4). Interestingly, at the shortest photoperiod, the birds reacted to food removal by an instantaneous decrease of body temperature. Whether this was a reaction to actual absence of food, or a conditioned reaction to procedures associated with experimentation cannot be resolved here. After the nocturnal drop, the diurnal level was further decreased on the following day. The body mass loss increased slightly but significantly with shortening scotophase (15.1±0.8, 17.1±0.5 and 17.5±0.5 g at 12:12, 18:6 and 20:4 L:D, respectively), confirming that the birds were able to save less energy at short scotophases as initially suggested by the lack of a temperature response. However, the mass loss was not linearly related to scotophase length, which indicates that the diurnal drops of body temperature helped in saving energy. Nocturnal hypothermia, often considered an adaptive and flexible response to food deprivation, seems to operate in a rather ballistic fashion and cannot be adjusted to allow a deeper metabolic depression at short scotophases.

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