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Neurocriminology & Compassion: Analysis of the parasympathetic response in male and female offenders

PH.D. IN NEUROSCIENCE

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*Tienes dos jardines: tu propio jardín y el de tu ser querido.
Primero, debes cuidar de tu propio jardín y dominar el arte de la jardinería.
En cada uno de nosotros hay flores y también hay basura.
La basura son la ira, el miedo, la discriminación y los celos dentro de nosotros.
Si riegas la basura, fortalecerás las semillas negativas.
Si riegas las flores de la compasión, la comprensión y el amor, fortalecerás las semillas positivas.
Lo que cultives depende de ti.*

Thich Nhat Hanh

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ABBREVIATIONS

Abbreviations

ANOVA = Analysis of Variance

ANS = Autonomous Nervous System

AUCi = Area Under the Curve with respect to the Increase

BMI = Body Mass Index

BPAQ = Buss-Perry Aggression Questionnaire

CFT = Compassion Focused Therapy

GO = General Offenders

HR = Heart Rate

IBI = Interbeat Intervals

IPV= Intimate Partner Violence

IRI = Interpersonal Reactivity Index

MANOVA = Multivariate Analysis of Variance

NGOs = Non-Governmental Organizations

PANAS = Positive and Negative Affect Schedule

PNS = Parasympathetic Nervous System

RMANOVA = Repeated Measures Analysis of Variance

RMSSD = Root - Mean - Square of successive differences

RSA = Respiratory Sinus Arrhythmia

SCS-SF = Self-Compassion Scale - Short Form

SNS = Sympathetic Nervous System

vmHRV = vagally mediated Heart Rate Variability

VR = Virtual Reality

VU-AMS = Vrije Universiteit Ambulatory Monitoring System

WHO = World Health Organization

Abreviaturas

ONGs = Organizaciones No Gubernamentales

SNA = Sistema nervioso autónomo

SNP = Sistema nervioso parasimpático

SNS = Sistema nervioso simpático

VG = violencia de género



ABSTRACT

This Doctoral Thesis arises from the interest in investigating the effects of compassion on the delinquent population. Within a Neurocriminological framework, efforts are made to integrate psychophysiological correlates with psychological and social components to provide an integrated perspective. To achieve this, a virtual reality compassion-eliciting task was created, and different groups of offenders were subjected to it. In the first study, the activity of the parasympathetic nervous system (PNS), specifically vagally mediated heart rate variability (vmHRV), was explored alongside mood and prosocial behavior during the compassion task in a group of intimate partner violence (IPV) perpetrators, compared with offenders of different nature and a group without a criminal history. The main results indicated that IPV perpetrators displayed a decrease in vmHRV, while the group without a criminal history exhibited an increase when connecting with suffering. This suggests challenges in experiencing compassion among IPV perpetrators. No differences were found in the rest of the correlates, although higher vmHRV explained lower negative affect across the sample. The second study aimed to observe female offenders' response of to the compassion task in comparison to a group without a criminal history. Heart rate (HR) was analyzed along with vmHRV, mood, and behavioral correlates. Main differences were also found in the connection with suffering, where female offenders showed lower vmHRV than controls, indicating greater difficulty in connecting with suffering. Additionally, the offender group exhibited lower HR when faced with prosocial behavior. Furthermore, lower vmHRV was linked to a greater prosocial behavior exclusively in women without a criminal history. This might suggest lower parasympathetic flexibility in facing compassionate motivation in the offender group. Finally, the third study analyzes the predictive value of empathy on violence, as well as the mediating role of self-compassion in the relationship between personal distress and violence in a population of offenders that includes both men and women. The results revealed a negative association between perspective-taking and violence, while personal distress proved to be a precipitating factor for violence. Self-compassion played a mediating role in the relationship between personal distress and violence, suggesting some influence in reducing violent behaviors. These findings provide new insights into socio-affective characteristics of male and female offenders, which could contribute to providing prevention and intervention gender-inclusive programs with new effective tools.



GENERAL INTRODUCTION

Neurocriminological perspective on crime: Intimate partner violence and female delinquency

Crime and violence are concerns that undeniably incur high economic, social, and, above all, human costs (World Health Organization [WHO], 2020; 2023). Both phenomena have accompanied human beings throughout evolution worldwide, manifesting in every social stratum, culture, and context (García-Pablos, 2007; Gilbert, 2005). In Spain alone, during the period from January to September 2023, a total of 1,826,911 criminal offenses occurred according to the latest Quarterly Crime Report. It results, therefore, necessary to conduct research that delves into the origins and underlying mechanisms of criminal and violent behavior, as well as understanding their development and goals. Such a study is essential for reducing incidence through the implementation of effective prevention and intervention strategies.

Criminology serves as the primary science responsible for proposing alternatives to reduce crime and violence through empirical and interdisciplinary studies of both phenomena and their various components (including perpetrator, victim, and social control). As both crime and violent behavior are complex and influenced by numerous interdependent and variable factors, various scientific fields have attempted to deepen the study of violent behavior and criminal activity. Among these, the neuroscientific approach has made significant advances by analyzing the neurobiological mechanisms related to these behaviors. This has led to the emergence and growth of Neurocriminology, which integrates the study of socio-cultural and psychological aspects, along with neurobiological factors (Bedoya & Portnoy, 2023; Moya-Albiol et al., 2017; Moya-Albiol, 2022; Moya-Albiol and Romero-Martínez, 2020). However, it is important to note that this discipline's theoretical framework significantly departs from the determinism inherited from the 19th-century *Scuola Positiva*. Instead, Neurocriminology is framed within the biopsychosocial model, providing a holistic study framework that understands violence as the result of a dynamic bidirectional interaction between the socio-cultural, psychological, and neurobiological spheres (Barnes et al., 2020; Moya-Albiol & Romero-Martínez, 2020). From this perspective, the existence of predisposing and/or vulnerability factors to violence and crime is proposed, but not as causal factors. It is understood that criminal behavior is the result of a set of conditions

and circumstances, including socio-cultural contexts and life experiences. Hence, approaching the understanding of criminal behavior from this perspective offers new complementary tools that can be used in existing prevention and intervention programs with the aim of minimizing violence and recidivism rates.

From a neurocriminological angle and considering the inherent diversity present in the realm of criminality, this Doctoral Thesis will emphasize the study of two forms of delinquency: intimate partner violence (IPV) and female delinquency.

The IPV addressed by Organic Law 1/2004, of December 28th, on Integrated Protection Measures against Gender Violence, has been defined in its first article as "violence exercised against women by their present or former spouses or by men with whom they maintain or have maintained analogous affective relations, with or without cohabitation, as an expression of discrimination, the situation of inequality and the power relations prevailing between the sexes" (p.10). This definition includes various types of violence in heterosexual relationships, including psychological, physical, and sexual violence. Thus, IPV is the most common form of violence experienced by women worldwide, accounting for 38 to 50% of murders of women committed within relationships (WHO, 2019). According to data from the latest European Survey on Gender Violence (Delegación del Gobierno contra la Violencia de Género, 2022), 27.8% of women had experienced psychological violence, 12.7% physical violence, and 6.7% sexual violence by their partners or ex-partners at some point in their lives. To address these rates of violence against women, an increasing number of empirical studies have focused on identifying the characteristics of IPV perpetrators in order to better comprehend the etiology of this form of violence and concretely establish the criminogenic needs of the aggressors (Lila and Gilchrist, 2023; Radatz, 2021). A specific profile of the IPV perpetrator has been constructed, encompassing various psychosocial variables, and highlighting characteristics such as emotional instability and antisocial behavior patterns (González-Álvarez et al., 2022; Holtzworth-Munroe et al., 2000), exposure to family violence and accumulation of stressful life events (Lila et al., 2019), or sexism and degrading attitudes towards women (Gracia et al., 2020), among others. Furthermore, there is a growing body of research considering the inclusion of neurobiological variables, alongside interactions with environmental factors, to enable

a broader understanding of IPV in general and, more specifically, the profile of perpetrators (Bueso-Izquierdo et al., 2019; Comes-Fayos 2022; 2024; Marín-Morales et al., 2022; Pinto et al., 2010; Romero-Martínez et al., 2023). This research aims to provide tools capable of complementing IPV prevention and intervention programs.

On the other hand, while women have often been victims of violence, they also have the capacity to commit violent and/or criminal acts. According to the Annual Penal Statistics report of the Council of Europe for 2023, 5.4% of individuals convicted to prison sentences were women (Aebi et al., 2023b), and approximately 11% were sentenced to alternative measures to imprisonment (Aebi et al., 2023a). As reflected in the figures, the percentage of female offenders is significantly lower than that of men, and this historical trend is consistent in multiple contexts (Mallicoat, 2022). However, despite the substantial disparity in the criminal population between men and women, the Spanish legislation guarantees sexual equality (Article 14 of the Spanish Constitution). Consequently, women merit research that examines their criminogenic characteristics as well as the development of tailored intervention programs. It is important to counteract the male bias present in most criminological studies to equip the penal and penitentiary system with specific tools that address the potential needs of women (Belknap, 2020; Renzetti, 2013). Although research has explored some characteristics and needs of female offenders, both psychosocial (Hidayati et al., 2023; WHO, 2007) and psychobiological (Choy et al., 2017), its scope remains very limited.

Compassion as a protective factor against violent and criminal behavior

From a criminological perspective, research has usually focused on identifying risk factors, especially for the development of treatment programs (Bonta & Andrews, 2016). However, the study of protective factors in crime prevention and treatment has also gained consideration, providing additional value to the exploration of risk factors (de Ruigh et al., 2021; de Vries Robbé & Willis, 2017; Morley, 2015). Protective factors have been described as internal and external conditions and circumstances that lead individuals to resiliently confront situations of risk and distress (Ronel & Segev, 2014). Part of the literature has emphasized individual protective factors that enhance social bonds, including compassion (Ribeiro da Silva et al., 2021; Sousa et al., 2023).

Compassion, from an evolutionary perspective, is hypothesized to have its roots in ancestral models of *sharing and caring* for others in secure contexts (Gilbert, 2020). These functions have been crucial for the survival of numerous species, particularly humans (Preston, 2013). Thus, the neurophysiological mechanisms underlying functions related to bonds and caregiving have adapted and extended, starting with offspring, moving to kin alliances, and reaching relationships with strangers (Gilbert, 2015). Additionally, compassion has been conceptualized in various ways, being associated with an emotional state as well as various multidimensional concepts. However, two fundamental components can be extracted from its definition: sensitivity to one's own and others' suffering, along with the intention to alleviate and/or prevent it (Di Bello et al., 2020; Gilbert, 2017; Goetz et al., 2010; Jazaieri et al., 2013; Stellar et al., 2015).

In this regard, for compassion to develop, the capacity to recognize and approach suffering in a healthy manner is required. Therefore, empathic competencies, often described as protective factors against violent and delinquent behavior (Jolliffe & Farrington, 2004; Moya Albiol, 2011; 2018), play a fundamental role as precursors in the development of compassion (Bellosta-Batalla et al., 2019). Recognizing (cognitive empathy) and resonating with others' feelings (affective empathy) are considered essential for connecting with others' suffering. Consequently, the triggers for compassion will generally be unpleasant stimuli associated with suffering and distress, which could evoke a negative affective response, increasing arousal in observers (Di Bello et al., 2021). An adequate perspective-taking that maintains the separation between others' experiences and one's own would be necessary. Otherwise, contact with suffering could lead to sympathy and, as a consequence, to personal distress, eliciting aversive emotional reactions such as sadness or anxiety (Eisenberg et al., 2015; Jensen et al., 2014; Klimecki & Singer, 2017). The empathic response could be directed towards relieving one's own discomfort (Lamm et al., 2007), potentially leading to a violent response as a coping strategy (Bloom, 2017; Palumbo & Latzman, 2021).

Likewise, it has been suggested that, to experience compassion, effective emotional management is crucial to inhibit personal distress when connecting with others' suffering without becoming immersed in it (Decety & Lamm, 2009; Klimecki & Singer, 2012). In this regard, self-compassion has been proposed as a tool that promotes

tolerance to discomfort while cultivating attention and sensitivity to one's own sources of suffering (Gilbert, 2023). According to Kristin Neff's definition (2003), self-compassion involves the ability to understand and respond to one's own suffering in a conscious and balanced manner, with kindness, and with an understanding of the situation as part of common humanity. Specifically, this has been proposed as a fundamental skill for cultivating effective emotional regulation (Inwood & Ferrari, 2018; Paucsik et al., 2022), thereby improving the processing of negative emotions such as anxiety and anger (Diedrich et al., 2017; Neff & Vonk, 2009). Particularly, in samples of offenders, it has been associated with greater self-control and social connectedness (Morley et al., 2016).

Thus, compassion would manifest through a healthy embrace of suffering from a secure foundation, generating positive emotions such as acceptance and tenderness capable of reducing one's own distress (Weidman & Tracy, 2020). It is from this state that compassionate motivation has been suggested to emerge as an externalized factor of compassion (Bellosta-Batalla et al., 2019; García-Campayo et al., 2016). This intention to alleviate suffering would be intimately linked to prosocial behavior (Goetz et al., 2010), which, in turn, has been postulated as opposed to aggressive behavior, as it facilitates positive interactions (Mestre et al., 2006).

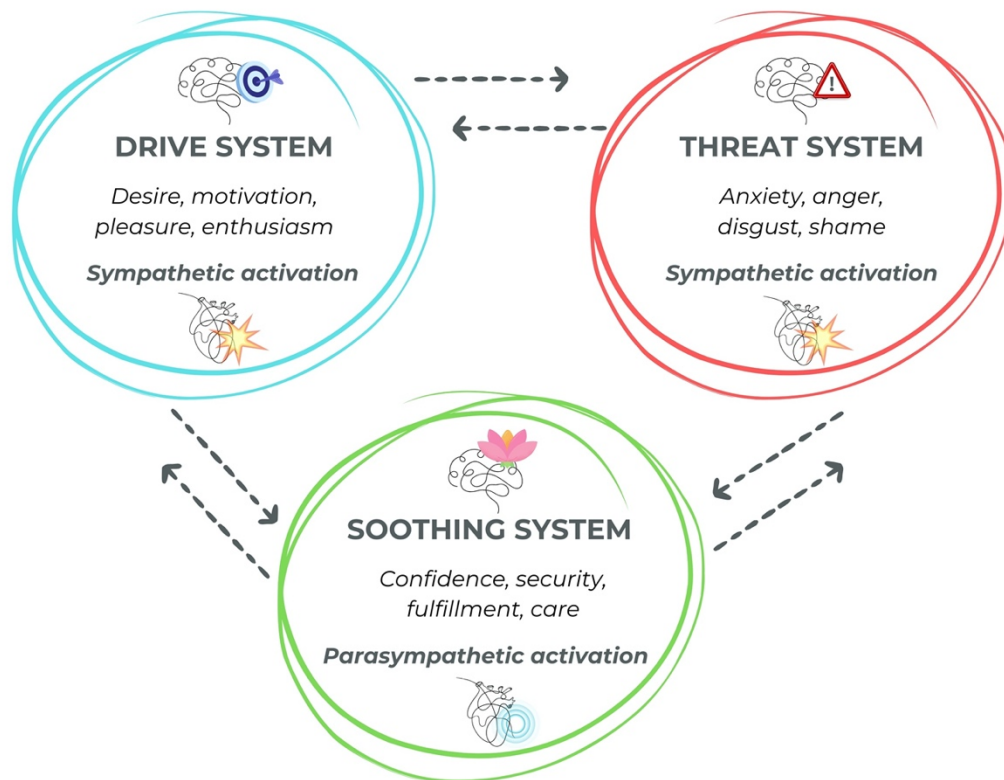
Nonetheless, it is noteworthy that humans are also capable of being indifferent or even gratified by the suffering of others, which may be defined as cruelty (Gilbert, 2005). From an evolutionary perspective, it has been proposed that such negative emotions and behaviors, such as violence, may serve as an alternative for *protection and self-care* in threatening and competitive environments, likely rooted from childhood (Gilbert, 2020; Mobbs et al., 2020). In contrast, the cultivation of self-compassion and compassion has been proposed as an alternative to these *protection and self-care* strategies associated with threat (Gilbert, 2010; Morley, 2018; Rezapour-Mirsaleh et al., 2021; Ribeiro da Silva et al., 2021; Rijo et al., 2023).

The Tripartite Model of Affect Regulation: Compassion as a regulatory mechanism in threat processing and the role of the parasympathetic nervous system

Paul Gilbert (2010), taking into account evolutionary psychology (Bowlby, 1980; Eisenberg et al., 2015) and neurophysiological foundations (Depue & Morrone-Strupinsky, 2005; LeDoux, 2000), proposed the existence of a set of innate human motivations linked to adaptive functions crucial for the survival of the species. These motivations were associated with three affect regulation systems (see Figure 1). Firstly, the *drive and resource-seeking* system is related to the function of generating positive feelings associated with pleasure and reward, aiming to mobilize and incentivize the search for the necessary resources to survive and thrive (e.g., food, sex, comfort, recognition). On the other hand, the *threat and self-protection* system is responsible for detecting potential threats in the environment and automatically selecting responses through the fight-or-flight mechanism. It is characterized by negative affect, mobilizing emotions such as anxiety, shame, or anger. It has been argued that this system is particularly susceptible to classical conditioning and has its roots in early learning experiences (Mobbs et al., 2020). Lastly, the *soothing* system, which is related to positive affect in the absence of threat and need, allowing for the creation of healthy bonds. This system is where compassion has been framed both conceptually and in its therapeutic application (CFT; see Gilbert, 2010).

While these systems frequently interact, distinct psychophysiological mechanisms associated with each of them have been proposed (Richardson et al., 2016; Sousa et al., 2021). In this regard, psychophysiology employs measures of the autonomic nervous system (ANS) responsible for regulating involuntary bodily functions, such as heart rate (HR) and breathing, with the purpose of establishing connections between these and the information processed by the central nervous system (Portnoy & Farrington, 2015). This system consists of two complementary branches with partially antagonistic functions: the sympathetic nervous system (SNS) and the parasympathetic nervous system (PNS). The SNS is closely associated with the fight-or-flight response and increasing heart rate (HR), a biomarker controlled by the intrinsic mechanisms of the heart (Levy, 1990). On the other hand, the PNS acts as a "brake" on the SNS, slowing down HR and downregulating fight-or-flight responses (Porges, 2017).

Figure 1. Affect Regulation Systems and psychophysiological correlates



Taking this information together, the *drive system* has been linked to the activation of the SNS (Richardson et al., 2016). Similarly, since the activation of the SNS is characteristic of the fight-or-flight response (Porges, 2007), it is particularly linked to the *threat system* (Sousa et al., 2021). In contrast, the *soothing system* has been associated with parasympathetic activation and the capacity to regulate the activation of both the *drive* and *threat systems* (Depue & Morrone-Strupinsky, 2005; Gilbert, 2017; Porges, 2007). It has been proposed that, throughout evolution, giving and receiving care have had a substantial impact on the myelination of the main nerve of the PNS, the vagus nerve (Gilbert, 2017; Porges, 2017). Hence, the *soothing system* has been more specifically associated with vagally mediated Heart Rate Variability (vmHRV), a biomarker reflecting the influence of the vagus nerve on the cardiac output. Elevated vmHRV would indicate a greater PNS activity and thereby a greater activation of the *soothing system*. Having higher vmHRV, and therefore higher PNS activity, has been associated, in the general population, with increased emotional self-regulation and

psychological flexibility (Geisler et al., 2013; Pinna & Edwards, 2020; Thayer & Lane, 2009), heightened empathic competencies (Yoo & Whang, 2020), more prosocial behaviors (Bornemann et al., 2016), and particularly, with experiencing compassion (Di Bello et al., 2020; Kim et al., 2020; Sousa et al., 2023). Moreover, the dynamic adaptability of vmHRV in response to environmental changes has been referred to as parasympathetic flexibility (Muhtadie et al., 2015). Given the dynamic nature of social demands, an increased flexibility has been associated with high social sensitivity and behavioral flexibility (Di Bello et al., 2021; Miller, 2018).

In line with the aforementioned, Sousa et al. (2022) analyzed vmHRV in relation to the tripartite model of emotional regulation in a sample of young offenders compared to a control group of young people without a criminal history. Their results showed a decrease in vmHRV during emotional induction related to the *drive* and *threat systems* for the entire sample. However, in response to the *soothing system* (stimuli related to calm and affiliative emotions), control participants increased vmHRV as expected, while offenders exhibited a decrease. It was argued that offenders perhaps perceived stimuli associated with affiliation/affectionate as aversive/threatening. It should be noted that offenders often develop in adverse and/or hostile environments (Bonta & Andrews, 2016), and the lack of experiences of secure attachment in the early stages of life may disturb or suppress trust in others, as well as compassionate caregiving behavior (Mikulincer et al., 2005; Mobbs et al., 2009; Mobbs et al., 2020).

In a separate study, Sousa et al. (2023) assessed vmHRV in a sample of young offenders with psychopathic traits before and after the implementation of the PSYCHOPATHY.COMP intervention program (Ribeiro da Silva et al., 2021). This program based on Compassion-Focused Therapy (CFT; for more details, see Gilbert, 2010) aims to cultivate and promote the *soothing system* and compassion among its main objectives. After the program was applied, a greater recovery of vmHRV was observed in participants following the presentation of stimuli related to the *soothing system* compared to the pre-treatment assessment, indicating higher parasympathetic flexibility. Furthermore, these outcomes remained consistent six months later (Sousa et al., 2023). Hence, compassion has been proposed to have potential to enhance the

psychophysiological regulation of threat processing (Gilbert, 2010; Geisler et al., 2013; Porges, 2017; Sousa et al., 2021; 2022; 2023).

In relation to the above, theoretical frameworks such as the Polyvagal Theory (Porges, 2007) and the Neurovisceral Integration Model (Thayer & Lane, 2000) propose bidirectional associations between vmHRV and brain activity, suggesting their impact on behavior. Research combining vmHRV analysis with neuroimaging techniques in the general population has associated vmHRV with specific brain regions, such as the orbitofrontal cortex, the medial and ventromedial prefrontal cortex, as well as limbic regions like the amygdala (Thayer et al., 2012), all of which in turn have been closely related to violent behavior and criminal conduct (Moya-Albiol & Romero-Martinez, 2020).

By integrating all of this, the aim is to emphasize the significance of understanding the interrelation between ANS activity, particularly the PNS, and behavior. This multidisciplinary approach provides a comprehensive framework to explore the psychobiological substrates underlying complex behavioral phenomena, such as violence and crime. The ANS has been used on numerous occasions as a biomarker of emotional response in delinquent populations (Looft et al., 2022). However, the SNS has been more extensively studied, possibly due to its close relationship with the fight-or-flight response (de Looft et al., 2022). Despite the existing background in this field (Palix et al., 2022; Romero-Martínez et al., 2021; Sarrate-Costa et al., 2022), PNS biomarkers, such as vmHRV, have received less exploration in these populations. Additionally, studies examining psychophysiological responses to emotion induction have observed discordant results depending on sample composition, the index employed, and the valence of stimuli (de Looft et al., 2022). For this reason, delving deeper into this aspect might be of particular interest.

Some recent studies with samples of IPV offenders have not found differences in vmHRV during inductions related to anger and marital conflicts when compared to control groups (Babcock & Potthoff, 2021; Trahan & Babcock, 2019). In contrast, a recent study utilizing a paradigm of negative-valence empathic induction did show differences between the two groups, revealing that IPV perpetrators exhibited a lower

vmHRV response (Comes-Fayos et al., 2024). Regarding female delinquency, studies to date are even scarcer. To the best of our knowledge, no empirical research related to vmHRV activity in offender women has been conducted. However, one study described a positive association between aggression in female university students and vmHRV in response to relational stressors (Murray-Close & Rellini, 2012). Conversely, negative associations between aggression and vmHRV were observed in response to fear induction paradigms (Thomson et al., 2021). Thus, these findings underscore the need for further research to elucidate the relationship between the PNS and female delinquency.

Objectives & Hypotheses

Considering the information presented, this Doctoral Thesis is structured around two general objectives, which lead to several specific objectives and their corresponding hypotheses. These were distributed throughout three *studies*.

1. The first aim was to explore whether there are differences between the groups in terms of their cardiorespiratory response, particularly focusing on the PNS, as well as emotional, and behavioral reactions to a compassion task. Additionally, the relationship between the cardiorespiratory response to the task and the changes in affect and behavioral outcomes is analyzed. The task was divided into two components: an emotional induction paradigm focused on connecting with suffering (Triggering-emotion) and a prosocial task reflecting compassionate motivation (Call-to-action).

- 1.1 Analyze vmHRV, mood, and prosocial behavior in response to the compassion task among a group of IPV perpetrators and two control groups of men, one composed of individuals without a criminal history and the other consisting of offenders of distinct nature (general offenders; GO). *This specific objective corresponds to Study 1.*

✱ *Hypothesis 1:* Previous studies based on the general population have found positive relationships between compassion and higher vmHRV (Di Bello et al., 2020; Stellar et al., 2015). This has also been associated with increased positive affect, decreased negative affect (Gilbert, 2019), and enhanced prosocial behavior (Petrocchi & Cheli, 2019). Earlier research has indicated socioaffective difficulties in IPV perpetrators compared to men without a criminal history (Romero-Martinez et al., 2019; Comes-Fayos et al., 2022; 2024). Additionally, there are preliminary findings related to structural differences and reduced brain activation patterns in areas linked to emotional processing and regulation in IPV offenders compared to offenders of distinct nature (Marín-Morales et al., 2022; Verdejo-Román et al., 2019). Therefore, we hypothesize that IPV perpetrators will show lower vmHRV in response to the compassion task compared to the two control groups, accompanied by lower positive affect, higher negative affect, as well as reduced prosocial behavior.

1.2 Explore whether the vmHRV response to the task could elucidate the change in mood state for the entire sample of IPV perpetrators and control groups, and whether this differed among the three groups. *This specific objective corresponds to Study 1.*

✱ *Hypothesis 2:* As mentioned, inducing a compassionate state in the general population leads to an increase in vmHRV, associated with heightened positive affect (Förster & Kanske, 2022) and a decrease in negative affect (Porges, 2017; Engen & Singer, 2015). In line with this, we anticipate that higher vmHRV will explain a better mood for the entire sample.

1.3 Examine the HR/vmHRV responses, mood, and prosocial behavior in response to the compassion task among a group of female offenders and another group composed of individuals without a criminal history. *This specific objective corresponds to Study 2.*

✱ *Hypothesis 3:* Previous studies in the general population, including women in the sample, have linked higher compassion with a decrease in HR (Stellar et al., 2012; 2015), as well as increases in vmHRV (Di Bello et al., 2020; Kim et al., 2020). Additionally, both compassion and higher vmHRV have been related to increased positive affect, decreased negative affect, and an augmentation in prosocial behavior (Gilbert, 2019; Petrocchi & Cheli, 2019). In light of research indicating emotional difficulties in female offenders (Edwards et al., 2019; van der Knaap et al., 2012), we expect that the group of offenders will exhibit higher HR and lower vmHRV, especially during the Triggering-Emotion period. This would be associated with lower positive affect, higher negative affect, and reduced prosocial behavior in the compassion task.

- 1.4 Examine whether HR/vmHRV responses could explain variations in prosocial behavior (measured through a donation amount), and determine if there are differences between female offenders and the control group. *This specific objective corresponds to Study 2.*

✱ *Hypothesis 4:* Previous studies in general population including women have associated higher prosocial actions with increases in both HR (Yu & Hao; 2023) and vmHRV (Di Bello et al., 2023). Therefore, estimating lower donations in the offender group would also be related to lower activity in both HR and vmHRV.

2. The second general objective was to study the predictive value of empathy as a protective factor for violence, analyzing its different components (cognitive and affective) in a sample of male and female offenders. Additionally, the aim was to explore the role of self-compassion as a mediator between personal distress and violence. *This objective corresponds to Study 3.*

✱ *Hypothesis 5:* We hypothesize that greater perspective-taking and empathic concern will predict lower violence (Jolliffe & Farrington, 2004; Miller & Eisenberg, 1988). On the other hand, we hypothesize that greater personal distress will predict higher violence (Palumbo & Latzman, 2021).

✱ *Hypothesis 6:* Based on previous literature suggesting self-compassion as a potential tool for distress regulation in the general population (Inwood & Ferrari, 2018; Diedrich et al., 2017), we expect that self-compassion will attenuate the relationship between personal distress and violence.

STUDY 1

Diminished vagally mediated Heart Rate Variability in a Compassion-eliciting Task in Intimate Partner Violence offenders



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ABSTRACT

Recent research has identified different psychobiological mechanisms underlying Intimate Partner Violence (IPV). However, vagally mediated heart rate variability (vmHRV), a measure of parasympathetic activity, has been scarcely studied in IPV perpetrators. Low vmHRV activity has been found to be associated with maladaptive emotion regulation strategies and negative affect, whereas high vmHRV functioning has been related to higher social engagement, positive affect, prosocial behavior and compassion. The present study examined vmHRV, mood state and prosocial behavior in a Compassion-eliciting Task, through a virtual reality paradigm, in 39 IPV offenders, compared to 42 general offenders (GO) and 43 non-forensic control participants. Additionally, it explored whether phasic vmHRV could explain the mood change in response to the Compassion Task. Our results exhibited that IPV offenders showed lower vmHRV activity during the task when compared to non-forensic participants. No significant differences were obtained between IPV and GO. Furthermore, higher vmHRV partially explained lower negative affect after the compassion task for the entire sample. Hence, our findings suggest that IPV offenders experience difficulties connecting with others' suffering. It also highlights that the use of biomarkers, such as vmHRV, in the study of criminogenic factors may provide a broader understanding that could promote more effective interventions.

INTRODUCTION

Crime is a concern and a public health issue with high costs at a social, economic and, above all, human level (World Health Organization [WHO], 2020). In particular, Intimate Partner Violence (IPV) has global proportions, constituting a violation of women's rights. IPV is the most common form of violence suffered by women in heterosexual relations, encompassing any act of physical, sexual and psychological violence by their partners. As specified by the WHO (2019), globally, 30% of women aged between 15 to 49 years have experienced physical and/or sexual violence by their partners.

An increasing number of reviews and empirical studies emphasized the importance of addressing specific characteristics in IPV in order to promote effective interventions to reduce this type of violence (Collison & Lynam, 2021; Santirso et al., 2020). Besides violence-related psychosocial features (Holtzworth-Munroe et al., 2000; González-Álvarez et al., 2021), recent research has considered the inclusion of psychobiological variables and their interactions with environmental factors to allow for a broader understanding of violent behavior, while aiming to detect key variables in different types of violence (Pinto et al., 2010; Palix et al., 2022a). It has also been highlighted that resorting to psychobiological measures would help to avoid self-reports biases, such as social desirability, while providing background information about cognitive and emotional processes (Ortiz & Raine, 2004; Pinto et al., 2010).

Among the psychobiological indicators that have been employed in the study of criminal behavior, Autonomous Nervous System (ANS) activity has been suggested to be a marker of emotional responsiveness, related with violent behavior in general (de Looff et al., 2022) and specifically with IPV (Romero-Martínez et al., 2014; 2021b; Trahan & Babcock, 2019). In this regard, the ANS is composed of two complementary branches with partially antagonistic functions: the sympathetic (SNS) and parasympathetic (PNS) nervous systems. The SNS has been more extensively addressed by the offending phenomenon literature due to its close relationship with the fight-or-flight response (de Looff, 2022; Porges, 2007). Particularly in IPV offenders, it has been related to psychophysiological reactivity within stress paradigms (Romero-Martínez et al., 2021b; Sarrate-Costa et al., 2022), anger paradigms (Babcock et al., 2005) or certain contexts,

such as marital conflicts (Trahan & Babcock, 2019), when compared to control populations. On the other hand, the PNS acts by exercising an inhibitory influence on cardiac activity, rapidly “braking” SNS activity and down-regulating flight-or-fight responses (Porges, 2017). Higher PNS activity has been related to psychological flexibility, social engagement (Di Bello et al., 2020; Petrocchi & Cheli, 2019) and emotional self-regulation (Thayer & Lane, 2009), conversely a poor PNS activity has been discussed as an indicator of maladaptive emotion regulation strategies (Thayer & Lane, 2000; Thayer et al., 2012), including low self-control (Porges, 2007).

A reliable biomarker that reflects the influence of vagal tone (the action of the vagus nerve, the main nerve of PNS) on the cardiac output is vagally mediated Heart Rate Variability (vmHRV). Vagal control of the heart increases heart rate variability indicating a higher PNS outflow (Laborde et al., 2017). VmHRV has been proposed by the polyvagal theory (Porges, 2007) and the neurovisceral integration model (Thayer and Lane, 2000) to represent the bidirectional communication between "the heart and the brain" (i.e., encompassing physiological and psychological and/or behavioral processes). Research has already combined vmHRV assessment with neuroimaging techniques, associating vmHRV with activity in specific brain regions, such as the amygdala and the prefrontal cortex (Thayer et al., 2012), areas closely related to violent behavior (Moya-Albiol & Romero-Martinez, 2020). Furthermore, high vmHRV functioning has been linked to increased emotional self-regulation (Geisler et al., 2013; Pinna & Edwards, 2020), empathy competencies (Yoo & Whang, 2020), prosocial behaviors (Bornemann et al., 2016) and compassion (Kim et al., 2020; Sousa et al., 2021, 2022). However, although some attempts have already been made (Palix et al., 2022a; 2022b; Romero-Martinez et al., 2021b), PNS' markers, such as vmHRV, have been scarcely studied in offender populations.

Regarding responses to emotional tasks, mixed results have been found about the association between vmHRV and violent behavior (de Looft et al., 2022). Concerning IPV samples, research on this topic remains even scarcer. Two recent studies found no differences between IPV men and non-violent men in respiratory sinus arrhythmia (RSA) (a vmHRV marker) during a standardized anger induction followed by a condition of rumination or distraction (Babcock & Potthoff, 2021), or in a laboratory task in which

they participated in verbal conflict with their partner (Trahan & Babcock, 2019). In contrast, during a cognitive stress task in IPV perpetrators, two different studies provide evidence of lower vagal tone (RSA) in IPV perpetrators in comparison to non-violent control population, specifically in the recovery period (Romero-Martinez et al., 2021b; Sarrate-Costa et al., 2022). Likewise, a study focusing on a negative-valence empathic induction task reported lower overall levels of RSA in IPV perpetrators when compared to a non-forensic control group, identifying the anticipation and recovery periods as particularly relevant (Comes-Fayos et al., Under review).

As it has been shown, research on criminality has usually focused on negative valence emotions, mostly in IPV offenders. However, positive valence stimuli remain underinvestigated (Morley, 2015; Ronel & Segev, 2014). Nevertheless, there is a growing body of literature investigating how positive emotional states, including compassion, could reduce risk outcomes (Ribeiro da Silva et al., 2021; Ruigh et al., 2021). Recent research into positive valence emotional induction, closely related to compassion, has reported lower vmHRV levels in young offenders compared to community samples (Sousa et al., 2022; 2023).

Human compassion is a construct that, from an evolutionary perspective, originates from ancient motivational models of "sharing and caring" (Gilbert, 2019, Di Bello et al., 2020). Giving and receiving care has had a substantial impact on neurophysiological circuits, including the ANS (particularly on myelination of the vagus nerve), which, as mentioned above, plays an essential role in self-identity, emotion regulation, and prosocial and antisocial behaviors (Gilbert, 2017; Di Bello et al., 2020; Kim et al., 2020; Porges, 2017). In this sense, compassion has been conceptualized within the proposal of the tripartite model of affect regulation linked to adaptative functions (i.e., threat, drive and soothing; see Gilbert, 2010; Sousa et al., 2021 for an in-depth review). Specifically, enhanced compassion has been linked to the soothing system, a positive emotion regulation system associated with feelings of safety, connectedness, and prosocial behaviors (Di Bello et al., 2020; Petrocchi & Cheli, 2019; Gilbert, 2020a). In particular, compassion has been proposed as a physiological regulator of threat processing by directing the individual to be sensitive towards the suffering of others and to respond helpfully rather than harmfully (Gilbert, 2019; Porges, 2017). It is worth

noting that stimuli-triggering compassion may initially evoke unpleasant emotions and be associated with distress and/or suffering (Di Bello et al., 2021; 2023). However, compassion is intrinsically linked to a sense of safety that would lead to coping with distress-related tendencies (Petrocchi & Cheli, 2019; Weidman & Tracy, 2020). Therefore, this mechanism could be related to the increase of positive affect and the decrease of negative affect (Di Bello et al., 2020; Gilbert, 2014; Sousa et al., 2021). Accordingly, two main components of compassion that have been highlighted throughout the literature (Gilbert, 2014, 2019) will be used in this study: sensitiveness to others' suffering and the motivation to alleviate and/or prevent it (these components will be represented in the experimental task as *Triggering-emotion* and *Call-to-action*, respectively).

Lastly, although several studies have examined the differences between IPV perpetrators and individuals without violent records, research within offenders with different criminal profiles is still scarce and mainly focused on neuroimaging (Bueso-Izquierdo et al., 2016; Marín-Morales et al., 2022), as no studies have been carried out to analyze ANS reactivity. Given this, rigorous research across different paradigms and offender profiles might help to adjust the therapeutic needs of IPV offenders.

For all these reasons, the main objective of this research is twofold. First, we explored whether IPV offenders differed from the two control groups (general offenders and a non-forensic group) on their vmHRV response, mood state and prosocial action in a Compassion-eliciting Task. Prior literature in the non-forensic population has found a positive relation between compassion and higher levels of vmHRV (Di Bello et al., 2020; Stellar et al., 2015). Likewise, compassion has been associated with increases in positive affect and decreases in negative affect (Gilbert, 2019). Furthermore, higher levels of vmHRV have been linked to prosocial behavior in general populations (Bornemann et al., 2016; Petrocchi & Cheli, 2019). Conversely, grounded on socio-affective impairments previously found in IPV offenders (Covell et al., 2007; Romero-Martinez et al., 2020; 2022), we expect that IPV offenders will show lower levels of vmHRV and a worse mood in response to the Compassion-eliciting Task compared to the other groups. Additionally, we hypothesized a decreased manifestation of prosocial behavior, linked to lower levels of vmHRV, in IPV perpetrators compared to the control groups. Secondly,

we also aimed to explore if phasic vmHRV could explain the change in the affect response to the Compassion Task for the whole sample. As stated before, in the general population, inducing a compassionate state increases vmHRV, linked to an increase in positive affect (Förster & Kanske, 2022) and a decrease in negative affect (Porges, 2017; Engen & Singer, 2015). Congruently, we expect that higher levels of vmHRV would explain a better mood for the whole sample.

METHOD

Participants

After screening a sample of 130 participants, 124 healthy male volunteers (39 IPV offenders, 42 general offenders and 43 non-forensic controls) were selected as part of the study. Our sample included participants with episodes of physical and/or psychological violence towards their couples or ex-couples in the case of IPV perpetrators, as well as offenders of distinct nature or general offenders (GO), including drug trafficking, driving offenses and robbery. All of them were sentenced for offenses of less than two years of prison, which was replaced by participation in an intervention program or by community service. IPV offenders were recruited from the *CONTEXTO Program*, a community-based psychoeducational intervention program that is mandatory for men convicted of gender violence in Spain as an alternative punishment of custodial sentence (Lila et al., 2018). The GO participants were recruited from the *Service of Management of Penalties and Alternative Measures of Valencia*. The non-forensic control group was required not to have any previous criminal record, and was also recruited in Valencia (Spain) through advertisements posted on social networks.

To evaluate their eligibility for the study, the following exclusion criteria were considered: 1) lack of knowledge of writing and speaking in Spanish; 2) presence of major mental disorders and/or neurological disorders; 3) presence of cardiovascular diseases; 4) presence of hearing/visual impairments. Of all participants, six were excluded after applying the exclusion criteria. For the IPV group, one for presenting a neurological disorder. Additionally, three participants were excluded for the GO group

(one for lacking knowledge of writing in Spanish and two for presenting a cardiovascular disease). Likewise, in the non-forensic control group, two participants were excluded for presenting cardiovascular disease.

Participants were asked to refrain from consuming substances with influence on the cardiovascular system, and to refrain from physical exercise for at least two hours before their participation in the experiment.

The research goals were explained to all participants and the voluntary nature of the study was also explained, specifying the necessary requirements. Those who decided to participate signed an informed consent form, ensuring total anonymity and confidentiality.

The experiment was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of the University of Valencia (Code: 1563895).

Procedure

The procedure (see Figure 2) was carried out in one experimental session in the Psychobiology laboratories at the University of Valencia, with an approximate duration of 60 minutes.

First, the participants voluntarily signed an informed consent form before being included in the study. Participants were accommodated in a room with a constant temperature (21 ± 1 °C) and humidity. Anthropometric measurements were obtained (weight and height measured with a scale and a height rod, respectively). Afterwards, the VU-AMS electro-psychophysiological device (later specified) was attached to the participants and questionnaires on the participants' affect states were collected. A 5-minute *resting period* was also collected.

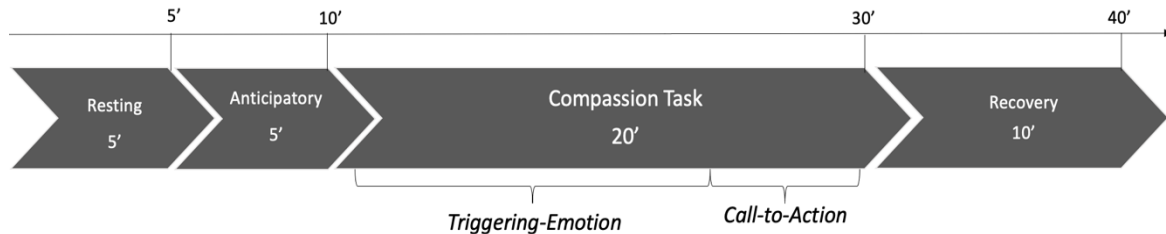
A Compassion-eliciting Task was performed with the support of virtual reality. Before starting the task, instructions were given to the participants. They were told to actively “put themselves in the place of the characters in the video” to ensure that all participants received the same information and were prepared for the affective induction. Afterwards, the Oculus Quest 2 virtual reality device was placed on the

participants (*anticipatory period*, 5 minutes). Then, the Compassion Task was carried out using a virtual reality 360° immersion paradigm created ad hoc with a total duration of 20 minutes, divided in two main parts (representing the subdivisions of the compassion construct): *Triggering-Emotion* and *Call-to-Action*. This virtual reality presentation includes several of the important immersive features identified by literature, combining a wide field of view (360°), rapid update rate and tracking of user actions (Cummings & Bailenson, 2015; Schutte & Stilić, 2017). First, the participants watched the adaptation of the United Nations documentary "*Clouds Over Sidra*", which depicts a young girl named Sidra providing a tour of a refugee camp in Syria. She shows her family, her classroom and other parts of the camp, and talks about her life in the camp, hoping for a better life in the future. Although the stimulus presented to the participants is intended to elicit some emotional reaction and cause participants to connect with the suffering of others, this paradigm of emotional induction was not designed to elicit distress, as the characters received help in the refugee camp, even though they were in poor conditions due to the consequences of the war (*Triggering-emotion*). Continuously, the second part of the task was conducted within the virtual experience itself, involving a prosocial activity where participants had the opportunity to "alleviate such suffering" by making a donation (using the financial compensation that they had received) to four designated NGOs (*Call-to-Action*). This procedure was based in the prosocial assessment paradigm of Hare et al. (2010). However, due to the convenience of integrating the prosocial action into the virtual reality experience, the donation format used was the classical and extended version of the *Dictator Game*, where participants had the opportunity to give each NGO an amount from 0 to 10 euros (Mayer et al., 2018). When that was over, the virtual reality device was carefully removed. After that, participants were asked to fill out again the affect state questionnaire (*recovery period*).

Once the recovery period was over, electro-psychophysiological electrodes were also removed. Subsequently, information was collected through a semi-structured interview to obtain socio-demographic and personal information, including age, nationality, education level, marital and socioeconomic status and criminal history.

All participants received a financial retribution of 40 euros for participating. It is worth noting that the “donation paradigm” is simulated and all participants keep the retribution.

Figure 2. *Experimental protocol*



Measures

VmHRV data collection and processing

We collected vmHRV employing the Vrije Universiteit Ambulatory Monitor System (VU-AMS). In order to obtain the cardiorespiratory signals from participants, seven pre-gelled disposable electrodes (EL503 electrodes, Biopac, USA) were placed on the participant’s chest and back (for more information see <http://www.vu-ams.nl/support/instruction-manual/>). An infrared interface cable connected the ambulatory recording device (VU-AMS5 fs) to the monitoring computer. We processed the recording with “Data Analysis and Management Software (DAMS)”, Version 5.3.1 (<http://www.vu-ams.nl/vu-ams/software/>). This software allows for the automated scoring of each signal, including an improved artifact and R-peak detection that makes it possible to remove artifacts automatically. Following the VU-DAMS v5.0 recommendation manual for vmHRV analysis, an additional visual inspection and manual correction of R-peak detection was carried out revising the “deviant IBI’s” (interbeat interval) and removing those strongly divergent, including ectopic beats and arrhythmic events.

Psychophysiological measures: vmHRV

A frequently used measure of PNS activity is vmHRV. It represents the variability in the time interval between successive heartbeats. Due to the fast temporal kinetics of the PNS signaling (<1s) at the sinoatrial node, changes in PNS activity are detectable on a beat-to-beat scale. Therefore, the variation in heart rate (in the order of milliseconds) is attributed to changes in PNS activity.

For the study, we used a time-domain vmHRV index, Root-mean-square of successive differences (RMSSD), which quantifies the amount of variability in the IBI over time. It is calculated by taking the difference between successive R-R intervals in milliseconds, squaring the differences and taking the root (Laborde et al., 2017). In addition, another valid marker that reflects the balance between the respiratory system and the heart rate variability was used: respiratory sinus arrhythmia (RSA) (Reyes del Paso et al., 2013). This index can be interpreted as part of vmHRV's response, since vagal tone has been known to include respiratory rhythm (Porges, 2007). RSA scoring by the DAMS program is based on the peak-valley method (Grossman & Taylor; 2007), which computes two IBIs per each respiratory cycle: the shortest IBI of inspiration and the longest IBI during expiration. It is calculated by the subtraction of the shortest IBI (highest HR) from the longest IBI (lowest HR).

In the case of both biomarkers, increased scores accompany higher PNS activity.

In addition, to ensure the congruence of vmHRV, Person's coefficient correlation between RMSSD and RSA was performed ($r = .770$; $p < .001$).

Psychological measures: positive and negative affect state

To measure the affect state, the Positive and Negative Affect Schedule (PANAS, Watson et al., 1988), adapted to the Spanish population (Sandín et al., 1999), was used. This instrument has 20 items, 10 markers of positive affect and 10 of negative affect. The score format is a five-category Likert scale with values between 1 ("very slightly or not at all") and 5 ("extremely"). Cronbach's α was ranged between .85 (pre) and .84 (post) for positive affect; and between .82 (pre) and .83 (post) for negative affect.

Data analyses

One-way ANOVAs for mean comparisons were performed, with the "Group" variable as an inter-subject factor for age scores, body mass index (BMI), resting period, and amount of total donation in the Dictator Game. Additionally, Chi-square tests were performed to compare socio-demographic data (marital status, education level, nationality, working status and annual income) again with the "Group" variable as an inter-subject factor. Normality of the psychophysiological data was evaluated with the Shapiro-Wilk test ($p < .05$) and, subsequently, both vmHRV indexes (RMSSD and RSA) were transformed based on a Logarithm base ten ($\log_{10}$). To compare the response of vmHRV in the Compassion- eliciting Task between the groups, a MANOVA was performed, with both indexes as dependent variables, in five moments (resting, anticipatory, Triggering-emotion, Call-to-action and 10-minute recovery) and "Group factor" as an independent variable. Post hoc tests were performed using Bonferroni correction for multiple comparisons.

To explore possible changes in psychological state throughout the task, we calculated positive and negative affect scores by subtracting the pretest from the posttest for the PANAS. To check for group differences, we conducted one-way ANOVAs.

Furthermore, the magnitude of the vmHRV response for the Compassion task was estimated by the area under the curve with respect to the increase (AUCi) for each index (RMSSD and RSA). For calculations, we employed the trapezoid formula taking the resting period as the reference point (Pruessner et al., 2003). It allows us to know whether variables change with regard to the resting period. Finally, linear regression models were applied for assessing whether the vmHRV response (measured by AUCi of RMSSD and RSA) explained the psychological measures (change in score for the positive and negative affect). Controlling the potential effect of "Group" by introducing it as a covariate.

Effect sizes were computed using partial eta square (η^2), with $\eta^2 = 0.01$ referring to a small effect size, 0.06 to a medium effect size, and 0.14 to a large effect size (Tabachnick & Fidell, 2013). Data analyses were conducted by using IBM SPSS Statistics v28.

RESULTS

Participant characteristics and preliminary analyses

There were no significant differences between the groups in demographic variables and anthropometric characteristics (see Table 1).

Furthermore, no differences in basal levels of vmHRV were found between groups for the indexes RMSSD ($F(2,121) = 2.905, p = .059$) and RSA ($F(2,121) = 2.598, p = .079$).

Table 1

Means (Standard Deviations), Percentages and Mean Comparisons for Demographic and Anthropometric Data for all Groups

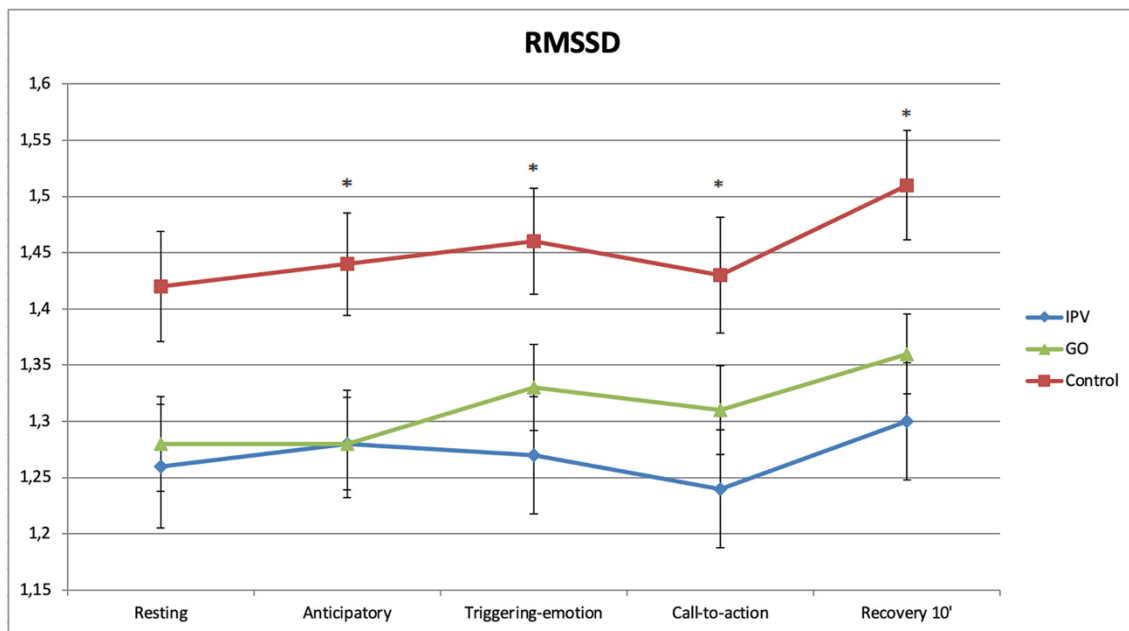
	IPV (<i>n</i> = 39)	General offenders (<i>n</i> = 42)	Controls (<i>n</i> = 43)	One-way ANOVA (<i>F</i>)
Age (<i>M, SD</i>)	39.18 (11.53)	39.14 (10.98)	33.93 (14.10)	2.535
BMI (<i>M, SD</i>)	25.33 (04.10)	25.52 (03.34)	24.83 (03.81)	0.371
Chi-Square				
Marital status (%)				
Married	28	43	49	4.53
Single/Divorced/Widowed	72	57	51	
Level of education (%)				
No studies	00	05	00	7.95
Primary	25	12	12	
Secondary/ vocational training	51	62	60	
University	23	21	28	
Nationality				
Spanish	79	86	65	5.29
Other countries	21	14	35	
Working status				
Employed	51	59	46	1.47
Unemployed	49	41	54	
Annual Income (%)				
Low Income	18	24	20	0.53
Medium Income	71	67	69	
High Income	11	09	11	

Note. IPV: Intimate Partner Violence Against Women; BMI: Body Mass Index; M: Mean; SD: Standard Deviation. Statistical significance * $p < .05$, ** $p < .01$

VmHRV response to Compassion-eliciting Task

Several significant differences were observed in both dependent variables. Regarding RMSSD, statistical differences were found (see Figure 3) in anticipatory ($F(2, 121) = 3.948, p = .022, \eta^2 = .061$), Triggering-emotion ($F(2, 121) = 4.525, p = .013, \eta^2 = .070$), Call-to-action ($F(2, 121) = 3.936, p = .022, \eta^2 = .061$), and recovery period ($F(2, 121) = 5.165, p = .007, \eta^2 = .079$). A post-hoc analysis revealed that IPV presented lower levels of RMSSD than the control group in every moment: anticipatory ($t = -0.15, p = .05$), Triggering-emotion ($t = -0.19, p = .011$), Call-to-action ($t = -0.19, p = .019$), and recovery period ($t = -0.20, p = .007$). No differences were found between the GO and the other groups.

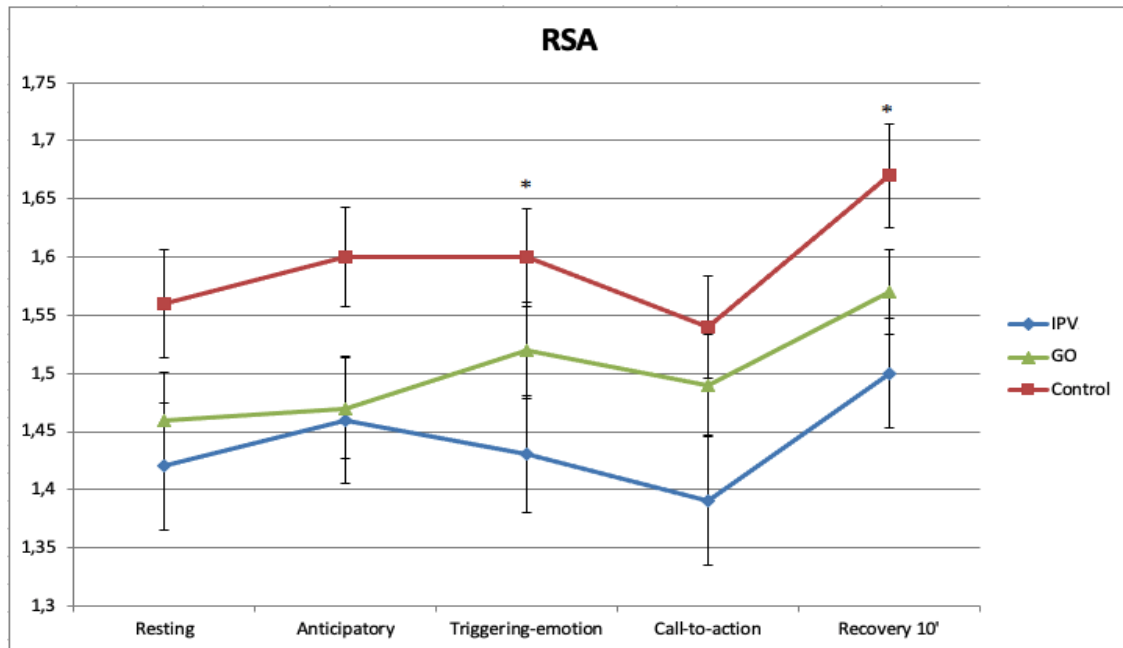
Figure 3. RMSSD responses to the Compassion-eliciting task



Note. IPV: Intimate Partner Violence Against Women; GO: General offenders; RMSSD: Root-mean-square of successive differences. Statistical significance * $p < .05$

For the RSA index (see Figure 4), differences were found in Triggering-emotion ($F(2, 121) = 3.380, p = .037, \eta^2 = .053$) and recovery period ($F(2, 121) = 4.082, p = .019, \eta^2 = .063$). Post-hoc test revealed again that IPV offenders presented lower levels of RSA than the non-forensic control group in both moments: Triggering-emotion ($t = -0.18, p = .032$) and recovery period ($t = -0.17, p = .016$) (for more details, see Table 2). There were no significant differences between the GO and the other groups.

Figure 4. *RSA responses to the Compassion-eliciting task*



Note. IPV: Intimate Partner Violence Against Women; GO: General offenders; RSA: Respiration sinus arrhythmia.
Statistical significance * $p < .05$

Psychological measures: Affect state to Compassion-eliciting task

With regard to the change in affect state scores, no differences were found between the groups: neither in positive affect ($F(2, 119) = .284, p = .753$) nor in negative affect ($F(2, 119) = .270, p = .764$).

Behavioral response in the Compassion-eliciting task

The results of the Dictator Game (Call-to-action) did not reveal statistically significant effects on the total amount of donation ($F(2, 118) = 1.787, p = .172$).

Predictive effects of vmHRV on affect state after the Compassion-eliciting Task

Only a significant result was found for the RMSSD AUCi model. The RMSSD AUCi variable accounted for 3.2% of the change in negative affect after the task ($\beta = -0.406$, $F(1, 120) = 4.262$, $p = .041$; $CI = -.796$ to $-.017$; $r^2 = .034$; collinearity (tolerance) = 1.00). After including the interaction terms between “AUCi RMSSD x Group” in step 2, the RMSSD model did not reach statistical significance.

However, non-significant association was found for the positive affect ($\beta = -0.149$, $p = .529$).

Table 2

Mean Scores and Standard Deviations of the Total Sample in the vmHRV Measures at Baseline, Anticipatory, Compassion-eliciting task and Recovery

	IPV ($n = 39$)	General offenders ($n = 42$)	Controls ($n = 43$)
RMSSD Basal (M, SD)	1.27 (.34)	1.28 (.27)	1.42 (.32)
RMSSD Anticipatory (M, SD)	1.28 (.30)	1.29 (.27)	1.44 (.30)
RMSSD Triggering-emotion (M, SD)	1.27 (.33)	1.34 (.25)	1.46 (.31)
RMSSD Call-to-action (M, SD)	1.24 (.33)	1.32 (.26)	1.43 (.34)
RMSSD Recovery (M, SD)	1.30 (.33)	1.36 (.23)	1.50 (.32)
RSA Basal (M, SD)	1.42 (.34)	1.46 (.26)	1.56 (.30)
RSA Anticipatory (M, SD)	1.46 (.34)	1.48 (.28)	1.60 (.28)
RSA Triggering-emotion (M, SD)	1.43 (.31)	1.53 (.27)	1.60 (.27)
RSA Call-to-action (M, SD)	1.39 (.34)	1.50 (.28)	1.54 (.29)
RSA Recovery (M, SD)	1.50 (.30)	1.57 (.23)	1.67 (.29)

Note. vmHRV = vagally mediated heart rate variability; RMSSD = square root of the mean of the sum of the squares of differences between adjacent RR intervals; RSA = respiration sinus arrhythmia; IPV = intimate partner violence group

DISCUSSION

The results of our study showed lower levels of RMSSD and RSA indexes throughout the Compassion Task in IPV offenders compared to the non-forensic control group. However, no significant differences were observed between IPV and GO, or between GO and the non-forensic group. Moreover, all three groups showed an increase in RMSSD and RSA levels in the recovery period after the task compared to its baseline value. Furthermore, no significant differences between the groups were found on psychological measures and behavioral outcomes. Finally, the regression model showed that a higher AUCi in the RMSSD index partially explained the lower negative affect after the task for the entire sample, regardless of group.

The main objective of this study was to explore the differences in vmHRV, mood state and prosocial action between IPV offenders, GO and a non-forensic group in response to a Compassion-eliciting Task. For the first part of the objective, in line with our hypothesis, the IPV group showed lower levels in vmHRV throughout the Compassion Task compared to the non-forensic control group in both indexes. For the RMSSD index, differences were observed in the Anticipatory, Triggering-emotion, Call-to-action and Recovery periods. Meanwhile, differences were found for the RSA index in the Triggering-emotion and Recovery periods. Notably, both vagal parameters showed a consistent pattern, making the interpretation of the results more congruent (Laborde et al., 2017).

Previous research on non-forensic samples has suggested that higher vmHRV activity is an important factor in sensitivity to suffering and caring (Di Bello et al., 2020; Petrocchi & Cheli, 2019). Consistent with this, our findings suggest that the control group of non-forensic men was better able to mobilize their parasympathetic resources to connect with suffering in the Compassion task, as the main differences were located in the Triggering-emotion period. In contrast, difficulties in mobilizing parasympathetic resources have been previously associated with the avoidance of connecting with the suffering of others in young offender samples (Sousa et al., 2022; 2023). As mentioned earlier, the IPV men showed a decreasing vmHRV trend in the Compassion Task. This apparent resistance to connecting with others' suffering, accompanied by decreases in

PNS activity, could be linked to self-protective strategies, such as emotional avoidance or a hostile attributional bias to emotional exposure that could predispose individuals to violent reactions (Gilbert, 2020b). Therefore, greater socioaffective deficits in this population, could be related to a lower vmHRV response toward compassion.

Nonetheless, no significant differences in vmHRV were found between the IPV and GO groups. In addition, although not significant, it may be observed that the GO group followed the vmHRV trajectory of the non-forensic group, especially during the Triggering-emotion period. Therefore, as shown in the charts (see Figures 3 and 4) the GO group seems to be an “in-between” of the IPV and the non-forensic groups. This could be explained by the very nature of the criminal act. Unlike the GO group’s offenses, IPV offenses always involve the suffering of the victim as a direct consequence. On the other hand, the offenses committed by the GO group, mostly related to robbery and driving offenses, did not necessarily involve an emotional component associated with the victims’ suffering (even if they were likely to cause harm and possible victims) despite their heterogeneity. In this regard, evidence has shown that IPV perpetrators present specific alterations in the ability to decode, connect and experience emotions (Romero-Martínez et al., 2019), which, together with poor competencies in empathy (Comes-Fayos et al., 2022), sexism (both hostile and benevolent) and degrading attitudes towards women (Gracia, et al., 2020), could make them more prone to IPV.

Furthermore, all three groups showed an increase in vmHRV during the recovery period compared to their baseline. However, IPV men presented significantly lower levels than the non-forensic control group in the RMSSD and RSA indexes. Relatedly, Di Bello and colleagues (2021) sought to explore the specific components of compassion in the general population, and their results showed decreased vmHRV while engaged with suffering and an increase in vmHRV after watching a video depicting intentional actions of giving help to distressed people, which most participants labeled as compassionate. Moreover, participants exhibited higher vmHRV following the observation of compassionate actions. As aforementioned, our research paradigm was not designed to elicit distress. Particularly, while the Triggering-emotion period was intended for participants to connect with the suffering of others, it placed the emphasis on helping behavior. The data obtained in our study may suggest that engagement with

compassion is linked to an increased response of vmHRV, probably associated with the mobilization of efficient self-regulatory resources (Di Bello et al., 2021; 2023; Laborde et al., 2017) even in offender populations. Nevertheless, further investigation on the compassion construct is necessary, specifically in forensic samples.

Additionally, we sought to explore the participants' mood response to the task. As mentioned earlier, IPV men have been found to reveal impairments on emotional processing (Romero-Martínez et al., 2021a). Therefore, we expected lower levels of positive affect and greater levels of negative affect following the Compassion-eliciting Task. However, non-significant differences were found between groups in affect measures. A possible explanation for these results could be related to IPV offenders' low perception of their own emotional states (Garaigordobil & Peña-Sarrionandia, 2015), which makes single self-reports susceptible to bias. In line with this, the lower vmHRV found in IPV offenders towards compassion give rise to compensatory mechanisms of emotional perception and integration, which in turn could bias the self-reported response. An increased arousal, associated with the threat regulation system and linked to a decreased vmHRV, could be perceived as distressing/aversive, thereby leading to the avoidance of negative sensations (Sousa et al., 2022). These results might support the importance of including psychophysiological variables to complement self-reported questionnaires and conducting in-depth research focused on the affect regulation systems in offenders.

Furthermore, contrary to our hypothesis, physiological changes (i.e., lower vmHRV levels) were not mirrored by significant effects at a behavioral level (i.e., lower prosocial behavior in the Dictator Game). Several studies have established a positive association between higher vmHRV and prosocial behaviors (Di Bello, 2020; Petrocchi & Cheli, 2017). For instance, Bornemann et al. (2016) showed that non-forensic participants who had been instructed to enhance their vmHRV by training (biofeedback) enhanced their prosocial behavior. On the other hand, at a behavioral level, Mayer et al. (2018) found less prosocial behavior among offenders following a negative valence empathetic induction, compared to controls, although both groups showed an increase in prosocial behavior after the emotional induction. In contrast, Comes-Fayos et al. (2022) did not observe any differences in prosocial behavior between IPV perpetrators

and a control group after a negative valence empathetic induction. This inconsistency may be partially explained by personal preferences and social biases that influence donation decisions (Berman et al., 2016), the variations in experimental paradigms, the utilization of different prosocial tasks during the assessment and their ecological validity (Bo O'Connor et al., 2022).

Finally, we aimed to investigate whether phasic vmHRV could explain the change in the affect response to the Compassion Task. Our hypothesis was partially confirmed, as one regression model, the AUCi of RMSSD, predicted a lower negative state after the task. These findings appear to be consistent with the literature, which has found low tonic vmHRV to be associated with an inability to accept negative emotions in general populations (Visted et al., 2017), as well as a direct relationship between an increased tonic vmHRV and attempts to suppress negative emotions in social interactions (Smith et al., 2011). However, further investigation utilizing phasic measures of vmHRV is needed.

Nevertheless, the generalization of our findings is limited for several reasons to be noted. First of all, the sample size was relatively small. This was partially due to the difficulty in collecting samples in this type of population. In this regard, the heterogeneity of offenders' profiles should also be considered, especially in the GO group. Therefore, it is important for future research to collect larger samples with different criminal profiles and to include a gender perspective. A second limitation could be that the presence of antisocial and psychopathy traits was not accounted for. These clinical and neurophysiological traits have been pointed out as having relevant characteristics when measuring vmHRV among offenders of distinct natures (de Looft et al., 2022). In the same line, it should be considered that some offenders might use camouflage strategies during emotional processing, for example, those linked to social desirability (Palix et al., 2022). This could interfere with their physiological response. Therefore, future research should extensively explore the personal characteristics of the recruited sample, as well as their habituation to camouflage. Additionally, given that our procedure was created ad hoc to adjust to the components of compassion, the video employed in Triggering-emotion had not been previously validated. However, it was created by the United Nations and it has been used in other affective induction research

(Schutte & Stilinović, 2017). Likewise, some authors have indicated the potential of using 360° video (Zulkiewicz et al., 2020) or virtual reality devices (Ventura et al., 2020) for an effective emotional elicitation. Moreover, virtual reality has been proven to be an efficient tool to work with offender populations (Dellazizzo et al., 2019). Lastly, we have to take in account that the main character for the compassion induction was a female. It has been shown that IPV offenders frequently present cognitive distortions concerning females that could distance them from the testimony (Eckhard et al., 2012).

Despite the mentioned limitations, the present study provides relevant information about the relation of IPV, vmHRV and compassion. Primarily, it integrates psychobiology-focused perspectives into the psychosocial profile of people convicted of IPV and includes a control group of offenders of distinct nature (GO), which should better explain a social problem in a more comprehensive, inclusive and effective manner (Pinto et al., 2010; Romero-Martinez et al., 2021b; Bueso-Izquierdo et al., 2016; Marín-Morales et al., 2022). Likewise, using psychobiological markers could help to avoid self-report biases by offering a broader understanding of behavior, while providing new insights into the characteristics of IPV perpetrators, which could help to create and apply more effective interventions (Comes-Fayos et al., 2022; Moya-Albiol et al., 2017). Finally, the split procedure employed in the Compassion-eliciting Task is a notable strength of this study, as it is tailored to capture the specificity of the construct of compassion within the experimental procedure. Remarkably, this approach represents one of the earliest affective induction paradigms that incorporates this construct (Di Bello et al., 2023), and it is complemented by the groundbreaking innovation of the virtual reality paradigm in the field. However, there remains considerable scope for further investigation using this approach.

Moreover, future studies should systematically investigate vmHRV and compassion in different contexts. In addition, including other biomarkers linked to social functioning in the study of compassion (Rockliff et al., 2008) in IPV perpetrators, such as hormones (e. g. oxytocin, testosterone and cortisol) and neuroimaging techniques, may help to improve the understanding of socioaffective functioning and the choice of violent coping strategies (Comes-Fayos, et al., 2022; Marín-Morales et al., 2022). Furthermore, it has been suggested that the self-observation of bodily signals, such as vmHRV

parameters, can provide valuable insights into an individual's emotional state, leading to greater awareness and the ability to engage in effective self-regulation (Pinna & Edwards, 2020). Specifically, the development of interoceptive skills has been linked to the ability to downregulate negative emotions (Füstös et al., 2012). Incorporating vmHRV training into interventions for IPV offenders has been proposed as a method of promoting the ability to efficiently react to and self-regulate high-arousal situations, such as anger, helplessness, or distress (Argese et al., 2020). Therefore, future research should aim to further explore the relationship between vmHRV, interoception, and emotional processing within offender populations, as this could provide effective tools for treatment. On the other hand, considering compassion training, such as *Compassion Focused Therapy (CFT)*, may be useful for loosening blocks and resistances and fostering connections with the self and others' suffering (Di Bello et al., 2020; 2021; Gilbert, 2020b).

In conclusion, this study highlights the relevance of investigating compassion and vmHRV among offenders, particularly those who have committed IPV. Evidence has been provided supporting that offenders could be better able to mobilize their parasympathetic resources towards compassion, whereas IPV perpetrators could show difficulties when they are supposed to connect with the suffering of others. Remarkably, RMSSD levels exerted an influence on self-reported negative affect after the Compassion task, which could underline the importance of using biomarkers, such as vmHRV, in the study of criminogenic factors. Therefore, knowing the dynamic profile of IPV aggressors in response to socio-affective tasks could help us to effectively complement intervention and prevention programs. Likewise, it is important to recognize both IPV and violence in general from a multidisciplinary approach that acknowledges its complex and multifactorial nature, allowing professionals to act according to their therapeutic needs in order to decrease violence rates.

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STUDY 2

Diminished parasympathetic flexibility in female offenders when experiencing compassion



Under review:

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ABSTRACT

Research on the emotional sphere of female offenders remains limited, with fewer studies being conducted compared to male offenders. However, investigations have identified psychobiological mechanisms in non-forensic women, such as autonomic nervous system activity, underlying emotional processing. Notably, increased parasympathetic activity has been associated with higher emotional self-regulation, social engagement and compassion. Thus, the present study examined heart rate (HR), vagally mediated heart rate variability (vmHRV), mood correlations, and prosocial behavior during a compassion-eliciting task using a virtual reality paradigm in female offenders ($n=31$) compared to non-forensic individuals ($n=35$). The primary findings showed that offenders exhibited reduced vmHRV when engaging with others' suffering. Additionally, during the prosocial task, offenders revealed lower HR levels. Non-forensic individuals showed the opposite pattern. Nonetheless, no differences were observed in mood and prosocial behavior. Finally, lower vmHRV was associated with higher donation rates only within the non-forensic group. The results suggest that offenders might encounter challenges in experiencing compassion, particularly when connecting with others' suffering and when facing compassionate motivation, as reflected in diminished parasympathetic flexibility. Furthermore, this study highlights the potential for using biomarkers when examining criminogenic needs, offering a multidisciplinary understanding of socio-affective functions, thereby paving the way for more effective interventions.

INTRODUCTION

Offending is a matter of great concern and a public health issue that incurs substantial costs on social, economic, and, most importantly, human fronts (World Health Organization [WHO], 2020; 2023). In criminology literature, the higher rate of offending among men compared to women is well-documented across time periods and cultures (Choy et al., 2017; Belknap, 2020). In this sense, various public policies have historically ignored women's realities in criminal contexts (Belknap, 2020). Although there have been significant gains in the inclusion of female offenders in research and improvements in treatments, there is still much work to be done (Mallicoat, 2022). However, currently in Europe, women constitute approximately around 11% of offenders (Aebi et al., 2023). Accordingly, it might be crucial to increase the number of empirical studies that emphasize the importance of addressing specific characteristics in developing gender-responsive programs that tackle the challenges and needs of women under the justice system (Bloom et al., 2005; Renzetti, 2013).

Although research has already explored different features and needs of female offenders (Bloom & Covington, 2009; Oktavia et al., 2023; WHO, 2007), its scope remains limited. For instance, van der Knaap et al. (2012) identified distinct criminogenic needs in a large offender sample. While men's recidivism was more closely linked to social risk factors (e.g., educational, work, and accommodation problems), they highlighted difficulties in emotional well-being as a contributing factor to women's recidivism. Thus, it might be crucial to emphasize the understanding of the emotional sphere in female offenders.

The autonomous nervous system in the study of antisocial behavior: Heart rate and vagally mediated heart rate variability

From a biopsychosocial perspective, numerous studies now integrate psychobiological variables and their interplay with environmental factors. This facilitates a more comprehensive grasp of emotional processing within forensic settings (Choy et al., 2017). In fact, research has underscored the utility of employing psychobiological measures to mitigate self-report biases (Moya-Albiol et al., 2017). These measures concurrently might offer foundational insights into cognitive and emotional processes

(de Looff et al., 2022). When studying criminal behavior, researchers have employed several psychophysiological indicators that are linked to the central nervous system. Both heart rate (HR) (Choy et al., 2017; Ortiz & Raine, 2004) and vagally mediated heart rate variability (vmHRV; Palix et al., 2022; Sousa et al., 2022), which serve as indicators of autonomic nervous system (ANS) function, have been suggested as potential markers of emotional responsiveness of offenders (de Looff et al., 2022). Nonetheless, there is a lack of awareness of psychophysiological mechanisms that lie behind emotion processing of female offenders (Soldino et al., 2016; Thomson et al., 2019).

The ANS is responsible for unconscious bodily functions, such as HR, respiration, and digestion, among others (Portnoy & Farrington, 2015). It consists of two interrelated branches with complementary functions: the sympathetic (SNS) and parasympathetic (PNS) nervous systems (Xu et al., 2016). The SNS has been associated with the fight-or-flight response in reaction to threatening stimuli (de Looff et al., 2022; Porges, 2007). In contrast, the PNS exerts an inhibitory influence on the SNS, down-regulating the fight-or-flight response (Porges, 2017). Recently, research has been advancing its comprehension of the connection between PNS psychophysiological markers and social sensitivity in non-forensic populations (Di Bello et al., 2020; Porges, 2017). Thus, higher PNS activity has been associated with increased social engagement (Petrocchi & Cheli, 2019) and enhanced emotional self-regulation (Thayer & Lane, 2009). Conversely, decreased PNS activity has been considered indicative of neurobiological vulnerability to emotional dysregulation (Thayer & Lane, 2000; Thayer et al., 2012). Moreover, considering the dynamic nature of social demands, the concept of parasympathetic flexibility has emerged. This concept involves a dynamic modulation of cardiac vagal control depending on the task. For example, it can be characterized by an increased vagal withdrawal during challenging tasks (Muhtadie et al., 2015). This adaptability in response to environmental shifts has been associated with improved empathic accuracy, social sensitivity, and behavioral flexibility (Di Bello et al., 2021; Miller, 2018; Muhtadie et al., 2015). Consequently, shortcomings in regulating both the SNS and PNS might contribute to the development of disruptive behaviors, such as inclinations towards violence (Comes-Fayos et al., 2024; Sousa et al., 2022).

Regarding this, heart rate (HR) serves as a biomarker controlled by the intrinsic mechanisms of the heart and the coordinated action of the SNS and PNS nerves at the sinoatrial node. SNS activity is linked to HR acceleration, while PNS activity is linked to HR deceleration (Levy, 1990; Thayer & Lane, 2009). Specifically, the literature has observed the influence of PNS on HR through vmHRV, reflecting the impact of the vagus nerve (the primary nerve of the PNS) on cardiac output, indicating higher PNS activity. Both the neurovisceral integration model (Thayer & Lane, 2000) and polyvagal theory (Porges, 2007) proposed that vmHRV serves as “the connection between the heart and the brain,” establishing bidirectional associations between vmHRV and brain activity. This includes regions such as the orbitofrontal cortex, the medial and ventromedial prefrontal cortex, and limbic regions like the amygdala (Thayer et al., 2012), brain areas that are also intimately related with violence and offending (Moya-Albiol & Romero-Martinez, 2020).

The prevailing findings, which encompassed females, regarding HR, vmHRV, and offending, have primarily been linked to resting periods, generally indicating diminished levels compared to non-forensic populations (Ortiz & Raine, 2004; Portnoy & Farrington, 2015). Nevertheless, inconsistent results have emerged concerning reactivity to emotional tasks. These inconsistencies might depend on modulating factors, such as the valence of stimuli (de Looft et al., 2022), gender disparities (Thomson et al., 2021), and environmental circumstances, including social adversity (Zhang & Gao, 2015) or a history of family conflict (Hagan et al., 2020). Notably, research focusing on this area in women remains even more limited (Murray-Close et al., 2017; Oldenhof et al., 2019). Thus, a lower HR and vmHRV reactivity to a relational stressor has been described in women who have experienced sexual abuse, specifically linked to proactive aggression rather than reactive violence (Murray-Close & Rellini, 2011). In contrast, a recent study by Thomson and colleagues (2021) analyzed the PNS response to a virtual reality (VR)-induced fear paradigm in non-forensic females, revealing an association between increased vmHRV and proactive aggression towards fear.

Study of protection factors: compassion and its psychophysiological correlates

As illustrated, studies on ANS reactivity in relation to offending and violence have predominantly focused on risk factors and negatively-valenced emotional paradigms, mostly cognitive or social stressors (Murray-Close et al., 2017). Nevertheless, despite the limited exploration of positive valence stimuli (Morley, 2015), there is a recent and expanding body of literature examining how positive states might contribute to reducing risk outcomes within the offender population (Dávila-Gomez et al., 2020; Ribeiro da Silva et al., 2021; Ronel & Segev, 2014; Sousa et al., 2023). One of the main constructs proposed as a mitigator of violent and criminal behavior has been compassion (Moreno et al., 2023; Sousa et al., 2022; 2023).

From an evolutionary standpoint, compassion is rooted in the “share and care” motivational system found in mammalian functions (Gilbert, 2010). It is defined as the sensitivity towards others’ suffering and an inherent motivation to alleviate or prevent it (Gilbert, 2017; Di Bello et al., 2020). While stimuli that trigger compassion might be associated with distress (Petrocchi & Cheli, 2019), compassion intrinsically combines an appraisal of others’ suffering with feelings of security, fostering the ability to handle tendencies toward distress. Therefore, it has been related to decreases in negative affect and increases in positive affect (Di Bello et al., 2020; Sousa et al., 2021).

Compassion has been conceptualized within the tripartite model of affect regulation, which encompasses adaptive functions (i.e., threat, drive, and soothing; see Gilbert, 2010 for an in-depth review). It enhances a positive emotion regulation system, the soothing system, which has been associated with feelings of connectedness and safety. This system is proposed to counter the threat system responsible for “protect the self” through flight-or-fight responses (Gilbert, 2020). Hence, compassion has been suggested as a modulator of threat processing, steering individuals to exhibit sensitivity toward the suffering of others (through empathetic competencies) and fostering helpful responses (through prosocial behaviors; Gilbert, 2019; Porges, 2017).

At the physiological level, compassion has been theorized to significantly impact neurophysiological circuits, particularly the myelination of the vagus nerve, thus likely having a close relationship with vmHRV (Gilbert, 2017; Porges, 2017). Overall, research

in non-forensic populations has consistently indicated a positive correlation between higher levels of compassion and increased vmHRV in both sexes (Di Bello et al., 2020; Kim et al., 2020). Specifically, in a study involving male offenders, non-forensic controls displayed higher vmHRV levels than offenders when engaged in a compassion-eliciting task. This disparity was associated with difficulties in connecting with others' suffering (Moreno et al., 2023). Furthermore, experiencing compassion has also been linked to reductions in HR, potentially attributable to the vagus nerve's inhibition of the sinoatrial node of the heart (Stellar et al., 2012; 2015). This negative correlation may be related to heightened activity of the PNS, coupled with an enhanced soothing emotion regulation system (Sousa et al., 2021; 2022).

Finally, previous research conducted with the non-forensic population, comprising both male and female, has linked greater prosocial behaviors to HR increases (Oyediran & Rivas, 2017; Yu & Hao, 2023) as well as higher vmHRV activity (Bornemann et al., 2016; Petrocchi & Cheli, 2019). However, concerning the physiological aspect of compassionate motivation, based on our understanding, two studies have addressed this issue. Di Bello and colleagues (2023) established a connection between prosocial behavior and an increase in vmHRV among non-forensic populations, primarily females. Additionally, Moreno et al. (2023) found lower levels of vmHRV in male offenders compared to non-forensic populations concerning compassionate motivation.

The present study

To the best of our knowledge, no studies have specifically examined the potential role of autonomic mechanisms in female offenders regarding compassion. Therefore, the main objective of this study was to explore whether this specific population differed from non-forensic women in their cardiovascular response (focusing on HR and vmHRV parameters), and mood state during a compassion-eliciting Task. Previous studies involving female samples have linked decreases in HR activity (Stellar et al., 2012; 2015) and increased vmHRV levels (Di Bello et al., 2020; Kim et al., 2020) as indicative of heightened PNS activity via the vagus nerve during experiences of compassion. Likewise, compassion has been linked to higher positive affect and reduced negative affect (Engen & Singer, 2015; Förster & Kanske, 2022). Consistent with the aforementioned research

and grounded in emotional difficulties described in women offenders (Edwards et al., 2019; van der Knaap, 2012), we expected higher HR and lower vmHRV values, especially during *Triggering-emotion* period (the compassion induction during the task), in the offender group (Moreno et al., 2023). Furthermore, we hypothesize increases in negative mood and decreases in positive mood following the compassion task in the offender sample.

Secondly, we aimed to explore group differences in prosocial behavior (donation amount during *Call-to-Action* period) as a reflection of compassionate motivation. Additionally, we sought to examine if variations in total donation amount could be explained by phasic HR and/or vmHRV, and whether these differences would be evident among the groups under study. Prior literature in male offender samples has shown fewer prosocial actions than non-forensic groups after an emotional induction (Mayer et al., 2018). On the other hand, studies in non-forensic populations encompassing females have associated greater prosocial actions with increases in both HR (Yu & Hao, 2023) and vmHRV (Di Bello et al., 2023). Hence, we estimated lower donations in the offender group linked to lower levels of both HR and vmHRV.

METHOD

Participants

After screening a sample of 70 participants, 66 volunteers were selected to take part in the study. The total sample was composed of 31 offenders and 35 non-forensic women. The offender sample included participants sentenced for offenses of less than two years of prison (minor crimes), which were replaced by participation in an intervention program or by community service. The offenses included domestic violence, offenses against road safety (e.g., speeding, driving without a license and driving under the influence of toxic drugs or alcoholic beverages), drug trafficking, fraud, larceny and robbery. Participants were recruited from the *Service of Management of Penalties and Alternative Measures*. Researchers had the opportunity to take part in different community programs, explaining the research goals to participants, and inviting them to join the study voluntarily, ensuring complete anonymity and confidentiality. The non-

forensic control group did not have a previous criminal record and was recruited through advertisements on social media.

In order to assess their eligibility for the study, the following exclusion criteria were considered: 1) insufficient proficiency in both written and spoken Spanish; 2) presence of cardiovascular diseases; 3) existence of hearing or visual impairments. After applying the exclusion criteria, a total of four participants were excluded. In each group, two individuals were excluded due to the presence of a cardiovascular disease.

Furthermore, participants were requested to avoid the intake of substances affecting the cardiovascular system and to abstain from engaging in physical exercise for a minimum of two hours before taking part in the experiment.

The experiment adhered to the principles outlined in the Declaration of Helsinki and received approval from the Ethics Committee of the University of Valencia (Code: 1563895).

Procedure

Prior to commencing the study, all participants received an explanation of the research objectives, along with an overview of the study's voluntary nature and specific requirements. All voluntarily provided their signature on the informed consent form, guaranteeing complete anonymity and confidentiality.

The procedure (Figure 5) took place during a single experimental session in a laboratory room maintained at a constant temperature (21 ± 1 °C) and humidity, lasting approximately 60 minutes. First, anthropometric measurements were obtained, including weight and height, measured using a scale and height rod, respectively. Afterward, participants were equipped with the VU-AMS electro-psychophysiological device (as detailed later) and were asked to complete questionnaires related to their emotional states while a 5-minute resting period was recorded.

A compassion-eliciting task was conducted utilizing immersive reality technology. To ensure uniformity of information among participants, instructions were provided by asking the participants to “put yourself in the shoes of the characters you

see on video". Subsequently, participants were outfitted with the Oculus Quest 2 VR device (anticipatory period, 5 minutes).

The compassion task was then conducted through a virtual experience using a 360° immersion paradigm. This experience comprised two parts, representing the subdivisions of the compassion construct: Triggering-Emotion (the emotional induction, emphasizing connection with suffering) and Call-to-Action (providing an opportunity for prosocial behavior). The entire task had a total duration of 20 minutes. During the Triggering-emotion period, participants viewed a clip depicting a child giving a tour of a refugee camp in Syria showcasing the challenging conditions. This clip was an adaptation of the United Nations documentary "Clouds Over Sidra". The subsequent Call-to-Action period, integrated within the VR experience, involved a prosocial activity where participants had the opportunity to donate a portion of the economic compensation that they had received for participating in the experiment. Participants could engage in the prosocial action by donating an amount ranging from 0 to 10 euros to four designated NGOs (Dictator Game paradigm; Hare et al., 2010). Upon concluding this task, the VR device was removed, and participants were asked to complete the affect state questionnaire once again during a 10-minute recovery period.

After the recovery period concluded, the electro-psychophysiological electrodes were detached. Successively, a semi-structured interview was conducted to acquire socio-demographic and personal data, including age, menstrual cycle information (i.e., first day of their last menstruation), marital status, educational level, nationality, annual income and criminal history. All participants received a compensation of 40 euros for their participation. It is noteworthy to empathize that the 'donation paradigm' was a simulation, and all participants retained the compensation.

Measures

Psychophysiological measures

HR and vmHRV were gathered using the Vrije Universiteit Ambulatory Monitory System (VU-AMS). To capture cardiovascular signals from participants, we positioned seven pre-gelled disposable electrodes (EL503 electrodes, Biopac, USA) on their chests and backs

(for additional details, see <http://www.vu-ams.nl/support/instruction-manual/>). The ambulatory recording device (VU-AMS) was linked to the monitoring computer via an infrared interface cable. Subsequently, we analyzed the recordings utilizing "Data Analysis and Management Software (DAMS)," Version 5.3.1 (accessible at <http://www.vu-ams.nl/vu-ams/software/>). This software facilitates automated signal scoring, incorporating enhanced artifact and R-peak detection and thereby enabling automatic artifact removal. In accordance with the cardiovascular analysis guidelines provided by VU-DAMS v5.0, we conducted an extra visual examination and manually refined the R-peak detection process. During this revision, we scrutinized the "deviant interbeat intervals" and eliminated those that exhibited substantial deviations, encompassing ectopic beats and arrhythmic occurrences.

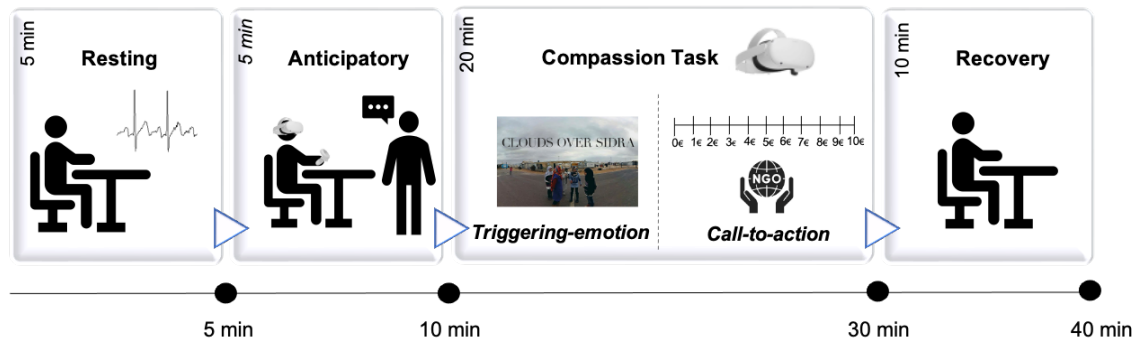
In this study, HR was examined as an indicator of the combination effects of SNS and PNS systems. Each heartbeat is initiated by the sinoatrial node that has an intrinsic rate between 60 and 100 beats/minute depending on an individual's age and gender (Kashou et al., 2020). Thus, the number of R-peaks per one minute (beats per minute) was collected to determine HR.

Additionally, we employed a time-domain measure known as the root mean squared of successive differences (RMSSD), which has been acknowledged as a reliable indicator of vmHRV (Williams et al., 2015). This metric quantifies the degree of variability in the interbeat intervals over time. Its computation involves obtaining the variance between consecutive R-R intervals in milliseconds, squaring these variances, and then extracting the square root (Laborde et al., 2017).

Psychological measures: positive and negative affect

For assessing the affective state, the Positive and Negative Affect Schedule (PANAS, Watson et al., 1988), adapted for the Spanish population (Sandín et al., 1999), was employed. This questionnaire comprises 20 items, with 10 gauging positive affect and the remaining 10 assessing negative affect. Responses are recorded on a five-point Likert scale, ranging from 1 ("very slightly or not at all") to 5 ("extremely"). The internal consistency, as measured by Cronbach's α , was found to be between .86 (pre) and .89 (post) for positive affect, and between .80 (pre) and .81 (post) for negative affect.

Figure 5. *Experimental protocol*



Data analyses

Independent means comparison t-tests were performed with the "group" variable as an inter-subject factor for body mass index (BMI) and age scores. Additionally, Chi-square tests were performed to compare menstrual cycle and socio-demographic data (nationality, education level, marital status and annual income) again with the "group" variable as an inter-subject factor.

Normality of the psychophysiological data was evaluated with the Shapiro-Wilk test ($p < .05$) and, subsequently, non-normal data (RMSSD) were transformed based on a Logarithm base ten (Log10).

First, we assessed the potential differences in the resting period of psychophysiological variables using a univariate ANOVA. To analyze and compare the cardiovascular response (HR and RMSSD indexes) to the compassion task between the groups, a repeated-measures (RM) ANOVA was performed with the variable "time" (resting, anticipatory, Triggering-emotion, Call-to-action and 10 minutes recovery) as the intra-subject factor and "group" as the inter-subject factor. Huynh-Feldt corrections for degrees of freedom were applied.

Furthermore, to explore possible changes in the psychological state to the task, we calculated positive and negative affect scores by subtracting the pretest from the posttest for the PANAS. To assess group differences, we performed a univariate ANOVA.

Moreover, we employed a univariate ANOVA to analyze the donation amount (Dictator Game results).

Additionally, the magnitude of the HR and vmHRV responses for the compassion task were estimated by the area under the curve with respect to the increase (AUCi) for each measure. In our calculations, we utilized the trapezoid formula with the resting period as the reference point (Pruessner et al., 2003). This enables us to assess whether there are variations in the variables concerning the resting period to the Call-to-action period. Subjects were divided into high- and low-AUCi for each physiological index using a median split (Lacobucci et al., 2015). Moreover, a comparison of means was performed by using a two-factor ANOVA with “group” and “high- / low-AUCi” as fixed factors and the total amount of donation as the dependent variable.

Effect sizes were computed using partial eta square (ηp^2).

Finally, it is worth noting that the menstrual cycle was included as a covariate in all analyses involving psychophysiological, psychological measures and behavioral (donation amount), due to its association with cardiac regulation (McKinley et al., 2009) and changes in the central nervous system (Rizor et al., 2023).

Data analyses were performed using IBM SPSS Statistics v28.

RESULTS

Participant characteristics and preliminary analyses

There were no significant differences between the groups in anthropometric characteristics, menstrual cycle data and socio-demographic variables (see Table 3).

Table 3

Means (Standard Deviations), Percentages and Mean Comparisons for Demographic, Anthropometric and Menstrual Cycle Data

	Offender women (n = 31)	Non-forensic women (n = 35)	T-student (t)
Age (M, SD)	37.83 (10.90)	35.97 (11.54)	-0.673
BMI (M, SD)	26.37 (06.64)	25.02 (04.74)	-0.953
Chi-Square			
Menstrual Cycle (%)			
Follicular phase	24	15	
Ovulation	07	15	
Luteal phase	17	15	
Menstruation	31	22	.57
Menopause	21	33	
Marital status (%)			
Married	40	60	
Single	48	52	
Divorced/Widowed	46	54	1.26
Educational level (%)			
No studies	50	50	
Primary	50	50	
Secondary/vocational training	45	55	
University	47	53	2.05
Nationality (%)			
Spanish	52	48	
Other countries	35	65	1.65
Annual Income (%)			
Low Income	58	42	
Medium Income	50	50	
High Income	00	100	5.20

Note. BMI: Body Mass Index; M: Mean; SD: Standard Deviation. Statistical significance *p < .05, **p < .01

Psychophysiological results to the compassion-eliciting task: HR and vmHRV

First, differences in resting levels were examined, revealing no significant disparities in either the HR [$F(1, 53) = .625, p = .433; \eta p^2 = .012$] or RMSSD [$F(1, 53) = 1.923, p = .171; \eta p^2 = .035$] indexes between the groups.

As regards the HR index, the RM-ANOVA found a significant “time” effect [$F(3, 156) = 2.7333, p = .046, \eta p^2 = .050$] in the Compassion task for the whole sample. Additionally, testing for HR indicated higher values during the resting and anticipatory periods than the Triggering-emotion ($p < .001$) and recovery ($p < .001$) periods. Regarding the RMSSD index, we did not find a significant “time” effect in the Compassion task for the whole sample.

Differences between offenders and non-forensic women in HR, vmHRV and mood state during the compassion- eliciting task

For the HR index, a significant “time x group” effect was found [$F(3, 156) = 3.208, p = .025, \eta p^2 = .058$]. As depicted in Figure 6, higher HR levels were observed in offenders with the exception of the Call-to-action period, when compared to the non-forensic group.

Additionally, the offenders’ group exhibited a significant decrease in HR from the resting period with respect to the Triggering-emotion ($p < .001$), Call-to-Action ($p = .008$) and recovery periods ($p = .021$). They also demonstrated a decrease from the anticipatory to the Triggering-Emotion ($p < .001$), Call-to-Action ($p = .014$) and recovery periods ($p = .029$). On the other hand, the non-forensic group also showed a significant HR decrease from the resting period compared to the Triggering-emotion ($p = .021$) and recovery periods ($p = .046$), as well as from the anticipatory to the Triggering-emotion ($p < .001$) and recovery periods ($p = .004$), but not in the Call-to-action period.

Furthermore, a significant “time x group” effect was found [$F(3, 154) = 3.561, p = .017, \eta p^2 = .063$]. As seen in Figure 7, lower RMSSD levels were observed in the offender group, especially in the Triggering-emotion period, with the exception of the Call-to-action period, when compared to the non-forensic group.

Moreover, for the offenders' group, RMSSD was higher during the recovery period compared to resting ($p < .001$), anticipatory ($p < .001$) and Triggering-emotion ($p = .017$) periods. Furthermore, the non-forensic group showed higher values of RMSSD during the recovery period than anticipatory ($p = .020$) and Call-to-action ($p = .002$) periods.

Figure 6 Heart rate levels in the compassion-eliciting task

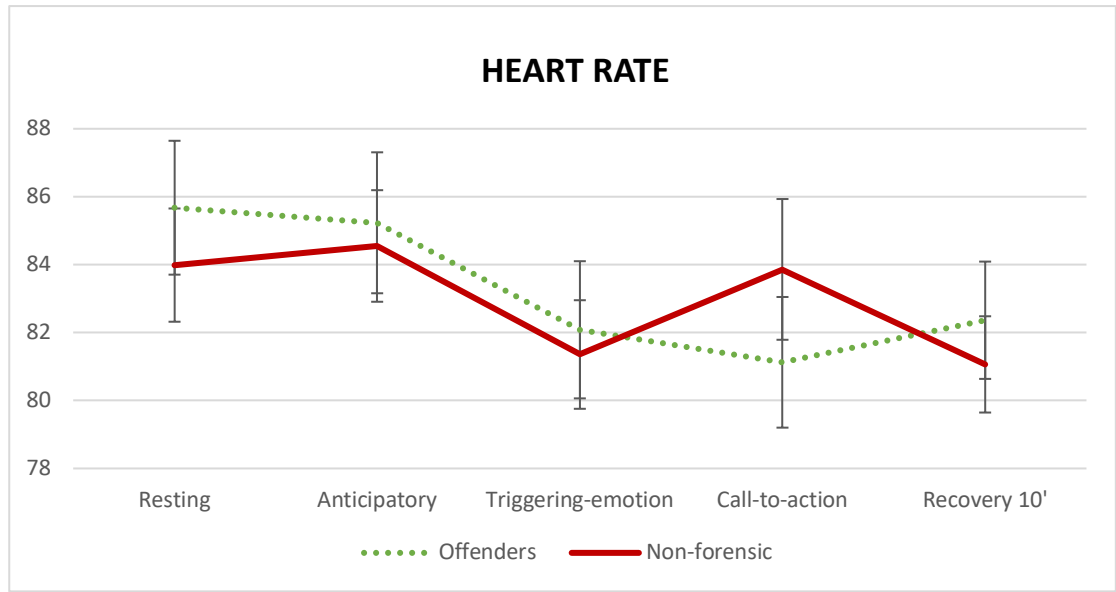
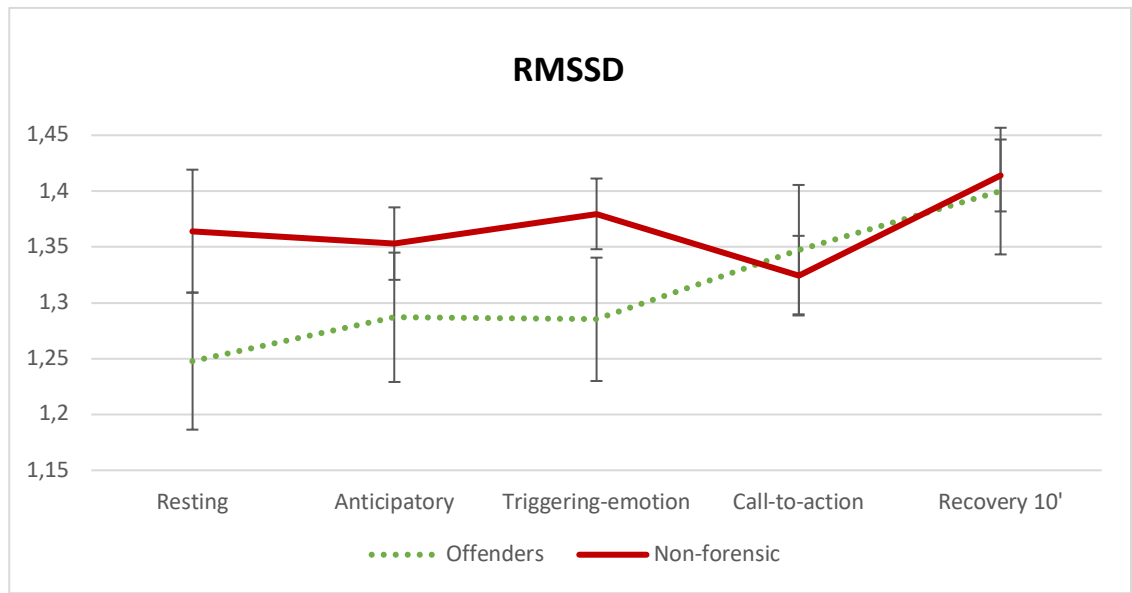


Figure 7 RMSSD levels in the compassion-eliciting task



Note. RMSSD = root mean squared of successive differences

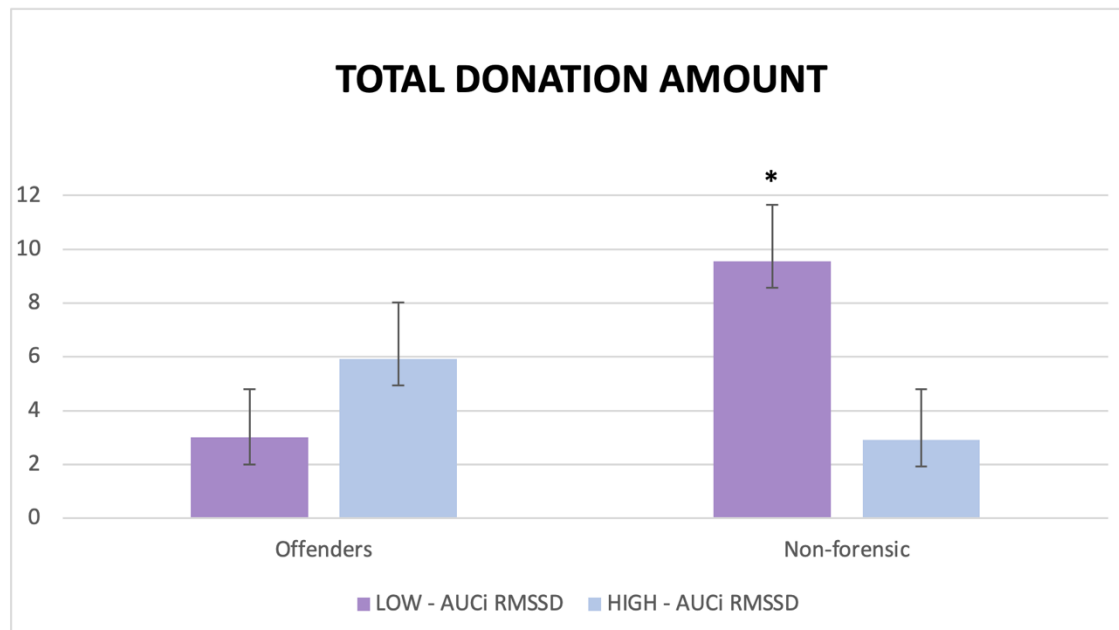
Finally, with regard to the change in mood state scores, no differences were found between the groups: neither in negative affect [$F(1, 53) = .238, p = .627; \eta p^2 = .004$] nor in positive affect [$F(1, 53) = 1.744, p = .192; \eta p^2 = .032$].

Call-to-action results: total donation amount and effects of HR and vmHRV on the total donation between the groups

The results of donations made during the Call-to-action period did not show any significant effects on the total donation amount between the groups [$F(1, 53) = 1.046, p = .311; \eta p^2 = .019$].

Additionally, we did not find significant differences in relation to AUCi HR and the donation amount between the groups [$F(1, 51) = .976, p = .328; \eta p^2 = .019$]. However, a significant main effect of “group $\times$ AUCi RMSSD” was found on the donation total amount [$F(1, 51) = 5.781, p = .020; \eta p^2 = .102$]. Post hoc testing revealed that non-forensic women with lower AUCi RMSSD made higher donations compared to offender women [$F(1, 50) = 5.686, p = .021; \eta p^2 = .100$].

Figure 8 Total donation amount and its relation with AUCi RMSSD



Note. AUCi = Area under the curve with respect to the increase; RMSSD = square root of the mean of the sum of the squares of differences between adjacent RR intervals; Statistical significance * $p < .05$

DISCUSSION

The results of our study revealed that throughout various phases of the compassion-eliciting task, women offenders exhibited consistently higher levels of HR and lower levels of RMSSD, except during the Call-to-action period. Particularly noteworthy was the lower vmHRV in the offender group while connecting with others' suffering, as well as reduced HR activity during the Call-to-action period (prosocial task) compared to the non-forensic group. Furthermore, there were no significant differences in self-reported affect measures between the two groups. On the other hand, no significant differences were found in prosocial behavior (donation amount). However, only among the non-forensic group did those with lower AUCi in the RMSSD make greater donations.

Our main objective was to explore differences in HR and vmHRV indexes together with the mood response during a compassion task. In the first part of the objective, consistent with our hypotheses, the offender group showed higher levels of HR and lower vmHRV activity during the Triggering-emotion period compared to the non-forensic women. In relation to this, prior research conducted on non-forensic population has linked lower levels of HR (Stellar et al., 2015) and higher levels of vmHRV (Kim et al., 2020) to experiencing compassion. The main differences were found in the RMSSD index during the connection with suffering, suggesting increased activity of PNS resources in the non-forensic group to manage the emotional induction associated with others' suffering (Thayer & Lane, 2009). Particularly, it has been indicated that heightened vmHRV significantly contributes to sensitivity towards suffering and caregiving (Petrocchi & Cheli, 2019). More specifically, in studies involving male offender samples, difficulties in activating parasympathetic resources have previously been associated with a tendency to avoid connecting with others' suffering (Comes-Fayos et al., 2024; Moreno et al., 2023; Sousa et al., 2022; 2023). Thus, female offenders, despite exhibiting a decrease in HR from the resting period to the Triggering-emotion period, were not able to increase their vmHRV levels during the emotional induction in this study. Hence, the noted emotional challenges among female offenders (Knaap et al., 2012; WHO, 2007) could be linked with a reduced vmHRV activity in response to compassion.

However, during the Call-to-action period, while a decrease in HR was observed in the offender group, non-forensic women revealed an increase in HR activity. Additionally, regarding vmHRV activity, both groups exhibited a convergence, with offenders displaying an increase in RMSSD levels while non-forensic women experienced a decrease. As stated before, the dynamic nature of social demands should be considered (Muhtadie et al., 2015). Hence, the Call-to-Action period essentially encompassed an economic decision-making process during the task, as participants were given the opportunity to donate money in an adapted version of the Dictator Game. Consequently, it might be considered potentially associated with an increase in SNS rather than PNS activity (Muhtadie et al., 2015). Therefore, a decreased HR activity and an increased vmHRV during the Call-to-action period might indicate a lower psychophysiological flexibility towards prosocial decision-making within the female offender's group (Muhtadie et al., 2015; Miller, 2018). Thus, future research should delve deeper into understanding adaptive psychophysiological changes in order to meet the demands of specific moments in forensic samples (Miller, 2018; Murray-Close et al., 2017).

Furthermore, both groups exhibited reductions in HR and rises in vmHRV during the recovery period compared to the periods before initiating the task. This finding aligns with Di Bello et al. (2021) who observed vmHRV increases primarily in female samples after watching a video depicting intentional acts of help towards distressed individuals. Additionally, Moreno and colleagues (2023) demonstrated that both male offenders and non-forensic individuals experienced heightened vmHRV during the recovery phase following a compassion task. This suggests that engagement in compassion may be linked with an amplified post-parasympathetic response, likely associated with the activation of effective self-regulatory mechanisms (Di Bello et al., 2020; 2023), even within offender populations (Moreno et al., 2023). However, further investigation into the compassion construct might be necessary, particularly within forensic samples, given that both HR and vmHRV seem to depend largely on the experimental tasks and their emotional valence (de Looft et al., 2022).

Additionally, we sought to evaluate the participants' mood response to the task. As mentioned earlier, women offenders have been linked to emotional difficulties

(Edwards et al., 2019). Therefore, we expected increases of negative mood and decreases in positive mood among the offender sample following the compassion task. Notwithstanding, our results revealed no differences between the groups in self-reported affect measures. A possible explanation for these outcomes might be associated with the susceptibility of self-reports to bias, since it has been suggested that offenders might have a lower perception of their own emotional states (Garaigordobil & Peña-Sarrionandia, 2015; Sousa et al., 2022). Hence, as previously mentioned, the offender group showed heightened HR and reduced vmHRV activity towards the emotional induction, which could be associated with increased arousal related to the threat rather than the soothing regulation system (Sousa et al., 2021; 2023). Taken together, this information suggests that encountering distressing stimuli, particularly those concerning the connection with suffering, might lead offenders to employ compensatory mechanisms in emotional perception and self-protective strategies, such as avoiding negative sensations (Sousa et al., 2022; Gilbert, 2005). This might contribute to bias in self-reports within offender populations. Therefore, these findings underscore the importance of integrating psychophysiological measures alongside self-reported assessments in the study of offending and violent behavior, providing a biopsychosocial perspective on such phenomena (Moya-Albiol et al., 2017). Additionally, they highlight the need for extensive research exploring affect regulation systems among offenders (Sousa et al., 2023).

Our second objective was to investigate distinctions in compassionate motivation by examining the donation outcomes during the second part of the compassion task (Call-to-action period). Additionally, we sought to explore the relationship between total donation amount and the psychophysiological variables in both groups. We hypothesized lower donations in the offender group (Mayer et al., 2018), which would be linked to lower levels of both HR (Yu & Hao, 2023) and vmHRV (Petrocchi & Cheli, 2019). For the first part of this objective, contrary to our hypothesis, no differences were observed in donation amounts between the groups. Despite findings indicating that offenders exhibit fewer prosocial behaviors than non-forensic controls following an emotional induction (Mayer et al., 2018), the subject remains controversial, with limited studies examining it. Lately, two studies have revealed no differences in the display of

prosocial behaviors among male offenders and non-forensic participants, following both positive (Moreno et al., 2023) and negative valence (Comes-Fayos et al., 2022) emotional inductions. These findings point to the capacity of offenders to engage in prosocial behaviors, but also to the fact that the inconsistency observed between them could stem from disparities in experimental designs, the use of diverse prosocial tasks during evaluation, and considerations regarding their ecological validity (Bo O'Connor et al., 2022).

Finally, regarding the psychophysiological variations related to the donation amount, we did not find differences in terms of the magnitude of HR response (measured by AUCi HR) and donation amount between the groups. Nevertheless, unexpectedly, it was observed that non-forensic women who exhibited a lower AUCi RMSSD response were associated with greater donations. Conversely, the literature based on non-forensic populations has associated higher vmHRV with greater prosocial behaviors (Di Bello et al., 2023), since higher PNS function has been related to social engagement (Petrocchi & Cheli, 2019). This discrepancy with our sample could be explained because prior experiments on vmHRV and prosociality usually did not focus on the phasic vmHRV but rather on the resting periods (Bornemann et al., 2016), prosocial traits and/or prosocial emotions (Kogan et al., 2014). Furthermore, research findings involving phasic vmHRV, emotional induction paradigms and prosociality are relatively scarce and have produced mixed results, indicating both positive (Barraza et al., 2015; Comes-Fayos et al., 2024) and negative associations (Liew et al., 2011) between vmHRV activity and prosocial actions. Thus, our findings could indicate that higher donations in the non-forensic group might be associated with a reduction in PNS functioning or an increase in the influence of the SNS toward the economic decision-making task. This could be related to higher parasympathetic flexibility in response to a social demand (Muhtadie et al., 2015; Miller, 2018). Moreover, despite the absence of observable differences in behavioral outcomes between the groups, as previously mentioned regarding the Call-to-Action period, female offenders exhibited a decrease in HR and an increase in vmHRV, whereas non-forensic women displayed the opposite pattern. These combined findings might reinforce the hypothesis that emotional challenges identified in female offenders (Edwards et al., 2019; WHO, 2007) might be

associated with reduced psychophysiological adaptability toward compassion. In contrast, the non-forensic group may exhibit greater parasympathetic flexibility when connecting with others' suffering and addressing their needs. Consequently, identifying difficulties in adjusting the vagus nerve's control over the heart in response to social and emotional changes, indicating a reduced ability to adapt the PNS, might be crucial for further understanding criminal behavior.

Limitations, strengths, future directions and conclusion

It is essential to acknowledge various limitations that curtail the broad application of our findings. Primarily, the sample size was relatively small, attributed to difficulties in recruiting participants from the offender population, especially women, due to their lower rate of offending (Belknap, 2020). Additionally, it is crucial to consider the diversity among offender profiles when interpreting the outcomes, given that our sample encompasses a spectrum of minor offenses, covering both violent and non-violent crimes. Moreover, studies on women, antisocial behaviors and psychophysiology have usually differentiated between reactive and proactive profiles (Murray-Close et al., 2017; Thomson et al., 2021). In line with this, we did not account for the presence of psychopathic traits, which have been noted as relevant when measuring psychophysiological variables in offenders (de Looft et al., 2022; Palix et al., 2022). Hence, further research should explore socio-affective functions, such as compassion, and their interactions with different offender characteristics in larger samples. Furthermore, our procedure was created ad hoc to correspond with the components of compassion. Therefore, the video used for emotional induction had not undergone prior validation, but it has been employed in various affective induction studies using VR paradigms (Schutte & Stilinović, 2017), including research involving forensic samples (Moreno et al., 2023). In line with this, it should be considered that in the prosocial task, the donations might be subject to social desirability bias and personal preferences toward the NGOs (Berman et al., 2016). Lastly, studies have pointed out that female offenders have also been victims, either currently or in the past (Laskey, 2016). This aspect might impact psychophysiology (Hagan et al., 2020; Zhang & Gao, 2015) and their experience of compassion (Gilbert, 2005). Therefore, it could be an interesting factor to investigate in future studies.

Notwithstanding the aforementioned limitations, the current research yields relevant information about female offenders' HR and vmHRV towards compassion. It contextualizes an emotional aspect of female offending, specifically compassion, within a biopsychosocial framework. This approach offers a more comprehensive and contemporary perspective to understand this social issue, potentially aiding in the development and implementation of more effective treatments. It is crucial to recognize the importance of adapting interventions and policies to better fit the realities of women's lives (Belknap; 2020; Renzetti, 2013). Overlooking the examination of specific needs that female offenders might have impedes their prospects for successful reintegration (Belknap; 2020; Bloom et al., 2005). Additionally, employing psychobiological markers could complement self-reported information, providing a broader understanding of emotion processing and offending (Ortiz & Raine, 2004; Choy et al., 2017). Lastly, the split procedure utilized in the compassion task stands out as a significant strength in this study, designed specifically to capture the nuances of the compassion construct. Notably, this method signifies one of the pioneering affective induction paradigms incorporating this construct (Di Bello et al., 2021; 2023), complemented by the innovative integration of the VR paradigm in this domain (Moreno et al., 2023). Yet, there is still ample room for further exploration using this approach.

Future studies should systematically investigate compassion and psychophysiological markers in different contexts. For instance, implementing and assessing compassion training, such as Compassion Focused Therapy (CFT; Kim et al., 2020), within offender populations, could enhance our understanding of the construct and its relation with behavior (Ribeiro da Silva et al., 2021). It might also help offenders in reducing resistance and nurturing connections with themselves and the suffering of others (Di Bello et al., 2020; Gilbert, 2005; 2020).

In conclusion, this study emphasizes the use of biomarkers in investigating criminal behavior (Choy et al., 2017), particularly among female offenders, and its relationship with compassion. Our findings suggest that experiencing compassion and engaging in compassionate motivation may trigger complex interactions within the ANS, specifically involving parasympathetic flexibility (Porges, 2017). Female offenders might have exhibited difficulties in this domain particularly when connecting with others' suffering

and with shifting to compassionate motivation. Hence, exploring protective factors through socio-affective tasks could effectively complement gender-responsive intervention and prevention programs, ultimately aiding in reducing recidivism rates (Belknap, 2020; Bloom et al., 2005).

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STUDY 3

Unraveling the Layers of Empathy: Self-Compassion as a Partial Mediator in Male and Female Offenders' Personal Distress and Aggression



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ABSTRACT

Violence and offending pose significant public health concerns, and understanding the factors associated with these behaviors is crucial for effective intervention and prevention programs. While extensive research has focused on risk factors, the role of protective factors, such as empathy and self-compassion, has received less attention. This study examines the predictive value of cognitive and affective empathy on aggression and explores the mediating role of self-compassion in the relationship between personal distress and aggression within an offender population. A sample of 120 offenders (90 men and 30 women) completed self-report measures of aggression (*Aggression Questionnaire*), empathy (*Interpersonal Reactivity Index*) and self-compassion (*Self-compassion scale – Short Form*). Additionally, a semi-structured interview was conducted to collect sociodemographic information and criminal history. Results showed a negative association between perspective-taking (a cognitive empathy component) and aggression, while personal distress (an affective empathy component) positively predicted aggression. Self-compassion partially mediated the relationship between personal distress and aggression, indicating its potential role in reducing violent tendencies. These findings highlight the importance of considering empathy and self-compassion in understanding and addressing aggression in offenders. Specifically, a deeper understanding of the affective empathy construct and considering self-compassion as a complementary tool could enhance gender-inclusive prevention and intervention programs, potentially reducing recidivism rates.

INTRODUCTION

Violence and offending represent a notable concern and a matter of public health significance. Various factors contribute to its occurrence, spanning different domains such as the societal, relationship, and individual levels, affecting health in all its dimensions (World Health Organization [WHO], 2020, 2023). To comprehend these issues, researchers have identified a wide range of sociological, psychological, and biological risk factors that have been associated with aggression, violence and criminal behavior (Bonta & Andrews, 2016; Loeff et al., 2022; Ortiz & Raine, 2004). However, despite the growing body of literature on protective factors, they have received less emphasis (Morley, 2015; Ronel & Segev, 2014). Deepening our understanding of protective factors can significantly enhance our ability to effectively complement intervention and prevention programs for offenders, reducing risk outcomes (O'Shea & Dickens, 2015; Ribeiro da Silva et al., 2021; de Ruigh et al., 2021).

Layers of Empathy and Aggression

Empathy has been widely studied as a protective factor against aggression and violent behaviors (Jolliffe & Farrington, 2004; Romero-Martinez et al., 2019b; Vachon et al., 2014). This complex socio-affective function, originated from the German term "Einfühlung" (which described the act of projecting one's body and soul into an art work; Robert Vischer, 1873), describes the process of resonating with others' feelings (regardless of positive or negative valence), while recognizing the origin of the emotion in others (Preckel, et al., 2018; de Vignemont & Singer, 2006). Two main components have been described across the literature in this construct: cognitive and affective.

Cognitive empathy refers to the capability to perceive and understand others' feelings or emotional states, using information acquired through observation, verbal communication, and/or prior personal experiences (perspective-taking). It involves the influence of factors such as motivation, memories, and attitudes on the perception of vicarious emotions (Lamm, et al., 2006). On the other hand, affective empathy stands as an isomorphic representation of someone else's emotional state (Decety & Jackson 2004; Singer, 2006). In this sense, it has been proposed to act as a precursor to

compassion (empathetic concern), enabling individuals to connect with others' suffering and serving as a motivating factor for engaging in prosocial behavior to alleviate their suffering (Bellosta-Batalla et al., 2019; Eisenberg, 2000; Gilbert, 2017). It has also been suggested as a preventive mechanism against causing harm to others (Miller & Eisenberg, 1988; Moya-Albiol et al., 2010; Moya-Albiol, 2018; 2021).

However, when confronted with the suffering of others, experiencing a connection to their pain can lead to personal distress, which is aversive (Chierchia & Singer, 2017; Klimecki et al., 2013; Lamm et al., 2011). For affective empathy to be healthy, it is crucial to maintain a separation between other people's experiences and one's own (Preckel et al., 2018). If individuals perceive and internalize vicarious emotions as their own (sympathy), it could lead to aversive emotional reactions such as anxiety or sadness (Eisenberg et al., 2015; Jensen et al., 2014). Consequently, the "empathetic response" could become self-centered, with the aim of alleviating personal distress (Eisenberg & Eggum, 2009; Lamm et al., 2007), potentially leading to aggression (Bloom, 2017; Palumbo & Latzman, 2021).

There is a longstanding trajectory in the literature suggesting that empathy serves as a protective factor against aggression and offending. It is proposed that a lack of ability to comprehend and connect with the emotions of others can lead to impaired social and moral development (Eisenberg, 2000). The most recent meta-analysis on the topic has yielded inconsistent findings, with weak or nonexistent relationships between these two constructs (Vachon et al., 2014). Nonetheless, a different meta-analysis pointed out that cognitive empathy is more closely and negatively associated with offending behavior than affective empathy (Jolliffe & Farrington, 2004). Miller and Eisenberg (1988) found that cognitive and affective empathy were negatively related to aggression and antisocial behaviors in children, adolescents and adults. This relation has been found weaker in adults, compared to younger samples (Jolliffe & Farrington, 2004), indicating the potential relevance of age as a factor. Taking these discrepancies into account, Vachon and colleagues (2014) proposed the consideration of moderator variables, such as age and sex, measurement issues, and a reconceptualization of empathy, particularly focusing on the affective empathy sphere. They advocated for a

"narrow conceptualization of affective empathy" and emphasized the necessity for further exploration of this construct in relation to violent behavior. The present study aims to address this specific issue.

Self-compassion as a tool to cope with negative emotions

It has been suggested that effective emotional management is crucial in order to experience the healthy empathic concern that inhibits personal distress (Decety & Lamm, 2009; Klimecki & Singer, 2012), while personal distress has been proposed as indicative of poor emotion regulation (Eisenberg 2000). The establishment of a secure base and internal equilibrium is fundamental in enabling individuals to sustain their empathic responses without becoming overwhelmed by the suffering of others (Bellosta-Batalla et al., 2019). Along with perspective-taking, which helps us establish boundaries between our own suffering and that of others, self-compassion has been proposed as an ability that promotes distress tolerance while being attentive and sensitive to our own sources of suffering (Gilbert, 2023). Specifically, self-compassion has been suggested as a foundation for the development of adaptive emotion regulation (Inwood & Ferrari, 2018; Paucsik et al., 2022), potentially leading to enhanced processing of negative emotions (Diedrich et al., 2017). Following Neff (2003), self-compassion involves the ability to respond to one's own suffering with kindness and understanding, to have a cognitive understanding of one's situation as a part of shared human experience, and to pay attention to suffering in a conscious and balanced manner (e.g., soothing distressing emotions). Self-compassion has shown a negative relationship with anger (Neff & Vonk, 2009), a positive correlation with self-control, self-esteem and social connectedness in offenders' samples (Morley et al., 2016) and has been proposed as a buffer against violent criminality (Morley, 2015). Similarly, empirical evidence has revealed effectiveness of self-compassion interventions in reducing criminal thinking (Rezapour-Mirsaleh et al., 2021) and criminal impulsivity in delinquents (Morley, 2018).

Lastly, research on offending behavior has traditionally focused on male populations due to their major representation within the criminal population. It is imperative to acknowledge the existence of female offenders and recognize the

necessity of their inclusion in studies. Thus, a more comprehensive and accurate understanding of criminal behavior can be achieved (Renzetti, 2013).

The main objective of this study is to analyze the predictive value of cognitive (perspective-taking), and affective empathy (empathetic concern and personal distress) on aggression within an offender population consisting of both men and women. We hypothesized that higher levels of perspective-taking and empathetic concern will negatively predict aggression (Jolliffe & Farrington, 2004; Miller & Eisenberg, 1988), while higher levels of personal distress will positively predict higher aggression scores (Palumbo & Latzman, 2021). This study aims to examine the potential mediating role of self-compassion in the relationship between personal distress and aggression within this specific offender population. Drawing from previous literature that suggests self-compassion as a potential distress regulation tool in non-forensic populations (Inwood & Ferrari, 2018; Diedrich et al., 2017), we expect that self-compassion will attenuate the relationship between personal distress and aggression scores.

METHOD

Participants

The sample consisted of 120 offenders, including 90 men and 30 women (see Table 4). The offenders were not imprisoned but sentenced, since, within the Spanish Penitentiary System, custodial sentences for less serious crimes (less than two years) can be substituted by community probation or community psychoeducational treatment programs, all while taking into account the personal characteristics of the offender and the offense (see Organic Law 10/1995, of November 23 of the Criminal Code). The offenses include domestic and intimate partner violence, drug trafficking, offenses against road safety (e.g., driving without a license, speeding, driving under the influence of toxic drugs or alcoholic beverages, driving with manifest recklessness) and offenses against property and the socio-economic order (e.g., larceny, burglary, robbery, fraud). Participants were recruited from different community programs coordinated by the *Service of Management of Penalties and Alternative Measures of Valencia*.

Table 4.

Means (Standard Deviations) and Percentages for Demographic Data for the participants

	Men (<i>n</i> = 90)	Women (<i>n</i> = 30)	Total sample (<i>n</i> = 120)
Age (<i>M</i> , <i>SD</i>)	38.35 (10.62)	37.25 (11.20)	38.09 (10.72)
Marital status (%)			
Married	36	44	38
Single/Divorced/Widowed	64	58	62
Level of education (%)			
No studies	02	04	03
Primary	24	11	21
Secondary/vocational training	57	46	54
University	17	39	22
Nationality (%)			
Spanish	86	79	84
Latin American	09	21	12
Other European countries	04	00	03
Africa	01	00	01
Working status (%)			
Employed	61	36	55
Unemployed	39	64	45
Annual Income (%)			
Low Income	16	15	15
Medium Income	73	85	77
High Income	11	00	08

Note. *M*: Mean; *SD*: Standard Deviation

Researchers were given the opportunity to attend various community programs and inform the participants of the research objectives, while also asking for their voluntary participation in the study, ensuring complete anonymity and confidentiality. For the eligibility of the sample, knowledge of writing and speaking Spanish was required, along with the non-presence of neurological disorders.

The study adhered to the principles outlined in the Declaration of Helsinki and received approval from the Ethics Committee of the University of Valencia (Code: 1563895).

Procedure

The procedure was carried out in one experimental session, in the Psychobiology laboratories at the University of Valencia. First, all participants voluntarily signed a consent form before starting the study. Researchers encouraged participants to ask any possible questions concerning the study throughout the session. The self-reported questionnaires were presented and, finally, information on sociodemographic variables and personal information (age, nationality and delinquent history) was collected through a semi-structured interview.

Measures

Aggression Questionnaire (BPAQ)

The Aggression Questionnaire (BPAQ; Buss & Perry, 1992) is widely recognized as one of the most frequently used psychometric instruments in research on violent behavior. The rating scale consists of 29 items, organized into four factors: physical aggression (9 items), verbal aggression (5 items), anger (7 items), and hostility (8 items). Each item is scored on a 5-point Likert scale, ranging from 1 (Completely false to me) to 5 (Completely true to me). In our study, we utilized the Spanish version of the questionnaire (García-Leon et al., 2002), and Cronbach's alpha coefficient was .92 for our sample.

Interpersonal Reactivity Index (IRI)

The Interpersonal Reactivity Index (IRI; Davis, 1980; 1983) is a commonly utilized tool for assessing empathy-related traits. Comprising 28 items, the ranking of items follows a 5-point Likert scale, ranging from 1 ("doesn't describe me at all") to 5 ("describes me very well"). Spanish adaptation (Mestre, Frías, & Samper, 2004) was used. Cronbach's α was .63 for the total score. It offers a comprehensive evaluation of interpersonal reactivity across four distinct scales: empathic concern, personal distress, perspective-taking and fantasy. In this study, we focused on perspective-taking, empathetic concern and personal distress subscales. Specifically, Perspective-taking focuses on the ability to adopt the psychological point of view of others and see things from their perspective

(e.g., "I sometimes try to understand my friends better by imagining how things look from their perspective"). Empathetic concern makes reference to feelings of compassion, concern, and affection towards the suffering of others (e.g., "I often have tender feelings and concern for people less fortunate than me"). Personal distress subscale reflects an individual's tendency to experience personal discomfort, anxiety, or distress when witnessing or being exposed to the emotional suffering of others (e.g., "I get nervous when others around me are feeling stressed or anxious").

Self-Compassion Scale – Short Form (SCS-SF)

The Self-Compassion Short Form Scale (SCS-SF; Raes et al., 2011), adapted for the Spanish population (García-Campayo et al., 2014), was utilized. This questionnaire comprises 12 items and utilizes a 5-point Likert scale ranging from 1 (almost never) to 5 (almost always) for ranking the responses. SCS-SF covers three distinct theoretical aspects of self-compassion, each characterized by pairs of opposing subscales (i.e., self-kindness and self-judgment, common humanity and isolation, mindfulness and over-identification). Following Neff. (2003), the facet of self-kindness offers an alternative to self-criticism and blame. Recognizing our common humanity acknowledges that suffering is a natural part of life and is interconnected with the suffering of others. This facet is associated with well-being. Furthermore, the facet of mindfulness promotes an attitude of equanimity, rather than over-identification, when confronted with challenging and uncomfortable thoughts and experiences. Cronbach's α was .71 for the total score.

Data Analyses

First, normality of the data was evaluated with the Shapiro-Wilk test ($p < .05$) and the non-normal data, subsequently, was transformed based on a Logarithm base ten (Log_{10}). Second, Pearson's bivariate correlation coefficients were calculated to assess the relationship between aggression, self-compassion, empathy subscale scores (perspective-taking, empathetic-concern, personal distress) and age. Spearman's Rho was used for the correlations of sex due to the categorical nature of the variable. We conducted a multiple regression model to assess whether perspective-taking, empathetic concern and personal distress explained aggression. Accordingly, aggression

was included as a dependent variable and we controlled the potential effect of “age” and “sex” by introducing them as a covariates in Step 0; independent variables (i. e., perspective-taking, empathetic concern and personal distress) were entered in Step 1. Lastly, model 4 of SPSS PROCESS Macro (Hayes, 2017) was conducted to examine the effects (through self-compassion) of personal distress on aggression. Bootstrapping method (5000 bootstrap resamples) was used to estimate the indirect effect with 95% confidence interval (CI). The corresponding effect was considered statistically significant if the 95% CI did not include zero. All continuous variables were standardized before this procedure. Data analyses were conducted by using IBM SPSS Statistics v28.

RESULTS

The correlation analysis revealed that aggression was negatively related to both self-compassion and perspective-taking, whereas it was positively related to personal distress. All associations were statistically significant ($p < .001$). Table 4 presents the descriptive statistics, including means and standard deviations of psychological variables by sex, and Table 5 lists the correlation coefficients of all variables.

Multiple regression models with three predictors (perspective-taking, empathetic concern and personal distress), controlling for age and sex, showed to be significant ($F(5,115) = 9.198, p < .001$, adjusted $R^2 = .26$). Perspective-taking ($\beta = -.360, t = -4.403, p < .001$; collinearity (tolerance, VIF) = .992, 1.01) was negatively associated with aggression. Empathetic concern also showed a negative relation with aggression, although it was not statistically significant as a predictor ($\beta = -.142, t = -1.64, p = .105$; collinearity [tolerance, VIF] = .998, 1.01). Conversely, personal distress showed a significant positive relation with aggression ($\beta = .303, t = 3.50, p < .001$; collinearity [tolerance, VIF] = .929, 1.08). In addition, the effect of age was also found to be significant ($\beta = -.271, t = -3.78, p < .001$, collinearity [tolerance, VIF] = .998, 1.01).

Table 4.

Means (Standard Deviations) for Aggression, Self-compassion, Perspective-taking, Empathetic Concern and Personal Distress

	Men (<i>n</i> = 90)	Women (<i>n</i> = 30)	Total sample (<i>n</i> = 120)
Aggression (<i>M, SD</i>)	74.64 (21.43)	76.50 (21.85)	75.05 (21.45)
Self-compassion (<i>M, SD</i>)	38.62 (7.63)	35.46 (7.72)	37.88 (7.73)
Perspective-taking (<i>M, SD</i>)	23.90 (4.90)	23.96 (4.75)	23.92 (4.85)
Empathetic concern (<i>M, SD</i>)	25.99 (4.16)	26.11 (5.78)	26.02 (4.56)
Personal Distress (<i>M, SD</i>)	16.51 (4.67)	19.32 (4.56)	17.17 (4.83)

Note. *M*: Mean; *SD*: Standard Deviation

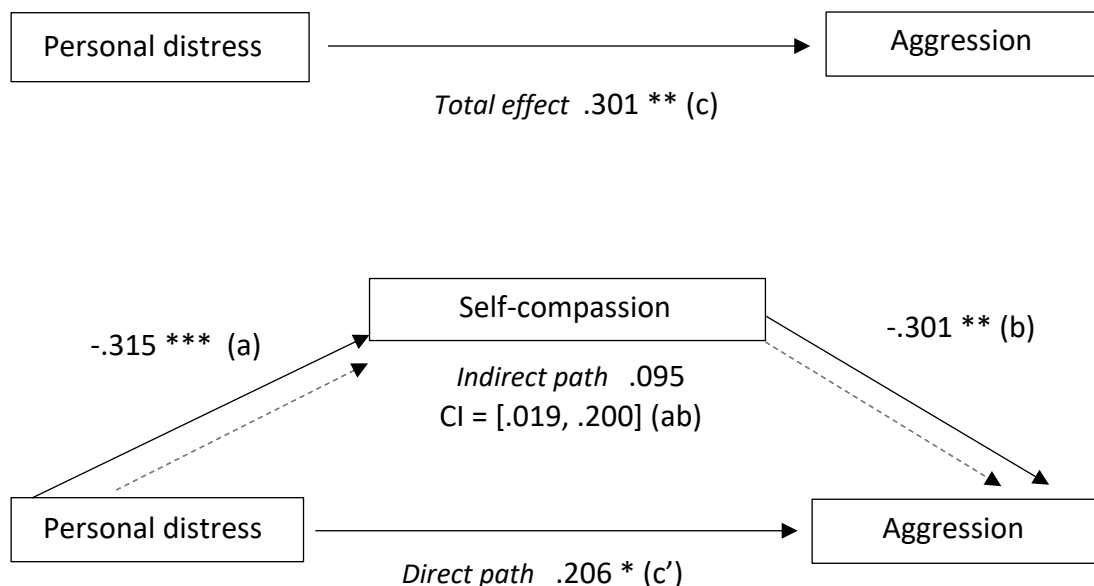
Table 5.

Bivariate correlations between Aggression, Self-compassion and Perspective-taking, Empathetic Concern and Personal Distress

Aggression	--					
Self-compassion	-.401(<.001)	--				
Perspective-taking	-.389(<.001)	.139(.131)	--			
Empathetic concern	-.105(0.254)	-.148(0.106)	.364(<.001)	--		
Personal distress	.316(<.001)	-.375(<.001)	-.205(.025)	-.074(0.422)	--	
Age	-.331(<.001)	.260(.004)	.091(.323)	-.049(.594)	-.142(.123)	--
Sex (Rho Spearman)	.034(.716)	-.174(.057)	.044(.636)	.035(.706)	.257(.005)	-047(.614)

The Hayes SPSS PROCESS macro (model 4) was adopted to examine the mediating effect of self-compassion on the relationship between personal distress and aggression (Figure 9). First, after controlling for the influence of age and sex, the total effect of personal distress on aggression was found to be positive and significant ($\beta = .301$, $t = 3.44$, $se = .087$, $p = .001$, $CI = [.128, .471]$, adjusted $R^2 = .181$). Second, after controlling for the influence of age and sex, personal distress had a significant negative effect on the mediator, self-compassion ($\beta = -.315$, $t = -3.61$, $se = .087$, $p < .001$, $CI = [-.487, -.142]$, adjusted $R^2 = .19$). Third, when adding self-compassion into the regression, while self-compassion had a negative significant effect ($\beta = -.301$, $t = -3.36$, $se = .090$, $p = .001$, $CI = [-.479, -.123]$), personal distress had a significant direct effect on aggression ($\beta = .206$, $t = 2.33$, $se = .088$, $p < .021$, $CI = [.031, .382]$). This model explained 25.4% of the variance (adjusted $R^2 = .254$). Finally, the indirect effect of personal distress on aggression via self-compassion was also significant ($\beta = .095$, boot 95% $CI = [.019, .200]$).

Figure 9. Mediation Model Results



Note. a: association between Personal distress and self-compassion; b: association between Self-compassion and Aggression; c: total effect between Personal distress and Aggression; c': direct effect between Personal distress and Aggression; ab: indirect effect between Personal distress and Aggression via Self-compassion; CI: Confidence Interval. * $p < .05$, ** $p < .01$ and *** $p < .001$

DISCUSSION

The results of our study identified cognitive and affective empathy as predictors of aggression, revealing perspective-taking as a protective factor against aggression and, conversely, personal distress as a precipitator. Age was also shown to have a significant effect for the regression model. Finally, the mediation model showed that self-compassion partially mitigates the positive relationship between personal distress and aggression scores, regardless of age and sex.

Predictive Value of Cognitive and Affective Empathy towards Aggression in Offenders

Our primary aim was to examine the prognostic significance of perspective-taking, empathetic concern, and personal distress in relation to aggression in a sample of offenders composed of both men and women. Our hypothesis was partially confirmed, as our findings were consistent with prior research (Day et al., 2012) that indicates a negative association between cognitive empathy and aggression within the offender population. Relatedly, Martinez et al. (2014) revealed a negative association between higher perspective-taking tendencies and reoffending. Additionally, their study found that offenders with higher levels of perspective-taking were more likely to experience empathetic concern. The preliminary correlation analysis conducted in our sample revealed a positive moderated relationship between perspective-taking and empathetic concern ($r = .364, p < .001$), and a negative relation with personal distress ($r = .205, p = .025$). Evidence suggests that, in order to experience healthy empathy, it might be necessary to maintain a clear boundary between oneself and others, ensuring that their pain is not mistaken for our own (Bellosta-Batalla et al., 2019; Decety & Lamm, 2009; Singer & Klimecki, 2014). However, it is noteworthy that our study did not find any evidence linking empathetic concern to aggression. This lack of association could potentially be attributed to measurement issues, specifically the presence of social desirability bias within the self-report measures used (Vachon et al., 2014), particularly among the offender population when responding to items related to “other-oriented” empathy for unfortunate others. To address this issue, an alternative approach could involve analyzing responses to socio-affective tasks that incorporate different correlates, such as psychobiological measures. This approach may provide a broader

understanding of the construct (Comes-Fayos et al., 2022; Moreno et al., 2023; Sousa et al. 2023).

Concerning the role of personal distress as a contributing factor to aggression, our findings contrast the conventional ideas generally presented in the literature (Blair & Blair, 2009; Jolliffe & Farrington, 2004; Miller & Eisenberg, 1988). It is worth noting that Palumbo and Latzman (2021) found an association between “self-oriented empathy” and aggression in non-forensic populations. It is important to highlight previous research that has explored the empathy construct in offenders’ samples, and has usually reflected in their results affective empathy as a “unified construct” (Jolliffe & Farrington, 2004; Vachon et al., 2014). However, neurosocial research in non-forensic populations has indicated that empathetic concern and personal distress involve distinct subjective processes that are underpinned by different psychobiological mechanisms, including neural circuits and psychophysiological activity (Chierchia & Singer, 2017; Decety & Ickes, 2009; Klimecki et al., 2013; Klimecki et al., 2014 for an in-depth review). For instance, studies examining vagally mediated Heart Rate Variability (vmHRV), which is a reliable biomarker of parasympathetic activity associated to empathy competencies (Yoo & Whang, 2020), and compassion in offender samples (Sousa et al., 2022; 2023), have shown increased activity during empathetic concern but decreased activity during personal distress (Di Bello et al., 2021; 2023; Moreno et al., 2023).

It is suggested that empathetic concern (precursor of compassion) is associated with feelings of warmth, concern and care for others, which in turn promotes positive emotions and might serve as a motivation to enhance the well-being of others (Batson, 2009; Gilbert, 2017). Conversely, individuals who exhibit signs of a lack of perspective-taking, such as difficulties in emotional decoding (Romero-Martinez et al., 2019a), self-other differentiation, and cognitive appraisal of others' suffering (Lamm et al., 2007; Preckel et al., 2018), may be prone to experiencing distress and intensifying negative affect (Singer and Klimecki, 2014), leading to aversive and egocentric responses aimed at alleviating their own distress (Singer and Klimecki, 2014; Bloom, 2017). We propose that aggression might be utilized by offenders as a coping strategy, akin to a fight-or-flight mechanism, to protect themselves from overwhelming negative emotions. Several studies have indicated that offenders may exhibit a tendency to avoid connecting with

the suffering of others (Moreno et al., 2023; Sousa et al., 2022; 2023). Thus, although victim distress may act as an aversive stimulus inhibiting the violent response (Blair & Blair, 2009), resonating with distressing/aversive emotions could lead offenders to avoid them (Moreno et al., 2023; Sousa et al., 2022; 2023), and this avoidance might be linked to the use of violent coping strategies (Jordaan & Hesselink, 2022).

Moreover, it is worth mentioning the importance of moderating variables in experiencing empathy and the manifestation of violent behaviors, such as the social environment (Decety & Lamm, 2006; Moya-Albiol et al., 2010), as well as the attachment style (Cricchio et al., 2022; Miyagawa & Kanemasa, 2022). Adverse childhood experiences might lead to insecure attachments, which in turn predispose individuals to difunctional interpersonal behaviors (Miyagawa & Kanemasa, 2022). These experiences have been closely related to increased impulsivity in general offenders (Zhong et al., 2022) and, more specifically, to higher levels of violence in individuals who engage in battering (Holtzworth-Munroe et al., 2000). Wang and colleagues (2021) also found that offenders who had experienced early relationship trauma exhibited higher levels of personal distress. Consequently, it is of particular importance to incorporate childhood maltreatment in future studies and investigate its relationship with aggression, empathy, and self-compassion.

The Mediating Role of Self-Compassion between Personal Distress and Aggression

Secondly, the objective was to explore the mediating role of self-compassion in the relationship between personal distress and aggression among a sample of individuals who have committed offenses. In line with our hypothesis, the mediation model indicated that self-compassion could potentially act as a mitigating factor in the association between personal distress and aggression, regardless of age and sex. The partial mediator, self-compassion, was found to be negatively related to both personal distress and aggression. The literature has proposed self-compassion as an attitude of acknowledging and experiencing painful emotions with kindness, understanding, acceptance and tolerance (Neff et al., 2007). This approach may serve as a basis for enhancing emotional regulation (Pauksik et al., 2022), enabling individuals to distance themselves from personal distress and facilitating a healthier expression of empathy

(Neff & Pommier, 2013). In this sense, in non-forensic populations, the three opposite factors of self-compassion (i.e., self-judgment, sense of isolation and overidentification) have been associated with mental health problems (Gilbert et al., 2023; Pandey et al., 2021). From a social mentality perspective, self-compassion could elicit “self-soothing feelings” associated with security and connectedness, thereby inhibiting threatening perceptions evoked by distress and steering individuals away from dysfunctional coping strategies (see Gilbert, 2010; 2023 for an in-depth review). Additionally, self-compassion has been positively linked to self-control in offender populations (Morley, 2016) and negatively related to psychological and neurological traits associated with criminal behavior (Morley, 2018) including aggression (Murphy et al., 2005). Particularly, since research has shown that self-compassion might function as a buffer against aggressive reactions (Miyagawa & Kanemasa, 2022; Wu et al., 2019), some interventions aimed at different offender profiles have focused on cultivating compassion both towards oneself and others (Browne et al., 1997; Ribeiro Da Silva et al., 2021). Training in self-compassion could offer valuable resources to offenders, enabling them to better comprehend and accept themselves (Neff, 2003), especially if they have experienced childhood mistreatment (Zhong et al., 2022). Nevertheless, the existing literature is still limited. Conducting further research in this area would contribute to a broader understanding of these constructs.

Contrary to our findings, a study examining the relationship between self-compassion and predictors of criminal behavior in a sample of adolescent offenders revealed no significant association between self-compassion and aggression. However, they found a positive correlation between self-compassion and self-control (Dávila-Gomez et al., 2020). In our study, we observed in the preliminary analyses, a positive correlation between age and self-compassion ($r = 0.260, p = 0.004$), as well as a negative correlation between age and aggression ($r = -0.331, p < 0.001$). Age emerged as a significant predictor in the multiple regression model for aggression. However, it did not reach significance in the mediation model examining the relationship between personal distress, self-compassion and aggression. These findings suggest that age may play a moderating role in the association between empathy, self-compassion, and aggression

within the offender population. Therefore, further investigation incorporating age as a potential moderating variable might be needed.

Limitations, Strengths and Future Directions

It is important to acknowledge the limitations that impact the generalizability of our findings. Firstly, the sample size was relatively small, which can be attributed to the challenges involved in recruiting participants from this specific population, especially women, who represent approximately 7% of the Spanish offender population (Consejo del Poder Judicial, 2022). It is crucial to take into consideration the heterogeneity of offenders' profiles and motivations when interpreting the results, as our sample encompasses a variety of crimes, including both violent and non-violent offenses. Moreover, it is important to note that the offenders included in this study were convicted of minor offenses. Therefore, conducting studies with larger samples and conducting in-depth investigations into the different typologies of offenses would significantly contribute to enhancing our understanding of the constructs under investigation (Palumbo & Latzman, 2021). The use of “paper-and-pencil” measures to assess empathy, self-compassion and aggression in this study may be seen as limited in capturing the complete complexity of these multidimensional constructs. As mentioned previously, incorporating complementary tools, such as psychobiological markers that mitigate self-report biases in offender populations (Comes-Fayos, 2022; Moreno et al., 2023; Pinto et al., 2010), along with implementing empathy and self-compassion interventions (Klimecki et al., 2013; 2014; Morley, 2018), could provide a more comprehensive understanding of these constructs. By integrating additional methodologies, we can enhance our understanding of empathy, self-compassion, and aggression in a more holistic manner.

Despite the aforementioned limitations, the present study provides valuable insights into the relationship between aggression, empathy components and self-compassion within the offender population. This investigation offers a more nuanced understanding of the multidimensional nature of affective empathy by examining its subcomponents separately and exploring their associations with the construct of aggression. Moreover, the inclusion of the self-compassion construct in the field of

criminology is relatively novel and has shown promising results as a complementary tool for offender intervention (Morley, 2018; Rezapour-Mirsaleh et al., 2021). It could be particularly useful in prevention and/or intervention programs that include therapeutic modules working on protective factors such as fostering empathy and emotional regulation. Additionally, effective tools for assessing protective factors (both internal and external) in offenders, such as the Structured Assessment of Protective Factors (SAPROF; De Vogel et al., 2012) might prove helpful for evaluating treatment progress and preventing future violent episodes (de Vries Robbé & Willis, 2017). It is of utmost importance, both professionally and scientifically, to include women in research on offending and ensure their adequate representation in such studies (Renzetti, 2013). In this study, Spearman correlations revealed a difference in personal distress between men and women ($r = .257, p = .005$), however in this case sex did not show any significant effect on any regression model. Nonetheless, further research with larger samples may be necessary to delve deeper into this aspect. Additionally, self-compassion has shown promise as a valuable tool for female offenders (Ptacek & Daubman, 2018). Therefore, ensuring gender diversity in the study of these constructs is crucial for creating gender-responsive programs that address the realities of women's lives.

Findings suggest that fostering healthy empathy may act as a protective factor against aggression in the offender population, with self-compassion potentially facilitating this process. By exploring these constructs, this study aims to enhance our understanding and provide valuable insights for the development of gender-inclusive prevention and intervention programs that effectively address aggression tendencies in offenders, thereby reducing recidivism rates.

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GENERAL DISCUSSION

This Doctoral Thesis has compared the response of the PNS during a compassion-eliciting task in a heterogeneous sample, including offenders and participants with no criminal history. It has also analyzed the emotional and behavioral response to the task and their relationship with PNS-cardiorespiratory variables. Furthermore, it has delved into the role of empathy as a protective factor against violence and self-compassion as a mediator between personal distress and violence.

The first objective aimed to compare PSN-cardiorespiratory, affect responses, and prosocial behavior during the compassion-eliciting task among IPV perpetrators and female offenders, along with their respective control groups. In line with our hypotheses, the results of *Study 1* showed that IPV offenders exhibited lower vmHRV, reflected in the RMSSD and RSA indexes during the compassion task, compared to the control group without a criminal history. However, no significant differences were observed between IPV offenders and GO, nor between the latter and the group without a criminal history. The most relevant findings were obtained during the Triggering-emotion period, where IPV offenders showed a decrease in vmHRV, while participants without a criminal history experienced an increase. Meanwhile, in *Study 2*, which examined female offenders compared to a control group without a criminal history, the main differences in vmHRV were also identified during the Triggering-emotion period. In line with the hypotheses, female offenders exhibited a slight reduction in RMSSD, while controls experienced an increase. Additionally, higher HR was observed in female offenders compared to control women during the connection with suffering.

The findings of both studies align with previous research conducted in the general population, which has linked higher vmHRV activity with greater empathy competencies (Yoo & Whang, 2020), increased compassion (Kim et al., 2020), and more specifically, higher sensitivity to suffering (Di Bello et al., 2020). Elevated vmHRV activity has been suggested to be crucial in caregiving relationships and healthy interactions (Petrocchi & Cheli, 2019). Additionally, compassion has been associated with lower HR (Stellar et al., 2015). In concordance, our findings suggest that groups without a criminal history were able to effectively mobilize parasympathetic resources, linked to the *soothing system*, especially during the period of connection with others' suffering.

Several studies conducted in offender samples have suggested that difficulties in flexibly mobilizing the PNS are related to the avoidance of connecting with suffering (Sousa et al., 2022; 2023), especially in IPV offenders compared to non-offender groups (Comes-Fayos et al., 2024).

The observed decreases in the PNS response in IPV and female offenders during emotional induction could reflect psychophysiological responses characteristic of the *threat system* (Sousa et al., 2022; 2023). *Threat system's* hyperactivity has been linked to reduced executive functions, increased social isolation and rumination, as well as increased vulnerability to the development of psychopathologies (Mobbs et al., 2020; Rodrigues et al., 2009). All of these are potential risk factors for violent behavior and criminality (Bonta and Andrews, 2016; Li et al., 2019; Moya-Albiol & Romero-Martinez, 2020). Therefore, the described socio-affective deficits in IPV populations (Comes-Fayos et al., 2022; Romero-Martínez et al., 2019; Ulloa & Hammett; 2016), along with emotional challenges observed in female offenders (van der Knaap et al., 2012; WHO, 2007), could be related to attenuated PNS activity in response to compassion, as well as underdeveloped or dysfunctional activation patterns of the *soothing system* (Sousa et al., 2022; 2023). This could increase the likelihood of manifesting violent and/or antisocial reactions among these populations (Gilbert, 2020; 2023).

Nonetheless, regarding the cardiorespiratory response to the Call-to-action period (the second part of the task) focused on compassionate motivation, the results of *Study 1* indicated that IPV perpetrators exhibited lower vmHRV compared to men without a criminal history. However, in *Study 2*, both groups showed a convergence in their vmHRV, as female offenders presented an increase in RMSSD while the control group exhibited a decrease. Simultaneously, in *Study 2*, a decrease in HR was observed in the female offender group, while the control group of women showed an increase. In this sense, it might be relevant to consider the dynamic nature of social demands (Muhtadie et al., 2015). The Call-to-action period fundamentally involves an economic decision-making process, potentially associated with an increase in SNS activity instead of the PNS (Muhtadie et al., 2015), which may be associated with the *drive system*. Therefore, the increase in vmHRV and the decrease in HR during the Call-to-action period, after connecting with suffering, could indicate lower parasympathetic flexibility

in the female offender group when faced with the demand to attend to others' needs. This suggests the importance of future research delving into the understanding of adaptive psychophysiological changes to meet social demands at specific moments in offender samples (Miller, 2018).

Nevertheless, all groups, regardless of their condition, showed an increase in vmHRV during the recovery period compared to the beginning of the task. Additionally, in the case of *Study 2*, the increase in vmHRV in women was accompanied by a reduction in HR. In relation to this, Di Bello et al. (2021) revealed that participants from the general population exhibited an increase in vmHRV after observing compassionate actions. Hence, our findings may suggest that engaging in compassion is associated with a subsequent rise in parasympathetic response, possibly attributed to the mobilization of self-regulation resources (Di Bello et al., 2020; 2021; Laborde et al., 2017), including within criminal populations. However, further research on the concept of compassion, particularly in offenders, is needed since both HR/vmHRV variables depend on sample characteristics, experimental tasks, and their emotional valence (de Looft et al., 2022).

On another note, contrary to what was hypothesized, no differences were observed in the emotional response to the task among any of the groups. This could be attributed to the susceptibility of self-reported questionnaires to biases, especially in the offender population, due to their lower ability to perceive their own emotional states (Garaigordobil & Peña-Sarrionandia, 2015; Sousa et al., 2022). In line with this, as mentioned, the psychophysiological results observed during the Triggering-emotion period in both offender groups could be associated with fears, blocks and/or resistances towards connecting with one's own suffering and that of others. This could lead to the development of compensatory mechanisms for self-protection, such as the avoidance of negative emotions (Gilbert, 2020; 2022; Sousa et al., 2023), which in turn would favor biases in self-reports. Therefore, the importance of including psychophysiological variables alongside the use of self-reported questionnaires in the research on socio-affective functions, such as compassion, in offender populations should be emphasized (Moya-Albiol et al., 2017; Moya-Albiol & Romero-Martínez, 2020).

Regarding the relationship between PNS cardiorespiratory variables and affect, in *Study 1*, we investigated whether vmHRV could explain the change in the affective response to the task. We expected that the entire sample would show a better mood linked to a higher phasic vmHRV response. We observed that a higher RMSSD during the task was related to a decrease in negative affect. These findings seem to be in line with studies that have evaluated tonic vmHRV in the general population, which has associated higher vmHRV with a better ability to accept negative emotions (Visted et al., 2017), as well as higher attempts to suppress negative emotions in social interactions (Smith et al., 2011). However, further research using phasic measures of vmHRV is needed.

Furthermore, no differences were found in the behavioral outcomes related to the prosocial task in either of the two studies. Regarding this, in addition to being scarce, research has shown empirical discrepancies regarding emotional inductions and prosocial response in offender populations. Hence, there are studies indicating behavioral differences between violent offenders and participants without a criminal history (Mayer et al., 2018) while others studies do not find such differences (Comes-Fayos et al., 2022). The inconsistency in the outcomes may be partly attributed to the diversity of prosocial tasks utilized during the assessment. Additionally, their ecological validity should be questioned when employed in contexts involving samples with a criminal history (Bo O'Connor et al., 2022). Nevertheless, our findings indicate that offenders have the capacity to engage in prosocial behaviors. In other words, having a criminal history is not incompatible with showing compassionate motivation, an aspect that would be interesting to explore in future studies.

To conclude the first objective, in *Study 2*, we analyzed whether variations in HR/vmHRV were related to the amount donated during the prosocial task. We expected to find higher HR and vmHRV associated to larger donated amounts (Di Bello et al., 2023; Yu & Hao; 2023). However, no differences were found in phasic HR. Additionally, the results indicated that only among the control group did participants with lower phasic RMSSD make greater donations. Therefore, we could conclude that higher prosocial behavior would only be related to a reduction in the functioning of the PNS in women without a criminal history. This aligns with previous research in the general population,

suggesting the existence of greater parasympathetic flexibility in response to a specific social demand (Miller, 2018; Muhtadie et al., 2015). Given that, from the Triggering-emotion period to the Call-to-action period, female offenders maintained an increasing trend in the PNS, while control women decreased it, we would infer a lower parasympathetic flexibility toward compassion in female offenders, and specifically regarding compassionate motivation.

The second general objective of this doctoral thesis, addressed in *Study 3*, was to investigate the predictive capacity of different empathy components as protective factors against violent behavior in a sample of male and female offenders. Our hypotheses were partially supported, as a negative association between perspective-taking and self-reported violence was observed. These findings were consistent with previous literature associating greater perspective-taking with lower violence and criminality (Day et al., 2012; Jolliffe & Farrington, 2004; Martinez et al., 2014). However, no relationship was shown to exist between empathic concern and violence. This outcome could be attributed to measurement issues, specifically related to social desirability biases (Vachon et al., 2014), especially when it comes to the offender population responding to elements related to empathy towards others in unfortunate circumstances. For all these reasons, it would be interesting to use complementary psychobiological markers in the analysis of socio-affective responses (Comes-Fayos et al., 2022; 2024).

Furthermore, in line with our hypotheses, greater personal distress predicted higher self-reported violence (Palumbo & Latzman, 2021). These results contrast with the general view presented by the literature that points to affective empathy as a protective factor against violent behavior (Jolliffe & Farrington, 2004; Miller & Eisenberg, 1988). Nevertheless, it is important to note that affective empathy, when relating it to violence, has generally been regarded as a unified construct (Vachon et al., 2014). However, various research studies in social neuroscience have indicated a differentiation between affective empathy oriented towards others (empathic concern) and that oriented towards oneself (personal distress), as they involve different subjective processes and there is evidence suggesting that they are supported by different neurophysiological mechanisms (Chierchia & Singer, 2017; Decety & Ickes,

2011; Klimecki et al., 2014; Klimecki & Singer 2017). Consequently, it has been suggested that empathic concern, associated with feelings of warmth and care, could serve as motivation for prosocial behavior (Gilbert, 2017). Meanwhile, individuals who resonate with the emotion but have difficulties in perspective-taking might be susceptible to experiencing discomfort and intensifying negative affect that empathizing with others can evoke (Singer and Klimecki, 2014). In the analyzed sample, we propose that aggression could be used by offenders as a coping strategy, similar to a fight-or-flight mechanism, to protect themselves from overwhelming negative emotions (Bloom, 2017).

Finally, and as expected, self-compassion emerged as a mediator between personal distress and violence, attenuating the relationship between the two. This finding aligns with prior research in offender populations, which has positively linked self-compassion with self-control (Morley, 2016) and negatively with psychological and neurological traits associated with criminal behavior (Morley, 2018). Thus, in the general population, self-compassion has been pointed out as an emotional management tool that promotes feelings related to the *soothing system* (Gilbert, 2023; Paucsik et al., 2022). Additionally, recent examples of interventions with offenders have focused on promoting self-compassion, finding various significant changes in psychosocial risk factors after the program's implementation (Morley, 2018; Rezapour-Mirsaleh et al., 2021). Hence, cultivating self-compassion in offenders could help inhibit the threat perception provoked by personal distress, thus reducing dysfunctional coping strategies, such as violence (Gilbert, 2023; Miyagawa & Kanemasa, 2022).

General limitations

There are several limitations that may affect the generalization of our results. Primarily, the sample size represented a significant limitation due to the challenge in recruiting participants with a criminal history, especially women, given their lower crime rate (Belknap, 2020). Thus, it was not possible to obtain a specific group of women who had committed domestic or interpersonal violence, preventing a comparison between criminal typologies. Additionally, due to the intrinsic nature of IPV/gender violence

(following the Organic Law 1/2004), a comparison between men and women was not considered. In this regard, the heterogeneity of offenders' profiles should be taken into account, as our sample encompasses a spectrum of minor offenses. Hence, for future research, it would be important to collect larger samples and aim to create homogeneous groups, differentiating between various classifications, such as violent and non-violent crimes. Furthermore, it would be of particular interest to analyze samples of serious crimes and, for rehabilitation purposes, consider the effect of the prison environment.

It was not feasible to explore the presence of antisocial and psychopathic traits, which have been highlighted as relevant in measuring vmHRV in offenders (de Looft et al., 2022; Palix et al., 2022). Moreover, some scientific investigations analyzing psychophysiological variables involved in violence have distinguished between reactive and proactive violence profiles (Murray-Close et al., 2017; Thomson et al., 2021). Therefore, it would be interesting for future research to explore socio-affective functions, such as compassion, and their interactions with different offender profiles. Several studies have also indicated that offenders are more likely to experience adversity and/or violence in their childhood (Bonta & Andrews, 2016; Graf et al., 2021; Hales et al., 2023). This aspect could have repercussions on their psychophysiological response (Hagan et al., 2020; Zhang & Gao, 2015), as well as on how they experience compassion, potentially generating fears, blocks and/or resistances (Gilbert, 2005; 2023). Therefore, the childhood development environment and possible victimization processes could be relevant factors to consider in future studies.

On another note, our procedure was created *ad hoc* to align with compassion components, and the video used in emotional induction had not been previously validated with a large sample of participants. However, it was created by the United Nations and has been used in other research as a tool for affective inductions (Schutte & Stilić, 2017; Jones and Dawkins; 2018). Some authors have also noted the potential use of VR devices in emotion-related research (Ventura et al., 2020), including criminal populations (Dellazizzo et al., 2019). However, it should be noted that the main character for emotional induction was a Syrian girl. Therefore, another limitation of this experiment is the lack of consideration of possible biases, including those related to

racism. Additionally, IPV perpetrators may have distorted perceptions of the female gender in general, including girls, which could affect their ability to empathize (Eckhard et al., 2012). In the second part of the task, it should be considered that donations could be subject to social desirability biases and personal preferences towards NGOs (Berman et al., 2016).

Moreover, it is essential to highlight that self-compassion has been assessed solely through a self-reported questionnaire. Therefore, incorporating complementary tools, such as psychobiological markers, along with the implementation and evaluation of interventions that integrate self-compassion (Klimecki et al., 2014; Morley, 2018), could provide a more comprehensive understanding of this construct. By combining diverse methodologies, we can enhance our comprehension of empathy, self-compassion, and violence.

Theoretical-practical applications and future directions

Taking into account the aforementioned limitations, the results of this Doctoral Thesis provide relevant information about the intricate relationship between compassion, criminality, and the PNS. Additionally, it explores the multidimensional nature of affective empathy, its connection to violence, and the mediating role of self-compassion. New insights are provided into the socio-affective characteristics of male and female offenders, which could contribute to equipping prevention and intervention programs with new effective tools.

Psychobiological variables are incorporated into the profiles of men and women offenders from a neurocriminological perspective. Without overlooking the social nature of crime, this approach has the potential to provide a more comprehensive and inclusive explanation for this issue (Bedoya & Portnoy, 2023; Moya-Albiol et al., 2017; 2022; Romero-Martinez et al., 2021). Nevertheless, it may be of particular interest for future studies to include other types of biomarkers linked to social functioning in the study of compassion, such as hormonal markers (oxytocin, vasopressin, testosterone, and/or cortisol; Rockliff et al., 2008) or neuroimaging techniques (Chierchia & Singer, 2017). This would serve to enhance the understanding of socio-affective functioning and

the choice of coping strategies based on violence. Moreover, in terms of research, the use of psychobiological markers could help complement self-reported questionnaires by offering a broader understanding of individuals who commit criminal acts (Choy et al., 2017)

Furthermore, it has been suggested that self-observation of bodily signals, such as vmHRV parameters, could provide individuals with awareness of their emotional state, thereby promoting effective self-regulation (Pinna & Edwards, 2020). Specifically, the development of interoceptive skills has been linked to the ability to regulate negative emotions (Füstös et al., 2012), suggesting that incorporating vmHRV training into interventions with offenders could enhance their ability to self-regulate in high arousal situations, such as anger, helplessness, or distress (Argese et al., 2020). Hence, future research should delve deeper into the relationship between vmHRV, interoception, and emotional processing within criminal populations, as this could provide effective tools for prevention and treatment.

Finally, there is a need to deepen the study of compassion and self-compassion as tools to address one's own and others' suffering in a regulated manner within criminal samples. Recent interventions with offenders of various ages have focused on cultivating these tools and have found a decrease in some risk factors or vulnerabilities such as impulsivity (Morley, 2018), criminal thinking (Rezapour-Mirsaleh et al., 2021), and psychopathic traits, the latter being related to insensitivity (Ribeiro da Silva et al., 2021; Rijo et al., 2023). Therefore, integrating the analysis of compassion and self-compassion-based training, such as adaptations of CFT or PSYCHOPATHY.COMP could be useful in overcoming fears, blocks, and resistances towards compassion, fostering greater emotional regulation and a predisposition towards engaging with suffering and seeking prosocial behavior (Di Bello et al., 2020; Gilbert, 2020; 2023; Morley, 2018; Rezapour-Mirsaleh et al., 2021; Ribeiro da Silva et al., 2021). Similarly, it could be particularly useful for prevention and/or intervention programs to include therapeutic modules focused on protective factors, such as promoting healthy empathy, compassion, and self-compassion.



CONCLUSIONS

1. The relationship between compassion and criminality was investigated from a neurocriminological perspective, since crime and violence are multifactorial phenomena that need to be addressed through an interdisciplinary approach.
2. Experiencing compassion and engaging in compassionate motivation trigger complex interactions within the ANS, particularly involving the PNS, and more specifically, the parasympathetic flexibility.
3. IPV offenders show lower vmHRV activity when confronted with suffering compared to men without a criminal history, which may reflect a difficulty in connecting with others' suffering.
4. No significant differences were observed between IPV perpetrators and GO in the compassion-eliciting task, nor between GO and the group without a criminal history.
5. Female offenders exhibited lower parasympathetic flexibility than the group without a criminal history in response to the compassion-eliciting task, especially when connecting with others' suffering and addressing compassionate motivation.
6. All participants showed an increase in vmHRV after the compassion-eliciting task. In this regard, there was an increase in parasympathetic activity after being exposed to a compassionate experience.
7. There were no differences between offenders and non-offenders in self-reported affect and prosocial behavior towards the compassion-eliciting task.
8. Higher vmHRV explained lower self-reported negative affect after the compassion-eliciting task across all men.
9. Lower vmHRV explained a higher number of donations only among the group of women without a criminal history, as compared to women offenders.

10. Perspective-taking emerged as a protective factor against violence, whereas personal distress was revealed as a precipitating factor in the criminal population.
11. Self-compassion was identified as a partial mediator between personal distress and violence in both men and women offenders.
12. The importance of using biomarkers in the study of criminogenic factors is emphasized. Understanding the dynamic profile of offenders in response to socio-affective tasks could effectively complement intervention and prevention programs.



DOCTORADO INTERNACIONAL / ESPAÑOL

RESUMEN

La conducta violenta y la delincuencia representan problemas complejos de salud pública que conllevan costes elevados a nivel social, económico y, sobre todo, humano. Por esta razón, un creciente cuerpo de investigación interdisciplinaria se esfuerza por entender los mecanismos subyacentes a estos fenómenos. En este sentido, la Neurocriminología incluye en su abordaje las variables psicobiológicas y sus interacciones con los factores ambientales y la experiencia, con el objetivo de lograr una comprensión más holística e integradora de estos aspectos. Desde esta perspectiva, el comportamiento criminal es el resultado de un conjunto de condiciones y circunstancias, incluyendo contextos socioculturales y experiencias. Asimismo, se propone la existencia de factores predisponentes o de vulnerabilidad hacia la violencia y la delincuencia. Además, el estudio de las variables psicobiológicas podría proporcionar conocimientos fundamentales sobre los procesos cognitivos y emocionales de la población delictiva, contribuyendo a evitar los sesgos de los cuestionarios autoinformados.

Entre los indicadores psicobiológicos utilizados en el estudio del comportamiento delictivo, se ha sugerido que la actividad del Sistema Nervioso Autónomo (SNA) podría ser un marcador de la respuesta emocional, relacionada con el comportamiento violento y la delincuencia. Específicamente, el sistema nervioso simpático (SNS) ha sido ampliamente estudiado posiblemente debido a su estrecha relación con la respuesta *fight-or-flight* en el procesamiento de las amenazas. Sin embargo, el sistema nervioso parasimpático (SNP), el cual ejerce una influencia inhibitoria sobre el SNS, regulando a la baja la respuesta *fight-or-flight*, ha sido menos estudiado. En relación a esto, la desaceleración de la frecuencia cardíaca (HR) se ha asociado con la influencia del SPN en la actividad cardiovascular. De forma particular, la en la literatura destaca el estudio de la actividad del SNP a través del biomarcador de la variabilidad cardíaca (vmHRV). Este biomarcador refleja el impacto del nervio vago, el principal nervio del SNP, en la actividad cardíaca, indicando con ello una mayor actividad del SNP. Ambos marcadores han sido empleados en el estudio de múltiples constructos psicosociales, incluyendo el comportamiento violento.

Además, los estudios sobre la delincuencia y la violencia, y más concretamente sobre la actividad del SNP, se han centrado predominantemente en el estudio de factores de riesgo a través de paradigmas basados en el conflicto, el miedo o la ira. Sin embargo, profundizar en la comprensión de los factores protectores y su interacción con el SNP, mejoraría la capacidad de complementar de forma efectiva los programas de intervención y prevención. En este sentido, existe un cuerpo de literatura cada vez más extenso que examina cómo los estados y emociones positivas podrían contribuir a mitigar el riesgo en la población delincuente. En las últimas décadas, estos estudios han incorporado la medición de algunos correlatos psicobiológicos.

Uno de los constructos propuestos como regulador del comportamiento violento y criminal es la compasión, que, desde un punto de vista evolutivo, surge de las motivaciones de *compartir y cuidar* en ausencia de amenaza y necesidad, permitiendo así la creación de vínculos saludables. Desde una concepción amplia, se ha definido como la sensibilidad hacia el sufrimiento propio y de los demás, acompañada de la motivación para aliviarlo o prevenirlo. En este sentido, será necesario poseer la habilidad de reconocer y abordar el sufrimiento de manera saludable. En consecuencia, para poder desarrollar la compasión, se necesitarían competencias empáticas, las cuales han sido frecuentemente entendidas como un factor protector contra la conducta violenta. Debido a que los estímulos que desencadenan la compasión pueden estar asociados con la angustia, se requiere una toma de perspectiva que preserve la distinción entre las experiencias de los demás y las propias. De lo contrario, el contacto con el sufrimiento generaría angustia empática, provocando reacciones emocionales adversas como la tristeza o la ansiedad. Por tanto, la respuesta empática se orienta hacia el alivio del propio malestar, lo cual incluso podría desencadenar una respuesta violenta como estrategia de afrontamiento. Debido a ello, se ha sugerido que para experimentar compasión es necesario un manejo emocional efectivo y adecuado. En relación a esto, la autocompasión, ha sido propuesta como herramienta para fomentar la tolerancia al propio malestar, al mismo tiempo que ayuda al cultivo de la atención y sensibilidad hacia nuestras propias fuentes de sufrimiento, mejorando con ello el procesamiento de las emociones negativas.

La compasión combina una evaluación del sufrimiento de los demás con sentimientos de seguridad propios, generando emociones positivas, como la aceptación y la ternura, capaces de reducir las tendencias hacia la propia angustia. Por ello, se ha relacionado con una mejora del afecto. Se ha sugerido que es desde ese estado donde surge la motivación compasiva como un factor externalizado de la compasión. Esta intención de aliviar el sufrimiento estaría íntimamente ligada a la conducta prosocial, que a su vez se ha postulado contraria al comportamiento agresivo, puesto que facilitaría las interacciones positivas. En este sentido, la compasión ha sido conceptualizada, tanto a nivel teórico como en su aplicación práctica a través de la *Compassion Focus Therapy* (CFT), en el modelo tripartito de regulación emocional vinculado a funciones adaptativas (*amenaza, logro y calma*) dentro del denominado *sistema calma y satisfacción*. Un sistema ligado al afecto positivo y a sentimientos de seguridad, cuidado y conexión interpersonal.

A nivel psicofisiológico se ha propuesto que el acto de dar y recibir cuidado ha tenido a lo largo de la evolución un impacto sustancial en los circuitos neurofisiológicos, especialmente en la mielinización del nervio vago. Así, una mayor actividad del SNP, y concretamente de vmHRV, se ha relacionado en poblaciones generales con mayores habilidades empáticas, mayor autorregulación emocional, mayores capacidades para la creación de vínculos saludables y con experimentar compasión. Asimismo, se ha estudiado la capacidad de adaptación dinámica de la vmHRV frente a cambios en el entorno, refiriéndose a ella como flexibilidad parasimpática. Dada la naturaleza cambiante de las demandas sociales esta mayor flexibilidad se ha asociado con una elevada sensibilidad social y flexibilidad conductual.

Respecto al análisis del SNP en poblaciones delictivas al experimentar compasión, investigaciones recientes que han empleado inducciones emocionales estrechamente relacionadas con la compasión, han mostrado una menor vmHRV en jóvenes delincuentes en comparación con grupos control al enfrentarse a estímulos afiliativos relacionados con el *sistema de calma*. Igualmente, se ha evaluado la vmHRV en jóvenes delincuentes con rasgos psicopáticos antes y después de la implementación del programa de intervención PSYCHOPATHY.COMP. Este programa, basado en la CFT, buscó promover el cultivo del *sistema de calma* y la compasión. Tras haber sido

impartido el programa de intervención, se observó una mayor recuperación de la vmHRV tras presentarles estímulos relacionados con el *sistema de calma*, indicando en la población delincente una mayor flexibilidad parasimpática. Estos resultados se mantuvieron hasta los seis meses posteriores a la intervención. Así, se ha propuesto que la compasión podría actuar como un regulador fisiológico del procesamiento de amenazas al dirigir al individuo a ser sensible al sufrimiento de los demás y a incentivar una respuesta para prevenirlo o aliviarlo.

Teniendo en cuenta todo lo mencionado previamente, esta Tesis Doctoral tiene como objetivo principal investigar, desde una perspectiva neurocriminológica, cómo diversas poblaciones delictivas, especificadas a continuación, experimentan la compasión. Además, se busca analizar la relación entre los distintos componentes de la empatía y la conducta violenta, así como el papel mediador de la autocompasión entre la angustia empática y la conducta violenta. Con el propósito de abordar estos objetivos, se implementó la siguiente metodología distribuida entre los tres estudios:

La muestra inicial estaba compuesta por un total de 200 participantes (130 hombres y 70 mujeres). Los cuales se distribuyeron en los siguientes grupos según los estudios:

- ✱ Para el *Estudio 1* la muestra se compuso finalmente de 124 participantes tras aplicar varios criterios de exclusión: 39 hombres penados por violencia de género (VG), 42 hombres penados por delitos de distinta índole y 43 hombres sin historial delictivo.
- ✱ Para el *Estudio 2* la muestra se compuso finalmente de 66 participantes tras aplicar varios criterios de exclusión: 31 mujeres penadas y 35 mujeres sin historial delictivo.
- ✱ En el *Estudio 3* la muestra se compuso de 120 participantes: 90 hombres y 30 mujeres.

La muestra de delincentes fue seleccionada entre participantes condenados por delitos con penas suspendidas, no superiores a dos años de prisión. Los participantes fueron

reclutados de diversos programas de intervención o comunitarios gestionados por el Servicio de Gestión de Penas y Medidas Alternativas de Valencia. Se incluyeron delitos de violencia doméstica y VG, delitos contra la salud pública y delitos contra la propiedad y el orden socioeconómico. De otro lado, los participantes sin historial delictivo fueron reclutados a través de anuncios en redes sociales.

El procedimiento se llevó a cabo en una sesión experimental en los laboratorios de Psicobiología de la Universitat de València, con una duración aproximada de 60 minutos. En primer lugar, los participantes firmaron voluntariamente un formulario de consentimiento informado antes de ser incluidos en el estudio. Seguidamente, fueron acomodados en una habitación con una temperatura constante (21 ± 1 °C) y se obtuvieron medidas antropométricas (peso y altura). Posteriormente, se les colocó el dispositivo electro-psicofisiológico VU-AMS y se registró un período de estado de reposo de 5 minutos. Al mismo tiempo, se recopilaron cuestionarios sobre sus estados de ánimo utilizando el *Positive and Negative Affect Schedule*.

Antes de comenzar la tarea se dieron instrucciones a los participantes para asegurar que todos recibieran la misma información y estuvieran preparados para la inducción afectiva. Se les indicó que “trataran de ponerse en el lugar de los personajes del video”. Luego, se les colocó el dispositivo de realidad virtual *Oculus Quest 2* (período anticipatorio, 5 minutos). A continuación, se llevó a cabo la Tarea de Compasión utilizando un paradigma de inmersión en realidad virtual 360° creado *ad hoc* con una duración total de 20 minutos. Esta tarea se dividió en dos partes, representando las subdivisiones del constructo de compasión: *Triggering-emotion* y *Call-to-action*.

En primer lugar, en el periodo *Triggering-emotion* o de conexión con el sufrimiento, los participantes vieron la adaptación del documental de las Naciones Unidas *Clouds Over Sidra*, que muestra a una joven llamada Sidra dando un recorrido por un campo de refugiados en Siria. Sidra muestra a su familia, su aula y otras partes del campo, y habla sobre las condiciones de vida que atraviesan con la esperanza de que las circunstancias cambien pronto y tengan una vida mejor en el futuro. Aunque el estímulo presentado a los participantes tiene la intención de provocar una reacción emocional y hacer que los participantes se conecten con el sufrimiento de otros, este

paradigma de inducción emocional no fue diseñado para provocar angustia, ya que los personajes se encuentran atendidos y tranquilos a pesar de estar en condiciones precarias debido a las consecuencias de la guerra.

Continuamente en el periodo Call-to-action o de llamada a la acción, la segunda parte de la tarea dentro de la experiencia de realidad virtual, se propuso una actividad prosocial donde los participantes tuvieron la oportunidad de "aliviar el sufrimiento ajeno" haciendo una donación a cuatro ONG designadas (utilizando la compensación financiera que recibían). El formato de donación utilizado fue la versión clásica y extendida del Juego del Dictador, donde los participantes tenían la oportunidad de dar a cada ONG una cantidad de 0 a 10 euros.

Tras la oportunidad de realizar conducta prosocial la experiencia de realidad virtual llega a su fin y se les retiró el dispositivo cuidadosamente. Después de eso, se pidió a los participantes que completaran nuevamente el cuestionario de estado de ánimo (período de recuperación 10 min). Una vez que finalizó el período de recuperación, se retiraron también los electrodos electro-psicofisiológicos.

Posteriormente, se recopiló información a través de una entrevista semiestructurada para obtener información sociodemográfica y personal, incluyendo edad, nacionalidad, nivel educativo, estado civil, nivel socioeconómico e historia delictiva. Asimismo, se administró una batería de cuestionarios autoinformados que incluía un cuestionario para medir los índices de expresión de la conducta violenta (*Aggression Questionnaire*), la empatía cognitiva y afectiva (*Interpersonal Reactivity Index*) y la autocompasión (*Self-Compassion Scale – Short Form*).

Todos los participantes recibieron al finalizar el experimento una retribución de 40 euros a cambio de su participación. Cabe destacar que el paradigma de donación fue simulado y todos los participantes conservaron la retribución íntegra.

El protocolo descrito se adhirió a los principios establecidos en la Declaración de Helsinki y recibió la aprobación del Comité de Ética de la Universitat de València (Código: 1563895).

A continuación, se describirán los objetivos específicos y los resultados de los tres estudios que componen la presente investigación:

El *Estudio 1* se centró principalmente en analizar las diferencias de vmHRV, estado de ánimo y conducta prosocial, en respuesta a la tarea de compasión entre un grupo de perpetradores de VG y dos grupos de hombres control, uno compuesto por población sin historial delictivo y otro por delincuentes de distinta índole. Asimismo, se trató de relacionar la respuesta de la vmHRV con el estado de ánimo y ver si ello difería entre grupos. Los resultados revelaron que los perpetradores de VG mostraron una menor actividad de vmHRV durante la tarea en comparación con los participantes sin historial delictivo. Las diferencias más llamativas se observaron durante la conexión con el sufrimiento, en el periodo de *Triggering-emotion*, donde se indicó que los perpetradores disminuyeron la vmHRV mientras que los participantes sin historial delictivo la aumentaron. Por otro lado, no hubo diferencias significativas en la vmHRV entre los delincuentes de VG y los delincuentes de distinta índole, ni entre los delincuentes de distinta índole con los participantes sin historial delictivo. Respecto a los resultados sobre correlatos emocionales y de conducta prosocial, no se evidenciaron disparidades entre los grupos. Sin embargo, una mayor vmHRV explicó parcialmente un menor afecto negativo en toda la muestra tras la tarea.

En el *Estudio 2*, se examinaron las diferencias en las respuestas HR/vmHRV, el estado de ánimo y la conducta prosocial durante la tarea basada en compasión, comparando un grupo de mujeres delincuentes con otro compuesto por mujeres sin historial delictivo. Además, se analizó si las respuestas HR/vmHRV podrían explicar las variaciones en la conducta prosocial, así como, si existían diferencias entre los grupos. Los resultados mostraron que las delincuentes exhibieron una vmHRV más baja que el grupo control al enfrentarse al sufrimiento de los demás, es decir durante el periodo *Triggering-emotion*. Además, durante el periodo *Call-to-action*, donde se llevaba a término la tarea prosocial, las mujeres delincuentes mostraron una tendencia creciente de vmHRV y revelaron una menor HR que el grupo control. Sin embargo, el grupo control mostró el patrón opuesto, con una mayor vmHRV durante el periodo *Triggering-emotion* y una reducción de la vmHRV junto a un aumento de la HR en el periodo *Call-to-action*. No se observaron diferencias en el estado de ánimo y el comportamiento prosocial entre

los grupos. Finalmente, únicamente en el grupo control, una menor vmHRV se asoció con donaciones más altas.

Por último, el *Estudio 3*, consistió en estudiar el valor predictivo de la empatía como factor de protección de la violencia, analizando sus distintos componentes (cognitivo y afectivo), en una muestra compuesta por hombres y mujeres delincuentes. Además, se pretendió explorar el papel de la autocompasión como mediadora entre la angustia empática y la violencia. Los resultados sobre los cuestionarios autoinformados mostraron una asociación negativa entre la toma de perspectiva (componente de empatía cognitiva) y la violencia, mientras que la angustia empática (uno de los componentes de empatía afectiva) la predijo positivamente. Sin embargo, no se hallaron resultados significativos respecto al componente afectivo preocupación empática. Por otro lado, la autocompasión medió parcialmente en la relación entre la angustia empática y la violencia disminuyendo la relación entre ellas.

Así, los tres estudios presentados tratan de abordar la complejidad del estudio de la compasión en una muestra de delincuentes desde la perspectiva neurocriminológica. Para ello se han estudiado correlatos psicobiológicos, en especial el SNP, y psicológicos, como el estado de ánimo, la conducta prosocial, los diferentes componentes de la empatía y la autocompasión, teniendo en cuenta variables de carácter social como el tipo de delincuencia y la sociodemografía de los participantes.

Tanto en el *Estudio 1* como en el 2 se examinó cómo diferentes muestras de delincuentes respondieron a nivel cardiorrespiratorio, con especial consideración del SNP, a una tarea creada para inducir compasión. Lo que se sugirió principalmente a partir de los resultados del *Estudio 1* fue que los perpetradores de VG experimentaron menores niveles de vmHRV que el grupo sin historial delictivo en el periodo de conexión con el sufrimiento. Lo que indicaría potenciales dificultades en los agresores de VG al conectar con el sufrimiento ajeno. En el *Estudio 2* los hallazgos igualmente indicaron, menores niveles de vmHRV en comparación con el grupo control, sugiriendo que las mujeres delincuentes podrían enfrentar desafíos al conectarse con el sufrimiento de los demás. Estos hallazgos van en línea con investigaciones previas realizadas en población general. Las cuales han asociado una mayor vmHRV con mayores competencias

empáticas, mayor compasión, y en especial, con una la sensibilidad al sufrimiento más elevada. Así, las investigaciones han sugerido que esta actividad elevada del SNP es crucial en las relaciones de cuidado y en interacciones saludables. En línea con estos hallazgos, nuestros resultados sugieren que los participantes sin historial delictivo fueron más efectivos en movilizar recursos parasimpáticos durante la conexión con el sufrimiento ajeno. En contraste, estudios anteriores en delincuentes han sugerido que las dificultades en la movilización flexible del SNP están relacionadas con la evitación de conectar con el sufrimiento, especialmente en agresores de VG en comparación con aquellos sin historial delictivo.

En la segunda parte de la tarea, centrada en la motivación compasiva (periodo *Call-to-action*), destacan especialmente los resultados del *Estudio 2* los cuales reflejaron una tendencia creciente de la vmHRV y una disminución de la HR en las mujeres delincuentes cuando se compararon con el grupo control. Además, los resultados indicaron que la menor respuesta de vmHRV explicó mayores cantidades donadas tan solo en el grupo control. El *periodo Call-to-action* involucra fundamentalmente un proceso de toma de decisiones económicas, potencialmente asociado con un aumento en la actividad del SNS en lugar del SNP. Por lo tanto, la mayor actividad parasimpática en el momento específico de atender las necesidades ajenas tras la conexión con el sufrimiento podría indicar una menor flexibilidad parasimpática hacia la motivación compasiva en el grupo de mujeres infractoras.

Sin embargo, en ambos estudios encontramos que todos los grupos, sin importar su condición, experimentaron un aumento en la vmHRV durante el período de recuperación en comparación con el inicio de la tarea. En consonancia con estudios realizados en población general, este patrón podría sugerir que la conexión con la compasión se relaciona con un aumento subsiguiente de la respuesta parasimpática posiblemente vinculado a la movilización de recursos de autorregulación, incluyendo a las poblaciones delictivas. Sin embargo, se destaca la necesidad de investigaciones adicionales sobre el concepto de compasión y su relación con el SNP, especialmente en poblaciones delictivas.

Por otro lado, no se encontraron diferencias en la respuesta emocional a la tarea entre los grupos. Esto podría explicarse por la susceptibilidad de los cuestionarios autoinformados a sesgos, especialmente en poblaciones delincuentes, debido a una menor capacidad de percepción de los propios estados emocionales. Los resultados psicofisiológicos podrían estar relacionados con miedos, bloqueos y resistencias hacia la conexión con el sufrimiento, dando lugar a mecanismos compensatorios de autoprotección, como, por ejemplo, la evitación de emociones negativas. No obstante, sí se observó en el *Estudio 1*, que los mayores niveles de vmHRV explicaron un menor afecto negativo en toda la muestra. Estos hallazgos parecen estar en línea con estudios realizados en la población general, que señalan que mayores niveles de vmHRV son indicativos de una mejor capacidad para lidiar con las emociones negativas.

En cuanto a la conducta prosocial durante la tarea, no se encontraron diferencias significativas entre los grupos. Se ha de destacar que en este aspecto los estudios han apuntado inconsistencias y sería interesante observar la validez ecológica de este tipo de tareas. Especialmente en poblaciones delincuentes. No obstante, estos resultados también sugieren la capacidad de los delincuentes de llevar a cabo conductas prosociales, en este caso, ligadas a una motivación compasiva.

Para finalizar, los resultados del *Estudio 3*, indicaron una asociación negativa entre la toma de perspectiva y la violencia autoinformada. Estos hallazgos resultaron coherentes con la literatura previa la cual ha asociado una mayor toma de perspectiva con menores índices de criminalidad y violencia. Por el contrario, el componente afectivo de preocupación empática no mostro ningún valor predictivo, esto podría ser debido a los sesgos de deseabilidad social al responder a elementos relacionados con la empatía hacia los demás cuando se hallan en situaciones desafortunadas. Respecto al otro componente afectivo de la empatía, la angustia empática, este predijo una mayor violencia autoinformada. Este último hallazgo contradice la idea comúnmente aceptada de que la empatía afectiva actúa como un factor protector contra la conducta violenta. Aunque se ha de destacar que tradicionalmente se ha tratado la empatía afectiva como un constructo unificado. Sin embargo, investigaciones recientes en neurociencia social distinguen, tanto a nivel subjetivo como neurofisiológico, entre la empatía afectiva

dirigida hacia los demás (preocupación empática) y la orientada hacia uno mismo (angustia empática). Por lo que tal vez sería conveniente estudiarlos como constructos separados. Por último, se identificó a la autocompasión como mediadora entre la angustia empática y la violencia, atenuando la relación entre ellas. Congruentemente, diversas investigaciones en poblaciones delincuentes han vinculado de forma positiva la autocompasión con el autocontrol y de forma negativa con rasgos psicológicos y neurológicos asociados con el comportamiento criminal. Así, en población general, se ha señalado a la autocompasión como una herramienta de manejo emocional que promueve sentimientos relacionados con el *sistema de calma*.

Los resultados de la presente Tesis Doctoral proporcionan información relevante sobre la relación entre la compasión, la delincuencia y el SNP. Además, investiga las diversas dimensiones de la empatía afectiva, su conexión con la violencia y el papel mediador de la autocompasión. Estos descubrimientos ofrecen una nueva perspectiva sobre las características socioafectivas de hombres y mujeres involucrados en conductas delictivas, lo cual podría enriquecer los programas de prevención e intervención al proporcionar una base empírica sólida. Asimismo, se considera relevante resaltar la importancia de incluir variables psicofisiológicas junto al uso de cuestionarios autoinformados en el estudio de las funciones socioafectivas en colectivos delincuentes para aumentar la probabilidad de evitar sesgos. De igual manera, sugerimos una investigación más exhaustiva sobre la compasión y la autocompasión puesto que intervenciones recientes centradas en el cultivo de la compasión y la autocompasión han evidenciado una reducción en diversos factores de riesgo. Por lo que resultaría de interés considerar el uso y el análisis de entrenamientos basados en la autocompasión y la compasión como herramientas para gestionar el sufrimiento propio y ajeno en poblaciones delincuenciales. Esto no solo podría fomentar una regulación saludable del sufrimiento, sino también motivar a estos individuos a contribuir de manera positiva en lugar de perjudicar tanto a la sociedad como a sí mismos.

En conclusión, se destaca que la compasión y la motivación compasiva generan interacciones complejas en el SNA, especialmente en el SNP, tanto en personas con cómo sin historial delictivo. De forma más concreta, se ha indicado que los agresores de

VG exhiben una menor vmHRV que los participantes sin historial delictivo en el periodo de la inducción afectiva (*Triggering-emotion*), posiblemente indicando en estos, mayor dificultad para conectar con el sufrimiento ajeno. Por otro lado, las mujeres delincuentes mostraron menor flexibilidad parasimpática en respuesta a la tarea de compasión, al conectar con el sufrimiento ajeno y también al abordar la motivación compasiva, en comparación con el grupo de mujeres sin historial delictivo. Es destacable que todos los participantes experimentaron un aumento en la vmHRV después de la tarea de inducción de compasión, indicando un incremento en la actividad parasimpática tras la experiencia compasiva. Respecto a la multidimensionalidad de la empatía en relación con la conducta violenta, se destacó que la toma de perspectiva se mostró como un factor protector ante la violencia, mientras que la angustia empática se reveló como factor precipitador en un grupo formado por hombres y mujeres delincuentes. Así, la autocompasión se mostró como mediadora atenuando la relación entre la angustia empática y la violencia en hombres y mujeres con historial delictivo. Por último, se destaca la importancia de incorporar biomarcadores en el estudio de las necesidades criminológicas, puesto que estos pueden ayudar a comprender el perfil dinámico de los delincuentes ofreciendo una comprensión más amplia de la conducta violenta, lo que, a su vez, podría promover intervenciones más efectivas.

INTRODUCCIÓN GENERAL

Perspectiva neurocriminológica de la delincuencia: violencia de género y la delincuencia femenina

La delincuencia y la violencia son fenómenos que innegablemente originan altos costes económicos, sociales y, sobre todo, humanos (WHO, 2020; 2023). Ambos fenómenos, han acompañado al ser humano a lo largo de la evolución en todo el mundo, poniéndose de manifiesto en cualquier estrato social, cultura y contexto (García-Pablos, 2007; Gilbert; 2005). Sólo en España, durante el periodo de enero a septiembre de 2023, según el último Balance Trimestral de Criminalidad, se produjeron un total de 1.826.911 de infracciones penales. Es por ello necesario llevar a cabo investigaciones que indaguen en los orígenes y mecanismos subyacentes de las conductas delictivas y violentas, así como comprender su desarrollo y los objetivos a los que se dirigen. Ello, con el firme propósito de reducir su incidencia, a través de la implementación de estrategias eficaces de prevención e intervención.

Así, la criminología es principalmente la ciencia encargada de presentar alternativas en favor a su disminución, a través del estudio empírico e interdisciplinar tanto de ambos fenómenos como de sus diferentes integrantes (perpetrador/a, víctima y control social). Debido a que, tanto la delincuencia como la conducta violenta son complejas y se encuentran envueltas y matizadas por numerosos factores interdependientes y variables, son varios los campos científicos que han tratado de profundizar en el estudio del comportamiento violento y la actividad delictiva. De esta manera la criminología se ha ido nutriendo y derivando en nuevos y diversos enfoques. Concretamente, la corriente neurocientífica ha aportado numerosos avances mediante el análisis de los mecanismos neurobiológicos relacionados con este tipo de conductas. Es ahí, donde nace y crece la Neurocriminología, la cual integra al estudio de la esfera socio-cultural y psicológica, así como los factores neurobiológicos (Bedoya y Portnoy, 2023; Moya-Albiol et al., 2017; Moya-Albiol, 2022; Moya-Albiol y Romero-Martínez, 2020). Sin embargo, es importante señalar que el planteamiento teórico de esta disciplina dista notablemente del determinismo heredado de la *Scuola Positiva* del siglo XIX. De este modo, la Neurocriminología se enmarca en el modelo biopsicosocial, el cual, ofrece un marco de

estudio holístico que entiende la violencia como resultado de una interacción bidireccional dinámica entre la esfera ambiental o socio-cultural, la psicológica y la neurobiológica (Barnes et al., 2020; Moya-Albiol y Romero-Martínez, 2020). Desde esta perspectiva se postula la existencia de factores de predisposición y/o vulnerabilidad a la violencia y la delincuencia, pero no de factores causales, entendiendo que la conducta criminal es fruto de un conjunto de condiciones y circunstancias que incluyen los contextos socio-culturales y las experiencias vividas. Por tanto, el acercamiento al conocimiento del fenómeno delictivo desde este prisma ofrece nuevas herramientas complementarias que pueden ser empleadas en los programas de prevención e intervención existentes, con la finalidad de reducir al máximo los índices de violencia, así como los de reincidencia.

Desde una perspectiva neurocriminológica y considerando la inherente diversidad presente en el ámbito de la criminalidad, en esta Tesis Doctoral se destacará el estudio de dos formas de delincuencia: la violencia de género (VG) y la delincuencia femenina.

La VG objeto de la Ley Orgánica 1/2004, de 28 de diciembre, de Medidas de Protección Integral contra la Violencia de Género, se ha definido en su artículo primero como una forma de violencia producto de la “manifestación de la discriminación, la situación de desigualdad y las relaciones de poder de los hombres sobre las mujeres, ejercida sobre las mujeres por parte de quienes sean o hayan sido sus cónyuges o de quienes estén o hayan estado ligados a ellas por relaciones similares de afectividad” (p.10). Esta definición incluye diversos tipos de violencia en relaciones heterosexuales, como son psicológica, física y sexual. Así la VG es la forma más común de violencia sufrida por las mujeres en todo el mundo, habiendo sido del 38 al 50% de los asesinatos de mujeres cometidos en el seno de la pareja (WHO,2019). Atendiendo a los datos recogidos por la última Encuesta Europea de Violencia de Género (Delegación del Gobierno contra la Violencia de Género, 2022) el 27.8% de las mujeres había sufrido violencia psicológica, el 12.7% violencia física y 6.7% violencia sexual por sus parejas o exparejas en algún momento de sus vidas. Con el fin de reducir dichas tasas de violencia hacia las mujeres, un creciente número de trabajos empíricos ha trabajado en dilucidar las características del agresor de género con el fin de comprender mejor la etimología de esta violencia, así como establecer de manera concreta las necesidades criminógenas

de los perpetradores (Lila y Gilchrist, 2023; Radatz, 2021). Asimismo, se ha ido construyendo un perfil específico del perpetrador VG que incluye diversas variables psicosociales, destacando características como la inestabilidad emocional y patrones de comportamiento antisocial (González-Álvarez et al., 2022; Holtzworth-Munroe et al., 2000), la exposición a la violencia familiar y acumulación de eventos vitales estresantes (Lila et al., 2019) o el sexismo y las actitudes degradantes hacia las mujeres (Gracia et al., 2020), entre otras. Igualmente, existe un cuerpo creciente de investigación que considera la inclusión de variables neurobiológicas, junto a las interacciones con factores ambientales, para permitir una comprensión más amplia de la VG en general y más concretamente del perfil de los agresores (Bueso-Izquierdo et al., 2019; Comes-Fayos 2022; 2024; Marín-Morales et al., 2022; Pinto et al., 2010; Romero-Martínez et al., 2023). Esta serie de investigaciones busca proporcionar herramientas coadyuvantes capaces de complementar programas de prevención e intervención de la VG.

Por otro lado, las mujeres no han sido únicamente víctimas de violencia, sino que también poseen la capacidad de cometer actos violentos y/o delictivos. Siguiendo el informe de Estadísticas Penales Anuales del Consejo de Europa de 2023, se señala que un 5,4% de las personas condenadas a penas de prisión fueron mujeres (Aebi et al., 2023b), y aproximadamente el 11% fueron condenadas a medidas alternativas a la prisión (Aebi et al., 2023a). Como se refleja en las cifras, el porcentaje de infractoras es notablemente inferior al de los hombres, una tendencia histórica que se repite en múltiples contextos (Mallicoat, 2022). Pero independientemente de la gran brecha que existe en la población delictiva entre hombres y mujeres, nuestra legislación garantiza la igualdad de derechos entre sexos (Artículo 14 de la Constitución Española), y consecuentemente que las mujeres sean merecedoras de investigaciones que evalúen sus características criminógenas, así como de la creación de programas de intervención específicos que las atiendan. Por ello, resulta importante contrarrestar el sesgo masculino que existe en la mayoría de estudios criminológicos con el fin de dotar al sistema penal y penitenciario de herramientas específicas que se ocupen de las potenciales necesidades de las mujeres (Belknap, 2020; Renzetti, 2013). Y aunque la investigación ha explorado algunas características y necesidades de las delincuentes

femeninas, tanto de índole psicosocial (Hidayati et al., 2023; WHO, 2007) como psicobiológico (Choy et al., 2017), su alcance sigue siendo muy limitado.

La compasión cómo factor protector de la conducta violenta y criminal

Desde la perspectiva criminológica las investigaciones se han centrado generalmente en la identificación de factores de riesgo, especialmente para la construcción de programas de tratamiento (Bonta y Andrews, 2016). Sin embargo, también se ha considerado relevante el estudio de los factores de protección en la prevención y el tratamiento de la delincuencia, añadiendo un valor adicional al estudio de los primeros (de Ruigh et al., 2021; de Vries Robbé y Willis, 2017; Morley, 2015). Los factores de protección, han sido descritos como condiciones y circunstancias de carácter interno y externo, que llevan a las personas a afrontar a las situaciones de riesgo y/o distrés de forma resiliente (Ronel y Segev, 2014). Parte de la literatura ha puesto el foco en factores protectores individuales que mejoran el vínculo social, hallándose entre ellos la compasión (Ribeiro da Silva et al., 2021; Sousa et al., 2023).

La compasión, enmarcada desde una perspectiva evolutiva se hipotetiza que tiene sus raíces en los modelos ancestrales de *compartir y cuidar* a los demás en contextos seguros (Gilbert, 2020). Dichas funciones, han resultado cruciales para la supervivencia de numerosas especies y concretamente de la especie humana (Preston, 2013). Con ello, los mecanismos neurofisiológicos que subyacen a las funciones relacionadas con los vínculos y el cuidado, se han ido adaptando y extendiendo empezando por la propia descendencia, pasando a las alianzas de parentesco y hasta alcanzar a las relaciones con extraños (Gilbert, 2015). Asimismo, se ha conceptualizado de múltiples formas, asociándola a un estado emocional, así como a diversos conceptos multidimensionales. No obstante, se pueden extraer dos componentes fundamentales en su definición: la sensibilidad hacia el sufrimiento propio y de los demás, junto a la intención de intentar aliviarlo y/o prevenirlo (Di Bello et al., 2020; Gilbert, 2017; Goetz et al., 2010; Jazaieri et al., 2013; Stellar et al., 2015).

En este sentido, para que se pueda desarrollar la compasión, en primer lugar, se requerirá la capacidad de reconocer y acercarse de forma saludable al sufrimiento. Por ello, las competencias empáticas, descritas en múltiples ocasiones como factor protector de la conducta violenta y delictiva (Jolliffe y Farrington, 2004; Moya Albiol, 2011; 2018), jugarán un papel fundamental como precursoras y en el desarrollo de la compasión (Bellosta-Batalla et al., 2019). Reconocer (empatía cognitiva) y sintonizarse con la emoción de los demás (empatía afectiva) se considera imprescindible para conectar con el sufrimiento ajeno. Con ello, generalmente los desencadenantes de la compasión serán estímulos desagradables asociados con el sufrimiento y la angustia, los cuales podrían producir una respuesta afectiva negativa elevando el *arousal* en las personas que observan (Di Bello et al., 2021). Se precisaría, por tanto, de una toma de perspectiva adecuada que mantenga la separación entre las experiencias ajenas y las propias. De lo contrario, el contacto con el sufrimiento podría conducir a la simpatía y, por ende, a la angustia empática, evocando reacciones emocionales aversivas, como por ejemplo la tristeza o la ansiedad (Eisenberg et al., 2015; Jensen et al., 2014; Klimecki y Singer, 2017). Consecuentemente, la respuesta empática se dirigiría hacia el alivio del propio malestar (Lamm, et al., 2007), que incluso podría desencadenar una respuesta violenta como estrategia de afrontamiento (Bloom, 2017; Palumbo y Latzman, 2021).

Del mismo modo, se ha sugerido que, para llegar a experimentar compasión, el manejo emocional efectivo será crucial para inhibir la angustia empática al conectar con el sufrimiento ajeno sin vernos inmersos en él (Decety y Lamm, 2009; Klimecki y Singer, 2012). Respecto a esto, la autocompasión se ha propuesto como una herramienta que promueve la tolerancia al malestar, al mismo tiempo que cultiva la atención y sensibilidad a nuestras propias fuentes de sufrimiento (Gilbert, 2023). Siguiendo la definición de Kristin Neff (2003), la autocompasión implica la capacidad de comprender y responder al propio sufrimiento de una manera consciente y equilibrada, con amabilidad, y desde una comprensión de la situación como parte de la experiencia humana. Concretamente, se ha propuesto como una habilidad fundamental para el cultivo de una regulación emocional efectiva (Inwood y Ferrari, 2018; Paucsik et al., 2022), mejorando así el procesamiento de emociones negativas como la ansiedad y la

ira (Diedrich et al., 2017; Neff y Vonk, 2009). En particular, en muestras de delincuentes, se ha asociado con mayor autocontrol y conexión social (Morley et al., 2016).

Así, la compasión se manifestaría a través del acogimiento saludable del sufrimiento desde una base segura, generando con ella una serie de emociones positivas como la aceptación y la ternura capaces de reducir el propio malestar (Weidman y Tracy, 2020). Es desde ese estado donde se ha sugerido que surgiría la motivación compasiva como factor externalizado de la compasión (Bellosta-Batalla et al., 2019; García-Campayo et al., 2016). Esta intención de aliviar el sufrimiento, estaría íntimamente ligada a la conducta prosocial (Goetz et al., 2010), que a su vez se ha postulado contraria al comportamiento agresivo, puesto que facilitaría las interacciones positivas (Mestre et al., 2006).

No obstante, se ha de tener en cuenta que los humanos también son capaces de mostrarse indiferentes o incluso sentirse gratificados ante el sufrimiento de otros, lo que se podría definir como crueldad (Gilbert, 2005). Igualmente, desde una perspectiva evolutiva, se ha propuesto que dichas emociones negativas y comportamientos, como por ejemplo la violencia, podrían ser una alternativa de *protección y autocuidado* ligado a contextos de amenaza y competición, probablemente arraigados desde la infancia (Gilbert, 2020; Mobbs et al., 2020). Contrariamente, el cultivo de la autocompasión y la compasión se ha propuesto como alternativa a estas estrategias de *protección y autocuidado* ligadas a la amenaza (Gilbert, 2010; Morley, 2018; Rezapour-Mirsaleh et al., 2021; Ribeiro da Silva et al., 2021; Rijo et al., 2023).

El Modelo Tripartito de Regulación Emocional. La compasión como mecanismo regulador del procesamiento de la amenaza y el papel del sistema nervioso parasimpático

Paul Gilbert (2010), teniendo en cuenta la psicología evolutiva (Bowlby, 1980; Eisenberg et al., 2015) y los fundamentos neurofisiológicos (Depue y Morrone-Strupinsky, 2005; LeDoux, 2000), postuló la existencia de un conjunto de motivaciones innatas en los seres humanos, asociadas a funciones adaptativas cruciales para la supervivencia de la

especie. Asimismo, estas motivaciones se relacionaron con tres sistemas de regulación emocional (véase Figura 1). En primer lugar, el *sistema de logro y búsqueda de recursos*, relacionado con la función de generar sentimientos positivos asociados al placer y la recompensa, con el fin de movilizar e incentivar hacia la búsqueda de recursos necesarios para sobrevivir y prosperar (p. ej. comida, sexo, comodidad, reconocimiento). Por otro lado, el *sistema de amenaza y autoprotección*, su función radica en detectar las potenciales amenazas en el entorno y en la selección automática de respuestas mediante el mecanismo *fight-or-flight*. Se asocia al afecto negativo movilizando emociones como la ansiedad, la vergüenza o la ira. Se ha argumentado que este sistema es especialmente susceptible al condicionamiento clásico, y asienta sus raíces en la etapa de aprendizaje temprano (Mobbs et al., 2020). Por último, el *sistema de calma y satisfacción*, el cual se ha relacionado con el afecto positivo en ausencia de amenaza y necesidad, permitiendo con ello la creación de vínculos saludables. Se trata del sistema donde se ha enmarcado la compasión tanto a nivel conceptual, como en su aplicación terapéutica (CFT; véase Gilbert, 2010).

Figura 1. *Sistemas de Regulación emocional y correlatos psicofisiológicos*



Y aunque estos sistemas a menudo se combinan, se han postulado diferentes procesos psicofisiológicos asociados con cada uno de ellos (Richardson et al., 2016; Sousa et al., 2021). En este sentido, la psicofisiología emplea medidas del sistema nervioso autónomo (SNA), encargado de regular funciones involuntarias del cuerpo, tales como la frecuencia cardíaca y la respiración, con el propósito de establecer una conexión entre estas y la información procesada por sistema nervioso central (Portnoy y Farrington, 2015). Este sistema está constituido por dos ramas complementarias con funciones parcialmente antagónicas: el sistema nervioso simpático (SNS) y el parasimpático (SNP). El SNS está estrechamente relacionado con la respuesta *fight-or-flight*, aumentando la actividad de la frecuencia cardíaca (HR, por sus siglas en inglés), un biomarcador controlado por los mecanismos intrínsecos del corazón (Levy, 1990). Por otro lado, el SNP actúa como un “freno” del SNS, desacelerando la HR y regulando a la baja las respuestas de *fight-or-flight* (Porges, 2017).

Tomando esta información en conjunto, se ha observado una conexión entre el *sistema de logro* y la activación del SNS (Richardson et al. 2016). Asimismo, debido a que la activación del SNS es propia de la respuesta *fight-or-flight* (Porges, 2007), se liga especialmente al *sistema de amenaza* (Sousa et al., 2021). Contrariamente, el *sistema de calma y satisfacción* se ha asociado con la activación del SPN, así como con la capacidad de regular la actividad de los otros dos sistemas mencionados. Se ha propuesto que, a lo largo de la evolución, el dar y recibir cuidado ha tenido un impacto especialmente sustancial en la mielinización del principal nervio del SPN, el nervio vago (Gilbert, 2017; Porges, 2017). Por lo tanto, este sistema se ha asociado más concretamente con la variabilidad de la frecuencia cardíaca mediada por el nervio vago (vmHRV, por sus siglas en inglés), el biomarcador que refleja la influencia el impacto del nervio vago en el índice cardíaco. Por lo que una mayor la vmHRV indicaría una mayor actividad del SPN y por consiguiente una mayor activación del *sistema de calma*. Conjuntamente, una mayor vmHRV, y por tanto mayor actividad del SNP, se ha asociado, en población general, con un aumento en la autorregulación emocional y flexibilidad psicológica (Geisler et al., 2013; Pinna y Edwards, 2020; Thayer y Lane, 2009), mayores competencias empáticas (Yoo y Whang, 2020), más comportamientos prosociales

(Bornemann et al., 2016) y especialmente, con experimentar compasión (Di Bello et al., 2020; Kim et al., 2020; Sousa et al., 2023). Asimismo, se ha destacado la capacidad de adaptación dinámica de la vmHRV en respuesta a cambios ambientales, denominándola como flexibilidad parasimpática (Muhtadie et al., 2015). Dada la naturaleza cambiante de las demandas sociales, esta mayor flexibilidad, se ha asociado con una elevada sensibilidad social y flexibilidad conductual (Di Bello et al., 2021; Miller, 2018).

En consonancia con lo previamente mencionado, Sousa et al. (2022) analizaron la vmHRV en relación al modelo tripartito de regulación emocional en una muestra de jóvenes delincuentes comparados con una muestra de jóvenes control sin historial delictivo. Sus resultados mostraron que toda la muestra manifestó un descenso de la vmHRV frente a la inducción emocional relacionada con el *sistema de logro* y el *sistema de amenaza*. Sin embargo, frente al *sistema de calma* (estímulos relacionados con la calma y los vínculos afectivos) mientras los participantes control aumentaron, como era esperado, la actividad de vmHRV, los delincuentes la disminuyeron. Se argumentó que tal vez los delincuentes relacionaron los estímulos asociados con la afiliación/afecto como estímulos aversivos/amenazantes. Se ha de tener en cuenta, que los delincuentes frecuentemente se desarrollan en ambientes adversos y/o hostiles (Bonta y Andrews, 2016), y que la falta de experiencias de apego seguro en las primeras etapas de la vida, puede perturbar o suprimir la confianza en los demás, así como el comportamiento de cuidado compasivo (Mikulincer, et al., 2005; Mobbs et al., 2009; Mobbs et al., 2020).

En un estudio diferente, Sousa et al. (2023) evaluaron la vmHRV en una muestra de jóvenes delincuentes con rasgos psicopáticos pre y post aplicación del programa de intervención *PSYCHOPATHY.COMP* (Ribeiro da Silva et al., 2021). Este, se fundamenta en la Terapia Centrada en la Compasión (CFT por sus siglas en inglés; para más detalles, véase Gilbert, 2010) y entre sus principales objetivos se halla promover el *sistema de calma* y la compasión. Tras la aplicación del programa se observó una mayor recuperación de la vmHRV de los participantes después de presentarles estímulos relacionados con el *sistema de calma* y *satisfacción* en comparación con la evaluación pre-tratamiento, lo que podría indicar una mayor flexibilidad parasimpática. Además, estos resultados se mantuvieron hasta los 6 meses después (Sousa et al., 2023). De este

modo, se ha asociado a la compasión la potencialidad de mejorar la regulación a nivel psicofisiológico del procesamiento de las amenazas (Gilbert, 2010; Geisler et al., 2013; Porges, 2017; Sousa et al., 2021; 2022; 2023).

En relación con lo expuesto, planteamientos teóricos como la teoría Polivagal (Porges, 2007) y el Modelo de Integración Neurovisceral (Thayer y Lane, 2000) proponen asociaciones bidireccionales entre la vmHRV y la actividad cerebral, sugiriendo su repercusión en el comportamiento. Investigaciones que combinan el análisis de la vmHRV con técnicas de neuroimagen en población general, han asociado la vmHRV con regiones cerebrales específicas, como la corteza orbitofrontal, la corteza prefrontal medial y ventromedial, así como regiones límbicas como la amígdala (Thayer et al., 2012). Estas áreas cerebrales, a su vez, han sido íntimamente relacionadas con la conducta violenta y el comportamiento delictivo (Moya-Albiol y Romero-Martinez, 2020).

Con todo ello, se pretende destacar la importancia de comprender la interrelación entre la actividad del SNA, y más específicamente del SPN y el comportamiento. Este enfoque interdisciplinar proporciona un marco integral para explorar los sustratos psicobiológicos subyacentes a fenómenos conductuales complejos como la violencia y la delincuencia. El SNA se ha empleado en numerosas ocasiones como biomarcador de la respuesta emocional, en poblaciones delictivas (Looft et al., 2022). Sin embargo, se ha profundizado en mayor medida en el SNS, posiblemente debido a su estrecha relación con la respuesta *fight-or-flight* (de Looft et al., 2022). Y a pesar de que existen antecedentes en este campo (Palix et al., 2022; Romero-Martínez et al., 2021; Sarrate-Costa et al., 2022), los biomarcadores del SPN, como la vmHRV, han sido menos estudiados en estas poblaciones. Además, los estudios que examinaron la respuesta psicofisiológica a la inducción de emociones han observado resultados discordantes dependiendo de la composición de la muestra, el índice empleado, así como, la valencia de los estímulos (de Looft et al., 2022). Por este motivo, la profundización en este aspecto resulta de especial interés.

Algunos estudios recientes con muestras de agresores de VG no han hallado diferencias en la vmHRV durante inducciones relacionadas con la ira y el conflicto al

compararlos con grupos control (Babcock y Potthoff, 2021; Trahan y Babcock, 2019). En contraste, un estudio reciente basado en un paradigma de inducción empática de valencia negativa si mostró diferencias entre ambos grupos, mostrando que los perpetradores de VG poseían una menor respuesta en la actividad de vmHRV (Comes-Fayos et al., 2024). Respecto a la delincuencia femenina, los estudios hasta la fecha son todavía más escasos. Hasta donde conocemos, no se ha llevado a cabo ninguna investigación empírica relacionada con la actividad de la vmHRV en mujeres condenadas. Sin embargo, un estudio describió una asociación positiva entre los índices de agresión en mujeres universitarias y la vmHRV frente a estresores relacionales (Murray-Close y Rellini, 2012). Por otro lado, se mostraron asociaciones negativas entre la agresión y la vmHRV frente a paradigmas de inducción del miedo (Thomson et al., 2021). Así, estos hallazgos apuntan la necesidad de una mayor investigación con el fin de dilucidar la relación entre el SNP y la delincuencia femenina.

Objetivos e hipótesis

Considerando la información expuesta, esta Tesis Doctoral se estructura en torno a dos objetivos generales los cuales derivan en varios objetivos específicos y sus correspondientes hipótesis. Estos se distribuyeron a lo largo de tres *estudios*:

1. El primer objetivo consistió en explorar si existen diferencias entre los grupos en cuanto a su respuesta cardiorrespiratoria, especialmente del SNP, emocional y conductual ante una tarea basada en la compasión. Además, se analiza la relación entre la respuesta cardiorrespiratoria a la tarea con los cambios en el afecto y los resultados conductuales. La tarea se dividió en dos componentes: un paradigma de inducción emocional focalizado en la conexión con el sufrimiento (Triggering-emotion) y una tarea de prosocial como reflejo de la motivación compasiva (Call-to-action).

- 1.1 Analizar la vmHRV, el estado de ánimo y la conducta prosocial, en respuesta a la tarea de compasión entre un grupo de perpetradores de VG y dos grupos de hombres control, uno compuesto por población sin historial delictivo y otro

por delinquentes de distinta índole. *Este objetivo específico se corresponde con el estudio 1.*

✱ *Hipótesis 1:* Estudios previos basados en población general han hallado relaciones positivas entre la compasión y una mayor vmHRV (Di Bello et al., 2020; Stellar et al., 2015). Esto, se ha relacionado a su vez con un aumento del afecto positivo, una disminución del negativo (Gilbert, 2019) y un aumento de la conducta prosocial (Petrocchi y Cheli, 2019). Investigaciones anteriores han señalado dificultades socioafectivas en perpetradores de VG en comparación con hombres sin historial delictivo (Romero-Martinez et al., 2019; Comes-Fayos et al., 2022; 2024). Además, existen hallazgos preliminares relacionados con diferencias estructurales y patrones de activación cerebral reducidos en áreas vinculadas con el procesamiento y la regulación emocional en los agresores de VG respecto a otros delinquentes (Marín-Morales et al., 2022; Verdejo-Román et al., 2019). Por ello, hipotetizamos que los agresores de VG mostrarían menor vmHRV en respuesta a la tarea de compasión en comparación con los dos grupos control, acompañado de menor afecto positivo, mayor afecto negativo, así como una menor conducta prosocial.

1.2 Explorar si la respuesta de la vmHRV a la tarea podría explicar el cambio en el estado emocional para toda la muestra de perpetradores de VG y grupos control, y si este diferiría entre los tres grupos. *Este objetivo específico se corresponde con el estudio 1.*

✱ *Hipótesis 2:* Como se ha mencionado, en población general, la inducción de un estado compasivo lleva a un aumento de la vmHRV, relacionada con un aumento en el afecto positivo (Förster y Kanske, 2022) y una disminución en el afecto negativo (Porges, 2017; Engen y Singer, 2015). En consonancia, esperamos que una mayor vmHRV explicase un mejor estado de ánimo para toda la muestra.

- 1.3 Examinar las respuestas HR/vmHRV, el estado de ánimo y la conducta prosocial ante la tarea basada en compasión entre un grupo de mujeres delincuentes y otro compuesto por población sin historial delictivo. *Este objetivo específico se corresponde con el estudio 2.*

✱ *Hipótesis 3:* Estudios anteriores en población general, donde la muestra incluyó mujeres, asociaron una mayor compasión con una disminución de la HR (Stellar et al., 2012; 2015) así como con incrementos en la vmHRV (Di Bello et al., 2020; Kim et al., 2020). Además, tanto la compasión como una mayor vmHRV, igualmente se ha relacionado con el aumento del afecto positivo, descenso del negativo y un incremento en la conducta prosocial (Gilbert, 2019; Petrocchi y Cheli, 2019). A la luz de la investigación que señala dificultades asociadas en la esfera emocional en mujeres delincuentes (Edwards et al., 2019; van der Knaap et al., 2012), esperamos que el grupo de las delincuentes registrase mayor HR y menor vmHRV, especialmente durante el período *Triggering-Emotion*. Ello, vinculado a un menor afecto positivo, mayor afecto negativo y menor conducta prosocial en la tarea de compasión.

- 1.4 Examinar si las respuestas HR/vmHRV podrían explicar las variaciones en la conducta prosocial (medida a través de un monto de donaciones), así como, si existían diferencias entre las mujeres delincuentes y el grupo control. *Este objetivo específico se corresponde con el estudio 2.*

✱ *Hipótesis 4:* Estudios previos en población general, que incluyeron mujeres, han asociado mayores acciones prosociales con aumentos tanto en la HR (Yu y Hao; 2023) como en la vmHRV (Di Bello et al., 2023). Por lo tanto, al estimar menores donaciones en el grupo de delincuentes, también se relacionarían con menor actividad tanto de HR como de vmHRV.

2. El segundo objetivo general consistió en estudiar el valor predictivo de la empatía como factor de protección ante la violencia analizando sus distintos componentes (cognitivo y afectivo) en una muestra de delincuentes compuesta por hombres y mujeres. Además, se pretendió explorar el papel de la autocompasión como mediador entre la angustia empática y la violencia. *Este objetivo se corresponde con el estudio 3.*

✱ *Hipótesis 5: Hipotetizamos* que una mayor toma de perspectiva y preocupación empática, predecirían una menor violencia (Jolliffe y Farrington, 2004; Miller y Eisenberg, 1988). Por otro lado, mayor angustia empática predeciría mayores índices de violencia (Palumbo y Latzman, 2021).

✱ *Hipótesis 6:* Basándonos en literatura previa que propone a la autocompasión como una potencial herramienta de regulación de la angustia en población general (Inwood y Ferrari, 2018; Diedrich et al., 2017), esperamos que la autocompasión atenúe la relación entre la angustia empática y la violencia.

DISCUSIÓN GENERAL

La presente Tesis Doctoral ha comparado la respuesta del SNP durante una tarea creada para evocar compasión en una muestra heterogénea de delincuentes y participantes sin historial delictivo. Igualmente, ha analizado la respuesta emocional y conductual a la tarea, además de relacionarlas con las variables del SNP-cardiorrespiratorias. Asimismo, se ha profundizado en el papel de la empatía como factor protector para la expresión de la violencia, y de la autocompasión como mediadora entre la angustia empática y la violencia.

El primer objetivo fue analizar la respuesta SNP-cardiorrespiratoria, emocional, así como la conducta prosocial durante la tarea basada en compasión en un grupo de agresores de VG y otro de mujeres delincuentes comparándolos con sus respectivos grupos control. En línea con nuestras hipótesis, los resultados del *estudio 1* mostraron que los agresores de VG mostraron menor vmHRV, reflejado en los índices RMSSD y RSA, durante la tarea de elicitación de la compasión en comparación con el grupo de control sin historial delictivo. Sin embargo, no se observaron diferencias significativas entre los agresores de VG y el grupo compuesto por delincuentes de distinta índole, ni tampoco entre estos últimos y el grupo sin historial delictivo. Así, los hallazgos más relevantes se obtuvieron en el periodo *Triggering-emotion*, dónde mientras que los agresores de VG mostraron una disminución de la vmHRV, los participantes sin historial delictivo experimentaron un aumento. Por otro lado, en el *estudio 2*, que examinó a mujeres delincuentes en comparación con un grupo control sin historial delictivo, se identificaron las principales diferencias en la vmHRV igualmente en el periodo *Triggering-emotion*. Así, en línea con las hipótesis, las mujeres delincuentes exhibieron una ligera reducción de la RMSSD mientras que las controles experimentaron un incremento. Por otra parte, se observó mayor HR en las mujeres delincuentes que en las mujeres control durante la conexión con el sufrimiento.

Los resultados de ambos estudios serían respaldados por la investigación previa en población general, la cual ha relacionado la mayor actividad de vmHRV con mayores competencias empáticas (Yoo y Whang, 2020), mayor compasión (Kim et al., 2020) y más concretamente, con mayor sensibilidad al sufrimiento (Di Bello et al., 2020). Así, se

ha sugerido que una actividad elevada de vmHRV es un factor importante en las relaciones de cuidado y en las interacciones saludables (Petrocchi y Cheli, 2019). Además, la compasión se ha asociado con una menor HR (Stellar et al., 2015). En concordancia, nuestros hallazgos parecen sugerir que los grupos sin historial delictivo fueron capaces de movilizar de forma más efectiva recursos parasimpáticos, ligados al *sistema de calma*, en especial, durante el periodo de la conexión con el sufrimiento ajeno. De hecho, varios estudios en muestras de delincuentes han sugerido que las dificultades en movilizar de manera flexible el SNP están relacionadas con evitación de conectar con el sufrimiento (Sousa et al., 2022; 2023), especialmente en agresores de VG en comparación con grupos sin historial delictivo (Comes-Fayos et al., 2024).

Las disminuciones del SNP observadas en los agresores de VG y las mujeres infractoras frente a la inducción emocional, podrían ser un reflejo de respuestas psicofisiológicas propias del *sistema de amenaza* (Sousa et al., 2022; 2023). La hiperactividad del *sistema de amenaza* se ha relacionado con una reducción de las funciones ejecutivas, un aumento del aislamiento social y de la rumiación, así como con una mayor vulnerabilidad al desarrollo de psicopatologías (Mobbs et al., 2020; Rodrigues et al., 2009). Todas ellas, factores de riesgo de la conducta violenta y la criminalidad (Bonta y Andrews, 2016; Li et al., 2019; Moya-Albiol y Romero-Martinez, 2020). Por consiguiente, los mayores déficits socioafectivos descritos en poblaciones VG (Comes-Fayos et al., 2022; Romero-Martínez et al., 2019; Ulloa y Hammett; 2016), así como los desafíos emocionales observados entre las mujeres delincuentes (van der Knaap et al., 2012; WHO, 2007) podrían estar relacionados con una actividad atenuada del SNP en respuesta a la compasión, así como con un subdesarrollo o patrón de activación disfuncional del *sistema de calma* (Sousa et al., 2022; 2023). Pudiendo aumentar con ello la probabilidad de que se manifiesten reacciones o acciones de naturaleza violenta y/o antisocial en este tipo de poblaciones (Gilbert, 2020; 2023).

Por otro lado, respecto a la respuesta cardiorrespiratoria a la segunda parte de la tarea, centrada en la motivación compasiva durante el periodo *Call-to-action*, los resultados del *estudio 1* indicaron que los agresores de VG exhibieron menor vmHRV, en comparación con los hombres sin historial delictivo. En cambio, en el *estudio 2*, ambos grupos mostraron una convergencia en su vmHRV, puesto que las infractoras

presentaron un incremento de la RMSSD mientras que el grupo de las controles exhibió una disminución. Paralelamente, en el *estudio 2* se observó una disminución de la HR en el grupo de infractoras, mientras que el grupo control de mujeres mostró un aumento. En este sentido, podría ser relevante considerar la naturaleza dinámica de las demandas sociales (Muhtadie et al., 2015). El *periodo Call-to-action* involucra fundamentalmente un proceso de toma de decisiones económicas, potencialmente asociado con un aumento en la actividad del SNS en lugar del SNP (Muhtadie et al., 2015), lo que tal vez podría estar asociado con el *sistema de logro*. Por lo tanto, el aumento de la vmHRV y la disminución de la HR durante el periodo *Call-to-action*, tras la conexión con el sufrimiento, podrían indicar una menor flexibilidad parasimpática en el grupo de mujeres infractoras frente a la demanda de atender las necesidades ajenas. Esto sugiere la importancia de investigaciones futuras que profundicen en la comprensión de los cambios psicofisiológicos adaptativos para satisfacer las demandas sociales en momentos específicos en muestras delictivas (Miller, 2018).

Sin embargo, todos los grupos, independientemente de su condición, mostraron un aumento de la vmHRV durante el período de recuperación en comparación con el inicio de la tarea. Asimismo, en el caso del *estudio 2*, el aumento de la vmHRV en mujeres fue acompañado con una reducción de HR. En relación con esto, Di Bello et al., (2021) revelaron que participantes provenientes de población general exhibieron un incremento de la vmHRV después de la observación de acciones compasivas. Con esto, los datos obtenidos en nuestro estudio podrían sugerir que vincularse con la compasión se relaciona con un aumento posterior de la respuesta parasimpática, probablemente asociada con la movilización de recursos de autorregulación (Di Bello et al., 2020; 2021; Laborde et al., 2017), también en poblaciones delictivas. Sin embargo, se precisaría de investigación adicional sobre el concepto de compasión, especialmente en delincuentes, dado que tanto las variables HR/vmHRV dependen de las características de la muestra, las tareas experimentales y su valencia emocional (de Looft et al., 2022).

Por otro lado, a diferencia de lo hipotetizado, no se hallaron diferencias en la respuesta emocional a la tarea entre ninguno de los grupos. Ello podría ser explicado por la susceptibilidad de los cuestionarios autoinformados a sesgos, especialmente en la población delincuente, debido, en parte, a una menor capacidad de percepción en lo

referente a sus propios estados emocionales (Garaigordobil y Peña-Sarrionandia, 2015; Sousa et al., 2022). En consonancia, como se ha comentado, los resultados psicofisiológicos hallados en el periodo *Triggering-emotion* en ambos colectivos de delincuentes, podrían estar asociados a miedos, bloqueos y/o resistencias de conexión con el sufrimiento propio y ajeno. Esto podría dar lugar al desarrollo de mecanismos compensatorios de autoprotección como la evitación de las emociones negativas (Gilbert, 2020; 2022; Sousa et al., 2023), que a su vez favorecerían a los sesgos en los autoinformes. Por tanto, se realza la importancia de la inclusión de variables psicofisiológicas junto al uso de los cuestionarios autoinformados en la investigación de funciones socioafectivas, como la compasión, en colectivos de delincuentes (Moya-Albiol et al., 2017; Moya-Albiol y Romero-Martínez, 2020).

Respecto a la relación entre las variables cardiorespiratorias del SNP y el afecto, en el *estudio 1* se investigó si la vmHRV podría explicar el cambio de respuesta afectiva a la tarea. Esperábamos que toda la muestra mostrara un mejor estado de ánimo ligado a una mayor respuesta de la vmHRV fásica. Se observó que una mayor RMSSD durante la tarea se relacionó con la disminución del afecto negativo. Estos hallazgos parecen estar en consonancia con aquellos que han evaluado la vmHRV tónica en población general, los cuales han asociado una mayor vmHRV con una mejor capacidad para aceptar emociones negativas (Visted et al., 2017), así como mayores intentos de suprimir emociones negativas en interacciones sociales (Smith et al., 2011). Sin embargo, se necesitaría una mayor investigación utilizando medidas fásicas de vmHRV.

Por otra parte, tampoco se encontraron diferencias en ninguno de los dos *estudios* a los resultados conductuales referentes a la tarea prosocial. Respecto a esto, se ha de señalar que, la investigación, además de escasa, ha mostrado discrepancias empíricas respecto a las inducciones emocionales y la respuesta prosocial en poblaciones delincuentes. Así, existen estudios que apuntan diferencias conductuales entre delincuentes violentos y participantes sin historial delictivo (Mayer et al., 2018) y otros que no hallan tales diferencias (Comes-Fayos et al., 2022). Esta inconsistencia en los resultados podría ser en parte debida a la diversidad de tareas prosociales empleadas durante la evaluación. Además, habría que cuestionarse su validez ecológica al ser empleadas en contextos que incluyan muestras con historial delictivo (Bo O'Connor et

al., 2022). No obstante, nuestros resultados indican que los y las delincuentes tienen capacidad para llevar a cabo conductas prosociales, es decir, el hecho de haber delinquido no es incompatible con poder mostrar motivación compasiva, cuestión en la que sería interesante profundizar en futuros estudios.

Para finalizar con el primer objetivo, en el *estudio 2*, se analizó si las variaciones de HR/vmHRV se relacionaban con las cantidades donadas durante la parte de la tarea prosocial. Esperamos hallar mayor HR y vmHRV si las cantidades donadas eran de mayor cuantía (Di Bello et al., 2023; Yu y Hao; 2023). Sin embargo, no se hallaron diferencias en cuanto a la HR fásica. Asimismo, los resultados apuntaron que, únicamente en el grupo sin historial delictivo, la menor RMSSD fásica se relacionaba con donaciones más altas. Por ello, podríamos concluir que únicamente en las mujeres sin historial delictivo una mayor conducta prosocial estaría relacionada con una reducción en el funcionamiento del SNP. Tal y como han descrito investigaciones previas en población general, estaría sugiriendo la existencia de una mayor flexibilidad parasimpática en respuesta a una demanda social concreta (Miller, 2018; Muhtadie et al., 2015). Considerando que desde el periodo *Triggering-emotion* hasta el periodo *Call-to-action*, las mujeres con historial delictivo mantuvieron una tendencia creciente del SNP, mientras que las mujeres control la disminuyeron, inferiríamos en las primeras la existencia de una menor flexibilidad parasimpática hacia la compasión, y concretamente hacia la motivación compasiva.

El segundo objetivo general de la presente Tesis Doctoral, del cual se ocupa el *estudio 3*, fue, en primer lugar, explorar la capacidad predictiva de los distintos componentes de la empatía como factor protector ante la conducta violenta en una muestra de hombres y mujeres delincuentes. Nuestras hipótesis fueron parcialmente confirmadas, puesto que se observó una asociación negativa entre la toma de perspectiva y la violencia autoinformada. Estos hallazgos resultaron coherentes con la literatura previa ha asociado una mayor toma de perspectiva con menores índices de violencia y criminalidad (Day et al., 2012; Jolliffe y Farrington, 2004; Martinez et al., 2014). Sin embargo, no se observó ningún tipo de relación respecto a los índices de preocupación empática y la violencia. Este resultado podría atribuirse a problemas de medición, y más concretamente a los sesgos relacionados con deseabilidad social

(Vachon et al., 2014), especialmente cuando se trata de la población delincente que ha de responder a elementos relacionados con la empatía hacia otros en situaciones desafortunadas. Por todo ello, sería interesante emplear marcadores psicobiológicos complementarios en el análisis de las respuestas socioafectivas (Comes-Fayos et al., 2022; 2024).

Por el contrario, también en línea con nuestras hipótesis, una mayor angustia empática predijo una mayor violencia autoinformada (Palumbo y Latzman, 2021). Estos resultados contrastan con la línea general presentada por la literatura que señala a la empatía afectiva como factor protector de la conducta violenta (Jolliffe y Farrington, 2004; Miller y Eisenberg, 1988). No obstante, es importante apuntar que, al relacionarla con la violencia, generalmente la empatía afectiva se ha tratado como un constructo unificado (Vachon et al., 2014). Sin embargo, diversas investigaciones enmarcadas en la neurociencia social han indicado una diferenciación entre la empatía afectiva orientada hacia los demás (preocupación empática) y la orientada hacia uno mismo (angustia empática), ya que involucran procesos subjetivos diferentes y existen evidencias que sugieren que están sostenidas por mecanismos neurofisiológicos distintos (Chierchia y Singer, 2017; Decety y Ickes, 2011; Klimecki et al., 2014; Klimecki y Singer 2017). Así, se ha sugerido que la preocupación empática, asociada con sentimientos de calidez y cuidado, podría servir como motivación para la conducta prosocial (Gilbert, 2017). Mientras que, individuos que se sintonizan con la emoción, pero presentan dificultades en la toma de perspectiva, podrían ser propensos a experimentar malestar e intensificar afectos negativos que puede evocar el empatizar con los demás (Singer y Klimecki, 2014). En la muestra aquí analizada, proponemos que la agresión podría ser utilizada por los delincentes como una estrategia de afrontamiento, similar a un mecanismo *fight-or-flight*, para protegerse de emociones negativas abrumadoras (Bloom, 2017).

Finalmente, y en línea con lo esperado, se identificó a la autocompasión como mediadora entre la angustia empática y la agresión, atenuando la relación entre ellas. Congruentemente, diversas investigaciones en poblaciones delincentes han vinculado de forma positiva la autocompasión con el autocontrol (Morley, 2016) y de forma negativa con rasgos psicológicos y neurológicos asociados con el comportamiento criminal (Morley, 2018). Así, en población general, se ha señalado a la autocompasión

como una herramienta de manejo emocional que promueve sentimientos relacionados con el *sistema de calma* (Gilbert, 2023; Paucsik et al., 2022). Además, existen ejemplos recientes de intervenciones con delincuentes que se han centrado en la promoción de la autocompasión, hallando diversos cambios significativos en factores de riesgo psicosociales tras la aplicación del programa (Morley, 2018; Rezapour-Mirsaleh et al., 2021). Por lo que el cultivo de la autocompasión en delincuentes, tal vez podría ayudar a inhibir la percepción de amenaza provocada por la angustia empática, reduciendo con ello estrategias de afrontamiento disfuncionales, como la violencia (Gilbert, 2023; Miyagawa y Kanemasa, 2022).

Limitaciones generales

Resulta relevante poner de manifiesto algunas limitaciones que pueden afectar a la generalización de nuestros resultados. Principalmente, el tamaño de la muestra, debido a la dificultad para recopilar participantes con historial delictivo, especialmente mujeres, por su menor tasa de delincuencia (Belknap, 2020). Por ello, no se pudo conseguir un grupo específico de mujeres que hubiesen cometido violencia doméstica o interpersonal que permitiese comparar entre tipologías delictivas. Asimismo, debido a la naturaleza intrínseca del delito de VG no se consideró realizar una comparativa entre hombres y mujeres. En este sentido, se debe considerar la heterogeneidad de los perfiles de los y las delincuentes, ya que nuestra muestra abarca un espectro de delitos menores. Por lo tanto, sería importante para la investigación futura recopilar muestras más amplias y tratar de crear grupos de mayor homogeneidad diferenciando entre distintas clasificaciones, cómo delitos violentos y no violentos. Asimismo resultaría de especial interés analizar muestras de delitos graves y, a efectos de resocialización, tener en cuenta el efecto del contexto penitenciario.

Tampoco fue viable registrar la presencia de rasgos antisociales y de psicopatía, aspectos que han sido señalados como relevantes al medir la vmHRV en delincuentes (de Looft et al., 2022; Palix et al., 2022). Además, algunas investigaciones científicas que analizan las variables psicofisiológicas implicadas en la violencia diferencian entre perfiles de violencia reactiva y proactiva (Murray-Close et al., 2017; Thomson et al., 2021). Por lo tanto, sería interesante que futuras investigaciones explorasen las

funciones socioafectivas, como la compasión, y sus interacciones con diferentes perfiles de delincuentes. Asimismo, varios estudios han señalado que los y las delincuentes son propensos a haber experimentado adversidad y/o violencia en su infancia (Bonta y Andrews, 2016; Graf et al., 2021; Hales et al., 2023). Este aspecto podría tener repercusiones en la respuesta psicofisiológica (Hagan et al., 2020; Zhang y Gao, 2015), así como en su relación con la compasión, pudiendo generar posibles miedos, bloqueos y/o resistencias (Gilbert, 2005; 2023). Por lo tanto, el entorno de desarrollo en la infancia, así como los posibles procesos de victimización, podrían ser factores relevantes para considerar en futuros estudios.

Por otro lado, nuestro procedimiento fue creado *ad hoc* para ajustarse a los componentes de la compasión, por lo que el video utilizado en la inducción emocional no había sido validado previamente con una amplia muestra de participantes. Sin embargo, fue creado por las Naciones Unidas y se ha utilizado en otras investigaciones como herramienta de inducción afectiva (Schutte y Stilić, 2017; Jones y Dawkins, 2018). Asimismo, algunos autores han señalado el potencial del uso de dispositivos de realidad virtual en investigación relacionada con la emoción (Ventura et al., 2020), incluyendo poblaciones delincuentes (Dellazizzo et al., 2019). No obstante, debemos tener en cuenta que el personaje principal para la inducción emocional era una niña siria. Por lo que otra limitación de este experimento es la falta de consideración de posibles sesgos, incluyendo aquellos relacionados con el racismo, así como la posibilidad de que los agresores de VG presenten percepciones distorsionadas sobre el género femenino en general incluyendo a las niñas, lo cual podría influir en su capacidad de empatizar (Eckhard et al., 2012). De la segunda parte de la tarea se ha de contemplar que, las donaciones podrían estar sujetas a sesgos de deseabilidad social y preferencias personales hacia las ONGs (Berman et al., 2016).

Junto a todo ello, se ha de destacar que la autocompasión, ha sido únicamente evaluada mediante un cuestionario autoinformado. Por ello, la incorporación de herramientas complementarias, como los marcadores psicobiológicos, junto con la implementación y evaluación de intervenciones que integren la autocompasión (Klimecki et al., 2014; Morley, 2018), podrían proporcionar una comprensión más

completa de este constructo. Al combinar e integrar metodologías, podemos mejorar la comprensión de la empatía, la autocompasión y la violencia.

Aplicaciones teórico-prácticas y direcciones futuras

Considerando las limitaciones mencionadas, los resultados de esta Tesis Doctoral proporcionan información relevante sobre la relación entre la compasión, la criminalidad y el SNP. Además, explora la naturaleza multidimensional de la empatía afectiva, su relación con la violencia y el papel mediador de la autocompasión. Por tanto, se proporcionan nuevos conocimientos sobre las características socioafectivas de hombres y mujeres delincuentes, lo cual podría contribuir a dotar a los programas de prevención e intervención de nuevas herramientas efectivas.

Desde una perspectiva neurocriminológica, se incorporan variables psicobiológicas en el perfil de hombres y mujeres condenadas. Sin obviar la naturaleza social de la delincuencia, esta aproximación podría ayudar a explicar esta problemática de manera más amplia e inclusiva (Bedoya y Portnoy, 2023; Moya-Albiol et al., 2017; 2022; Romero-Martinez et al., 2021). No obstante, podría resultar de especial interés que los estudios futuros incluyan otro tipo de biomarcadores vinculados al funcionamiento social en el estudio de la compasión, como por ejemplo, marcadores hormonales (oxitocina, vasopresina, testosterona y/o cortisol; Rockliff et al., 2008)) o técnicas de neuroimagen (Chierchia y Singer, 2017;). De esta forma, se trataría de mejorar la comprensión del funcionamiento socioafectivo y la elección de estrategias afrontamiento basadas en la violencia. Asimismo, en materia de investigación, el uso de marcadores psicobiológicos podría ayudar a complementar los cuestionarios autoinformados al ofrecer una comprensión más amplia de las personas que comenten actos delictivos (Choy et al., 2017).

Por otro lado, se ha sugerido que la autoobservación de señales corporales, como los parámetros de vmHRV, podría proporcionar a las personas conciencia sobre el propio estado emocional, favoreciendo con ello una autorregulación efectiva (Pinna y Edwards, 2020). Específicamente, el desarrollo de habilidades interoceptivas se ha relacionado

con la capacidad para regular las emociones negativas (Füstös et al., 2012). Así, la incorporación del entrenamiento de la vmHRV en las intervenciones con delincuentes podría promover la capacidad de autorregularse ante situaciones de alta excitación, como la ira, la impotencia o la angustia (Argese et al., 2020). Por lo tanto, la investigación futura debería aspirar a explorar más a fondo la relación entre la vmHRV, la interocepción y el procesamiento emocional dentro de las poblaciones delictivas, ya que esto podría proporcionar herramientas efectivas para la prevención y el tratamiento.

Finalmente, proponemos la profundización en el estudio de la compasión y la autocompasión como herramientas para abordar el sufrimiento propio y ajeno de manera regulada en muestras delincuenciales. Intervenciones recientes con delincuentes de distintas edades se han centrado en el cultivo de dichos fenómenos, hallando una disminución de algunos factores de riesgo o vulnerabilidad como la impulsividad (Morley, 2018), el pensamiento criminal (Rezapour-Mirsaleh et al., 2021) y los rasgos psicopáticos, estos últimos relacionados con la insensibilidad (Ribeiro da Silva et al., 2021; Rijo et al., 2023). Por ello, podría resultar de interés considerar el uso y el análisis de entrenamientos basados en la autocompasión y la compasión, como adaptaciones de la CFT o PSYCHOPATHY.COMP. Este enfoque, podría ser útil para superar miedos, bloqueos y resistencias hacia la compasión, generando una mayor regulación emocional y una predisposición hacia el contacto con el sufrimiento y la búsqueda de la prosocialidad (Di Bello et al., 2020; Gilbert, 2020; 2023; Morley, 2018; Rezapour-Mirsaleh et al., 2021; Ribeiro da Silva et al., 2021). Igualmente, podría ser particularmente útil que programas de prevención y/o intervención incluyan módulos terapéuticos centrados en factores protectores, como el fomento de la empatía saludable, la compasión y la autocompasión.

CONCLUSIONES

1. Resulta de especial relevancia investigar la relación entre compasión y criminalidad desde una perspectiva neurocriminológica, puesto que la delincuencia y la violencia son fenómenos complejos y multifactoriales que requieren ser abordados desde enfoque interdisciplinar.
2. Experimentar compasión y participar en la motivación compasiva desencadena interacciones complejas dentro del SNA, específicamente involucrando al SPN, y más concretamente a la flexibilidad parasimpática.
3. Los agresores de VG muestran menor vmHRV frente a la conexión con el sufrimiento que los hombres sin historial delictivo, pudiendo ello reflejar una dificultad para conectar con el sufrimiento de los demás.
4. No se mostraron diferencias significativas entre los agresores de VG y delincuentes de distinta índole frente a la tarea basada en la compasión, tampoco entre estos últimos y el grupo sin historial delictivo.
5. Las mujeres delincuentes mostraron menor flexibilidad parasimpática que el grupo sin historial delictivo en respuesta a la tarea de inducción de compasión, especialmente al conectar con el sufrimiento ajeno y al abordar la motivación compasiva.
6. La totalidad de los y las participantes mostraron un aumento de la vmHRV tras la tarea de inducción de compasión. En este sentido, se produjo un aumento de la actividad parasimpática tras ser expuestos a una experiencia compasiva.
7. No hay diferencias entre delincuentes y no delincuentes en el afecto autoinformado y la conducta prosocial evaluada tras finalizar la tarea de inducción de compasión.
8. La mayor vmHRV explicó un menor afecto negativo autoinformado tras la tarea de compasión en todos los hombres.

9. La menor vmHRV explicó el mayor número de donaciones únicamente en el grupo de mujeres sin historial delictivo en comparación con las mujeres delincuentes.
10. La toma de perspectiva se mostró como un factor protector ante la violencia, mientras que la angustia empática se reveló como factor precipitador en población delictiva.
11. La autocompasión se evidenció como mediador parcial entre la angustia empática y la violencia en hombres y mujeres con historial delictivo.
12. Se resalta la importancia de utilizar biomarcadores en el estudio de factores criminógenos. Comprender el perfil dinámico de los y las delincuentes en respuesta a tareas socioafectivas podría ayudarnos a complementar de manera efectiva los programas de intervención y prevención.



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