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Intimate partner violence is associated with increased maternal hair cortisol in mother–child dyads

Mariana G. Boeckel[a], Thiago Wendt Viola[a], Ledo Daruy-Filho[a], Manuela Martinez[b], Rodrigo Grassi-Oliveira[a,*]

[a]*Developmental Cognitive Neuroscience Lab (DCNL), Pontifical Catholic University of Rio Grande do Sul, Av. Ipiranga, 6681 Prédio 11 Sala 936, Porto Alegre, RS 90619-900, Brazil*

[b]*Department of Psychobiology, Faculty of Psychology, University of Valencia, Avda Blasco Ibañez, Valencia 2146010, Spain*

Abstract

Background: The chronic consequences of intimate partner violence (IPV) on HPA activation are a topic of debate. The current study investigated hair cortisol concentrations in female victims of IPV and their children.

Methods: A total of 52 mother–child dyads were divided into two groups depending on exposure to IPV: IPV group (n = 27 dyads) and control group (n = 25 dyads). Hair cortisol concentration was measured in 1-cm-long hair strands, representing 30 days of exposure before assessment. PTSD and depression symptoms were assessed in the mother and child.

Results: Women reporting IPV presented with higher hair cortisol levels, depression and PTSD symptoms severity in comparison to control women. Children who witnessed IPV reported more severe PTSD symptoms, but depressive symptoms and hair cortisol were not statistically different than those in control children. Correlation analyses revealed a positive association between the number of injury events and the level of hair cortisol in children. No associations between the hair cortisol levels in mothers and those in their children were found.

Conclusion: Higher hair cortisol levels detected in women exposed to IPV reflected long-lasting changes in HPA axis functioning associated with chronic stress exposure. Children whose parents recurrently engage in violent conflicts with intimate partners may often feel threatened and consequently reporting more PTSD-related symptoms. Given that experiencing and witnessing violence during childhood and adolescence are predictive of intimate partner violence in adulthood, the need of early interventions is crucial.

1. Introduction

Violence against women inflicted by intimate partners is an important worldwide public health problem that significantly affects women's mental and physical health [1]. Globally, an estimated 30% of women are exposed to intimate partner violence during their lifetimes [2,3]. In most cases, this chronic social traumatic stressor involves repeated episodes of physical, psychological, and sexual violence that dramatically disturb the victim's sense of security [4]. Specifically, sexual abuse occurs in approximately 40% of all cases of intimate partner violence. The mental health consequences are greater in women who are sexually abused than in those who are not [5–7]. Intimate partner violence (IPV) refers to physical violence, sexual violence, or psychological aggression (including coercive acts) perpetrated by a current or former intimate partner [8]. Despite the relevance of IPV, most research to date have focused on assessing the consequences of IPV on mental health [9–11], while its biological correlates have been relatively underexplored [5,12,13].

As in other stressful conditions, exposure to IPV might trigger a series of harmful biological consequences in victims [14–17]. For example, chronic violence or sexual abuse is usually associated with short- and long-term alterations in the functioning of the hypothalamic-pituitary-adrenal (HPA) axis and with automatic nervous system dysregulation [18]. Although HPA axis activation acts primarily as a protective response against stress [19], chronic and recurrent exposure to stressful experiences increases metabolism. Resources are consumed without sufficient recovery, promoting long-term

* Corresponding author at: Av. Ipiranga, 6681, Prédio11, Sala 928, Porto Alegre, RS 90619-900, Brazil. Tel.: +55 5133203633.

E-mail address: rodrigo.grassi@pucrs.br (R. Grassi-Oliveira).

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changes in the functioning of stress-related biological systems. Consequently, the risk for physical and mental health problems increases [14,19]. This process, named "allostatic load", can inhibit neurogenesis, block neuronal plasticity, and induce neurotoxicity [14]. Brain regions such as the hippocampus, amygdala, and prefrontal cortex undergo structural and functional remodeling in response to acute and chronic stress and chronic HPA axis activation [16].

Measurement of cortisol, a steroid hormone released from the adrenal gland, is often used to investigate the association between chronic stress exposure and HPA axis reactivity [20]. Previous investigations have yielded mixed results regarding cortisol levels in women exposed to IPV, with cortisol levels both higher and lower than those in control women [17,21]. Psychiatric conditions such as the severity of depressive and posttraumatic stress disorder (PTSD) symptoms may be important mediators of the relationship between IPV and cortisol levels [4,22]. For example, a systematic review [23] found that patients with major depression presented with increased cortisol levels, while patients with anxiety disorders (generalized anxiety, panic, and PTSD) presented with lower levels, suggesting that distinct pathways contribute to the dysregulation of the HPA axis in the development and/or maintenance of psychiatric conditions.

In addition, some studies have also shown higher cortisol levels and increased physiological arousal in children who witness marital violence [24]. Children and adolescents in families characterized by higher levels of marital functioning showed lower wake-up cortisol levels [25]. However, children whose parents recurrently engage in violent conflicts with intimate partners may often feel threatened and consequently stressed, leading to chronic elevation of cortisol levels. Furthermore, some authors highlight associations between hormone levels in parents and their children [25,26]. In children with higher cortisol levels, one or both parents also exhibit elevated cortisol concentrations [25]. Specifically, for victims of intimate partner violence, maternal and infant salivary cortisol concentrations were positively correlated [26]. Therefore, the mother–child bond might deeply influence and regulate behavioral and physiological responses to stress [26,27].

Although some studies have investigated the relationship between cortisol levels and intimate partner violence in women [23,28–30], the majority have used plasma, serum, or saliva samples to assess cortisol. These measurement methods are subject to major physiological daily fluctuations, making the assessment of overall long-term systemic cortisol exposure difficult and leading to inconsistent results. On the other hand, in recent years, hair cortisol measurement has emerged as a promising way to measure chronic stress and capture systemic cortisol exposure over longer periods of time [28,30,31]. Hair grows at a median rate of 1 cm/month; therefore, the first centimeter of hair at the scalp follicle indicates the past month's cortisol production, while the second centimeter section indicates the cortisol production of the month before, and so on [30]. In addition, evidence has shown that hair cortisol concentrations are not affected by sex, hair treatments, or pharmacological interventions, indicating that hair cortisol could be a highly important biomarker in stress studies [30,32]. On the other hand, a recent study found that hair cortisol was higher in boys than in girls [33].

Given that hair cortisol assessment is a promising approach with which to investigate chronic stress load in children and adults [34–38], the present study compared hair cortisol levels in women exposed to IPV and their children to hair cortisol levels in women without such exposure and their children. To our knowledge, this study is the first to test the hypothesis that both women exposed to IPV and their children will present with higher hair cortisol levels. We also hypothesized that PTSD or/and depressive symptoms would be associated with variations in cortisol levels.

2. Materials and methods

2.1. Participants

A total of 118 participants were included in this study. Thirty-five women exposed to IPV and their biological children were recruited through the Center for Helping Women Victims of Intimate Partner Violence in Southern Brazil; three withdrew from the study (n = 32). This service is designed to protect women from contact with their partner in such a way that no participant had ongoing partner violence when assessed. For each woman, one child aged 6–12 years who had witnessed IPV in any form was included in the study. If a woman had more than one child in this age range, she was asked to select the child she thought had the most exposure to the consequences of intimate partner violence. Thirty-five control participants were recruited from Community Family Associations. We invited potential research volunteers by direct approach. When these volunteers agreed to join the research, we interviewed them. After screening for the absence of psychiatric symptoms and any violence exposure, we retained 27 mothers and 27 children in this group. For all participants, the inclusion criteria were: at least 1 cm of hair length, lower income according to Brazilian parameters (U$450 per capita per month, according to Brazilian parameters – Social quotas' law n° 12.711, August 29th, 2012), no severe medical illness, no severe cognitive impairment, no psychotic symptoms, no substance abuse in the past 30 days, no illiteracy, and no corticosteroid use. The ethical committee of institutions approved this study, and all participants provided written informed consent.

2.2. Demographics and clinical assessments

Trained researchers conducted face-to-face interviews just after collecting hair samples. Each mother and child was