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An experimental increase of nestbox temperature during egg-laying affects maternal effects and nestling health in great tits

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Prenatal maternal effects can be a source of phenotypic plasticity and may play a role in adaptation to climate change. However, we do not know how far temperature could influence such effects, if at all. We studied the influence of temperature during egg laying on maternal reproductive investment, on egg characteristics, and on the phenotype of nestlings. We expected temperature to have an effect, as it influences maintenance costs for females, who can also use it as a cue of the advancement of the breeding season. We experimentally increased night-time nestbox temperatures by approximately 1°C throughout the entire laying period in great tits (*Parus major*). Clutch size was negatively correlated with laying date in heated females. Also, heated females did not delay incubation after clutch completion as frequently as control females did. Egg content (androgen yolk concentration and lysozyme concentration in the albumen) and egg mass were not affected by the heating treatment. Yet, last-laid eggs in clutches from control nestboxes had a thicker eggshell than last-laid eggs from heated nestboxes, suggesting a decrease of maternal investment with the heating treatment. Finally, nestlings' blood sedimentation rate, which is an indicator of acute infections and inflammatory diseases, was positively correlated with hatching date in control broods. This suggests that nestlings were of lower quality in late-hatched broods than in early-hatched broods. This seasonal effect was not detected in heated nests. Our results show that a small increase in temperature during laying can influence breeding strategy and nestling characteristics. These results suggest that birds used temperature as a cue of seasonal advancement to adjust breeding phenology, with beneficial effects on nestling health. To better understand the consequences of maternal adjustments during egg laying, it would be interesting to combine studies with heating treatment during different periods of the breeding cycle.