Hormones and Behavior 67 (2015) 54–59

Contents lists available at ScienceDirect

Hormones and Behavior

journal homepage: www.elsevier.com/locate/yhbeh

Regular article

The reward value of infant facial cuteness tracks within-subject changes in women's salivary testosterone

Amanda C. Hahn *, Lisa M. DeBruine, Claire I. Fisher, Benedict C. Jones

Institute of Neuroscience & Psychology, University of Glasgow, Glasgow G12 8QB, UK

ARTICLE INFO

Article history:
Received 4 June 2014
Revised 17 September 2014
Accepted 21 November 2014
Available online 3 December 2014

Keywords:
Parenting
Testosterone
Reward
Face perception
Incentive salience

ABSTRACT

"Baby schema" refers to infant characteristics, such as facial cues, that positively influence cuteness perceptions and trigger caregiving and protective behaviors in adults. Current models of hormonal regulation of parenting behaviors address how hormones may modulate protective behaviors and nurturance, but not how hormones may modulate responses to infant cuteness. To explore this issue, we investigated possible relationships between the reward value of infant facial cuteness and within-woman changes in testosterone, estradiol, and progesterone levels. Multilevel modeling of these data showed that infant cuteness was more rewarding when women's salivary testosterone levels were high. Moreover, this within-woman effect of testosterone was independent of the possible effects of estradiol and progesterone and was not simply a consequence of changes in women's cuteness perceptions. These results suggest that testosterone may modulate differential responses to infant facial cuteness, potentially revealing a new route through which testosterone shapes selective allocation of parental resources.

Introduction

Konrad Lorenz suggested that infant cues ("baby schema"), and infant *facial* cues in particular, function in part to motivate adult caregiving and protective behavior (Lorenz, 1943). Consistent with this proposal, exaggerating baby schema in images of infant faces increases the perceived cuteness of infants (Alley, 1981, 1983a; Glocker et al., 2008; Little, 2012). Moreover, adults typically report being more likely to care for, protect, and form close bonds with infants displaying facial cues that are perceived to be cute (Alley, 1981, 1983b; Glocker et al., 2008; Hildebrandt and Fitzgerald, 1978). Similar patterns of results have also been observed in studies of both the actual care provided for infants (Badr-Zahr and Abdallah, 2001) and the strength of mother–infant bonds (Hildebrandt and Fitzgerald, 1983; Langlois et al., 1995).

Recent studies of the reward value of infant facial cues have also underlined the importance of infant cuteness. For example, Glocker et al. (2009) reported that women showed greater activity in brain regions associated with the processing of rewards (e.g., nucleus accumbens and anterior cingulate cortex) when viewing high-cuteness versions of images of infant faces (i.e., versions in which baby schema was exaggerated) than when viewing low-cuteness versions (i.e., versions in which baby schema was reduced). Studies using behavioral measures of the reward value of faces, such as key-press tasks (Aharon et al., 2001), also suggest that viewing cute infant faces is rewarding; people are willing to expend more effort to view high-cuteness versions of infant face images than they are to view low-cuteness versions (Hahn et al., 2013). This pattern of results has also been observed using unmanipulated infant faces (Parsons et al., 2011; Sprengelmeyer et al., 2013).

Several lines of evidence suggest that perceptions of adult faces covary with hormone levels in women. For example, preferences for masculine characteristics in men's faces tend to be stronger when women's testosterone (Bobst et al., 2014; Welling et al., 2007) and/or estradiol (Roney and Simmons, 2008; Roney et al., 2011) levels are high. While these studies focused on women's judgments of the attractiveness of men's faces, other studies have investigated the effects of changes in women's hormone levels on their perceptions of emotional expressions in adult faces (Conway et al., 2007; Derntl et al., 2008; Guapo et al., 2009). For example, women appear to be more sensitive to facial expressions associated with threat when their progesterone levels are high (Conway et al., 2007; Derntl et al., 2008).

Given the large and rapidly growing body of research demonstrating links between hormone levels and women's responses to adult faces, together with the importance of facial cues for motivating care and protection of infants (Alley, 1983b; Glocker et al., 2008) and links between sex hormones and parental behaviors (Rilling, 2013), it is perhaps surprising that relatively little work has investigated whether women's hormone levels also predict their responses to infant facial cuteness. The current study sought to address this issue, focusing on the possibility that within-subject changes in women's hormone levels may predict the reward value of infant facial cuteness.

To explore the possible links between within-subject changes in women's hormone levels and the reward value of infant facial cuteness, we assessed the reward value of infant facial cuteness to women in five weekly test sessions. Reward value was assessed via a standard key-press task similar to those used to assess the reward value of infant

* Corresponding author.
E-mail address: Amanda.Hahn@glasgow.ac.uk (A.C. Hahn).

http://dx.doi.org/10.1016/j.yhbeh.2014.11.010
0018-506X/

faces in previous research (Hahn et al., 2013; Parsons et al., 2013; Yamamoto et al., 2009). Saliva samples were also collected in each test session and analyzed for testosterone, estradiol, and progesterone levels. Multilevel modeling was then used to test whether changes in the reward value of infant facial cuteness were predicted by changes in salivary testosterone, estradiol, or progesterone levels. Following other recent research on responses to infant facial cuteness (Hahn et al., 2013; Lobmaier et al., 2010; Sprengelmeyer et al., 2009), stimuli were images of infant faces in which shape characteristics associated with perceived cuteness had been exaggerated or reduced using computer graphic methods (see Fig. 1).

Methods

Participants

Sixty heterosexual women (mean age = 21.03 years, SD = 2.81 years) participated in the study. All participants were students at the University of Glasgow (Scotland, UK) and provided informed consent prior to participation. None of these women were currently pregnant, breastfeeding, or taking any form of hormonal supplement, and all indicated that they had not taken any form of hormonal supplement in the 90 days prior to participation. None of our participants had children. Data from 37 of these participants are also reported in Pisanski et al.'s (2014) recent study of hormone-modulated voice preferences. Data from 44 of these participants are also reported in Wang et al.'s (in press) recent study of hormone-modulated responses to adult facial cues. Note that, other than the hormone values, there was no overlap in the data analyzed across these three pieces of work.

Infant face stimuli

The techniques we used to manufacture high-cuteness and low-cuteness versions of infant faces have been used to manufacture stimuli in many previous studies of women's responses to infant facial cues (Hahn et al., 2013; Lobmaier et al., 2010; Sprengelmeyer et al., 2009). First, we used established computer-graphic techniques for manufacturing face prototypes (Tiddeman et al., 2001) to create high-cuteness and low-cuteness prototypes with the average shape information of images of the 20 infant faces that received the highest cuteness ratings (for the high-cuteness prototype) and 20 infant faces that received the lowest cuteness ratings (for the low-cuteness prototype) in a previous study of cuteness ratings of 58 white infant faces (Sprengelmeyer et al., 2009). Following Hahn et al. (2013), we then created high-cuteness versions of 10 different infant face images by adding 50% of the linear differences in 2D shape between the high-cuteness and low-cuteness infant prototypes to each of the 10 infant face images. Low-cuteness versions of the 10 infant face images were also created by subtracting 50% of the linear differences in 2D shape between the high-cuteness and low-cuteness infant prototypes from each of the 10 infant face images. The computer graphic methods used to transform shape information in face images are described in Tiddeman et al. (2001). Following Hahn et al. (2013), the mouth shape was held constant between the high-cuteness and low-cuteness versions of each image, controlling for the possible effects of expression on responses to infant faces (Lobmaier et al., 2010). Example images are shown in Fig. 1.

Procedure

Each woman completed five weekly test sessions. During each test session, participants provided a saliva sample via passive drool (Papacosta and Nassis, 2011). Each woman's test sessions took place at the same time of day to control for possible effects of diurnal changes in hormone levels (Bao et al., 2003; Veldhuis et al., 1988). In each test session, participants completed two tasks (rating task and key-press task) in a randomized order.

Key-press task

The key-press task that we used to measure the reward value of infant facial cuteness has also been used to assess the reward value of infant faces in several previous studies (Charles et al., 2013; Hahn et al., 2013; Parsons et al., 2011, 2013; Yamamoto et al., 2009). In this key-press task, all 20 infant face images (i.e., the high-cuteness and low-cuteness versions of the 10 infant faces) were presented in a fully randomized order. Participants controlled the viewing duration of each face image by repeatedly pressing designated keys on their keyboard after initiating each trial by pressing the space bar. Participants could either increase the length of time a given face was displayed by alternately pressing the 7 and 8 keys or decrease the length of time a given face was displayed by alternately pressing the 1 and 2 keys. Each key press increased or decreased the viewing duration by 100 ms. The default viewing duration for each image (i.e., the length of time a face remained onscreen if no keys were pressed) was 4 s. Participants were told that the key-press task would last for a total of 1.5 min in order to discourage responses aimed at changing the length of engagement with the task. However, in reality, the total length of the key-press task was dependent on participants' responses. All participants key pressed at least once in all test sessions (mean number of total key presses = 269.21, SD = 212.67). Participants completed a block of practice trials at the start of each test session to ensure they understood the key-press task (face images were not shown in this block of practice trials).

Following previous studies of the reward value of infant facial cues (e.g., Hahn et al., 2013; Parsons et al., 2013; Yamamoto et al., 2009),

Fig. 1. Examples of high-cuteness (left) and low-cuteness (right) versions of faces used in our study. High-cuteness and low-cuteness versions differ in 2D shape only along an empirically defined perceived cuteness dimension.