Published in final edited form as:
Physiol Behav. 2019 July 01; 206: 85–92. doi:10.1016/j.physbeh.2019.03.020.

Family-of-origin aggression, dating aggression, and physiological stress reactivity in daily life

Adela C. Timmons[a,*], **Sohyun C. Han**[b], **Theodora Chaspari**[c], **Yehsong Kim**[b], **Corey Pettit**[b], **Shrikanth Narayanan**[b], and **Gayla Margolin**[b]

[a]Florida International University, United States of America

[b]University of Southern California, United States of America

[c]Texas A&M University, United States of America

Abstract

Individuals exposed to aggression and who perpetrate aggression against others show differences in their physiological activation during stress; the goal of the present study is to investigate physiological stress reactivity as a factor contributing to the intergenerational transmission of aggression. To test associations between family-of-origin aggression (FOA), physiological reactivity in daily life, and dating aggression perpetration, we used ecological momentary assessment to monitor fluctuations in young adult (M_{age} = 23.1 years) dating couples' electrodermal activity (EDA) over an entire day and examined how naturally-occurring bouts of annoyance between partners relate to EDA, FOA, and dating aggression perpetration. Dating perpetration was linked to lower general levels of EDA in both men and women, while FOA was linked to lower general levels of EDA in men only. For women, multi-group, multilevel models showed that FOA and dating aggression perpetration moderated the association between feeling annoyed and EDA, such that those with greater FOA and dating aggression perpetration showed greater EDA reactivity during naturally-occurring relationship stress. Furthermore, this pattern of EDA reactivity mediated the link between FOA and dating aggression perpetration in women. These results provide evidence that FOA and dating aggression perpetration are linked to patterns of physiological responsivity in everyday life and suggest that these patterns could be important factors contributing to the intergenerational transmission of aggression.

Keywords

Family-of-origin aggression; Dating aggression; Electrodermal activity; Ambulatory assessment

1. Introduction

1.1. The intergenerational transmission of aggression

It is well-documented that being exposed to aggression in one's family of origin puts one at risk for perpetrating aggression against friends, dating partners, and one's own children in

*Corresponding author at: Center for Children and Families, Department of Psychology, Florida International University, AHC1 341, 11200 SW 8th St, Miami, FL 33199, United States of America. atimmons@fiu.edu (A.C. Timmons).

adulthood (e.g., [5,12]). However, research also indicates that the majority of people exposed to aggression in their family of origin do not go on to perpetrate aggression against others. Explanatory models often focus on how family-of-origin aggression (FOA) impacts self-regulatory capacity, positing that children exposed to aggression evidence alterations in their regulatory profiles, setting the stage for perpetrating aggression later in life [21]. Conceptual models typically incorporate emotional, cognitive, and behavioral regulatory processes, but little research has specifically examined the role of physiological stress reactivity in the intergenerational transmission of aggression. Exposure to aggression in childhood may alter biological reactivity to stress, causing heightened physiological reactions to interpersonal stressors experienced in adult relationships [28]. The current study investigates young adults' physiological reactivity during periods of naturally-occurring annoyance between dating partners. We test if FOA and dating aggression amplify patterns of physiological reactivity in daily life and examine physiological reactivity as a mediator of the association between FOA and dating aggression perpetration in young adulthood.

1.2. Development and physiological regulatory processes

Although it has long been known that sensitivity to environmental stress is programmed by our genetic makeup, more recent research has demonstrated that early childhood experiences can turn on and off genes that affect such processes [46]. Caregivers play a primary role in helping kids modulate stress and contribute to children's development of autonomous regulatory capacities over time [18]. Supportive caregiving is theorized to buffer stress in children and shield the developing brain from neurotoxins; conversely, insensitive and punitive parenting styles are thought to elevate stress reactions, negatively impacting children's physiological systems (e.g., [37]). Children's brains, though in part biologically programmed, retain a degree of plasticity that is shaped by the environmental context [22]. Current theories of bio-social development maintain that such plasticity is evolutionarily adaptive because childhood experiences, such as exposure to high levels of stress, provide important information about whether one's environment is likely to be dangerous or safe over the lifespan [2].

In the short-term, exposure to aggression and other stressors activates the body's "fight or flight" response. This activation is associated with various physiological changes that help prepare organisms to contend with environmental threats. For example, the hypothalamic-pituitary-adrenal (HPA) axis outputs the stress hormone cortisol, while the sympathetic nervous system increases electrodermal activity (EDA), measured as sweat secreted by the sweat glands [20]. While adaptive in the short-term, mounting intense and frequent stress responses is metabolically costly; chronic activation can cause damage to the body's regulatory systems and lead to "wear and tear" over time, putting individuals at risk for later health problems [37]. Activation of the "fight or flight" response is thus theorized to be an evolutionary trade-off that maximizes short-term survival at the expense of long-term health. Moreover, exposure to high levels of stress in the family of origin may alter physiological set points, causing children to develop "short-term life strategies," where physiological responsivity is upregulated to protect against immediate environmental threats (e.g., [38]).

1.3. Aggression and physiological reactivity

A number of studies have documented how childhood exposure to FOA and adversity more broadly are related to physiological reactivity, though the exact findings across studies have varied by the physiological index measured, child characteristics, and timing of the stressor. Generally, exposure to aggression, marital conflict, or negative parenting styles is linked to decreased cortisol reactivity during laboratory-based stress tasks [10,27], although this effect is moderated by other variables. For example, one study with toddlers found higher cortisol reactivity in children with high levels of temperamental vigilance and inhibition but marginally blunted reactivity in children with bold, aggressive temperaments [9]. In another study testing cardiovascular activity, only children with high self-blame and perceived threat showed amplified reactivity to interpersonal stress [13]. Other research shows that FOA is related to heightened cortisol output in wives, but not husbands, during lab-based marital conflict [1].

In studies investigating associations between physiological arousal and marital violence, higher cortisol reactivity has generally been linked to greater levels of violence, although, again, findings have been mixed. For example, two studies examining cortisol reactivity found that intimate partner aggression was related to greater cortisol output during laboratory conflict, but only in women [25,39]. In a similar study, intimate partner aggression was associated with greater basal cortisol [16]. Limited research using other measures, such as heart rate and EDA, has found a similar pattern, with intimate partner violence being linked to greater physiological reactivity [29]. Measuring EDA may be particularly informative because sweat glands are exclusively innervated by the sympathetic nervous system [3,20,47]. Additionally, EDA can be passively monitored over long time-frames in real life.

1.4. Physiological reactivity during periods of annoyance between dating partners in daily life

Although laboratory-based studies testing links between aggression and physiological reactivity to stress have been informative, testing these patterns during naturally-occurring, everyday periods of annoyance between romantic partners could provide important data about how such processes actually unfold in real-life contexts. In contrast to conflict episodes, feelings of annoyance capture commonplace fluctuations in the ongoing emotional tone of a relationship. While seemingly unimportant, it is critical to understand and target micro-level processes in order to alter macro-level outcomes, such as aggression, especially because large-scale conflicts and arguments often start with small-scale emotions that develop gradually and escalate over time. Measuring these processes in daily life also increases ecological validity and reduces biases due to retrospective reporting [6,24].

1.5. Present study

The present study investigates EDA reactivity during naturally-occurring periods of annoyance between dating partners in daily life and tests how these patterns of reactivity relate to FOA and dating aggression perpetration in adulthood. Fig. 1 presents an overview of the hypothesized associations. We first conduct a set of exploratory analyses to test direct associations between feeling annoyed, EDA, FOA, and dating aggression. Specifically, we examine: (1) if feeling annoyed is associated with concurrent increases in EDA and (2) if FOA and dating aggression perpetration are associated with differences in general levels of EDA measured over the entire day of data collection. We then test three interrelated hypotheses focusing on patterns of EDA reactivity, operationalized as changes in EDA during periods of naturally-occurring annoyance between romantic partners. Based on past research documenting heightened cortisol reactivity during laboratory-based marital conflict in individuals exposed to FOA [1], we expect that FOA will be associated with greater EDA reactivity (HO1). Second, in line with research finding increased cortisol and autonomic reactivity in couples with greater intimate partner aggression [25,29,39], we hypothesize that perpetrators of dating aggression will show increased EDA reactivity when annoyed (HO2). Finally, we test physiological reactivity as a factor contributing to the intergenerational transmission of aggression, hypothesizing that EDA reactivity mediates the link between FOA and dating aggression perpetration (HO3). Given previously reported gender effects [1,25,39], we also conduct exploratory multi-group analyses to determine if findings differ between men and women.

2. Materials and methods

2.1. Participants

Participants consisted of 218 people (3 female same-sex and 106 opposite sex couples) recruited via word of mouth, flyers, and advertisements posted online and in the community. To be eligible for the study, participants were required to be 18–25 years old (*M* age = 23.1; *SD* = 3.0), fluent in English, and in a relationship for at least 2 months. The sample was ethnically/racially diverse, with 27.5% of participants identifying as Caucasian, 23.9% Hispanic/Latino, 16.1% African American, 12.8% Asian, 0.5% Native Hawaiian or Pacific Islander, 15.6% multiracial, and 3.7% other. Approximately half of the participants were part-time or full-time students (54.1%); the majority were employed at least part time (73.5%). Couples had been dating for 32.2 months on average (*SD* = 26.8); 44.0% of couples were cohabitating.

2.2. Procedures

Couples responded to advertisements posted online and in the community that requested participation in a study on “how young dating couples talk to each other, what types of physiological reactions couples have when having such discussions, and whether experiences in one’s family when growing up play a role in young adult relationships.” Couples responding to the advertisements were screened for eligibility. Eligible couples then participated in a lab-based visit during which they engaged in several discussion tasks unrelated to the current study and scheduled a day to participate in the home data procedures. At this visit, partners separately completed questionnaires assessing family-of-origin aggression and dating aggression on opposite facing computers with privacy screens. On the day of home data collection, participants met the experimenters at the laboratory at 10:00 am and provided consent for the at-home procedures. To passively collect EDA in daily life, each participant was outfitted with a small, wireless wrist monitor. Participants were also lent a smartphone that alerted them to independently complete short surveys at the beginning of every hour from 10:00 am until 3:00 am or until they went to bed. The first phone survey was completed in the laboratory with an experimenter so that the participants could practice using the phones. Couples were instructed to complete the surveys separately and not to discuss their answers; to wear the monitors at all times; go about their days as they usually would; and spend at least 5 h together, which did not need to be spent consecutively. The next day, participants came back to the laboratory to return the equipment and complete a questionnaire assessing their experiences during the day of data collection. This questionnaire included information on the participants' activities each hour of the day, as well as data on if and in what ways participating in the study changed their behaviors or disrupted their normal daily activities (see [43] for further details). All questionnaires and hourly surveys were automatically uploaded to a secure online server. Each person was compensated $100 for participating in the at-home portion of the study.

2.3. Equipment

2.3.1. Smartphones—Each member of the couple was lent one 5-in. Nexus 5 phone to take the hourly phone surveys. Phone applications were password protected so that no data could be extracted by the couples using the phones and so that participants did not leave additional data on the phones, beyond what was intentionally collected by the experimenters. All data were cleared from the phones between uses.

2.3.2. Q sensor—The Q sensor is an ambulatory monitor that collects EDA, three dimensions of movement, body temperature, and time [33]. Although the measurement of EDA via the wrist is less sensitive than the fingers and palms, wrist monitors show adequate reliability with laboratory-based EDA measures and have been shown to correlate with various psychological and physical health constructs measured in daily life (e.g., [32,33,43,45]. The Q sensor consists of a small rectangular box worn on the inside of the wrist attached with a band; the sensor was applied to the non-dominant hand to minimize movement artifacts. Sampling rate was set to 8 hertz, consistent with current standards for wearable EDA devices, which typically utilize lower sampling rates to ensure adequate storage and battery life for data collected over multiple days ([32,33].

2.4. Measures

2.4.1. Hourly feelings of annoyance—Using the application Survelytics on the smartphones, participants rated the degree to which they felt "annoyed or irritated toward my dating partner" within the past hour on a scale from 0 (*not at* all) to 10 (*extremely*). The surveys took participants 1 min and 56 s to complete on average and assessed a variety of items not examined here, including feelings of closeness between dating partners; positive and negative mood states; and other contextual variables (e.g., physical activity, consumption of tobacco, alcohol, caffeine, or other drugs, and if couples were together or interacting).

2.4.2. General levels of electrodermal activity—After participants returned the equipment, EDA data collected on the Q Sensors were downloaded onto a computer for processing. Matlab scripts were used to automatically detect artifacts in the EDA signals. Next, research assistants visually inspected all computer identified artifacts and made revisions if necessary. Matlab scripts were then used to remove all identified artifacts. We averaged the signals across 60-min periods to obtain one score for each person's EDA per hour. EDA was quantified as skin conductance level measured in microsiemens. General levels of EDA were operationalized as EDA values entered for each hour of the day, tested as the outcome variable in multilevel models with observations nested in people and people nested in couples.

2.4.3. Electrodermal activity reactivity—In addition to examining general levels of EDA over the day, we examined EDA reactivity, or increases in EDA during hours of naturally-occurring annoyance between dating partners. EDA reactivity was operationalized as the level 1 association between feelings of annoyance and EDA and was tested by creating a level 2 latent factor representing the level 1 slopes, which was then entered as a level 2 variable in multilevel models.

2.4.4. Family-of-origin aggression—FOA was measured via 14 items from the Parent/Child Conflict Tactics Scale (CTS; [41,42]). This scale assesses exposure to psychological and physical aggression from at least one parent (e.g., "Insulted you or told you that you were not good enough" and "Pushed, grabbed, or shoved you"). Participants reported the frequency of these behaviors on a 0 (*never*) to 4 (> 6 *times*) scale. Final scores were obtained by taking the mean across items so that higher scores reflected greater exposure to FOA (possible range of final scores = 0–4; Cronbach's alpha = 0.95 for women and 0.94 for men).

2.4.5. Dating aggression perpetration—To assess aggression in the current dating relationship, we used the How Dating Partners Treat Each Other Scale (HDPTEO; [4]). This questionnaire includes 70 items assessing electronic, psychological, physical, and sexual aggression (e.g., "Has your dating partner ever sent a threatening email?" and "Have you ever kicked, hit, or punched your partner?"). Each person reported on the frequency of each behavior within the past year, with scores on each item ranging from 0 (*never happened*) to 4 (*> 10 times*). Because aggression perpetration tends to be underreported (e.g., [19]), we obtained the maximum score across the two reporters for each item (e.g., the maximum of partner 1's report of victimization and partner 2's report of perpetration per item). Final scores were then calculated by taking the average across all items so that higher scores reflected more dating aggression perpetration (possible range of final scores = 0–4). Cronbach's alpha was 0.96 for women and 0.94 for men.

2.5. Overview of analyses

In a preliminary set of analyses, we tested direct associations between feeling annoyed, EDA, FOA, and dating aggression perpetration using multilevel models. The hourly link between feeling annoyed and EDA was tested using a three-level model with observations nested in people and people nested in couples. Specifically, feelings of annoyance were added as a level 1 predictor of level 1 EDA:

$$\text{Level 1: Hourly EDA}_{\text{ijk}} = \beta_{0\text{jk}} + \beta_{1\text{jk}}\left(\text{Hourly Feelings of Annoyance}_{1\text{ijk}}\right) + e_{\text{ijk}}$$

$$\text{Level 2: } \beta_{0jk} = \gamma_{00k} + u_{0jk}$$
$$\beta_{1jk} = \gamma_{10k}$$

$$\text{Level 3: } \gamma_{00k} = \lambda_{000} + r_{00k}$$
$$\gamma_{10k} = \lambda_{100}$$

Links between (1) FOA and EDA and (2) dating aggression and EDA were examined using the same general modeling framework. We also examined the association between FOA and dating aggression using a two-level model, with people nested in couples:

$$\text{Level 1: Dating aggression perpetration}_{ij} = \beta_{0j} + \beta_{1j}\left(\text{FOA}_{1ij}\right) + e_{ij}$$

$$\text{Level 2: } \beta_{0j} = \gamma_{00} + u_{0j}$$
$$\beta_{1j} = \gamma_{10}$$

The main hypotheses were tested using multi-group, multilevel structural equation modeling. For each hypothesis, we tested three-level models with observations nested in people and people nested in couples. After testing these initial models, we conducted multilevel (observations nested in people) multi-group (men and women) analyses to test gender effects. To test if FOA moderates the link between hour-to-hour feelings of annoyance and EDA (HO1), we added FOA as a level 2 moderator of the level 1 slopes:

$$\text{Level 1: Hourly EDA}_{ijk} = \beta_{0jk} + \beta_{1jk}\left(\text{Hourly Feelings of Annoyance}_{1ijk}\right) + e_{ijk}$$

$$\text{Level 2: } \beta_{0jk} = \gamma_{00k} + \gamma_{01k}\left(\text{FOA}_{1jk}\right) + u_{0jk}$$
$$\beta_{1jk} = \gamma_{10k} + \gamma_{11k}\left(\text{FOA}_{1jk}\right)$$

$$\text{Level 3: } \gamma_{00k} = \lambda_{000} + r_{00k}$$
$$\gamma_{01k} = \lambda_{010}$$
$$\gamma_{10k} = \lambda_{100}$$
$$\gamma_{11k} = \lambda_{110}$$

We then constrained hypothesized paths to be equal across men and women and conducted Wald tests.

The same general method was used to determine if dating aggression moderates the link between feelings of annoyance and EDA (HO2). That is, we tested a cross-level interaction by adding dating aggression perpetration as a level 2 moderator of the level 1 link between hourly feelings of annoyance and EDA:

$$\text{Level 1: Hourly EDA}_{\text{ijk}} = \beta_{0\text{jk}} + \beta_{1\text{jk}}\left(\text{Hourly Feelings of Annoyance}_{1\text{ijk}}\right) + e_{\text{ijk}}$$

$$\text{Level 2: } \beta_{0\text{jk}} = \gamma_{00\text{k}} + \gamma_{01\text{k}}\left(\text{Dating Aggression Perpetration}_{1\text{jk}}\right) + u_{0\text{jk}}$$
$$\beta_{1\text{jk}} = \gamma_{10\text{k}} + \gamma_{11\text{k}}\left(\text{Dating Aggression Perpetration}_{1\text{jk}}\right)$$

$$\text{Level 3: } \gamma_{00\text{k}} = \lambda_{000} + r_{00\text{k}}$$
$$\gamma_{01\text{k}} = \lambda_{010}$$
$$\gamma_{10\text{k}} = \lambda_{100}$$
$$\gamma_{11\text{k}} = \lambda_{110}$$

We then conducted two-level (observations nested in couples) multi-group (women and men) analyses and used Wald tests to determine if constraining hypothesized paths to be equal resulted in a statistically significant decrease in model fit.

To determine whether EDA reactivity mediates the link between FOA and dating aggression (HO3), we extracted an index of EDA reactivity for each person by creating a level 2 latent variable representing the level 1 association between feeling annoyed and EDA. This level 2 latent variable was then entered as a mediator of the level 2 association between FOA and dating aggression perpetration [34,35]. The mediation path was tested via the Sobel test using confidence intervals.

We ran our hypothesized models with and without potential covariates to determine if the inclusion of covariates altered the pattern of results. Time-varying, level 1 covariates included: time, physical activity, if the participants were together, interacting, communicated by phone, and consumed alcohol, caffeine, tobacco, or other drugs. Level 2 covariates included gender, age, ethnic/racial status, education level, and employment status. Level 3 covariates included relationship length and whether or not the couple was cohabitating. Covariates were simultaneously entered into the models; though several covariates were significantly associated with our outcome variables, their inclusion did not alter the general size, direction, or significance of the hypothesized associations between our main study variables; for parsimony, we present the results of models without covariates included. We also ran all models with and without same-sex couples included. The inclusion of the same-sex couples did not alter the patterns of findings. Thus, we present model results for the complete sample. All tests were conducted using robust standard errors. Intercepts were estimated as random, but all other effects were fixed to avoid convergence problems and to increase parsimony in our models [36]. Consistent with recommendations for testing cross-level interactions [15,31], level 1 variables were group-mean centered and level 2 and 3 variables were grand-mean centered. Missing data were handled using Full Information Maximum Likelihood Estimation [14].

3. Results

3.1. Descriptive statistics

Table 1 presents descriptive statistics and correlations for the main study variables. We obtained 3118 h of data (M = 14.4 h per person); participants completed 87.5% of the hourly surveys. Of the surveys that were completed, 92.0% were initiated within 15 min of the survey alarm. Across the day of data collection, 185 people (84.9%) reported feeling annoyed at their partner at least once (M number of hours endorsed = 5.9). In total, 183 people (83.9%) reported at least some FOA, while 157 (72.0%) reported perpetrating at least some dating aggression, consistent with other studies examining rates of psychological and physical aggression across different age ranges (e.g., [11,17,40,44]). Additionally, 139 people (63.8%) reported both FOA and dating aggression, 44 (20.2%) reported FOA but not dating aggression, 18 (8.3%) reported dating aggression but not FOA, and 17 (7.8%) reported neither FOA nor dating aggression.

Paired sample t-tests conducted on opposite-sex couples indicated that men ($M = 6.79$) had higher levels of EDA on average than did women ($M = 4.54$), $t(105) = 2.68$, $p < .01$. As found in previous research [48,49], women ($M = 0.20$) perpetrated more dating aggression than men ($M = 0.14$), $t(105) = 2.64$, $p < .05$. No other gender differences for the main study variables were observed. Correlation analyses conducted separately for women and men showed several significant associations: FOA was significantly associated with greater dating aggression perpetration in men and was marginally associated with greater dating aggression perpetration in women. Feelings of annoyance were linked to more dating aggression perpetration in both men and women and with greater exposure to FOA in men. FOA was marginally associated with lower EDA in men.

As preliminary analyses, we next used multilevel models to test direct effects between hourly feelings of annoyance, EDA, FOA, and dating aggression perpetration. Results showed that feeling annoyed was not significantly associated with concurrent increases in EDA for the sample as a whole ($b = -0.02$, $p = .15$). Both FOA ($b = 0.26$, $p < .001$) and dating aggression perpetration ($b = 0.39$, $p < .001$) were associated with higher levels of annoyance with dating partners in daily life. Dating aggression was associated with lower EDA for both men and women ($b = -0.14$, $p = .02$) while FOA was associated with lower EDA for men only ($b = -0.09$, $p = .03$). Consistent with past research (e.g., [5,12]), exposure to aggression in the family of origin was associated with heightened risk of perpetrating dating aggression in young adulthood ($b = 0.21$, $p < .01$). No other significant associations were obtained for the sample as a whole or in analyses testing effects separately by gender.

3.2. HO1: hourly feelings of annoyance and EDA moderated by FOA

To test whether FOA moderated the hourly association between feelings of annoyance and EDA, we added FOA as a level 2 moderator of the level 1 slopes. This effect was marginally significant ($b = 0.25$, $p = .09$). However, multi-group analysis using a Wald test indicated that the effect was significantly different for women and men ($\chi^2(1) = 6.62$, $p = .01$). For women, the moderation effect was significant ($b = 0.24$, $p = .01$, PRV in level 1 EDA = 12.08%, PRV in level 2 EDA = 11.32%, ICC = 0.58; see Fig. 2, Panel A): analysis of the regions of significance showed that women exposed to FOA at least 1.89 standard deviations below the mean showed decreased EDA ($b = -0.55$, $p = .05$; denoted by black solid line in Fig. 2, Panel A), while those women with FOA at least 1.28 standard deviations above the mean showed increased EDA ($b = 0.21$, $p = .05$; denoted by gray dashed line in Fig. 2, Panel A). For men, the moderation effect was nonsignificant ($b = 0.25$, $p = .26$, PRV in level 1 EDA = 5.83%, PRV in level 2 EDA = 11.56%, ICC = 0.54); however, FOA was linked to lower general levels of EDA in men ($b = -0.40$, $p = .03$) in this model. The results of these analyses presented separately for women and men are provided in Table 2.

3.3. HO2: hourly feelings of annoyance and EDA moderated by dating aggression

We next tested if dating aggression perpetration, added at level 2, moderated the level 1 association between hourly feelings of annoyance and hourly EDA. Results of this moderation test were nonsignificant ($b = 0.15$, $p = .33$). Follow-up, multi-group analyses indicated that the moderation effect significantly differed between the male and female groups ($\chi^2(1) = 7.29$, $p = .01$), such that the effect was significant for women ($b = 0.18$, $p = .01$, PRV in level 1 EDA = 12.27%, PRV in level 2 EDA = 11.38%, ICC = 0.58, see Fig. 2, Panel B) but not for men ($b = -0.04$, $p = .89$, PRV in level 1 EDA = 6.62%; PRV in level 2 EDA = 10.01%, ICC = 0.55). Analysis of the regions of significance indicated that women with dating aggression perpetration at least 0.24 standard deviations below the mean showed decreased EDA ($b = -0.24$, $p = .05$; denoted by solid black line in Fig. 2, Panel B), while those with aggression perpetration at least 2.66 standard deviations above the mean had increased EDA ($b = 0.28$, $p = .05$; denoted by gray dashed line in Fig. 2, Panel B). Table 3 presents findings for the moderation models tested separately for men and women.

3.4. HO3: EDA reactivity as a mediator in the intergenerational transmission of aggression

We then tested physiological stress reactivity in daily life as a mediating variable in the intergenerational transmission of aggression. EDA reactivity, quantified as a level 2 latent variable representing the level 1 slopes for EDA and feeling annoyed, was entered as a mediator of the level 2 link between FOA and dating aggression perpetration. This mediation effect was significant ($b = 0.22$, CI[0.10, 0.34]). Moreover, results of a multi-group analysis indicated that this mediation effect differed between men and women ($\chi^2(1) = 4.81$, $p = .03$). Specifically, the mediation effect was significant in women ($b = 0.23$, CI[0.02, 0.43], PRV in level 2 dating aggression = 27.01%, ICC = 0.58), but not men ($b = 0.13$, CI[−0.51, 0.77], PRV in level 2 dating aggression = 7.10%, ICC = 0.55). Fig. 3 presents results of mediation models tested separately by gender.

4. Discussion

The current study investigated how physiological reactivity to interpersonal stress in daily life relates to FOA and dating aggression perpetration. FOA was linked to lower general levels of EDA in men, while dating aggression perpetration was linked to lower general levels of EDA in both men and women. In women only, high levels of FOA (HO1) and dating aggression perpetration (HO2) were associated with increases in EDA when feeling annoyed at one's partner; unexpectedly, low levels of FOA and dating aggression were associated with decreases in EDA when feeling annoyed. Finally, EDA reactivity mediated the link between FOA and dating aggression perpetration (HO3) in women but not men. Our findings suggest that physiological reactions to small-scale, commonly occurring interpersonal events, such as feeling annoyed with a dating partner, relate to prior experiences with aggression and that these patterns of physiological reactivity could help explain pathways of risk and resilience among children exposed to FOA.

Our data point to distinct patterns of general versus reactive physiological activity in individuals exposed to FOA and who perpetrate aggression against others. Individuals who acted aggressively had lower levels of EDA on average, suggesting generalized under-arousal. At the same time, women exposed to FOA or who perpetrated aggression toward dating partners had greater EDA reactivity, indicating heightened arousal to interpersonally-relevant interpersonal stressors. Perhaps exposure to FOA blunts general EDA levels while also amplifying reactivity to environmental threats. Although such reactivity may be adaptive by helping people respond to stressors, it might also negatively impact relationships by escalating conflicts and contributing to the intergenerational transmission of aggression. Interestingly, these patterns dovetail with competing theories about how autonomic arousal relates to aggression. On the one hand, some researchers have theorized that individuals with antisocial traits are chronically under-aroused and that aggression is driven by fearlessness and sensation seeking [23]. Conversely, others have posited that individuals who act aggressively evidence heightened reactivity and emotional dysregulation, increasing risk of impulsive and hostile behavior (see [8] for a review of these perspectives). One meta-analysis investigating these patterns found evidence of under-arousal in EDA at rest among adults with antisocial traits, though under-arousal at rest was not specifically linked to aggression [26]; however, this meta-analysis did find that aggression was associated with increased EDA reactivity during stress.

Importantly, the finding that aggression is associated with heightened reactivity to interpersonal stress was specific to women in our sample. This result is consistent with research investigating cortisol reactivity during conflict discussions, which shows elevated reactivity in women, but not men [1,25,29,39]. Interestingly, women in our sample were more likely to perpetrate dating aggression than were men, as has been found in other studies (e.g., Foshee, 1996; O'Leary et al., 2018). According to demand-withdraw theory, women are, stereotypically, more approach-oriented during marital conflicts, whereas men are generally more likely to withdraw [7]. As a result, women may be more attuned and reactive during conflict, may track interactions more closely, and may also be more likely to engage with their partners as a method of conflict resolution. Men's tendency to disengage could trigger increased demanding behavior in female partner, further heightening women's engagement and physiological reactions during conflict. Contrary to our expectations, women with low levels of FOA and aggression showed decreases in EDA levels when feeling annoyed with their partners, suggesting that some women actually downregulated their physiological arousal during interpersonal stress. Perhaps women are more reactive and sensitive generally, showing either increases or decreases in EDA activity when stressed, depending on their family history and individual regulatory capacity.

The current study has a number of strengths, including the use of a detailed ecological momentary assessment procedure to investigate patterns of naturally-occurring interpersonal stress reactivity in real life; however, a number of limitations of our study should be noted. First, we focused on concurrent links between feelings of annoyance and EDA; thus, we cannot ascertain if feelings of annoyance elicited an EDA response or vice versa. Future research should examine time-lagged effects to test the directionality of these processes. Second, we aggregated the EDA scores across each hour to match the time scale of the hourly self-report data. While informative, future work should attempt to gain greater temporal precision, perhaps by using audio recordings of couples' arguments via smartphones or even smart home devices (e.g., [30]). Third, we relied on retrospective reports of FOA exposure and past year reports of dating aggression perpetration. What remains unclear in our data is if these patterns reflect general, temperamental tendencies toward aggression or were caused by early environmental experiences; our results should be replicated using prospective data. Fourth, it is important to note that EDA in daily life can be influenced by a variety of external factors, such physical activity; though the inclusion of covariates did not alter our results, we cannot be certain if changes in EDA were the result of other ongoing emotional experiences or concurrent factors. Fifth, because we collected data for only one day, we did not capture feelings of annoyance in all of our participants. As a result, these findings may not reflect patterns of reactivity for those couples with very low levels of conflict. Relatedly, because we focused on commonplace and small-scale relationship events, we cannot be certain that these results generalize to more intense and infrequent types of conflicts. Even so, our data speak to the utility of capturing small-scale events, suggesting that micro-level processes could have important downstream impacts on macro-level outcomes.

5. Conclusion

Exposure to aggression in the family of origin may alter physiological response profiles, so that patterns of activation at baseline and under stress are matched to one's environmental context, increasing the likelihood of short-term survival, oftentimes at the expense of long-term health. Our study identified distinct patterns of physiological responsivity in individuals exposed to aggression and who perpetrate aggression against others. These patterns of responsivity may help explain pathways of risk and resilience in children exposed to FOA. Understanding how environmental contexts impact physiological response profiles is an important step in creating effective interventions for interrupting cycles of maltreatment and aggression.

Acknowledgments

This project is based on work supported by NSF Grant No. BCS-1627272 (Margolin, PI), SC CTSI (NIH/NCATS) through Grant No. UL1TR000130 (Margolin, PI), NIH-NICHD Grant No. R21HD072170-A1 (Margolin, PI), NSF GRFP Grant No. DGE-0937362 (Timmons, PI), an APA Dissertation Award (Timmons, PI), and NSF GRFP Grant No. DGE-0937362 (Han, PI). Its contents are the responsibility of the authors and do not necessarily represent the views of NSF, APA, or NIH. The authors have no any conflicts of interest that might be interpreted as influencing this research.

References

[1]. Arbel R, Rodriguez A, Margolin G, Cortisol reactions during family conflict discussions: influences of wives and husbands' exposure to family-of-origin aggression, Psychol. Violence 6 (2015) 519–528, 10.1037/a0039715.

[2]. Beldare P, Mateus ARA, Keller R, Evolution and molecular mechanisms of adaptive developmental plasticity, Mol. Ecol 20 (2011) 1347–1363, 10.1111/j.1365-294X.2011.05016.x. [PubMed: 21342300]

[3]. Benedek M, Kaernbach C, A continuous measure of phasic electrodermal activity, J. Neurosci. Methods 190 (2010) 80–91, 10.1016/j.jneumeth.2010.04.028. [PubMed: 20451556]

[4]. Bennet DC, Guran EL, Ramos MC, Margolin G, College students' electronic victimization in friendships and dating relationships: anticipated distress and associations with risky behaviors, Violence Vict 26 (2011) 410–429, 10.1891/0886-6708.26.4.410. [PubMed: 21882666]

[5]. Berlin LJ, Appleyard K, Dodge KA, Intergenerational continuity in child mal-treatment: mediating mechanisms and implications for prevention, Child Dev 82 (2011) 162–176, 10.1111/j.1467-8624.2010.01547.x. [PubMed: 21291435]

[6]. Bolger N, Davis A, Rafaeli E, Diary methods: capturing life as it is lived, Annu. Rev. Psychol 54 (2003) 579–616, 10.1146/annurev.psych.54.101601.14530. [PubMed: 12499517]

[7]. Christensen A, Heavey CL, Gender differences in marital conflict: The demand/withdraw interaction pattern, in: Oskamp S, Costanzo M (Eds.), Claremont Symposium on Applied Social Psychology, Vol. 6. Gender Issues in Contemporary Society, Sage Publications, Inc, Thousand Oaks, CA, US, 1993, pp. 113–141.

[8]. Coyne SM, Ostrov JM, The Development of Relational Aggression, Oxford University Press, New York, NY, 2018.

[9]. Davies PT, Sturge-Apple ML, Cicchetti D, Interparental aggression and children's adrenocortical reactivity: testing an evolutionary model of allostatic load, Dev. Psychopathol 23 (2011) 801–814, 10.1017/S0954579411000319. [PubMed: 21756433]

[10]. Davies PT, Sturge-Apple ML, Cicchetti D, Cummings EM, The role of child adrenocortical functioning in pathways between inter-parental conflict and child maladjustment, Dev. Psychol 43 (2007) 918–930, 10.1037/0012-1649.43.4.918. [PubMed: 17605525]

[11]. Doroszewicz K, Forbes GB, Experiences with dating aggression and sexual coercion among Polish college students, J. Interperson. Viol 23 (2008) 58–73, 10.1177/0886260507307651.

[12]. Ehrensaft MK, Cohen P, Brown J, Smailes E, Chen H, Johnson JG, Intergenerational transmission of partner violence: a 20-year prospective study, J. Consult. Clin. Psychol 71 (2003) 741–753, 10.1037/0022006X.71.4.74. [PubMed: 12924679]

[13]. El-Sheik M, Harger J, Appraisals of marital conflict and children's adjustment, health, and physiological reactivity, Dev. Psychol 37 (2001) 875–885, 10.1037/0012-1649.37.6.875. [PubMed: 11699760]

[14]. Enders CK, Applied Missing Data Analysis, Guildford Press, New York, NY, 2010.

[15]. Enders CK, Tofighi D, Centering predictor variables in cross-sectional multilevel models: a new look at an old issue, Psychol. Methods 12 (2007) 121–138, 10.1037/1082-989X.12.2.121. [PubMed: 17563168]

[16]. Feinberg ME, Jones DE, Granger DA, Bontempo D, Relation of intimate partner violence to salivary cortisol among couples expecting a first child, Aggress. Behav 37 (2011) 492–502, 10.1002/ab.20406. [PubMed: 21830223]

[17]. Fernandez-Fuertes AA, Fuertes A, Physical and psychological aggression in dating relationships of Spanish adolescents: motives and consequences, Child Abuse Negl 34 (2010) 183–191, 10.1016/j.chiabu.2010.01.002. [PubMed: 20207002]

[18]. Gunnar M, Quevado K, The neurobiology of stress and development, Annu. Rev. Psychol 58 (2007) 145–173, 10.1146/annurev.psych.58.110405.085605. [PubMed: 16903808]

[19]. Herbert M, Van Camp T, Lavoie F, Gurrier M, Understanding the hesitancy to disclose teen dating violence: correlates of self-efficacy to deal with teen dating violence, Temida 17 (2014) 43–64, 10.2298/TEM1404043H. [PubMed: 28190973]

[20]. Hugdahl K, Psychophysiology, Harvard University Press, Cambridge, MA, 1995.

[21]. Jouriles EN, McDonald R, Mueller V, Grych JH, Youth experiences of family violence and teen dating violence perpetration: cognitive and emotional mediators, Clin. Child Family Psychol. Rev 15 (2012) 58–68, 10.1007/s10567011-0102-7.

[22]. Kaas JH, The Mutable Brain: Dynamic and Plastic Features of the Developing and Mature Brain, Harwood Academic, Amsterdam, Netherlands, 2001.

[23]. Latvala A, Kuja-Halkola R, Almqvist C, Larsson H, Lichtenstein P, A longitudinal study of resting heart rate and violent criminality in more than 700,000 men, J. Am. Med. Assoc. Psychiatry 72 (2015) 971–978, 10.1001/jamapsychiatry.2015.1165.

[24]. Laurenceau J, Bolger N, Using diary methods to study marital and family processes, J. Fam. Psychol 19 (2005) 86–97, 10.1037/0893-3200.19.1.86. [PubMed: 15796655]

[25]. Laurent HK, Powers SI, Laws H, Gunlicks-Stoessel M, Bent E, Balaban S, HPA regulation and dating couples' behaviors during conflict: gender-specific associations and crosspartner interactions, Physiol. Behav 118 (2013) 218–226, 10.1016/j.physbeh.2013.05.037. [PubMed: 23711564]

[26]. Lorber MF, Psychophysiology of aggression, psychopathy, and conduct problems: a meta-analysis, Psychol. Bull 130 (2004) 531–552, 10.1037/0033-2909.130.4.531. [PubMed: 15250812]

[27]. Luecken LJ, Kraft AJ, Hagan M, Negative relationships in the family-of-origin predict attenuated cortisol in emerging adults, Horm. Behav 55 (2009) 412–417, 10.1016/j.yhbeh.2008.12.007. [PubMed: 19470368]

[28]. Margolin G, Ramos MC, Timmons AC, Miller KF, Han SC, Intergenerational transmission of aggression: physiological regulatory processes, Child Dev. Perspect 10 (2016) 15–21, 10.1111/cdep.12156. [PubMed: 26929773]

[29]. Murray-Close D, Holland AS, Roisman GI, Autonomic arousal and relational aggression in heterosexual dating couples, Pers. Relat 19 (2011) 203–218, 10.1111/j.1475-6811.2011.01348.x.

[30]. Nelson BW, Allen NB, Extending the passive-sensing toolbox: using smart-home technology in psychological science, Perspect. Psychol. Sci 13 (2018) 718–733, 10.1177/1745691618776008. [PubMed: 30217132]

[31]. Peugh JL, A practical guide to multilevel modeling, J. Sch. Psychol 48 (2010) 85–112, 10.1016/j.jsp.2009.09.002. [PubMed: 20006989]

[32]. Poh M, Loddenkemper T, Reinsberger C, Swenson NC, Goyal S, Sabtala MC, Madsen JR, Picard RW, Convulsive seizure detection using a wrist-worn electrodermal activity accelerometry biosensor, Epilepsia 53 (2012) 93–97, 10.1111/j.1528-1167.2012.03444.x.

[33]. Poh M, Swensen NC, Picard RW, A wearable sensor for unobtrusive, long-term assessment of electrodermal activity, IEEE Trans. Biomed. Eng 57 (2010) 1243–1252, 10.1109/TBME.2009.2038487. [PubMed: 20172811]

[34]. Preacher KJ, Zhang Z, Zyphur MJ, Multilevel structural equation models for assessing moderation within and across analysis, Psychol. Methods 21 (2016) 189–205, 10.1037/met0000052. [PubMed: 26651982]

[35]. Preacher KJ, Zyphur MJ, Zhang Z, A general multilevel SEM framework for assessing multilevel mediation, Psychol. Methods 15 (2010) 209–233, 10.1037/a0020141. [PubMed: 20822249]

[36]. Raudenbush SW, Bryk AS, Hierarchical Linear Models: Applications and Data Analysis Methods, 2nd ed, Sage, Newbury Park, CA, 2002.

[37]. Repetti RL, Taylor SE, Seeman TE, Risky families: family social environments and the mental and physical health of offspring, Psychol. Bull 128 (2002) 330–366, 10.1037//0033-2909.128.2.330. [PubMed: 11931522]

[38]. Repetti RL, Robles TF, Reynolds B, Allostatic processes in the family, Dev. Psychopathol 23 (2011) 921–938, 10.1017/S095457941100040X. [PubMed: 21756442]

[39]. Rodriguez A, Margolin G, Wives' and husbands' cortisol reactivity to proximal and distal dimensions of couple conflict, Fam. Process 52 (2013) 555–569, 10.1111/famp.12037. [PubMed: 24033248]

[40]. Shorey RC, Temple JR, Febres J, Brasfield, Sherman AE, Stuart GL, The consequences of perpetrating psychological aggression in dating relationships: a descriptive investigation, J. Interperson. Violence 27 (2012) 2980–2998, 10.1177/0886260512441079.

[41]. Straus MA, Measuring intrafamily conflict and violence: the conflict tactics (CT) scales, J. Marriage Fam 41 (1979) 75–88, 10.2307/351733.

[42]. Straus MA, Hamby SL, Finkelhor D, Moore DW, Runyan D, Identification of child maltreatment with the Parent–Child Conflict Tactics Scales: development and psychometric data for a national sample of American parents, Child Abuse Negl 22 (1998) 249–270, 10.1016/S0145-2134(97)00174-9. [PubMed: 9589178]

[43]. Timmons AC, Baucom BR, Han SC, Perrone L, Chaspari T, Narayanan S, Margolin G, New frontiers in ambulatory assessment: big data methods for capturing couples' emotions, vocalizations, and physiology in daily life, Soc. Psychol. Personal. Sci 8 (2017) 552–563, 10.1177/1948550617709115.

[44]. Timmons AC, Arbel R, Margolin G, Daily patterns of stress and conflict in couples: associations with marital aggression and family-of-origin aggression, J. Fam. Psychol 31 (2017) 93–104, 10.1037/fam0000227. [PubMed: 27504754]

[45]. Timmons AC, Chaspari T, Han SC, Perrone L, Narayanan S, Margolin G, Using multimodal wearable technology to detect conflict among couples, IEEE Computer 50 (2017) 50–59, 10.1109/MC.2017.83.

[46]. Romens SE, McDonald J, Svaren J, Pollak SD, Associations between early life stress and gene methylation in children, Child Develop 86 (2015) 303–309, 10.1111/cdev.12270. [PubMed: 25056599]

[47]. Dawson ME, Schell AM, Filion DL, The electrodermal system, in: Cacioppo JT, Tassinary LG, & Bernste GG (Eds.), Handbook of Psychophysiology, 3rd ed., Cambridge University Press, New York, NY, 2007, pp. 159–181.

[48]. Foshee VA, Gender differences in adolescent dating abuse prevalence, Health Edu. Res 11 (1996) 275–286, 10.1093/her/11.3.275-a.

[49]. O'Leary KD, Smith Slep AM, Avery-Leaf F, Cascardi M, Gender differences in dating aggression among multiethnic high school student, Journal of Adolescent Health 42 (2008) 473–479, 10.1016/j.jadohealth.2007.09.012. [PubMed: 18407042]

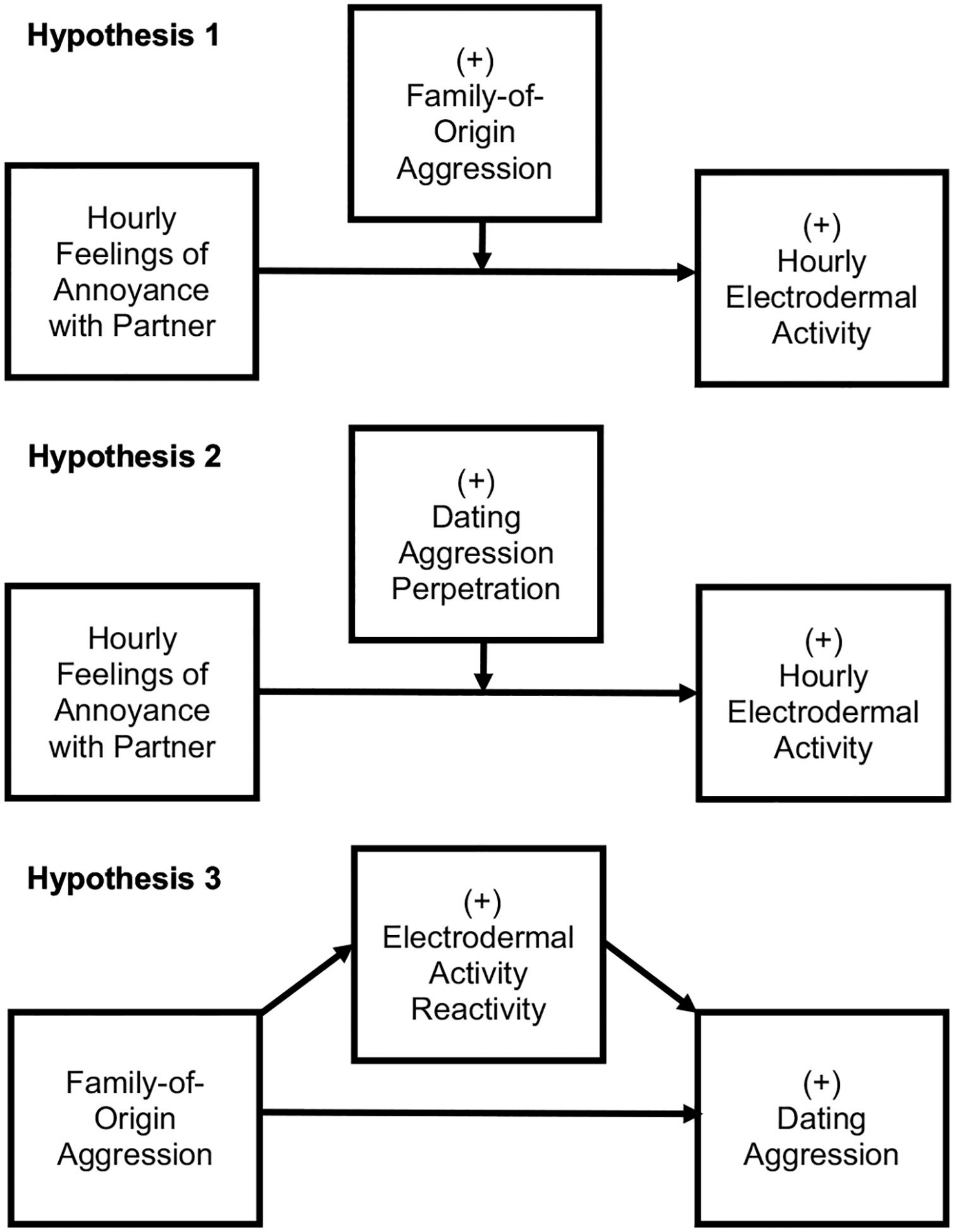

Fig. 1.

Hypothesized associations between hourly feelings of annoyance, family-of-origin aggression, dating aggression, and hourly electrodermal activity.

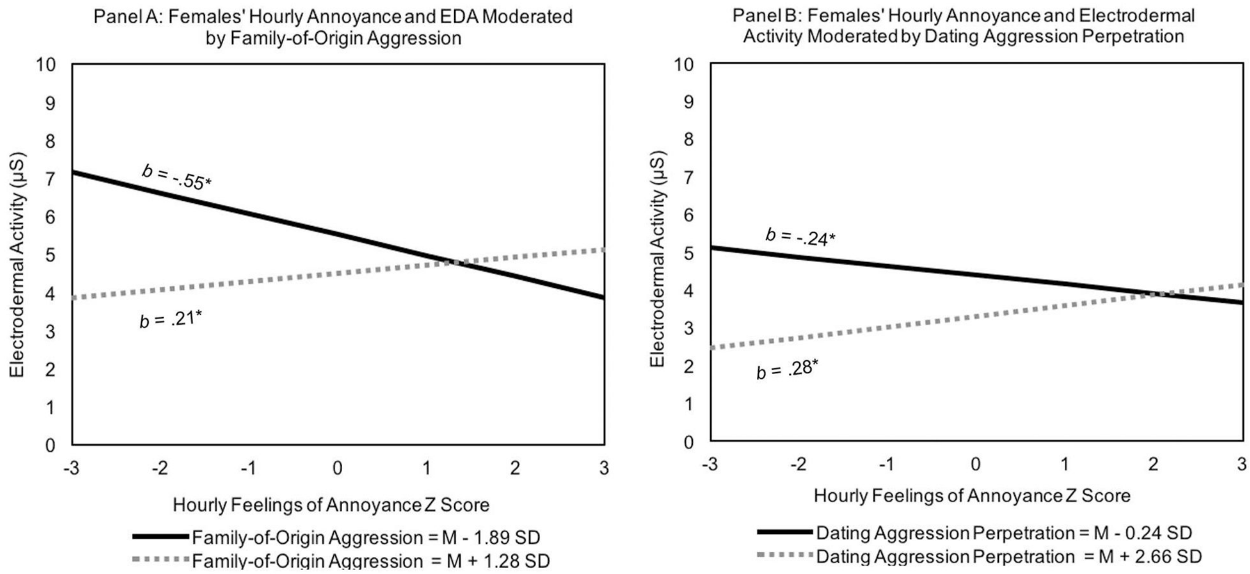

Fig. 2.

The association between hourly feelings of annoyance and electrodermal activity moderated by family-of-origin aggression (Panel A) and dating aggression perpetration (Panel B). Values are plotted at the regions of significance. µS = microsiemens.

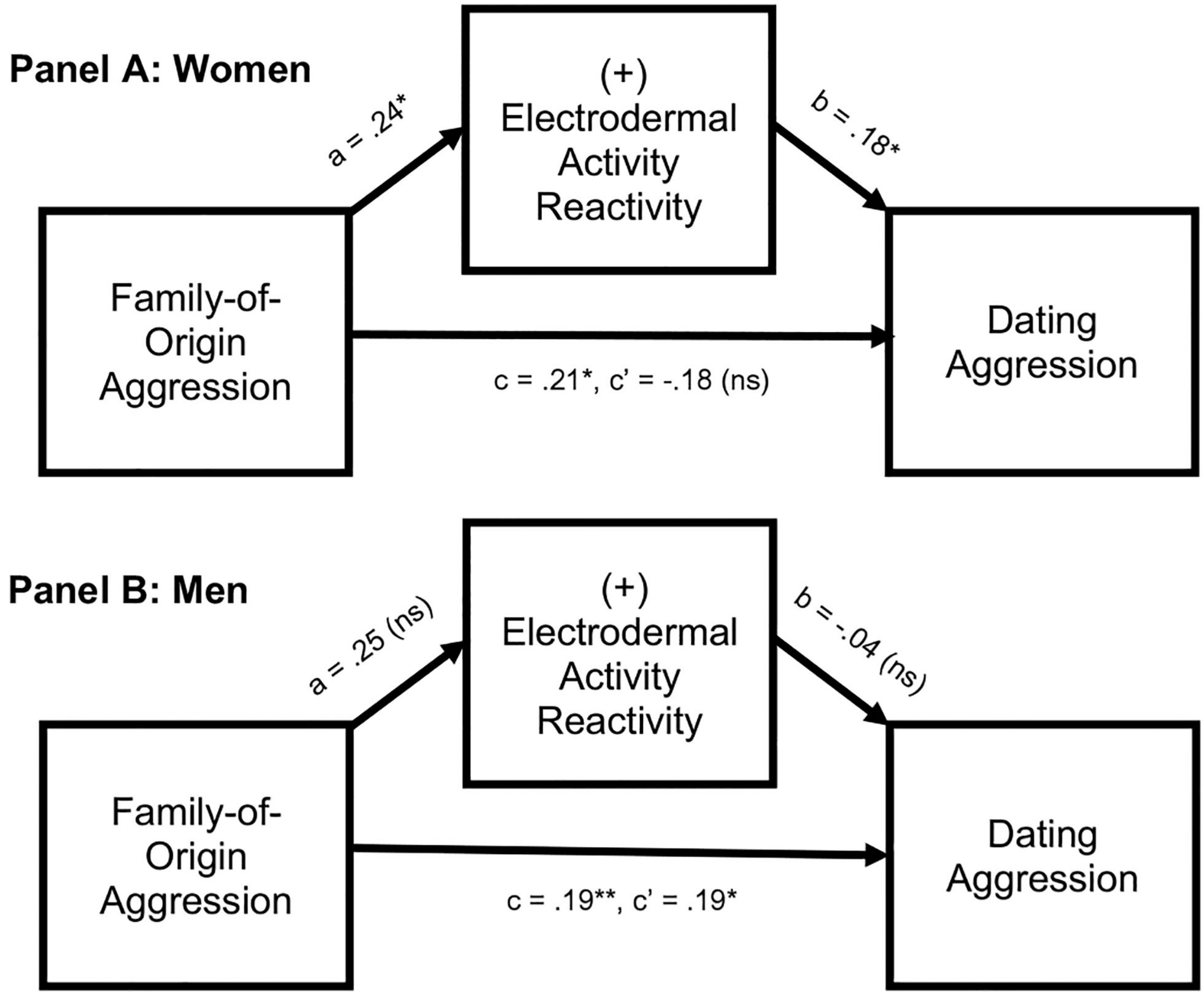

Fig. 3.

Multi-group, multilevel mediation model testing electrodermal activity as a mediator of the association between family-of-origin aggression and dating aggression; Panel A = women; Panel B = men; Women: $b = 0.23$, CI[0.02, 0.43]; Men: $b = 0.13$, CI[−0.51, 0.77]. PRV = percent reduction in variance explained by the mediation model. Women: PRV in level 2 dating aggression = 27.01%, ICC = 0.58; Men: PRV in level 2 dating aggression = 7.10%, ICC = 0.54.

Table 1

Descriptive statistics for the main study variables.

	Women			Men			1.	2.	3.	4.
	M	*SD*	*Min-Max*	*M*	*SD*	*Min-Max*				
1. Electrodermal activity[1]	4.54	5.72	0–28.98	6.79	6.56	0–32.21	-	−0.02	−0.08	−0.08
2. Hourly feelings of annoyance[1]	8.84	10.01	0–59.73	7.11	10.62	0–90.18	−0.08	-	0.13	0.33**
3. Family-of-origin aggression	1.04	0.92	0–3.57	0.87	0.96	0–3.64	−0.162†	0.25*	-	0.18†
4. Dating aggression	0.20	0.34	0–0.71	0.14	0.19	0–0.86	−0.08	0.31	0.27**	-

Note. Top diagonal = women; bottom diagonal = men. Women family-of-origin aggression % endorsement: parent-to-parent psychological = 39.4, parent-to-parent physical = 40.7, parent-to-child psychological = 83.5, parent-to-child physical = 70.6; Men family-of-origin aggression % endorsement: parent-to-parent psychological = 57.5, parent-to-parent physical = 31.1, parent-to-child psychological = 75.9, parent-to-child physical = 60.2. Women dating aggression perpetration % endorsement: psychological = 69.7, physical = 23.9, sexual = 9.2, electronic = 43.1; Men dating aggression perpetration endorsement: psychological = 65.1, physical = 12.8, sexual = 19.8, electronic = 35.8.

* $p < .05$.

** $p < .001$.

[1] Hourly scores averaged over the day of data collection.

† Marginally significant at $p < .10$.

Table 2

Multi-group, multilevel models of hourly feelings of annoyance and electrodermal activity moderated by family-of-origin aggression.

	b	*SE*	*p*
Women: fixed effects			
Intercept	4.29	0.51	< 0.001
Hourly feelings of annoyance	−0.10	0.13	0.45
Family-of-origin aggression	−0.31	0.46	0.51
Hourly feelings of annoyance × family-of-origin aggression	0.24	0.10	**0.01**
Women: random effects			
Level 1 intercept	19.28	4.09	< 0.001
Level 2 intercept	17.81	4.22	< 0.001
Men: fixed effects			
Intercept	6.68	0.60	< 0.001
Hourly feelings of annoyance	−0.47	0.22	0.03
Family-of−origin aggression	−1.00	0.47	0.03
Hourly feelings of annoyance × family-of-origin aggression	0.25	0.22	0.26
Men: random effects			
Level 1 intercept	28.57	4.62	< 0.001
Level 2 intercept	33.83	7.65	< 0.001

Note. PRV = percent reduction in variance explained by the moderation model; Women: PRV in level 1 electrodermal activity (EDA) = 12.08%, PRV in level 2 electrodermal activity (EDA) = 11.32%, ICC = 0.58; Men: PRV in level 1 electrodermal activity (EDA) = 5.83%, PRV in level 2 electrodermal activity (EDA) = 11.56%, ICC = 0.54. Bold signifies *p < .05.

Table 3

Multi-group, multilevel models of hourly feelings of annoyance and electro-dermal activity moderated by dating aggression perpetration.

	b	***SE***	***p***
Women: fixed effects			
Intercept	4.29	0.51	< 0.001
Hourly feelings of annoyance	−0.20	0.12	0.10
Dating aggression perpetration	−0.37	0.24	0.12
Hourly feelings of annoyance × dating aggression perpetration	0.18	0.07	**0.01**
Women: random effects			
Level 1 intercept	19.24	4.06	< 0.001
Level 2 intercept	26.61	7.34	< 0.001
Men: fixed effects			
Intercept	6.64	0.60	< 0.001
Hourly feelings of annoyance	−0.41	0.25	0.10
Dating aggression perpetration	−0.71	0.58	0.22
Hourly feelings of annoyance × dating aggression perpetration	−0.04	0.27	0.88
Men: random effects			
Level 1 intercept	28.34	4.58	< 0.001
Level 2 intercept	34.40	7.73	< 0.001

Note. PRV = percent reduction in variance explained by the moderation model; Women: PRV in level 1 electrodermal activity (EDA) = 12.27%, PRV in level 2 electrodermal activity (EDA) = 11.38%, ICC = 0.58; Men: PRV in level 1 electrodermal activity (EDA) = 6.62%, PRV in level 2 electrodermal activity (EDA) = 10.01%, ICC = 0.55. Bold signifies *p < .05.