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An ability to employ tactical deception against conspecifics is argued to have been a factor favouring the evolution of increased encephalization and cognition in primates. However, few systematic observations of deception in wild primates exist, and no previous study has tested whether such behaviours are underpinned by cognitive mechanisms, or can be more parsimoniously explained by non-cognitive mechanisms. Previous research has shown that wild tufted capuchins (*Cebus apella nigrinus*) use functionally deceptive false alarm calls to usurp food resources, with false alarms being produced more often: 1) during competitive feeding contexts than in other contexts, 2) when food is clumped (and therefore monopolizable) than when dispersed, and 3) by subordinates than by dominants. This study tests an alternative to the cognitive hypothesis, namely that “deceptive” alarms are underpinned by the production of glucocorticoids, hormones associated with stress. If the stress hypothesis is correct, it was predicted that: 1) competitive feeding would lead to increased stress relative to baseline levels, 2) stress levels would be higher when food was more clumped, and 3) these stress effects would be stronger in subordinates than dominants. This was tested experimentally in Iguazú, Argentina by manipulating within-patch food distribution using feeding platforms filled with banana pieces during periods of low fruit availability. Faecal samples associated with nine alternating 10-day periods of clumped (mean 6.4 samples/individual), baseline (12.8/individual), and dispersed (6.9/individual) conditions were collected from 30 individuals (two social groups) and analyzed for concentrations of glucocorticoids using a corticosterone enzyme immunoassay. Results do not support the stress hypothesis, as stress hormone levels were significantly lower in association with competitive feeding and did not vary based on food distribution or rank. Additional research is needed to determine if “deceptive” alarms are indeed underpinned by cognitive mechanisms.

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PS6

Comparison of faecal cortisol metabolite concentrations in white rhinoceroses (*Ceratotherium simum*) living in three different environments

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Captive conditions may influence animal endocrine physiology, female reproductive cycles, and behaviour. Many efforts are undertaken to minimize animal handling and to improve welfare of animals kept in captivity. The aim of this study was to investigate how habitat conditions, from total captivity to natural habitat, may affect cortisol metabolite concentrations in white rhinoceroses. We studied nine female and six male rhinoceroses. Three rhinoceroses from the Zoo of Madrid were considered to be kept in total captivity; four individuals from the Bioparc of Valencia were considered to live in semi-captivity, because of larger enclosures allowing intra and inter-specific relationships with other savannah species (such as zebras, antelopes and birds); furthermore eight wild rhinoceroses from a South African reserve (Mabula) were considered to live in their natural habitat. Faecal samples were collected early in the morning, twice a week, for approximately one year and were frozen (-20°C) until analysis. The enzyme immunoassay (EIA) performed used an antibody against 5 α -pregnane-3 β ,11 β ,21-triol-20-one. The technique was validated by HPLC analysis. Since parturition is a natural event resembling a stressful situation, we considered peak faecal cortisol metabolite concentration shown on the day of parturition in one of our females (4,500 ng/g) as a reference value for high concentration. Hormone results indicated

statistically significant differences ($p < 0.001$) between samples collected from the three habitats studied, supporting our initial hypothesis. Mean cortisol metabolite values were about three times higher in animals kept in total captivity ($1,429 \pm 67$ ng/g), and also higher in semi captivity (687 ± 13 ng/g), as compared to results from animals in the wild (444 ± 29 ng/g). We also found statistically significant differences ($p < 0.001$) between females ($1,022 \pm 37$ ng/g) and males (523 ± 17 ng/g) indicating that females had approximately two times higher cortisol metabolite mean concentrations. We conclude that rhinoceroses kept in total captivity might have higher cortisol levels than animals living under natural conditions.

PS7

Faecal cortisol and progesterone metabolites concentration in four captive white rhinoceros (*Ceratotherium simum*) kept in different housing conditions

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Captive breeding is an important safeguard for the white rhinoceroses (*Ceratotherium simum*), as free ranging populations are increasingly threatened by poaching. However, white rhinoceroses are not breeding well in captivity and many efforts focus on improving captive breeding to increase knowledge about reproductive requirements. Cortisol is frequently used as an indicator of stress, and progesterone is a reliable indicator for monitoring reproductive cycles. The aim of this study was to investigate faecal hormone concentrations of captive white rhinoceroses and to correlate results to housing conditions. We studied four rhinoceroses; three individuals (two females and one male) shared an enclosure, whereas one male displaying a strong stereotypy was housed alone. Behavioural observations suggested a dominant-subordinate relationship between the two females. Faecal samples were collected at 10:00 every

day over a year and frozen (-20°C) until analysis. Faecal cortisol and progesterone metabolites were measured by a 5α -pregnane- $3\beta,11\beta,21$ -triol-20-one and a 5β -pregnane- 3α -ol-20-one enzyme immunoassay, respectively. The technique was validated by HPLC analysis. Statistical analysis identified significant differences ($p < 0.001$) in mean cortisol metabolite concentrations between the two males, being higher in the male living with the two females. Although there were no differences on mean cortisol metabolite concentration between both females, statistically significant differences ($p < 0.001$) were found on mean progesterone metabolite concentrations between both females, because the dominant female had oestrus cycles of 29.9 ± 2.13 days in length, whereas the subordinate female was not normally cycling. Results in the two females studied suggested that social status is possibly related to ovarian activity. We found that intra-specific relations between males and females elevated faecal cortisol metabolite concentrations, while hormone concentrations in the single housed male displaying stereotypy were lower. Results of our preliminary study in four animals need to be confirmed in a larger number of animals and under varying social housing conditions.

PS8

Human activity is not the main source of stress in wolves

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Human disturbance has been proven to be a source of stress for several mammalian species and prolonged stress may adversely affect their fitness. The aim of our study was to test if human activity causes chronic stress in wolves (*Canis lupus*). Glucocorticoids in scats have been used as physiological indicators of stress in a variety of species. We therefore assessed the stress level of wolves from six packs (from south-eastern and central Poland) by measuring the concentration of glucocorticoid metabolites in 59 fresh faecal