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A comparison of age, cognitive, hormonal, symptomatic and mood correlates of Aggression towards Others in boys with ASD

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ABSTRACT

Background: Aggression is a major problem in children with Autism Spectrum Disorder (ASD) but little is known about the possible contributors to this behaviour.
Aims: To determine the relative strength of the relationships between developmental, cognitive, symptomatic, hormonal and mood factors and 'Aggression towards Others' in boys with ASD.
Method: Predictors of Aggression towards Others were investigated in a sample of 136 boys with Autism Spectrum Disorder (*M* age = 11.3yr, SD = 3.2yr, range = 6yr to 17yr). Data were collected from the boys themselves and their parents (14 fathers, 122 mothers).
Results: Results indicated that age and Low Registration on the Sensory Profile were the only significant correlates of this form of aggression. Importantly, testosterone levels did not account for level of social aggression.
Conclusions: These data suggest that these boys may have learnt more effective methods of dealing with their frustration as they grew older or benefitted from cognitive maturation, and that having a high neurological threshold may be a source of frustration for these boys. The relationship between Aggression towards Others and Low Registration is discussed and clinical implications of the findings explicated.

What this paper adds

Results clarify the relatively low impact that testosterone and cortisol have on the aggressive behaviour of boys with ASD, and further indicate that it may be their sensory features that predispose these boys towards aggression. There is evidence of an age-related decline in this form of aggression, arguing for early intervention strategies to assist younger boys with ASD to manage their aggression.

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1. Introduction

As well as core impairments in communication and reciprocal social interaction, plus the presence of restricted and repetitive behaviour (APA, 2013), children with Autism Spectrum Disorder (ASD) also often exhibit increased rates of aggressive behaviour (Farmer & Aman, 2011; Farmer et al., 2015). In fact, more than 40% of children with ASD also meet the diagnostic criteria for Oppositional-Defiant Disorder (ODD) (Mayes et al., 2012), well above the reported prevalence of 3.3% for the general community (APA, 2013). Thus, aggression remains a particular behavioural issue for these children, and research into the moderating factors of that aggression holds the potential to inform clinical assessment and treatment options based on an understanding of pathways to aggression in children with ASD.

Several models purporting to explain aggressive behaviour have been postulated, including the General Aggression Model (GAM) (DeWall, Anderson, & Bushman, 2011). The GAM described three critical stages in understanding aggression, including person and situation inputs, the internal (arousal, cognitive and affective) states of the organism exhibiting aggression, and the results of the organism's appraisal and decision-making processes. These three stages can contribute to future aggressive behaviour by providing feedback to the organism regarding the environmental stimuli it is experiencing, how the organism responds to those stimuli, plus the success/failure of previous aggression responses (DeWall & Anderson, 2011). However, this model has not been tested in ASD samples, and therefore it cannot be used to set hypotheses for formal testing. Instead, the GAM may be a source of relevant theory when considering the aggressive behaviour of children with ASD, and may provide some insight into the results of studies into that phenomenon.

Five possible moderating factors for aggression in children with ASD may be grouped under the GAM first and second stages (i.e., person and situation inputs, the internal state of the child with ASD when they are aggressive). These five possible factors include: (i) age (individuals may learn more effective coping styles or self-restraint as they grow older), (ii) cognitive level (which may influence their understanding of environmental cues, social interactions and task demands, leading to frustration and aggression), (iii) ASD-related symptomatology such as sensitivity to sensory stimuli and other ASD characteristics including impairments in interpersonal behaviour, communication, and repetitive/stereotypic behaviour (that may predispose the child with ASD to frustration and extreme reactions including aggression), (iv) levels of anxiety and depression (both of which include irritability as core symptoms), and (v) hormonal factors such as testosterone, cortisol and the ratio between these two (which have been associated with aggression in previous studies).

Although developmental, cognitive, ASD-related symptoms, and mood factors have been examined in the ASD research literature, the roles of testosterone and cortisol, especially in relation to aggression, are relatively unexplored but may also contribute to the arousal, cognitive and affective states of these children as aspects of the second of the three stages of the GAM. In multiple populations, testosterone has been associated with aggression via its affect upon the arousal, cognitive and affective states of persons exhibiting aggressive behaviour, particularly social aggression in males (see Book, Starzyk, & Quinsey, 2001, for a meta-analysis of 45 independent studies). This may arise from the enhancing effect that testosterone has upon the responsiveness of brain circuits associated with social aggression within the amygdala, hypothalamus and orbitofrontal cortex (Hermans, Ramsey, & van Honk, 2008). By contrast, cortisol (derived from the Hypothalamus-Pituitary-Adrenal axis) has been found to moderate the association between testosterone and aggression (Popma et al., 2007). These two sets of findings have been combined into a model that describes an 'imbalance' between testosterone and cortisol that predicts socially aggressive behaviour (Montoya, Terberg, Bos, & van Honk, 2012) and which focusses upon the second stage of the GAM. That is, the higher the ratio of testosterone to cortisol, so the greater the likelihood of aggression occurring due to the effects that these neurohormones have upon the arousal, cognitive and affective states of the person showing aggression.

The previous literature is inconsistent as regards the association between aggression, testosterone and cortisol in males with ASD. Further, that relationship has been examined in relatively small samples to date. For example, a positive relationship between testosterone and aggression was reported in an early observation by Tordjman, Ferrari, Sulmont, Duyme, and Roubertoux (1997), who noted that three children with ASD who had plasma testosterone concentrations more than two standard deviations above the mean of a non-ASD comparison group "showed aggression against others" (p. 11). However, another team of researchers has reported different results across three studies of this association. For example, Pivovarciova et al. (2016) found no significant association between testosterone and hyperactivity levels in 60 boys with ASD, but significant direct correlations between testosterone levels and rage behaviour in one of three children with ASD (Pivovarciova, Hnilicova, Tomova, & Ostatnikova, 2014), and a significant direct correlation between testosterone levels and conduct problems in 31 boys with ASD (Pivovarciova, Jaroslava, Hnilicova, Filcikova, & Ostatnikova, in press). Often, evaluations of children's aggression were based upon parental responses to a single question about their child's aggressive behaviour. Thus, there is a need for a study to investigate the testosterone-aggression association in relation to a more sophisticated evaluation of aggressive behaviour in boys with ASD in a larger sample. This is clinically important as the lack of a consistent association between testosterone and aggression has not impeded recommendations that ASD boys with high testosterone and who display aggression should be treated with anti-androgen medication (Geier & Geier, 2007). Because of diverse effects on mood and medical health of such treatments in adult males (Sharpley, Christie, & Bitsika, 2014), there is a clinical need for a more conclusive study of the importance of testosterone in aggression in ASD to justify its implementation.

In addition to neuroendocrine factors, the comparative strength of each of the five potential causes of aggression in boys with ASD remains to be investigated in a single sample. Similarly, the role of the second stage of the GAM in aggressive behaviour in children with ASD has yet to be clarified. Therefore, these issues were the focus of this study, with several

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