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Affective reactivity differences in pregnant and postpartum women

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Abstract

Reactions to emotional cues, termed affective reactivity, promote adaptation and survival. Shifts in affective reactivity during pregnancy and postpartum may invoke altered responses to environmental and biological changes. The development and testing of affective reactivity tasks, with published normative ratings for use in studies of affective reactivity, has been based on responses provided by healthy college students. A comparison of the healthy norms with ratings provided by peripartum women has yet to be conducted, despite its value in highlighting critical differences in affective reactivity during peripartum phases. This study compared arousal ratings of unpleasant, neutral, pleasant, and threat stimuli from the International Affective Picture System (IAPS; Lang et al., 2008) between three samples: (a) women measured during pregnancy and again at postpartum, (b) age-matched nonpregnant women, and (c) college-aged women from the normative sample used to test the stimuli. Using mixed-design GLMs, results showed that the pregnant and postpartum women and the age-matched women showed suppressed arousal relative to the college-age women. Additionally, postpartum women showed increased arousal to unpleasant/threat images compared to other types of images. The data suggest that future research on peripartum women should include affective reactivity tasks based on norms reflective of this specific population.

Keywords

arousal; perinatal; affective reactivity; maternal; emotional stimuli

1. Introduction

An understanding of emotion and emotional processing has been a key question in psychology. Emotions were traditionally characterized as discrete experiences with differing neural pathways, circuits, and physiological changes (James, 1884; Cannon, 1927; Papez,

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1937; Arnold, 1960). Later theorists adopted a dimensional view, characterizing emotions as individual labels used to describe changes in physiological arousal, suggesting that emotions exist on various points along a continuum (Schachter and Singer, 1962). Dimensional models describe affect, the state experience of emotion, and affective reactivity, the immediate response to emotional stimuli, as involving changes in the properties of valence (pleasant/unpleasant) and arousal (high intensity/low intensity) (Wundt, 1924; Feldman, 1995; Posner et al., 2005). Within these dimensional models, emotions are conceptualized as falling along the spectrum of valence and arousal; specific emotions (happiness, anger, sadness, surprise, fear, disgust) can be experienced at different intensity and valence levels across individuals and over time. The dimensional approach of emotion has also been supported by neuroscience and psychophysiological studies, with specific, distinguishable correlates of valence (frontal lobe activation, facial electromyography) and arousal (posterior frontal lobe, skin conductance, heart rate) (Lang et al., 1993; Davidson, 1998; Cacioppo et al., 2007).

Following from dimensional models, affective reactivity can be quantified by ratings of valence and arousal (Watson and Clark, 1984; Lang et al., 1993; Bradley and Lang, 1994; Lang et al., 2008). Changes in affective reactivity represent implicit emotional processes that impact the way individuals respond to their environment; these processes may be varied depending on age, gender, or developmental stage (Gruhn and Scheibe, 2008) including pregnancy and motherhood. For example, studies of affective reactivity in healthy postpartum women have shown heightened reactivity and increased activation in brain reward centers while viewing distressed infants (Swain et al., 2007; Pearson et al., 2011). These changes observed at neurological levels may facilitate women's responses to environmental cues. By noticing and organizing their behavior towards stimuli that promote infant's health and minimize danger, mothers maintain a bond with their newborn. These affective experiences are especially important during the critical period of pregnancy and postpartum as they also have long-lasting implications for mother, baby, and the entire family context (for a review, see Gollan et al., 2014).

Though the dimensional theories of emotion support the positive – negative (valence) dimension (Watson et al., 1988), research has suggested a unique influence of threat. In particular, the evolutionary threat hypothesis (Pratto and John, 1991) argues that the detection of stimuli that threaten survival is more adaptive than the detection of other stimuli (including other types of unpleasant stimuli). This theory has placed specific emphasis on this survival-threat detection mechanism that has evolved during human evolution; this may be particularly salient for mothers, as they must ensure survival of not only themselves, but also their infants. The influence of threat on attention and affective reactivity has been well-documented across samples (Hansen and Hansen, 1988; Williams et al., 1996; Ohman et al., 2001), though it has been less studied in pregnant and postpartum women. This suggests an implicit difference between threatening stimuli (i.e., snakes, spiders, violence) and general unpleasant stimuli (injuries, cigarettes, pollution). Additionally, Ferri and colleagues (2012) showed that while there are differences in processing of neutral stimuli with faces compared to neutral stimuli without faces (using psychophysiological measures), there were no differences when processing threatening stimuli with and without faces. This suggests that individuals do not differentiate between human versus other types of threat when

emotionally responding. Furthermore, within the evolutionary threat hypothesis and affective reactivity more generally, the arousal dimension may be emphasized to capture attention more readily and ensure adequate resources to respond effectively to the threat (Schimmack, 2005).

Affective reactivity processes are measured in different ways. For example, tasks including facial expression classification and rating emotional stimuli on dimensions of valence and arousal have allowed researchers to characterize affect recognition and reactivity in a variety of samples. Standardized databases of emotional stimuli, including the International Affective Picture System (IAPS; Lang et al., 2008) and adult faces (Ekman and Friesen, 1971), have been widely used in studies of emotion. Additionally, researchers have developed their own sample-specific stimuli for perinatal samples (i.e., Strathearn et al., 2008; Gil et al., 2011). Stimulus selection has been based on available normative ratings acquired during validation of these stimuli, which includes college students, research assistants, and other convenience samples. Unfortunately, this ignores the possibility of age or developmentally-related differences, such as the transition through pregnancy into motherhood, on emotional processing of these stimuli. Understanding the ways in which maternal affective reactivity differs from other developmental phases will permit more nuanced interpretation of significant findings between groups.

Previous research provides support for age-related differences in the perception of emotional stimuli, such that older adults rated images as more extreme (unpleasant images as more negative and pleasant images as more positive; Gruhn and Scheibe, 2008); however, the results have not been consistent across studies (e.g., Mikels et al., 2005). Furthermore, studies of clinical populations, including depressed and anxious adults, have shown different responses to these stimuli compared to matched healthy participants (Sloan et al., 2001; Lang and McTeague, 2009). This raises the question of whether developmental phases across the lifespan, such as pregnancy and postpartum, and individual differences, such as mood and temperament, alter affective reactivity. Extrapolating the unique contributions of individual (e.g., depression and anxiety) and shared (e.g., pregnancy or motherhood) factors becomes important in characterizing affective reactivity during pregnancy and postpartum as this has implications for mother-infant dyads and their well-being. To the authors' knowledge, information on affective reactivity processes in healthy and clinical samples of pregnant and postpartum women is limited. If nonperipartum, healthy women in early adulthood show a heightened or dampened response to affective stimuli compared to the normative ratings, the unique effects of pregnancy, mood, or other differences can be parceled out, thereby allowing for more specific characterization of affective processing. This suggests that standardized tasks and stimuli sets, similar to other cognitive and neuropsychological tests, would be greatly enhanced by having population-specific norms.

The aim of this study was to examine differences in affective reactivity, particularly self-reported arousal ratings, between healthy (nondepressed) women in pregnancy and postpartum compared to nonpregnant, age-matched healthy women, and whether these groups differed from a normative nonclinical sample. We compared arousal ratings from both of these samples of women (peripartum with age-matched nonperipartum) with the ratings of the same stimuli (provided by healthy college females during the validation

process). In doing this, we were able to directly compare the peripartum and nonperipartum women with college students using the official IAPS norms. We included 120 stimuli from the IAPS (30 unpleasant, 30 neutral, 30 pleasant, and 30 threat) in the affective reactivity task. Following from both the dimensional approach to emotion and the evolutionary threat theory (Pratto and John, 1991; Bradley and Lang, 1994), we included threat stimuli separate from unpleasant stimuli to understand any unique effects of stimuli that are more likely to threaten survival compared with those that are unpleasant, but not threatening.

2. Methods

2.1. Participants

Forty-eight healthy, currently pregnant, unmedicated women between ages 18 and 44 were recruited via advertisements in prenatal clinics, community groups, and the Internet.

Participants attended two visits at Northwestern Memorial Hospital in a laboratory, one at 32–36 weeks of pregnancy and another at 6–8 weeks postpartum. Data were collected between 04/2009 and 12/2010. Twenty-two nonpregnant, nonpartum, age-matched healthy, unmedicated women between ages 18 and 44 were also recruited via advertisements online and in the community between 06/2006 and 10/2009 as part of a separate study¹.

Participants in both groups passed a urine toxicology screen, completed symptom questionnaires, and completed the IAPS affective reactivity task. Inclusion criteria for both groups included symptoms below a certain threshold on several symptom measures (for the pregnant/postpartum group: < 10 on at least two of the following: Quick Inventory of Depressive Symptoms, Self Report [QIDS-SR16], Patient Health Questionnaire [PHQ-9], Edinburgh Postnatal Depression Scale [EPDS]). For the age-matched nonpregnant/nonpartum women: no diagnoses as determined by a clinical interview, < 14 on Hamilton Rating Scale for Depression [HRSD], < 19 on Beck Depression Inventory, Second Edition [BDI-II], < 10 on Hamilton Anxiety Rating Scale [HARS], < 15 on Beck Anxiety Inventory [BAI]).

Exclusion criteria included: (1) comorbid medical or psychiatric illness; (2) imminent risk of suicide or homicide; (3) use of psychotropic medications in the last two weeks that might affect valence and arousal ratings; (4) insufficient understanding of the research procedures to voluntarily participate.

Detailed information about the participants for the normative ratings can be found in the IAPS Manual (Lang et al., 2008). For this study, healthy college students in introductory psychology courses were recruited from undergraduate institutions and received course credit for their participation. Unfortunately, descriptive data about the participants' age was not provided. Separate groups of males and females were recruited for the purposes of IAPS development; only the female participants' normative ratings were used for this study.

¹Because women in the age-matched sample were recruited for a separate study, only those who fell within the age range used for the pregnant/postpartum women (ages 18–44) were included (participants who fell outside of this age range were excluded). T-tests revealed no differences between the two groups. $M_{\text{peripartum}}=30.5$, $SD=4.9$; $M_{\text{age-matched}}=29.4$, $SD=6.7$; $t(31.8)=0.68$, $P=0.50$.

2.2. Measures

2.2.1. Pregnant and Postpartum Sample—The QIDS-SR16 (Rush et al., 2003) is a 16-item self-report scale quantifying the frequency, duration, intensity, and severity of depressive symptoms which we used to generate a metric of depressive symptoms in the past week. The PHQ-9 (Kroenke et al., 2001) is a 9-item measure of DSM-IV criteria of Major Depressive Disorder in the past week. PHQ-9 scores > 10 have high sensitivity (88%), specificity (88%) for major depression. The EPDS (Cox et al., 1987) is a 10-item self-report questionnaire of depressive and anxious symptoms used for screening postpartum women.

2.2.2. Age-Matched Sample—Participants in this sample were selected from another study conducted by Dr. Gollan and colleagues. The HRSD (Hamilton, 1967) is a 17-item clinician-rated scale of depressive symptoms, designed to measure severity of symptoms experienced in the past week. The BDI-II (Beck et al., 1996) is a 21-item self-report measure asking about depressive symptoms in the past two weeks, with responses ranging from 0 to 3. The HARS (Hamilton, 1959) is a 14-item clinician-rated scale designed to measure the severity of anxiety, with scores above 17 indicating severe symptoms. Finally, the BAI (Beck et al., 1988) is a 21-item self-report measure of anxiety in the past week, including somatic and cognitive symptoms. Scores above 26 indicate severe anxiety.

2.2.3. Affective Reactivity Task—Stimuli for the affective reactivity task consisted of 120 images from the International Affective Pictures System (IAPS, Lang et al., 2008), 30 in each of the following categories: unpleasant, neutral, pleasant, and threat. Stimuli were chosen according to normative ratings provided by Lang and colleagues in the IAPS manual. To create a set of ecologically valid stimuli, the entire collection of pictures was divided into categories on the basis of their normative ratings, ranging from extremely unpleasant to neutral to extremely pleasant. Thirty pictures from each category (pleasant, unpleasant, and neutral) were chosen; pleasant and unpleasant stimuli were matched for normative arousal ratings. Analyses confirmed that there were no differences in the arousal ratings between these two sets of stimuli. Within each category, an equal number of social (stimuli where person(s) were the main focus of the image) and non-social stimuli were chosen. This selection procedure resulted in an equal sampling of stimuli across the valence dimension while controlling for arousal. Threat stimuli were chosen separately and designated as those with survival-threat potential (e.g., images that depict events or animals that would result in imminent loss of life, such as aimed guns, attack dogs, sharks, bears, bombs, and terrorist attacks), and an equal number of human and animal threat images were chosen. Both social and non-social stimuli were chosen given that research has shown a difference in processing of human faces, particularly within neutral stimuli (Ferri et al., 2012). There were significant differences for valence ratings between the unpleasant and threat stimuli, such that unpleasant stimuli had significantly lower negative ratings (i.e., were rated as more unpleasant) than threat stimuli².

After a three second baseline period, participants viewed each image for six seconds and then provided ratings of valence and arousal via computer. A fixation point appeared at the center of the screen during the baseline and recovery periods, which was replaced by the

stimulus during the presentation period. Valence was rated using a bi-dimensional affect matrix (assessing positive and negative valence simultaneously) with positive affect represented on the horizontal axis and negative affect on the vertical axis (Norris et al., 2011). Arousal was rated using a unidimensional scale in a format similar to the Self-Assessment Manikin (SAM; Lang, 1980). The scale was presented as a single line of squares and ranged from 1–9, with 1 representing “not at all arousing,” 5 representing “moderately arousing” and 9 representing “extremely arousing”. Prior to the experiment, participants were given instructions on how to use the rating scales and used practice stimuli.

Mean valence and arousal ratings of each stimulus are provided by Lang and colleagues in the IAPS manual for males and females separately; only the mean female ratings were used for comparison with the other groups. As stated above, data was compared for arousal ratings only due to the comparable rating scale used across groups (unidimensional with possible values of 1–9).

2.3. Analytic Plan

Two 4 (Valence: unpleasant, neutral, pleasant, threat) $\times$ 3 (Group: IAPS, Pregnant/Postpartum, Age-matched women) ANOVAs (using mixed-design Generalized Linear Models [GLM]) were conducted at the picture level (i.e., with a total of 120 individual IAPS stimuli representing subjects) to compare arousal ratings across participant groups on the same set of stimuli. Arousal rating of each picture was the dependent variable, valence was the between-subjects factor and participant group was the within-subjects factor. Because the same group of women was measured twice (pregnancy and postpartum) while the other groups were measured only once, two GLMs were conducted (one including women during pregnancy and one including women during postpartum) to avoid violation of the assumption of independence. Analyses were two-tailed at the 0.05 level of significance, and post-hoc mean comparisons were performed using Bonferroni-corrected *t*-tests. When the assumption of sphericity was violated, Greenhouse-Geisser corrected values were reported. Partial-eta squared values are reported to demonstrate effect sizes for significant results.

3. Results

3.1. Demographics and clinical characteristics

Frequency statistics were run to characterize both samples. The healthy pregnant/postpartum sample consisted of 30 Caucasian (62.5%), 9 African American (18.8%), 4 Asian (8.3%) and 5 Hispanic women (10.4%). The mean age was 30y (range: 19–43), and over half were college educated ($n = 25$). Additionally, 31 (64.6%) were employed and 38 (79.2%) were married. The healthy age-matched women consisted of 13 Caucasian (59.1%), 6 African

²IAPS IDs: Pleasant set: 1590, 2339, 2345, 2346, 4606, 4610, 4617, 4623, 4624, 4625, 4641, 5270, 5450, 5660, 5849, 7250, 7260, 7280, 7289, 7390, 7400, 7430, 7470, 7480, 7508, 8120, 8371, 8461, 8496, 8540 ($M_{\text{valence}}=7.01$, $SD=0.31$). Unpleasant set: 1274, 1275, 2278, 2700, 2717, 3216, 3220, 3300, 5973, 6311, 7359, 7360, 7361, 9041, 9090, 9101, 9265, 9280, 9290, 9300, 9301, 9342, 9373, 9390, 9419, 9424, 9530, 9592, 9630, 9830 ($M_{\text{valence}}=2.99$, $SD=0.40$). Neutral set: 2038, 2191, 2200, 2210, 2215, 2385, 2397, 2441, 2445, 2499, 2512, 2595, 2840, 2850, 5471, 5520, 7006, 7009, 7030, 7037, 7038, 7041, 7050, 7170, 7186, 7235, 7242, 7249, 7500, 9070 ($M_{\text{valence}}=4.99$, $SD=0.25$). Threat set: 1050, 1051, 1052, 1111, 1113, 1120, 1201, 1205, 1300, 1301, 1321, 1390, 1525, 1726, 1930, 2691, 2692, 2704, 3022, 6210, 6211, 6213, 6244, 6250, 6410, 6550, 6555, 6836, 6840, 9402 ($M_{\text{valence}}=3.60$, $SD=0.55$). Valence ratings provided are overall ratings (male and female).

American (27.3%), 1 Hispanic (4.5%), and 2 Asian (9.1%) women. The mean age was 29y (range: 21–44), and 19 attained a college education or higher (86.4%). Additionally, 10 (45.5%) were employed and 6 (27.3%) were married. Chi square analyses revealed differences between the two samples in employment ($\chi(3)=18.02$, $P<0.001$) and marital status ($\chi(2)=23.36$, $P<0.001$), such that there were significantly more married and employed women in the pregnant/postpartum sample. There were no differences between the two groups with regards to race/ethnicity ($\chi(3)=1.16$, $P=0.76$) or education level ($\chi(4)=1.07$, $P=0.90$).

Clinical characteristics in both samples revealed minimal levels of depression and anxiety and below the threshold considered mild symptom severity. In the pregnant/postpartum group, mean EPDS scores were 4.6 ($SD=3.1$) during pregnancy and 4.8 ($SD=2.7$) during postpartum. Mean PHQ-9 scores were 3.0 ($SD=2.5$) in pregnancy and 1.9 ($SD=1.4$) in postpartum. Mean QIDS-16 scores were 5.9 ($SD=2.2$) in pregnancy and 5.2 ($SD=2.8$) in postpartum. In the healthy age-matched control group, scores were 0.7 ($SD=1$) for HRSD, 0.8 ($SD=1.6$) for BDI-II, 0.9 ($SD=1.3$) for HARS, and 0.8 ($SD=0.9$) for BAI.

3.2. Arousal ratings between pregnant, age-matched, and IAPS women

Means and standard deviations for each group and each valence are presented in Table 1 and a graph of means is presented in Figure 1. Results of the GLM demonstrated a main effect of participant group ($F(1.83, 212.4)=218.7$, $P<0.001$, $\eta_p^2=0.65$), a main effect of valence ($F(3, 116)=168.49$, $P<0.001$, $\eta_p^2=0.81$), and an interaction effect of participant group*valence ($F(5.49, 212.4)=30.25$, $P<0.001$, $\eta_p^2=0.44$). For neutral, pleasant, and threat stimuli, the college-aged women's arousal ratings were higher than the pregnant women's ratings, which were higher than the age-matched women's ratings (all P 's<0.01). There were no differences in ratings of unpleasant stimuli between any of the groups. The main effect of valence revealed the following pattern of arousal ratings: unpleasant and threat stimuli > pleasant stimuli > neutral stimuli.

The interaction revealed that for the IAPS group, there were no differences between unpleasant and pleasant arousal ratings, but both were higher than neutral ratings and lower than threat ratings (P 's<0.001). However, for the pregnant women, there were no arousal rating differences between unpleasant, pleasant and threat ratings but all were higher than neutral ratings. Finally, for nonpregnant, age-matched women, unpleasant images were rated the highest, followed by threat images, then pleasant images, and neutral images were rated the lowest.

3.3 Arousal ratings between postpartum, age-matched, and IAPS women

Means and standard deviations for each group are presented in Table 1 and a graph of means is presented in Figure 1. There was a main effect of participant group ($F(1.85, 214.14)=204.26$, $P<0.001$, $\eta_p^2=0.64$), a main effect of valence ($F(3, 116)=163.85$, $P<0.001$, $\eta_p^2=0.81$), and an interaction effect of participant group*valence ($F(5.54, 214.14)=27.35$, $P<0.001$, $\eta_p^2=0.41$). The two main effects revealed the same results as reported above.

The trend of ratings for the IAPS and age-matched women is the same as reported above. The postpartum women, however, showed a different pattern compared to their arousal ratings in pregnancy: there were no differences between unpleasant and threat images, but both were rated significantly more arousing than pleasant images (unpleasant ν pleasant: $P=0.004$, threat ν pleasant: $P=0.01$), and all were rated higher than neutral images.

4. Discussion

This study sought to evaluate differences in affective reactivity, specifically self-reported arousal ratings, in a pregnant and postpartum sample compared to normative and age-matched samples. Arousal ratings of unpleasant, neutral, pleasant, and threat stimuli provided by healthy pregnant and postpartum women were compared to the normative college female ratings of the same set of IAPS stimuli, as well as to an age-matched group of healthy women. Results suggest that there are differences in arousal ratings between postpartum and nonpartum female samples compared to the college-aged female sample that provided normative ratings. Findings also corroborate research that processing of affective stimuli at later stages of development may be characterized by differences in the experience of arousal during emotional response and point to the potential role of life experiences in mediating this process (Gruhn and Scheibe, 2008).

Specifically, our results showed differences in arousal ratings of stimuli within groups as well as between groups. The normative college female sample showed a linear pattern such that threat stimuli were rated higher than both pleasant and unpleasant stimuli, all of which were rated higher than neutral stimuli. Lang and colleagues suggest that stimuli at either end of the valence spectrum (i.e., highly pleasant and highly unpleasant) invoke similar levels of intensity in healthy subjects (Lang et al., 2008). This also suggests that stimuli eliciting a threat to survival invoke increased affective responses (Pratto and John, 1991). However, in our pregnant sample, there were no differences in ratings of arousal for threat, unpleasant, and pleasant images, suggesting that valenced stimuli may be equally arousing for this population. Differentially, when these women transitioned to the postpartum phase, they rated unpleasant and threat images equally arousing and more arousing than pleasant images. This may mean that during the postpartum phase, greater intensity of experience is noticed during exposure to negative emotional stimuli as these are deemed more likely to cause harm to the well-being of the infant (as opposed to pleasant stimuli). This explanation is supported by neuroimaging and psychophysiological studies of affective reactivity during pregnancy and postpartum (for a review, see Gollan et al., 2014). Finally, the age-matched sample of women rated unpleasant images as more arousing than threat images, followed by pleasant images, then neutral images. This may point to a development difference, such that older women experience unpleasant images as more arousing than pleasant images, contributing to a different emotional experience relative to healthy college-aged women.

The heightened ratings of unpleasant/threat images compared to pleasant stimuli in the postpartum women provides support for the heightened reactivity to threat that occurs in early motherhood (Pearson et al., 2011). Notably, this heightened arousal rating to unpleasant/threat compared to pleasant images was found only in the postpartum phase (and not during pregnancy); this may highlight the protective/evolutionary role of heightened

reactivity in the transition to motherhood that allows a woman to safely meet the needs of her baby and respond to detected danger. Though this does not directly support the evolutionary threat hypothesis (Pratto and John, 1991), which purports that threat plays a unique role in influencing attention compared to other types of stimuli (including other types of unpleasant stimuli), it suggests that women in the postpartum phase may not differentiate between unpleasant and threatening images during affective response, or potentially view all negatively-valenced stimuli as equally threatening and therefore eliciting a heightened arousal response. Additionally, because there were no differences in arousal ratings between pleasant and unpleasant stimuli in the healthy college females, but there were in the postpartum women, these findings support the utility of considering arousal as a dimensional component to emotional experience in this phase.

Additionally, we found that while there were no differences between groups for ratings of unpleasant stimuli, the normative college ratings were higher than the pregnant and postpartum women and the age-matched women for threat, pleasant, and neutral images. This supports previous research that various samples rate standardized stimuli differently compared to the normative sample used in creating the stimuli, and there are age-related components to these differences (Gruhn and Scheibe, 2008). This has been demonstrated with healthy college individuals from another university (Sandt et al., 2001), as well as younger and older adults (Bucks et al., 2005; Mather and Knight, 2005). Post-hoc tests also showed that for pleasant, neutral, and threat stimuli, arousal ratings were heightened for the pregnant and postpartum women compared to the healthy age-matched women. Notably, pregnancy and postpartum, rather than age, may function as key developmental experiences in their effect on arousal.

Taken together, this finding suggests the need for specific norms representing different phases of life experiences. It also informs future research by outlining the importance of taking validation of stimuli into account when considering methodology. As researchers increasingly use standardized imagery in studies of emotion, determining the normative ratings for the sample being studied may indicate individual differences. This may be particularly important to consider when studying perinatal samples, as affective reactivity in mothers has an impact on cognitive, emotional, and behavioral development of offspring (Grace et al., 2003). Specifically, our focus on arousal supports the importance of considering intensity of response as a dimensional component of emotional experience (Feldman, 1995; Posner et al., 2005; Schimmack, 2005). Furthermore, an understanding of the link between affective reactivity and clinical disorders that occur during this phase (such as depression, bipolar disorder, or anxiety) remains unclear. The results from this study also suggest a need to be sensitive to age; this makes sense given other changes that occur during development in temperament, personality, and affect regulation (i.e., Lawton et al., 1992; Labouvie-Vief and Gonzalez, 2004).

A limitation of this study is that we were unable to obtain education and other demographic-related information of the normative sample to create a demographically-matched sample for comparison. Additionally, we did not obtain information about participants' history of pregnancies (i.e., if this was the mother's first child). Furthermore, we were limited by the specific stimuli chosen; future research should expand these findings to examine additional

stimuli or develop and validate new stimuli (for example, of mother-baby dyads or other stimuli specific to mothers and their infants). We were also limited to examining arousal due to the comparable scales of measurement; future studies should also examine valence ratings. Finally, we were limited by the number of age-matched nonpregnant/nonpartum women which created an unequal sample size in each of the groups, although there were no differences between the groups on demographic characteristics such as education and race. Nonetheless, these findings provide support for additional changes in the processing of affective stimuli throughout development. They point to the utility of considering samples when using standardized stimuli for the study of emotion. Future research should consider creating sample-specific norms for the study of affective reactivity, particularly when using a perinatal sample.

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Highlights

- We compared arousal ratings of peripartum women to age-matched and college women.
- Pregnant/postpartum and age-matched women provided lower arousal ratings overall.
- Postpartum women gave higher arousal ratings to unpleasant/threat images.
- Affective reactivity tasks may be enhanced by having perinatal normative ratings.

Figure 1. Arousal ratings of unpleasant, neutral, pleasant, and threat IAPS stimuli by IAPS college women, pregnant and postpartum women, and age-matched women

Table 1

Arousal Ratings in Healthy Pregnant and Postpartum Women, Age-matched Nonpregnant Women, and IAPS Normative Female Sample

Stimuli (N = 120)	Healthy Pregnant M(SD)	Healthy Postpartum M(SD)	Age-matched M(SD)	IAPS Female M(SD)
Unpleasant (n=30)	4.90 (0.89) 95% CI: 4.64 – 5.16	5.01 (0.96) 95% CI: 4.73 – 5.28	5.08 (0.54) 95% CI: 4.88 – 5.29	5.17 (0.63) 95% CI: 4.97 – 5.37
Neutral (n=30)	2.50 (0.70) 95% CI: 2.24 – 2.76	2.48 (0.70) 95% CI: 2.21 – 2.76	2.12 (0.60) 95% CI: 1.92 – 2.33	3.24 (0.50) 95% CI: 3.04 – 3.44
Pleasant (n=30)	4.41 (0.49) 95% CI: 4.15 – 4.66	4.31 (0.56) 95% CI: 4.04 – 4.59	3.47 (0.46) 95% CI: 3.26 – 3.68	5.08 (0.54) 95% CI: 4.88 – 5.29
Threat (n=30)	4.78 (0.71) 95% CI: 4.52 – 5.04	4.94 (0.79) 95% CI: 4.67 – 5.22	3.95 (0.66) 95% CI: 3.74 – 4.15	6.26 (0.56) 95% CI: 6.05 – 6.46