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Natural variation in circulating testosterone does not predict nestling provisioning rates in the northern cardinal, *Cardinalis cardinalis*

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Behavioural transitions between territoriality and parental care are necessary for many seasonally breeding vertebrates. Among birds, such transitions can be mediated by the steroid hormone testosterone (T), resulting in a T-mediated behavioural trade-off.

This theory is supported by many implantation studies with birds demonstrating that the administration of exogenous T during parental phases can negatively affect offspring care. However, little is known about relationships between naturally circulating levels of T and parental behaviour in wild bird populations. We examined covariation in circulating levels of T (before and after injection of gonadotropin-releasing hormone (GnRH)) and nestling provisioning rates in male and female northern cardinals, *Cardinalis cardinalis*, a highly aggressive, biparental resident songbird. Results indicate that both sexes had detectable levels of initial T when providing parental care, but only males produced significantly higher elevations of T following GnRH injections. Furthermore, T levels (both initial and following GnRH injections) and nestling provisioning rates did not covary for either sex, and these measures were not correlated between members of breeding pairs. When results of this study are considered with prior work indicating that elevations in T might not be necessary to support male or female aggression in this species, it appears that relationships between circulating T and reproductive behaviour could be more complex for the cardinal than for many others birds similarly examined. Such findings warrant additional examination of interrelationships between T, aggression and other forms of parental care to assess whether this species engages in T-mediated behavioural trade-offs. Possible alternative mechanisms influencing behaviour in the cardinal and future directions for research are discussed.

Highlights

► We examined the relationship between circulating testosterone and nestling feeding rates in northern cardinals. ► Both male and female cardinals had detectable testosterone levels while caring for offspring. ► Testosterone was significantly elevated after GnRH injection in parental males but not in parental females. ► We found no relationship between nestling feeding rate and circulating testosterone level.

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General Field Methods

This study was performed during the breeding season (April–June) in 2008, 2009, 2010 and 2011 at the Eubanks/Lake Thoreau property of the University of Southern Mississippi (ELT-USM, Hattiesburg, MS, U.S.A.). Cardinals are multibrooded, and in our focal population, breeding begins in early April and continues through late September. As a safety precaution, fieldwork was terminated each year at the end of June due to excessive temperatures (35–38 °C) typical of the latter months of the breeding…

Initial Testosterone Levels of Male and Female Cardinals

Male cardinals had significantly higher levels of initial T than females (independent samples *t* test: t_{65}=4.67, P<0.0001; Table1, Fig.1), but there was no significant relationship between initial T and feeding scores of males (Table2) or females (Table3, Fig.2). There was also no significant effect of year on initial T in either sex (males: Table2; females: Table3)....

Testosterone Response of Male and Female Cardinals following GnRH Injections

Parental male cardinals had significantly elevated T levels following GnRH injections (paired *t* test: t_{33}=2.32, P=0.03), but ...

Discussion

From a hormonal perspective, results of our study were similar to others that have quantified endogenous concentrations of T (both initial levels and elevations following GnRH injections) in breeding temperate-zone birds (e.g. males: McGlothlin et al. 2007; females: Jawor et al. 2007). Male cardinals providing offspring care had higher levels of initial T than females and could produce significant elevations in circulating T following standardized GnRH injections during this reproductive...

Acknowledgments

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References (46)

J.D. Buntin *et al.*

Facilitation of parental behavior in ring doves by systemic or intracranial injections of prolactin

Hormones and Behavior (1991)

M.S. DeVries *et al.*

Testosterone elevation and response to gonadotropin-releasing hormone challenge by male northern cardinals (*Cardinalis cardinalis*) following aggressive behavior

Hormones and Behavior (2012)

K.E. Hunt *et al.*

Testosterone implants increase song but not aggression in male Lapland longspurs

Animal Behaviour (1997)

J.M. Jawor *et al.*

Multiple ornaments correlate with aspects of condition and behaviour in female northern cardinals, *Cardinalis cardinalis*

Animal Behaviour (2004)

J.M. Jawor *et al.*

Seasonal and individual variation in response to GnRH challenge in male dark-eyed juncos (*Junco hyemalis*)

General and Comparative Endocrinology (2006)

J.M. Jawor *et al.*

Seasonal and sex-related variation in song control nuclei in a species with near-monomorphic song, the northern cardinal

Neuroscience Letters (2008)

E.D. Ketterson *et al.*

Testosterone and avian life histories: the effect of experimentally elevated testosterone on corticosterone and body mass in dark-eyed juncos

Hormones and Behavior (1991)

S.U. Linville *et al.*

Plumage brightness as an indicator of parental care in northern cardinals

Animal Behaviour (1998)

S.E. Lynn

Behavioral insensitivity to testosterone: why and how does testosterone alter paternal and aggressive behavior in some avian species but not others?

General and Comparative Biology (2008)

S.E. Lynn *et al.*

Aphylogenetically controlled test of hypotheses for behavioral insensitivity to testosterone in birds

Hormones and Behavior (2005)

S.E. Lynn *et al.*

Dissociation of testosterone and aggressive behavior during the breeding season in male chestnut-collared longspurs, *Calcarius ornatus*

General and Comparative Endocrinology (2008)

D.M. O'Neal *et al.*

Experimentally-elevated testosterone, female parental care, and reproductive success in a songbird, the dark-eyed junco (*Junco hyemalis*)

Hormones and Behavior (2008)

S.J. Schoech *et al.*

The effects of exogenous testosterone on parental behavior, plasma prolactin, and prolactin binding sites in dark-eyed juncos

Hormones and Behavior (1998)

B. Silverin

Effects of long-acting testosterone treatment of free-living pied flycatchers, *Ficedula hypoleuca*, during the breeding period

Animal Behaviour (1980)

E. Van Duyse *et al.*

Effects of testosterone on song, aggression, and nestling feeding behavior in male great tits, *Parus major*

Hormones and Behavior (2002)

B.L. Van Roo

Exogenous testosterone inhibits several forms of male parental behavior and stimulates song in a monogamous songbird: the blue-headed vireo (*Vireo solitarius*)

Hormones and Behavior (2004)

E. Adkins-Regan

Hormones and Animal Social Behavior

(2005)

L.D. Belesky *et al.*

Testosterone and polygyny in birds

E.D. Clotfelter *et al.*

Consequences of elevating plasma testosterone in females of a socially monogamous songbird: evidence of constraints of male evolution?

Hormones and Behavior (2004)

E. De Ridder *et al.*

Experimental evidence of a testosterone induced shift from paternal to mating behavior in a facultatively polygynous songbird

Behavioral Ecology and Sociobiology (2000)

M.S. DeVries *et al.*

Non-breeding gonadal testosterone production of male and female northern cardinals (*Cardinalis cardinalis*) following GnRH challenge

General and Comparative Endocrinology (2011)

J. Dittami *et al.*

Parental investment and territorial/sexual behavior in male and female reed warblers: are they mutually exclusive?

Ethology (1991)

T.S. Filliater *et al.*

Predation on northern cardinal nests: does choice of nest site matter?

Condor (1994)

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Cited by (27)

Tissue-specific gene regulation corresponds with seasonal plasticity in female testosterone

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