

Causes and consequences of oxidative stress in a cooperatively breeding bird



Submitted by

Dominic Laurence Cram

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Dominic L. Cram

SUMMARY

Oxidative stress has recently been highlighted as a potential physiological mechanism underpinning life-history trade-offs in animals. While the role of oxidative stress in mediating such trade-offs is receiving increasing attention, its importance in wild populations remains poorly understood. In this thesis, I use a wild population of cooperatively breeding white-browed sparrow weavers *Plocepasser mahali* to investigate the role that oxidative stress plays in mediating the costs of reproduction and immune defence. Cooperative animal societies offer a unique opportunity to investigate the costs of reproduction, because dominants frequently monopolise breeding opportunities (exhibiting higher reproductive effort than subordinates), and subordinate cooperative contributions frequently lighten reproductive workloads. My findings reveal, first, that dominants' reproductive monopolies do not arise because they exhibit superior oxidative balance, as no such rank-related differences in oxidative state exist *prior* to breeding (Chapter 2). However, the higher reproductive effort of dominant females may underpin their differential declines in antioxidant protection *after* the breeding season (Chapter 2). Second, experimental manipulation of reproductive effort reveals marked oxidative damage and body mass costs incurred during reproduction. However, these costs are entirely mitigated in large social groups, suggesting that the cooperative contributions of helpers may offset the costs of reproduction for all group members (Chapter 3). While this represents rare evidence of an oxidative stress cost of reproduction in the wild, longitudinal data suggests that these costs do not endure after the breeding season (Chapter 4), highlighting that circulating markers of oxidative balance are unlikely to mediate long-term costs of reproduction. Finally, an immune activation experiment reveals that, while mounting an immune response causes no net change in oxidative balance, the scale of the response can be adjusted according to baseline antioxidant protection in an oxidative-condition-dependent manner (Chapter 5). Together my results provide support for the role of oxidative stress in shaping life histories in the wild. Furthermore, evidence of rank-related disparities in oxidative balance and the avoidance of reproductive costs in large social groups may have important implications for our understanding of both the evolution of cooperative breeding and the patterns of health and ageing in societies.

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