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Evaluación de los factores de riesgo y protección en agresores de violencia de género desde una perspectiva biopsicosocial. Importancia del procesamiento emocional y la conducta prosocial.

Tesis Doctoral presentada por:

Javier Comes Fayos

Dirigida por:

Dr. Luis Moya Albiol y Dr. Ángel Romero Martínez

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Dr. Luis Moya Albiol, Catedrático del Dpto. de Psicobiología de la Universitat de València.

Dr. Ángel Romero Martínez, Profesor Titular del Dpto. de Psicobiología de la Universitat de València.

CERTIFICAN:

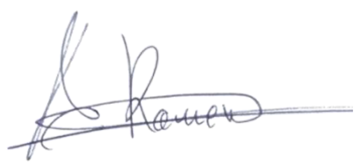
Que la presente memoria, titulada “**Evaluación de los factores de riesgo y protección en agresores de violencia de género desde una perspectiva biopsicosocial. Importancia del procesamiento emocional y la conducta prosocial**” corresponde al trabajo realizado bajo su dirección por **Javier Comes Fayos**, para su presentación como Tesis Doctoral en el Programa de Doctorado en Neurociencias de la Universitat de València.

Y para que conste firman el presente certificado en Valencia, a 09/01/2024

Director de la Tesis:

Fdo.: Luis Moya Albiol

Director de la Tesis:



Fdo.: Ángel Romero Martínez

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Abreviaturas

Abreviatura	Nomenclatura
AED	Actividad electrodérmica
ASR	Arritmia sinusal respiratoria
C	Cortisol
Cs	Cortisol en saliva
FC	Frecuencia cardíaca
DGVG	Delegación del Gobierno contra la Violencia de Género
FR	Frecuencia respiratoria
OMS	Organización Mundial de la Salud
ONU	Organización de las Naciones Unidas
OXT	Oxitocina
OXTp	Oxitocina en plasma
OXTs	Oxitocina en saliva
OXT/C	Ratio oxitocina/cortisol
OXT/T	Ratio oxitocina/testosterona
PEP	Periodo de pre-eyección
SNA	Sistema nervioso autónomo
SNP	Sistema nervioso parasimpático
SNS	Sistema nervioso simpático
T	Testosterona
Ts	Testosterona en saliva
T/C	Ratio testosterona/cortisol

Abbreviations

Abbreviation	**Nomenclature**
ANOVA	Analysis of Variance
ANS	Autonomic Nervous System
AUCg	Area Under the Curve with respect to the Ground
AUCi	Area Under the Curve with respect to the Increase
AUDIT	Alcohol Use Disorder Identification Test

BMI	Body Mass Index
C	Cortisol
sC	Salivary Cortisol
CTS-2	Revised Conflict Tactic Scale
DEQ	Discrete Emotions Questionnaire
EMG	Electromyography
HR	Heart Rate
IBI	Interbeat Intervals
IPV	Intimate Partner Violence
IRI	Interpersonal Reactivity Index
MANOVA	Multivariate Analysis of Variance
NGO	Non-Governmental Organizations
OXT	Oxytocin
OXT/C	Oxytocin/Cortisol Ratio
OXT/T	Oxytocin/Testosterone Ratio
pOXT	Plasma Oxytocin
sOXT	Salivary Oxytocin
PEP	Pre-Ejection Period
PNS	Parasympathetic Nervous System
POMS	Profiles of Mood State
RMET	Reading the Mind in the Eyes Test
RR	Respiration Rate
RSA	Respiratory Sinus Arrhythmia
SAM	Self-Assesment Manikins
SCL	Skin Conductance Level
SNS	Sympathetic Nervous System
STAI	State-Trait Anxiety Inventory
T	Testosterone
pT	Plasma Testosterone
sT	Salivary Testosterone
TAS-20	Toronto Alexithymia Scale - 20 items
T/C	Testosterone/Cortisol Ratio
VU-AMS	Vrije Universiteit Ambulatory Monitoring System
WHO	World Health Organization

I. RESUMEN

La violencia de género se define como cualquier acto que pueda provocar o provoque daños físicos, psicológicos o sexuales a las mujeres por parte de los hombres, incluyendo la amenaza, la coerción o la privación arbitraria de la libertad, tanto si se produce en el ámbito público como en el privado (Organización de las Naciones Unidas, 1993). Como consecuencia de la violencia de género, se han expuesto graves efectos en la salud de las mujeres, incluyendo daños físicos, psicológicos y sociales a corto y largo plazo (Vilariño et al., 2018) y cuya expresión más extrema son los feminicidios (Walklate et al., 2019). Por lo tanto, la violencia de género representa una violación de los derechos humanos que atenta contra la integridad física, psicológica y emocional de millones de mujeres (Organización Mundial de la Salud, 2021).

Se han considerado diferentes aproximaciones teóricas con el propósito de identificar las condiciones que propician la aparición de la violencia de género y, así, poder implementar medidas eficaces para prevenirla. Estas explicaciones teóricas conciben la violencia de género como un fenómeno complejo que integra tanto factores socioculturales (Bosch-Fiol & Ferrer-Pérez, 2019; Heise, 2011) como individuales (Clare et al., 2021), y que requiere de una aproximación holística que aborde los distintos elementos implicados (Hilton & Radatz, 2021). Recientemente, ha aumentado el interés por los sustratos biológicos que, mediante una compleja interacción con factores psicosociales, predisponen al ejercicio o al cese de la violencia (Moya-Albiol & Romero-Martínez, 2020). En el caso de la violencia de género, se ha propuesto que ciertos factores biológicos interactúan con el contexto cultural y social, influyendo en la predisposición de los agresores de violencia de género a adoptar conductas violentas (Moya-Albiol et al., 2017).

En consecuencia, la investigación está cada vez más orientada a aplicar una perspectiva biopsicosocial con el objetivo de profundizar en los principales factores de riesgo y protección de la violencia de género (Pinto et al., 2010).

En este sentido, la empatía, la capacidad de comprender y compartir la experiencia emocional de otra persona, ha sido propuesta como un importante factor de protección que favorece la reducción de comportamientos violentos y el incremento de conductas prosociales (Covell et al., 2007; Moya-Albiol, 2021; Romero-Martínez et al., 2023; Van Langen et al., 2014). En agresores de violencia de género, la literatura ha expuesto dificultades tanto en la empatía como en funciones socioafectivas relevantes para un buen funcionamiento empático (Clement et al., 2007; Covell et al. 2007; Ulloa & Hammett, 2016). Notablemente, diversos autores han expuesto que los bajos niveles de empatía en agresores de violencia de género podría asociarse con el abandono de la intervención y con mayores tasas de reincidencia (Romero-Martínez et al., 2016a; 2023). No obstante, pocos estudios se han centrado en la evaluación de la empatía en estos agresores desde una perspectiva biopsicosocial. Este hecho es llamativo debido a la alta prevalencia de sesgos en el dominio afectivo presentes en esta población, como la baja autopercepción emocional, la elevada deseabilidad social o la manipulación intencionada (Garaigordobil-Landazabal & Peña-Sarrionandia, 2015; Visschers et al., 2017). Por todo ello, se destaca la necesidad de ahondar en los déficits en funciones relevantes para la empatía en agresores de violencia de género (Romero-Martínez, Lila et al., 2021), combinando la evaluación psicosocial de la empatía con biomarcadores menos susceptibles a sesgos y manipulación (Moya-Albiol & Romero-Martínez, 2020).

Existe una literatura relativamente extensa que ha documentado que un desajuste en marcadores endocrinos como la oxitocina (OXT), vinculada al procesamiento de estímulos socioafectivos, la testosterona (T), asociada al estatus social, y el cortisol (C), implicado en la respuesta al estrés, podría interferir en funciones relevantes para la empatía (Crespi, 2016; Moya-Albiol & Martín, 2010). En concreto, la OXT es un neuropéptido que ha ganado especial atención en el estudio de la violencia debido a su implicación en el procesamiento de estímulos socioafectivos (Gedeon et al., 2019). La OXT desempeña un papel importante en la saliencia de la información social, facilitando procesos como la decodificación emocional o la motivación social (Crespi, 2016; Shamay-Tsoory & Abu-Akel, 2016) y, en consecuencia, también se ha relacionado con la empatía. (Barchi-Ferreira & Osorio, 2021).

Por otro lado, la psicoendocrinología ha destacado el papel de la T, una hormona asociada con la dominancia y el estatus social, en la predisposición a la violencia (Moya-Albiol & Romero-Martínez, 2020). Inicialmente, se sugirió que la T estaba directamente relacionada con la violencia (Cohan et al., 2003; Soler et al., 2000). Sin embargo, estudios posteriores revelaron que el papel facilitador de la T en la violencia era más complejo; siendo más un factor modulador que influye en diversas funciones socioafectivas (Crespi, 2016; Geniole et al. 2020). En población general, la T se ha vinculado con una mayor saliencia de estímulos amenazantes (van Honk & Schutter, 2007), una menor motivación social (Wu et al., 2019), y una peor toma de perspectiva (Ronay & Carney, 2013). Estos autores han propuesto que la T podría interferir con la saliencia de los estímulos sociales, dificultando funciones de la cognición social, como la empatía.

Finalmente, el C, una hormona implicada en la respuesta al estrés (Dedovic et al., 2009), también se ha propuesto como un posible modulador de la violencia (Moya-Albiol & Romero-Martínez, 2020). Un grueso importante de la literatura ha vinculado la violencia con menores niveles de C, a través de una hiporresponsividad al estrés y a los conflictos interpersonales (Montoya et al., 2012). Sin embargo, mayores niveles de C también se han relacionado con la conducta violenta al aumentar el foco en las señales sociales de amenaza. Por lo tanto, aunque hace falta más investigación al respecto, los resultados parecen indicar que un funcionamiento desajustado del eje hipotálamo-pituitaria-adrenal dificultaría el abordaje del estrés, lo que se ha relacionado con problemas en la empatía (Moya-Albiol & Romero-Martínez, 2020).

Asimismo, el sistema nervioso autónomo (SNA) también parece jugar un papel crucial en la predisposición a la violencia, dada su implicación en la regulación de la conducta, el procesamiento emocional y la empatía (Smith et al., 2020; Zaehringer et al., 2020). En este sentido, se han aportado argumentos sólidos que sugieren que la actividad del SNA podría ser especialmente relevante para caracterizar los patrones de conducta de los agresores (Babcock et al., 2005; Moya-Albiol & Romero-Martínez, 2020). En consecuencia, se ha incrementado el interés en el funcionamiento del sistema nervioso simpático (SNS), relacionado con la respuesta de lucha o huida, y del sistema nervioso parasimpático (SNP), relacionado con la regulación de la actividad simpática, en respuesta a estímulos relacionados con la violencia. En particular, el SNS se ha vinculado con el aumento del arousal ante estímulos afectivos, siendo crucial para el acercamiento emocional a las emociones ajenas (asociado con la empatía afectiva). Por otro lado, el SNP está asociado con la regulación de la activación emocional, favoreciendo funciones como la conducta orientada a los demás o la toma de perspectiva (asociadas con la empatía cognitiva; Palix et al., 2022). Por lo tanto, un patrón de actividad diferencial en marcadores fisiológicos como el SNS y el SNP podría influir en el mal funcionamiento de la respuesta empática (Holland et al., 2021; Zaehringer et al., 2020).

Finalmente, junto a la actividad del SNA, el patrón de expresión facial de emociones se presenta como otro marcador fisiológico relevante para el estudio de la empatía (Egger et al., 2019). Las expresiones faciales de emociones se conciben como respuestas automáticas biológicamente programadas a estímulos socioafectivos externos (Ekman, 1993). Se ha postulado que las expresiones faciales pueden reflejar la respuesta afectiva a señales emocionales en interacciones sociales (Hess & Fischer, 2022). En este sentido, un patrón de respuesta facial alineado con las emociones observadas, o mímica facial, se vincularía con niveles más altos de empatía afectiva (Rymarczyk et al., 2016). En su metaanálisis, Holland et al. (2021) concluyeron que las personas que exhibían una mayor mímica facial tenían niveles más elevados de empatía.

Sin embargo, la literatura expuesta se ha centrado en población general. La investigación de la empatía en agresores de violencia de género desde un enfoque biopsicosocial es particularmente escasa. Estudios recientes han observado que mayores niveles basales de T se vinculaban con un pobre procesamiento emocional ante estresores sociales (Romero-Martínez, Lila et al., 2013; Romero-Martínez et al., 2016c), así como una menor respuesta del C al estrés agudo en comparación a hombres sin antecedentes (Romero-

Martínez, Blanco-Gandía et al., 2021). Respecto a la OXT, se han obtenido resultados inconsistentes que la relacionan con una reducción o un incremento de la violencia, dependiendo del contexto y de las características individuales (DeWall et al., 2014; Roels et al., 2021). A su vez, se ha observado que estos agresores presentan una menor actividad del SNS en respuesta al conflicto interpersonal (Babcock et al., 2005; Trahan & Babcock, 2019) y del SNP ante el sufrimiento ajeno (Moreno et al., 2023). Por último, ningún estudio realizado hasta la fecha ha analizado la respuesta facial en estos agresores. En conjunto, los hallazgos presentados exponen la existencia de una relación entre los niveles psicobiológicos y la conducta violenta. No obstante, se observa una escasa investigación que analice los marcadores endocrinos y psicofisiológicos en relación a la empatía en agresores de violencia de género. Por lo tanto, es necesario integrar múltiples marcadores biológicos en el estudio de los principales factores involucrados en la perpetración de la violencia de género.

Considerando la investigación existente, esta Tesis Doctoral se presenta con el fin de avanzar en el conocimiento sobre las bases psicobiológicas de la empatía en agresores de violencia de género. De este modo, el objetivo principal de la presente Tesis Doctoral es evaluar la respuesta psicológica, endocrina, del SNA y de la expresión facial a una inducción empática realizada mediante el visionado de videos diseñados para provocar emociones; y estudiar su relación con la realización de conductas prosociales en un grupo de agresores de violencia de género en comparación con hombres sin antecedentes penales. Para llevar a cabo este objetivo, la tesis consta de un total de cuatro estudios.

El primer y segundo estudio se centraron en comparar los niveles endógenos de OXT, T y C de un grupo de agresores de violencia de género y un grupo de hombres sin antecedentes penales después de realizar la tarea de inducción empática. Como resultado del primer estudio, se observaron diferencias en la respuesta de la OXT de los agresores de violencia de género a la tarea en comparación con el grupo control, mostrando niveles más bajos de OXT específicamente a los 40 minutos después de la inducción empática. Los agresores de violencia de género mostraron una tendencia decreciente en sus niveles de OXT, contraria a la exhibida por el grupo control. De particular relevancia fue que, para toda la muestra, una mayor respuesta emotional autoinformada a la tarea y menores niveles de alexitimia (la dificultad para identificar y expresar emociones) predecían mayores niveles de OXT tras la inducción empática. Estos resultados sugieren la existencia de una relación entre la OXT y las funciones socioafectivas, donde los niveles de OXT pueden cambiar en respuesta a estímulos sociales.

Respecto al segundo estudio, nuestros datos revelaron que los agresores de violencia de género mostraron menores niveles de OXT, replicando el primer estudio, así como mayores niveles de T tras la inducción emocional en comparación al grupo control. En este estudio, también se observaron diferencias en la interacción de las ratios hormonales. Específicamente, al comparar los resultados con el grupo control, los agresores de violencia de género presentaron una disminución en los niveles de la ratio OXT/T después de la tarea, así como mayores niveles totales de la ratio T/C. En suma, se observaron diferencias en cuestionarios autoinformados que evaluaron funciones relevantes para la empatía. En este sentido, el grupo de agresores de violencia de género exhibió unas

puntuaciones más bajas en la toma de perspectiva, o capacidad de entender las perspectivas y emociones ajenas. Notablemente, cuanto menor fue la puntuación en la toma de perspectiva, menores fueron los niveles de OXT y mayores fueron los de T para toda la muestra. Por último, una baja toma de perspectiva también predijo menores niveles de la ratio OXT/T después de la inducción empática, y mayores niveles de T/C.

El tercer estudio analizó la actividad del SNA tras la tarea de inducción empática en ambos grupos. Los agresores de violencia de género mostraron una menor actividad del SNA al observar el sufrimiento ajeno. El grupo de agresores reportaron un menor incremento de la frecuencia cardíaca desde sus niveles basales hasta el periodo previo a la tarea, resultando en una menor frecuencia cardíaca a lo largo de toda la inducción empática. Este resultado es significativo ya que un incremento de la frecuencia cardíaca ante escenas de alto contenido emocional se ha vinculado con la empatía en población general (Steiger et al., 2019; Trautmann et al., 2018). De manera coherente, el grupo de agresores exhibió una menor respuesta simpática durante la inducción empática. Una mayor actividad del SNS ante el malestar ajeno se ha vinculado con el acercamiento emocional (Boucsein, 2012; Brown et al., 2021), por lo que la actividad simpática observada en los agresores podría ser indicativa de una menor activación al observar a terceras personas sufriendo violencia. En cuanto a la actividad parasimpática, los agresores reportaron niveles más bajos de arritmia sinusal respiratoria (un marcador parasimpático) en el periodo previo a la tarea y en el periodo de recuperación, aunque no durante la tarea en sí. Estos resultados sugieren una menor actividad general del SNP en los agresores de violencia de género, en lugar de un patrón de respuesta alternativo al presenciar el sufrimiento ajeno.

En este sentido, una mayor actividad general del SNP se han relacionado con la conducta orientada a los demás (Miller, 2018) y, a su vez, con una mayor empatía (Di Bello et al., 2020; Stellar et al., 2020).

El cuarto estudio incluyó el análisis de la respuesta facial al observar a personas sufriendo violencia. Complementariamente al tercer estudio, los resultados del cuarto estudio mostraron un patrón distintivo en la expresión facial de emociones por parte de los agresores de violencia de género durante la tarea. El grupo de agresores exhibió una menor prevalencia de expresiones faciales de tristeza y una mayor prevalencia de expresiones faciales de alegría en comparación con el grupo control. Se ha sugerido que las personas que exhiben una mímica facial ajustada, es decir, una expresión facial alineada con las emociones observadas, presentan niveles más elevados de empatía (Holland et al., 2021). De este modo, el menor registro de expresiones de tristeza en los agresores de violencia de género frente a víctimas de violencia, así como las expresiones de alegría, podrían indicar una discrepancia en la respuesta emocional al observar el sufrimiento ajeno. De hecho, el grupo de agresores también informó de una tristeza y ternura autoinformadas reducidas, lo cual se asoció con un menor registro de expresiones faciales de tristeza durante la inducción empática, independientemente del grupo. Finalmente, es importante destacar que el grupo de agresores mostró una peor capacidad de decodificación emocional, y que dificultades en esta habilidad predijeron una menor prevalencia de expresiones faciales de tristeza y una mayor prevalencia de expresiones de alegría durante la inducción empática. Teniendo esto en cuenta, los resultados del presente estudio sugieren una falta de mímica facial en los agresores de violencia de género al observar a otras personas sufriendo violencia. Asimismo, la menor mímica facial se relacionó con una menor respuesta emocional autoinformada y una peor decodificación emocional.

Finalmente, en el primer y tercer estudio se comparó la realización de una donación altruista entre ambos grupos, y se analizó su relación con la respuesta endocrina y psicofisiológica a la inducción empática. Los resultados mostraron una cantidad equiparable de donaciones en ambos grupos. Sin embargo, aquellas personas que realizaron conductas de donación (conductas prosociales) exhibieron un patrón endocrino y psicofisiológico específico durante la inducción empática. En concreto, mayores niveles de OXT y una mayor activación tanto del SNS como del SNP. Estos correlatos biológicos predijeron una mayor donación monetaria para todos los participantes. Hay evidencias de que un aumento en los niveles de OXT (Barraza & Zak 2009; Marsh et al., 2015), en la actividad del SNS (Sze et al., 2012; Yu & Hao, 2022) y en la actividad del SNP (Bornemann et al., 2016; Oveis, 2009; Stellar et al., 2015) al empatizar con personas sufriendo se asocia con una mayor prevalencia de conductas prosociales. Como se ha expuesto, estos marcadores juegan un papel importante en el procesamiento de los estímulos sociales y de la respuesta emocional ante el sufrimiento ajeno (Crespi, 2016; Decety, 2011; Gilbert, 2015; Porges, 2017). Por este motivo, nuestros hallazgos son especialmente relevantes ya que afianzan la relación entre estos marcadores endocrinos y psicofisiológicos con la conducta prosocial (Marsh et al., 2021; Miller, 2018), y lo hacen de forma independiente al grupo de pertenencia.

Los resultados de esta Tesis Doctoral contribuyen al conocimiento sobre los correlatos psicobiológicos de los agresores de violencia de género al intentar empatizar con personas sufriendo violencia. En conjunto, nuestros hallazgos proporcionan información significativa del patrón de respuesta psicológico, endocrino, psicofisiológico y facial de los agresores de violencia de género en la función empática, como se discute a continuación.

A nivel psicológico, los agresores exhibieron niveles especialmente elevados de alexitimia, dificultades en la toma de perspectiva y una decodificación emocional limitada. Además, los agresores informaron de una emocionalidad negativa reducida al observar personas sufriendo violencia. Estos resultados sugieren dificultades en los procesos tanto cognitivos como afectivos de la empatía en los agresores de violencia de género. Por lo tanto, apoyan las investigaciones anteriores que han propuesto alteraciones específicas en funciones socioafectivas relevantes para la empatía en esta población (Clements et al., 2007; Covell et al., 2007; Romero-Martínez et al., 2016a; 2016b; Romero-Martínez Lila, et al., 2021).

A nivel endocrino, los agresores de violencia de género exhibieron una disminución en sus niveles de OXT y OXT/T, así como mayores niveles de T y T/C, marcadores hormonales que se han vinculado con una menor empatía (Barraza & Zak, 2009; Procyshyn et al., 2020; Zilioli et al., 2015). Coherentemente, esta respuesta endocrina se relacionó con déficits en la toma de perspectiva, una menor respuesta emocional y mayores niveles de alexitimia. Nuestros hallazgos son congruentes con la hipótesis que propone que menores niveles de OXT, combinados con un alto nivel de T, dificultaría procesos relevantes para la empatía, como la saliencia de estímulos sociales, la capacidad de hacer inferencias de la perspectiva ajena o el acercamiento afectivo (van Anders et al., 2011; 2012; Gordon et al., 2017). Además, apoyan la literatura que ha vinculado una mayor T/C con la violencia de género

(Manigault et al., 2019; Romero-Martínez et al., 2016c; Romero-Martínez, González-Bono et al., 2013) y la relacionan con déficits socioafectivos (Mehta & Josephs, 2010; Zilioli et al., 2015).

A nivel psicofisiológico, los agresores exhibieron una menor respuesta del SNS y menores niveles totales del SNP al observar a personas sufriendo violencia respecto al grupo control. Este patrón psicofisiológico contrasta con la literatura existente sobre el SNA y la empatía. El incremento en la actividad del SNS al observar el malestar ajeno se ha vinculado con el acercamiento emocional (Brown et al., 2021; Stellar et al., 2020), y mayores niveles de actividad del SNP se han asociado con una mayor regulación emocional y conductas orientadas a los demás (Miller, 2018; Palix et al., 2022). En este contexto, el patrón psicofisiológico del grupo de agresores parece indicar una actividad del SNA que dificulta la respuesta empática. De acuerdo a la literatura, la actividad del SNA observada en los agresores de violencia de género seria indicativa de una menor sensibilidad ante el malestar ajeno, lo que podría dificultar una conducta orientada a los demás y, en última instancia, a la empatía.

A nivel del patrón facial de emociones, en comparación con el grupo control, el grupo de agresores registró menos expresiones faciales de tristeza y más expresiones faciales de alegría ante el sufrimiento ajeno. Se ha postulado que las expresiones faciales reflejan la respuesta afectiva a señales emocionales (Hess & Fischer, 2022; Seibt et al., 2015), estableciéndose una conexión entre la mímica facial y un mayor grado de empatía (Holland et al., 2021; Rymarczyk et al., 2016). De acuerdo con esta premisa, el patrón en la expresión facial de emociones de los agresores de violencia de género ante la inducción empática apoyaría los hallazgos relativos a otras poblaciones con conductas violentas, que muestran una mímica emocional reducida, especialmente ante las emociones negativas de los demás (Fanti et al., 2016; 2017; Frick et al., 2014). En este sentido, la relación entre una pobre decodificación emocional y una mímica facial desajustada sería congruente con esta afirmación, vinculando las dificultades en la decodificación emocional, una mímica facial reducida y una pobre empatía.

Por último, respecto a la conducta prosocial, el grupo de agresores y el grupo control mostraron la misma prevalencia de conductas de donación. Este hallazgo contradice la conceptualización de las personas violentas como incapaces de ser prosociales (Llorca-Mestre et al., 2017). De hecho, la realización de conductas prosociales, a través de donaciones, se asoció a mayores niveles de los correlatos biológicos de la respuesta empática, como una mayor OXT, mayor respuesta del SNS y mayores niveles de la actividad del SNP. Según el modelo de Marsh et al. (2021), la OXT parece mediar en la conducta prosocial a través de circuitos relacionados con el procesamiento de los estimulos socioafectivos, dependiendo de diversos factores individuales, como la sensibilidad a emociones ajenas o la conducta orientada a los demás. Esto es particularmente relevante, dado que estas funciones están estrechamente relacionadas con la actividad del SNA (Miller, 2018), y las personas que exhibieron una mayor actividad del SNS y del SNP durante la inducción empática también exhibieron una mayor prevalencia de conductas prosociales. De acuerdo a las teorías actuales, parece coherente hipotetizar que la conducta prosocial se relaciona con una mayor respuesta empática (Davis, 2015; Moya-Albiol, 2018). Así, nuestros hallazgos apoyan la relación entre los presentes correlatos psicobiológicos de la respuesta empática y el incremento de las conductas prosociales (Marsh et al., 2021).

Los resultados de esta Tesis refuerzan la relevancia del modelo biopsicosocial para explorar los factores de riesgo y protección de la violencia de género y contribuyen al campo de la neurocriminología, disciplina que estudia la relación bidireccional entre la neurobiología y la conducta criminal (Moya-Albiol et al., 2017; Moya-Albiol & Romero-Martínez, 2020). En conjunto con la interrelación de factores expuestos por los modelos socioculturales (Bosch-Fiol & Ferrer-Pérez, 2013, 2019; Heise, 1998, 2011), el patrón de funcionamiento psicobiológico observado en los agresores al intentar empatizar podría predisponerlos a relacionarse con el entorno en ciertos términos, constituyendo un factor de riesgo para el ejercicio de la violencia (Moya-Albiol & Romero-Martínez, 2020). De este modo, aunque los factores biológicos no pueden determinar, por sí solos, la violencia de género, sí forman parte de la interrelación de factores que contribuyen al ejercicio de este tipo de violencia (Pinto et al., 2010).

En conclusión, se proporcionan evidencias de déficits en la empatía en esta población, evidenciándolos como un factor de riesgo para el ejercicio de la violencia de género, al dificultar la inhibición de comportamientos perjudiciales para otros (Moya-Albiol, 2010; 2018; Van Langen et al., 2014). A partir de los resultados obtenidos y en línea con la literatura publicada por nuestro equipo de investigación, sugerimos que un enfoque de intervención centrado en la empatía podría ser útil para reducir la incidencia de este tipo de violencia. Por lo tanto, los programas de intervención, en línea con el modelo de Buenas Vidas (Santirso et al., 2020), deberían centrarse no solo en

minimizar los factores de riesgo, sino también en apoyar los factores protectores (por ejemplo, mejorar la empatía). Fomentar la empatía y la conducta prosocial es esencial en todas las etapas de prevención: en la primaria, reduciendo la probabilidad de ejercicio de violencia; en la secundaria, al promover dichas habilidades en hombres con mayor riesgo de violencia para prevenir su ocurrencia; y en la terciaria, mediante el tratamiento psicológico de agresores de violencia de género, con el objetivo de disminuir la reincidencia y favorecer la rehabilitación y reinserción de los agresores.

II. INTRODUCCIÓN

Capítulo 1. Marco conceptual de la violencia de género

1.1. Marco teórico, prevalencia y modelos explicativos

La violencia de género se define como cualquier acto que pueda provocar o provoque daños físicos, psicológicos o sexuales a las mujeres por parte de los hombres, incluyendo la amenaza, la coerción o la privación arbitraria de la libertad, tanto si se produce en el ámbito público como en el privado (Organización de las Naciones Unidas [ONU], 1993). Este tipo de violencia tiene como característica fundamental su base en cuestiones de género (ONU, 1995), por lo que trasciende períodos históricos, culturas, estratos sociales, etnias, religiones y grupos de edad (Font et al., 2006; Mallory et al., 2016; Ranganathan et al., 2021).

Como consecuencia de la violencia de género, se han expuesto graves efectos en la salud de las mujeres, incluyendo daños físicos, psicológicos y sociales a corto y largo plazo (Ellsberg et al., 2008; Vilariño et al., 2018) y cuya expresión más extrema son los feminicidios (Walklate et al., 2019). Además, la violencia de género no solo afecta a las víctimas directas, sino que tiene un impacto en su entorno cercano y en la comunidad en general (Loxton et al., 2017). Por consiguiente, representa una violación transversal de los derechos humanos, pues atenta contra la integridad física, psicológica y emocional de millones de personas y, en última instancia, niega la igualdad de género y el derecho a una vida libre de violencia para las mujeres (Organización Mundial de la Salud [OMS], 2021).

En España, con la creación en 1983 del Instituto de la Mujer y el trabajo conjunto de la investigación científica y la acción social del movimiento feminista, se inició un proceso de sensibilización para un abordaje multidisciplinar de la violencia de género (Pastor-Gosálbez et al., 2021; Valiente, 2006). Como resultado, se aprobó la Ley Orgánica 1/2004, de 28 de diciembre, de Medidas de Protección Integral contra la Violencia de Género. Esta ley conceptualiza legalmente el término de violencia de género y lo considera como la "manifestación de desigualdad, discriminación y relación de poder de los hombres sobre las mujeres, ejercida contra ellas por quienes son o han sido sus parejas (o relación análoga de afectividad), incluso sin convivencia" (p.10). Esta demarcación de la violencia de género en el contexto español representa un punto de inflexión en la lucha por la igualdad entre géneros, ya que establece que este tipo de violencia está dirigido a las mujeres simplemente por el hecho de serlo, identificándola como una forma de violencia específica.

Sin embargo, pese a los avances alcanzados, las cifras de víctimas siguen siendo alarmantes. En la Unión Europea, la Macroencuesta de Violencia contra la Mujer (Agencia de los Derechos Fundamentales, 2014) expuso que el 31% de las mujeres mayores de 15 años había sufrido uno o más actos de violencia física; el 11% había sufrido violencia sexual, y el 43% había sufrido algún tipo de violencia psicológica por parte de su pareja. En España, la última Macroencuesta de Violencia contra la Mujer (Delegación del Gobierno contra la Violencia de Género [DGVG], 2019) reveló que el 23,2% de las mujeres encuestadas había sufrido violencia psicológica y el 14,2% había sido víctima de violencia física o sexual por parte de su pareja, en algún momento de sus vidas. Esta información sobre la prevalencia de la violencia de género en España culmina con los datos referentes a los feminicidios, que exponen que, solamente en el año 2023, 55 mujeres fueron asesinadas por su pareja (DGVG, 2023). Por todo ello, la violencia de género se reconoce como una de las problemáticas más acuciantes de nuestros tiempos (Campbell et al., 2002; Trabold et al., 2020).

Para abordar esta problemática, se han considerado diferentes aproximaciones teóricas con el propósito de identificar las condiciones que propician su aparición y, así, poder implementar medidas eficaces para prevenirla. Estas explicaciones teóricas conciben la violencia de género como un fenómeno complejo que se manifiesta en diversos contextos y que integra características personales, situacionales y socioculturales (Allen et al., 2018; Moya-Albiol & Romero-Martínez, 2020). De este modo, se entiende que no existe una única causa explicativa de la violencia de género, sino que se requiere una aproximación holística que aborde los distintos elementos implicados (Hilton & Radatz, 2021). Para ello, es crucial comprender sus principales factores de riesgo, es decir, las condiciones que aumentan su probabilidad de aparición, así como sus factores de protección, cualquier condición que reduzca dicha probabilidad.

Entre las principales teorías explicativas de la violencia de género, destaca el modelo ecológico propuesto por Heise (1998; 2011). Este modelo muestra el fenómeno de la violencia de género como multifacético, basado en la interacción de varios factores posicionados en cuatro niveles de influencia: (1) el primer nivel representa los factores individuales que cada individuo aporta a su comportamiento y sus relaciones, seguido por (2) el microsistema, que abarca las dinámicas relacionales inmediatas. En el tercer nivel se encuentra el (3) exosistema, que incluye las instituciones y sistemas sociales, formales e informales, que envuelven al microsistema. Finalmente, (4) el macrosistema agrupa las visiones y actitudes generales de la sociedad, subyacentes a la cultura de la violencia de género (para una descripción más detallada, ver Tabla 1).

Niveles de influencia	***Factores integrados***
(1) Individual	Características biológicas, cognitivas, emocionales y conductuales que el individuo aporta a la pareja y que influyen en la probabilidad para cometer actos de violencia de género o ser víctima.
(2) Microsistema	Contexto inmediato en el que tiene lugar la violencia. Comprende las interacciones interpersonales del individuo y los significados que atribuye a esas interacciones. En la violencia de género, la más significativa es la que se genera con la pareja.
(3) Exosistema	Comprende los sistemas en los que arraigan las relaciones sociales, como la escuela, el lugar de trabajo o el vecindario. Hace referencia a las características de estos entornos que pueden predisponer a la violencia de género, como el bajo apoyo social o la aceptación de actitudes machistas.
(4) Macrosistema	Valores culturales e ideologías presentes en las sociedades que integra al resto de niveles. Entre los factores principales del macrosistema asociados a la violencia de género se encontraría la cultura patriarcal.

Tabla 1. *Modelo Ecológico. Extraída de Heise, (1998; 2011).*

En la misma línea, Bosch-Fiol y Ferrer-Pérez (2013; 2019) desarrollaron un modelo que considera la interacción entre niveles desde una perspectiva piramidal, incorporando una base fundamental de género que subyace a todos los demás factores. Este modelo consta de cinco niveles. El primero, la cultura patriarcal, establece, justifica y fomenta la violencia de género (De Miguel, 2010). En el segundo nivel, se encuentran los procesos de socialización diferencial, que difunden creencias y actitudes derivadas de la cultura patriarcal, dando origen a los roles tradicionales de género que estructuran las dinámicas relacionales sexo-afectivas. El tercer nivel está constituido por las expectativas de control derivadas de los roles tradicionales de género. A continuación, cobran fuerza los eventos desencadenantes, que incluyen cualquier factor individual o social que facilite la aparición de la violencia. Este modelo culmina con el estallido de la violencia (ver Figura 1).

Figura 1*. Modelo Piramidal. Extraída de Bosch-Fiol & Ferrer-Pérez (2019).*

Ambos paradigmas conciben la violencia de género como la interrelación de diversos factores expuestos en varios niveles de influencia. Así, determinadas condiciones socioculturales que sustentan y estructuran la violencia de género interactúan con características individuales que predisponen a las personas a convertirse en víctimas o agresores.

En este contexto, el modelo biopsicosocial emerge como un enfoque que añade información especialmente significativa. Este modelo entiende la violencia desde una perspectiva integradora, según la cual la conducta violenta sería el resultado de una compleja interacción bidireccional y dinámica entre los sustratos biológicos (neuroanatómicos, hormonales, genéticos y moleculares) y los factores psicosociales y culturales (Moya-Albiol & Romero-Martínez, 2020; Pinto et al., 2010). Estos sustratos biológicos facilitan la activación o inhibición de funciones que influyen en la interpretación de la información del entorno y, a su vez, predisponen al individuo a relacionarse con este en ciertos términos (Bolton, 2022; Frieze et al., 2020).

En el caso de la violencia de género, se ha propuesto que ciertos factores biológicos interactúan con el contexto cultural y social planteado por los modelos anteriores, influyendo en la predisposición de los agresores a adoptar conductas violentas (Moya-Albiol et al., 2017). Teniendo esto en cuenta, la identificación de factores de riesgo y protección específicos para la violencia de género desde una perspectiva biopsicosocial contribuiría a enriquecer su marco teórico explicativo y, consecuentemente, a mejorar su abordaje (Corvo & Dutton, 2015). Esto incluye aquellos correlatos biológicos asociados con dificultades en la regulación socioafectiva y conductual del individuo (Chester & DeWall, 2018), pero, también, los correlatos biológicos asociados con el fomento del ajuste socioafectivo y comportamental. De esta manera, aunque los factores biológicos no pueden determinar la violencia de género por sí solos, sí que forman parte de la interrelación de factores socioculturales, ambientales e individuales que contribuyen a ella (Bueso-Izquierdo et al., 2022; Pinto et al., 2010; Stover et al., 2022).

En vista de la alta incidencia y de la gravedad de las consecuencias de la violencia de género, es evidente la necesidad de continuar con el estudio de todos aquellos factores de riesgo y protección que estén relacionados con esta problemática social. Es pertinente señalar que esta perspectiva no busca minimizar ni excluir las contribuciones realizadas desde el enfoque psicosocial y cultural. Más bien, aboga por un enfoque de la violencia de género que contemple el análisis de los factores psicobiológicos que influyen en la conducta violenta del agresor. Al exponer características nuevas y profundizar en las ya conocidas, aumentaremos las herramientas disponibles para abordar la violencia de forma integral y transversal a largo plazo.

1.2. Importancia del estudio de los agresores

Actualmente, se ha enfatizado la importancia de entender al agresor como un elemento fundamental de la violencia de género, reconociendo la necesidad de analizar los principios que impulsan su conducta violenta (García-Moreno et al., 2015; Karakurt et al., 2019).

La investigación en agresores pretende identificar las características intrínsecas de esta población para comprender los factores que los predisponen a la conducta violenta y, así, optimizar los recursos disponibles para intervenir desde las áreas de salud, justicia y servicios sociales (Capaldi et al., 2012; Lila et al., 2019). Con este objetivo en mente, se ha hecho hincapié en un enfoque de intervención basado en la evidencia, que permita aumentar su efectividad en la reducción de la violencia de género (Radatz & Wright, 2016; Radatz et al., 2021). De este modo, al conocer sus principales factores de riesgo, se provee información sobre las necesidades terapéuticas más relevantes a abordar en los programas de prevención primaria, secundaria y terciaria (Eckhardt et al., 2013; Travers et al., 2021).

En conjunto, la literatura ha revelado que se trata de una población heterogénea (Amor et al., 2009; Crane & Easton, 2017). A nivel sociodemográfico, se ha planteado que una menor edad y un bajo nivel educativo y socioeconómico podrían vincularse con la violencia de género (Center for Disease Control and Prevention, 2020). Sin embargo, la relación de estas variables sociodemográficas con la violencia de género dista mucho de ser concluyente (Biglia & San Martín, 2007; Clare et al., 2021; Vives-Cases et al., 2007). Además, aunque algunos estudios han identificado rasgos psicopatológicos en esta población (Sesar et al., 2018), no todos los agresores presentan un diagnóstico psicopatológico (Weber & Bouman, 2020).

Teniendo esto en cuenta, se ha descartado la existencia de un único perfil de agresor y, en su lugar, se ha propuesto la existencia de características prevalentes que aumentan la probabilidad de ejercer violencia de género (Clare et al., 2021). Diversas líneas de investigación han descrito la presencia de patrones cognitivos antisociales, como actitudes favorables hacia la violencia, sesgos de atribución hostil o actitudes degradantes hacia la mujer (Gracia et al., 2020; Senkans et al., 2020). Asimismo, se ha descrito una regulación emocional deficiente (Maloney et al., 2023) junto con mayores niveles de impulsividad, hostilidad y un menor control de la ira (Birkley & Eckhardt, 2015; Finkel, 2007; Leone et al., 2016; Sesar et al., 2018), así como una elevada incidencia de abuso del alcohol y otras sustancias (Vitoria-Estruch et al., 2018a). Todo ello puede resultar en una incapacidad para resolver conflictos mediante mecanismos no violentos, como la negociación o la cooperación empática (Moya-Albiol et al., 2017), incrementando significativamente la posibilidad de realizar conductas violentas.

Los resultados de estos estudios nos ayudan a tomar conciencia sobre factores relevantes que influyen en el ejercicio de la violencia de género. Sin embargo, se destaca la necesidad de continuar explorando en sus características, incrementando la evidencia que permita mejorar las estrategias de intervención (Clare et al., 2021; Gunarathne et al., 2023; Lila & Gilchrist, 2023; Travers et al., 2021). A pesar de que los datos sobre la eficacia de los programas de intervención señalan un efecto positivo en la reducción de la reincidencia, aún se observan resultados modestos tanto a nivel global (Aaron & Beaulaurier, 2017; Arce et al., 2020; Eckhardt et al., 2013; Wilson et al., 2021) como en España (Ferrer-Pérez & Bosch-Fiol, 2018). En consecuencia, los investigadores en este campo subrayan la relevancia de ampliar el conocimiento sobre esta población para incrementar la eficacia terapéutica y reducir la reincidencia (Lila & Gilchrist, 2023; Lila et al., 2019; Romero-Martínez et al., 2019a; Travers et al., 2021).

En este contexto, la empatía, una función socioafectiva compleja que integra la capacidad de comprender y compartir la experiencia emocional de otra persona, se ha propuesto como un factor protector contra la conducta violenta (Chialant et al., 2016; Cuff et al., 2016; Moya-Albiol, 2011; 2018). Diversos autores han sugerido que la inclusión del trabajo en empatía podría aumentar la eficacia de los programas de intervención con delincuentes violentos y promover relaciones interpersonales basadas en el bienestar (Day et al., 2010; Jolliffe & Farrington, 2004; Van Langen et al., 2014).

Del mismo modo, también se ha propuesto un papel relevante de la función empática en la perpetración de la violencia de género (Godfrey et al., 2020; Romero-Martínez et al., 2019a; Ulloa & Hammett, 2016). Por ello, en el próximo capítulo se analizarán los principales resultados del estudio de la empatía en el agresor de violencia de género y el impacto que tiene en el ejercicio de este tipo de violencia.

Capítulo 2. Estudio de la empatía en agresores

La empatía se define como una respuesta compleja, en parte automatizada pero también moldeada por diversos procesos cognitivos, que se manifiesta al observar o imaginar las emociones ajenas (Hall & Schwartz, 2019). La empatía incluye elementos cognitivos y afectivos. Por un lado, implica la capacidad de comprender el estado emocional ajeno (empatía cognitiva); por otro, genera una respuesta emocional (empatía afectiva; Moya-Albiol et al., 2010). Para un buen funcionamiento empático, es crucial reconocer que la fuente de la emoción no es propia, dando lugar a una emoción similar a la percibida, aunque no idéntica (Cuff et al., 2016; Moya-Albiol, 2018).

La empatía se ha considerado una herramienta importante para reducir los comportamientos violentos hacia los demás. Por el contrario, se cree que la falta de empatía está asociada con la violencia y la conducta antisocial, ya que dificulta la inhibición de comportamientos potencialmente perjudiciales para otros (Chialant et al., 2016; Moya-Albiol, 2011). En dos meta-análisis exhaustivos, se observó que niveles más bajos de empatía se vinculaban con una mayor delincuencia violenta (Jolliffe & Farrington 2004; Van Langen et al., 2014). Estos autores han enfatizado la importancia de integrar la empatía en la intervención con delincuentes violentos, facilitando el cese de conductas antisociales y el incremento de conductas prosociales (Day et al., 2010; Jolliffe & Farrington, 2004; Van Langen et al., 2014).

En agresores de violencia de género, la literatura ha expuesto dificultades en la empatía y en funciones socioafectivas relevantes para un buen funcionamiento empático. Clement et al. (2007) evidenciaron un peor rendimiento al intentar comprender los pensamientos y sentimientos de sus parejas en hombres violentos durante una tarea de conflicto marital. Ese mismo año, Covell et al. (2007), mediante la administración de un cuestionario autoinformado a un grupo de agresores, observaron que una peor puntuación en la toma de perspectiva, la capacidad de entender las perspectivas y emociones ajenas, y una mayor puntuación en distrés empático, un profundo malestar ante las emociones ajenas, se relacionaban con una mayor frecuencia de la violencia de género. Asimismo, Ulloa & Hammett, (2016) advirtieron que una menor puntuación en un cuestionario de empatía también se relacionaba con una mayor frecuencia de violencia de género en esta población.

Estudios más recientes han intentado ahondar en las funciones socioafectivas relevantes para la empatía. Como resultado, se ha reforzado la presencia de dificultades en la toma de perspectiva y un mayor distrés en esta población (Vitoria-Estruch et al., 2018a) y se han vinculado con problemas en la identificación y expresión emocional, o alexitimia (Romero-Martínez, Lila et al., 2021). Notablemente, diversos autores han expuesto que una peor toma de perspectiva y una decodificación emocional empobrecida podrían asociarse con el abandono de la intervención y con mayores tasas de reincidencia (Romero-Martínez et al., 2016a; 2023). A su vez, los programas de intervención han mostrado resultados positivos, aunque modestos, a la hora de mejorar la capacidad empática de los agresores (Romero-Martínez et al., 2016b; Romero-Martínez et al., 2019a; Zosky, 2016).

Estos hallazgos sugieren que la capacidad empática podría influir tanto en la violencia de género como en la eficacia de las intervenciones, lo que afianza la importancia de incorporar el trabajo en empatía. Sin embargo, se requiere una investigación más extensa al respecto, ya que aún no contamos con una comprensión profunda de la relación entre la empatía y la violencia. En este sentido, Vachon et al. (2014), en su metaanálisis en población general, observaron que dicha relación dependía en gran medida de la metodología utilizada y concluyeron que es necesario aumentar la diversidad en los protocolos de evaluación de la empatía. De este modo, se podría comprender mejor los procesos socioafectivos implicados.

La empatía es un constructo complejo que, aunque depende de características relativamente estables, también se ve influenciada por factores situacionales (Cuff et al., 2016), lo que hace difícil abordarla únicamente a través de cuestionarios autoinformados. Por ello, se ha destacado la importancia de estudiar la empatía mediante el uso de paradigmas de evaluación naturalmente inducidos (Fernández-Aguilar et al., 2018; Fernández-Megías et al., 2011). En este sentido, la visualización de películas de alto contenido emocional se ha consolidado como uno de los procedimientos de inducción emocional más eficaces, subrayando su potencial para inducir estados de ánimo negativos (Fernández-Aguilar et al., 2019; Vaughan et al., 2007). Este procedimiento de inducción empática, en combinación con instrumentos y cuestionarios validados, contribuiría a incrementar la validez ecológica de los resultados (Dziobek, 2012).

Como valor añadido, estos procedimientos han sido previamente empleados para estudiar la empatía desde una perspectiva biopsicosocial, integrando aspectos biológicos (principalmente correlatos endocrinos y psicofisiológicos) junto a aspectos psicológicos del procesamiento emocional (Barraza & Zak 2009; Procyshyn et al., 2020; Stellar et al., 2015).

Este enfoque es particularmente relevante, dado que pocos estudios se han centrado en la evaluación de la empatía en estos agresores desde una perspectiva biopsicosocial. Este hecho es llamativo debido a la alta prevalencia de sesgos en el dominio afectivo presentes en esta población, como la baja autopercepción emocional, la elevada deseabilidad social o la manipulación intencionada (Garaigordobil-Landazabal & Peña-Sarrionandia, 2015; Visschers et al., 2017). Por lo tanto, hay un creciente énfasis en combinar la evaluación psicosocial de la empatía en los agresores con biomarcadores menos susceptibles a sesgos y manipulación (Moya-Albiol & Romero-Martínez, 2020). Teniendo esto en cuenta, la integración de un protocolo de inducción empática en agresores de violencia de género (p. ej., mediante la visualización de escenas de alto contenido emocional), junto a cuestionarios autoinformados, que considere los principales factores psicobiológicos, favorecería una comprensión más realista de la empatía (Pinto et al., 2010; Siedlecka & Denson, 2019; Vachon et al., 2014).

Con el objetivo de contribuir en esta línea de investigación, el siguiente capítulo se enfocará en los principales resultados sobre los correlatos endocrinos y psicofisiológicos de la empatía y sus funciones asociadas y cómo se ha relacionado, si se ha hecho, con la violencia de género.

Capítulo 3. Correlatos biológicos de la empatía en agresores de violencia de género

3.1. Marcadores endocrinos

Existe una literatura relativamente extensa que, mediante la aplicación de técnicas y principios de la neurociencia, ha documentado patrones de funcionamiento biológico relevantes para la conducta violenta (Moya-Albiol & Romero-Martínez, 2020; Pinto et al., 2010; Saladino et al., 2021; Sontate et al., 2021). Como resultado, se ha observado que el desajuste endocrino en los niveles de hormonas como la oxitocina (OXT), la testosterona (T) y el cortisol (C) podría interferir en funciones de la cognición social, como la empatía, facilitando la aparición de la conducta violenta (Crespi, 2016; Frieze et al., 2020; Rosell & Siever, 2015).

La OXT es un neuropéptido producido en los núcleos supraóptico y paraventricular del hipotálamo, que ha ganado especial atención en el estudio de la violencia debido a su implicación en el procesamiento de estímulos socioafectivos (Gedeon et al., 2019). La OXT desempeña un papel importante en la saliencia de la información social, facilitando procesos como la decodificación emocional o la motivación social (Crespi, 2016; Shamay-Tsoory & Abu-Akel, 2016). La OXT también se ha relacionado con la empatía. En población general, la visualización de escenas de personas sufriendo ha reportado aumentos en los niveles de OXT en plasma (OXTp), relacionándose con una mayor empatía autoinformada (Barraza & Zak, 2009; Kampka et al., 2019). En un estudio análogo, se observó un aumento en los niveles de OXT salivar (OXTs) durante una tarea similar (Procyshyn et al., 2020). Sin embargo, Barchi-Ferreira & Osorio, (2021), pese a presentar una relación positiva entre la OXT y la empatía en su revisión sistemática, expusieron resultados modestos que precisan de más investigación.

En relación a la violencia de género, la investigación sobre la OXT es muy limitada y arroja resultados inconsistentes. Ditzen et al. (2009) advirtieron que la administración de OXT reducía las conductas violentas en parejas heterosexuales sin antecedentes durante una tarea de conflicto marital. En esta línea, Roels et al., (2021) observaron, en una muestra similar, que mayores niveles basales de OXTp se asociaban con estrategias positivas de resolución de conflicto de pareja. No obstante, en hombres violentos, dos estudios no reportaron efectos de la administración de OXT en su predisposición a la violencia durante una tarea de conflicto marital (Flanagan et al., 2022; Jarnecke et al., 2018), mientras que otro estudio sí expuso que aumentaba la propensión a la violencia (DeWall et al., 2014).

Esta inconsistencia en los resultados podría explicarse por la diversidad en las metodologías utilizadas. Además, según la hipótesis de la saliencia social (Shamay-Tsoory & Abu-Akel, 2016), la actividad del sistema oxitocinérgico y su influencia en la interacción social depende del contexto, su valencia afectiva o la relevancia del vínculo interpersonal (Bartz et al., 2011), e interactúa con variables individuales, como la capacidad de decodificación emocional o la sensibilidad a las emociones ajenas (Barchi-Ferreira & Osório, 2021; Marsh et al., 2021). Por lo tanto, parece imperativo considerar estas variables socioafectivas en el estudio de la OXT y la empatía.

Por otro lado, la psicoendocrinología también ha destacado el papel de la T, una hormona esteroidea gonadal asociada con la dominancia y el estatus social, en la predisposición a la violencia (Moya-Albiol & Romero-Martínez, 2020; Moya-Albiol & Serrano-Rosa, 2009; Frieze et al., 2020). Inicialmente, se sugirió que la T estaba directamente relacionada con la violencia (Cohan et al., 2003; Soler et al., 2000). Sin embargo, estudios posteriores revelaron que el papel facilitador de la T en la violencia era más complejo y no necesariamente unidireccional. De hecho, varios metaanálisis establecieron que la relación entre T y la violencia, aunque positiva, era baja (Archer, 2006; Geniole et al. 2020); siendo más un factor modulador, que influye en diversas funciones socioafectivas (Crespi, 2016; Romero-Martínez, 2023), que el factor desencadenante para la conducta violencia.

Respecto al funcionamiento socioafectivo, la administración de T en población general se ha vinculado con una mayor saliencia de estímulos amenazantes (van Honk & Schutter, 2007) y una menor motivación social (Wagels et al 2018; Wu et al., 2019). Además, mayores niveles basales de T salivar (Ts) se han relacionado con una peor toma de perspectiva (Ronay & Carney, 2013). Asimismo, un estudio reciente observó una disminución en los niveles de Ts durante una tarea de inducción empática al observar escenas de personas sufriendo (Procyshyn et al., 2020). Estos autores concluyeron que la T podría interferir con la saliencia de los estímulos sociales, especialmente cuando estos no se perciben como amenazantes. Esta afirmación es coherente con los resultados observados en una revisión sistemática que relacionó mayores niveles de T con una peor decodificación de las emociones en las expresiones faciales ajenas (Romero-Martínez, Sarrate-Costa et al., 2021).

En agresores de violencia de género, la investigación ha asociado mayores niveles basales de Ts con una decodificación emocional empobrecida y mayores niveles de ansiedad e ira ante estresores sociales (Romero-Martínez, Lila et al., 2013; Romero-Martínez et al., 2016c). Estos resultados sugieren que niveles elevados de T podrían disminuir la capacidad para decodificar emociones que, combinado con una inestabilidad emocional (altos niveles de ansiedad e ira), podría dificultar la función empática y, en última instancia, predisponer a la conducta violenta (Crespi, 2016; Geniole et al., 2020; Romero-Martínez, 2023). Sin embargo, no hay estudios específicos que se hayan focalizado en la respuesta endógena de la T a una tarea de inducción empática en esta población.

Finalmente, el C, una hormona esteroidea adrenal implicada en la respuesta al estrés (Dedovic et al., 2009), también se ha propuesto como un posible modulador de la violencia, aunque los resultados son heterogéneos (Moya-Albiol & Romero-Martínez, 2020). Un grueso importante de la literatura ha vinculado la violencia con menores niveles de C, a través de una hiporresponsividad al estrés y a los conflictos interpersonales (Montoya et al., 2012; Pante et al., 2022). Sin embargo, mayores niveles de C también se han relacionado con la conducta violenta al aumentar el foco en las señales sociales de amenaza. Abercrombie et al., (2005) expusieron que la administración de C aumentaba la probabilidad de sentir ira ante estímulos neutros. Asimismo, se ha observado que la administración de C podría recortar el tiempo de reacción a estímulos negativos y empeorar el reconocimiento emocional (Ma et al., 2017; Van Peer et al., 2007). De hecho, el aumento de C salivar (Cs) se ha vinculado con una peor decodificación de las emociones en las expresiones faciales (Romero-Martínez, Sarrate-Costa et al., 2021).

Respecto a la investigación en violencia de género, se ha observado un menor cambio en el Cs de los agresores en respuesta a una tarea de estrés social en comparación a hombres sin antecedentes (Romero-Martínez, Lila et al., 2013), Además, Romero-Martínez, Blanco-Gandía et al. (2021) informaron de bajos niveles de Cs en estos agresores después de una tarea de estrés cognitivo agudo. Por lo tanto, aunque hace falta más investigación al respecto, los resultados parecen indicar un funcionamiento del eje hipotálamo-pituitaria-adrenal atenuado para hacer frente al estrés agudo.

Sin embargo, el sistema endocrino es altamente complejo y es importante tener en cuenta la interacción entre hormonas. En este sentido, se ha propuesto la teoría esteroide/peptídica de los vínculos sociales que propone que menores niveles de OXT, combinados con un alto nivel de T, podrían dificultar procesos relevantes para la empatía, aunque la literatura al respecto es todavía escasa (van Anders et al., 2011; 2012; Gordon et al., 2017).

Por otro lado, la hipótesis dual sostiene que la T se relaciona con la violencia cuando los niveles de C son bajos (Mehta & Josephs, 2010). Esta hipótesis se fundamenta en una posible relación inversa entre la liberación de C y de T. De acuerdo a la misma, la presencia de una ratio T/C elevada se vincularía con una predisposición a la violencia de género, debido al aumento de la cognición auto-focalizada y a una disminución en la sensibilidad hacia el castigo (Manigault et al., 2019). Coherentemente, se han observado niveles más altos de T/C en un grupo de agresores de violencia de género comparados con un grupo de hombres sin antecedentes penales después de someterse a una tarea de estrés social con retroalimentación negativa (Romero-Martínez, González-Bono et al., 2013). A pesar de los resultados obtenidos, es fundamental destacar que la relación entre estas dos hormonas es altamente compleja y depende de diversos factores (Rosell & Siever, 2015). Un ejemplo de esta complejidad se encuentra en la investigación de Salis (2017), que reveló una correlación positiva entre niveles elevados de la ratio T/C y la perpetración de violencia de género, dependiendo del nivel de hostilidad del agresor.

En conjunto, los hallazgos presentados descartan la posibilidad de una relación unidireccional y simplista entre los niveles endocrinos y la conducta violenta. Por lo tanto, es necesario integrar múltiples marcadores hormonales en el estudio de los principales factores involucrados en la conducta violenta. No obstante, se observa una escasa investigación que analice los niveles endógenos de estos marcadores endocrinos, tanto basales como de cambio, en una tarea de inducción empática en agresores de violencia de género.

3.2. Marcadores psicofisiológicos

El sistema nervioso autónomo (SNA) también parece jugar un papel crucial en la predisposición a la violencia (McGarry & Portnoy, 2022), dada su implicación en la regulación de la conducta, el procesamiento emocional y la empatía (Smith et al., 2020; Zaehringer et al., 2020). En este sentido, se han aportado argumentos sólidos que sugieren que la actividad del SNA podría ser especialmente relevante para caracterizar los patrones de conducta de los agresores (Babcock et al., 2005; Stover et al., 2022; Moya-Albiol & Romero-Martínez, 2020). En consecuencia, se ha incrementado el interés en el funcionamiento del sistema nervioso simpático (SNS), relacionado con la respuesta de lucha o huida, y del sistema nervioso parasimpático (SNP), relacionado con la regulación de la actividad simpática, en respuesta a estímulos relacionados con la violencia (para más información, ver Figura 2).

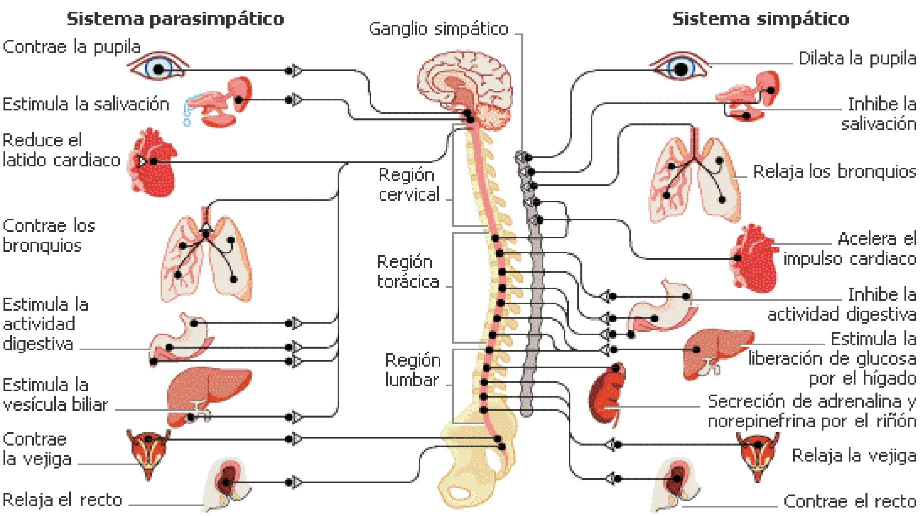

***Figura 2**. Funciones fisiológicas del SNS y SNP.*

Gran parte de los estudios en agresores de violencia de género se han enfocado en evaluar marcadores generales de activación fisiológica, como la frecuencia cardíaca (FC) o la frecuencia respiratoria (FR), de la actividad simpática, como el periodo de pre-eyección (PEP) o la actividad electrodérmica (AED), y de la actividad parasimpática, como la arritmia sinusal respiratoria (ASR; De Looff, 2022; Reyes del Paso et al., 2013). Basándose en estos marcadores, se ha expuesto una mayor activación del SNS y una menor activación del SNP en agresores de violencia de género ante paradigmas de estrés social (Romero-Martínez et al., 2014) y cognitivo (Romero-Martínez et al., 2022; Vitoria-Estruch et al., 2018b) con retroalimentación negativa, en comparación con un grupo control. Específicamente, los agresores exhibieron una predominancia simpática, mayor AED y PEP más cortos, durante el periodo de recuperación, manifestando una mayor activación incluso cuando los estresores ya no estaban presentes. Estos resultados apuntan a una activación simpática prolongada ante la evaluación negativa que podría dificultar la regulación del estrés, siendo, a su vez, un factor precipitante de comportamientos violentos.

No obstante, también se han registrado descensos en los niveles de FC y AED (indicativos de una menor activación simpática) durante tareas de conflicto marital en agresores con altas tasas de violencia (Babcock et al., 2005; Trahan & Babcock, 2019). Estos resultados destacan que la actividad del SNA de los agresores podría diferir según una variedad de factores socioafectivos relevantes para la violencia, como las características del estresor (centrado en uno mismo o centrado en otros), el contexto en el que sucede y el procesamiento emocional derivado del estresor.

El estudio de la respuesta psicofisiológica a tareas socioafectivas puede proporcionar información valiosa sobre el patrón de funcionamiento del SNA en estos agresores (Christopoulos et al., 2019), ya que los estímulos emocionales inician rápidamente una respuesta del SNA (Obradović & Boyce, 2012). En particular, el SNS se ha vinculado con el aumento del arousal ante estímulos afectivos, siendo crucial para el acercamiento emocional a las emociones ajenas (asociado con la empatía afectiva). Por otro lado, el SNP está asociado con la regulación de la activación emocional, favoreciendo funciones como la conducta orientada a los demás o la toma de perspectiva (asociadas con la empatía cognitiva; Palix et al., 2022).

Como resultado de esta línea de investigación, se han expuesto resultados interesantes en agresores de violencia de género. Respecto al SNS, Godfrey & Babcock (2020) observaron que aquellos agresores con comportamientos más violentos presentaban una menor respuesta de la AED ante el conflicto marital, enfatizando la importancia de la capacidad de decodificación emocional como variable moderadora. En esta línea, Babcock & Potthoff, (2021) proporcionaron evidencias de una menor respuesta de la AED en estos agresores después de una tarea de inducción de emociones negativas en comparación con un grupo control. Ambos estudios sugieren una menor actividad del SNS ante conflictos interpersonales. Respecto al SNP, una menor actividad parasimpática en agresores de violencia de género, evaluada a través de la ASR, se vinculó con dificultades en la regulación de la ira (Sarrate-Costa et al., 2023). Este hallazgo es coherente con el hecho de que el SNP parece facilitar la regulación del distrés y la conducta orientada a los demás (Miller, 2018; Porges, 2007). Otro estudio reciente observó que un grupo de agresores de violencia de género exhibieron menores niveles de ASR al observar el sufrimiento ajeno, durante una tarea de inducción de compasión, en comparación con un grupo control (Moreno et al., 2023).

Estos resultados proporcionan evidencias de una actividad del SNA diferencial en los agresores frente a estímulos socioafectivos, caracterizada por una menor actividad del SNS y del SNP, lo cual, dependiendo de otros factores, podría predisponer a la violencia. Sin embargo, también parece evidente la necesidad de más investigación en este campo, que integre los posibles factores mediadores. Así, mediante el estudio de la respuesta psicofisiológica durante una inducción empática, se podría profundizar en cómo influye el SNA en una función clave para la regulación conductual y la inhibición de la violencia (Godfrey et al., 2020; Sáez et al., 2022).

Finalmente, junto a la actividad del SNA, el patrón de expresión facial de emociones se presenta como otro marcador fisiológico relevante para estudio del procesamiento de estímulos socioafectivos (Egger et al., 2019). Las expresiones faciales de emociones se conciben como respuestas automáticas biológicamente programadas a estímulos socioafectivos externos (Ekman, 1993). Se ha postulado que las expresiones faciales pueden reflejar la respuesta afectiva a señales emocionales en interacciones sociales (Hess & Fischer, 2022; Seibt et al., 2015). En este sentido, un patrón de respuesta facial alineado con las emociones observadas, o mímica facial, se vincularía con niveles más altos de empatía afectiva (Rymarczyk et al., 2016). En su metaanálisis, Holland et al. (2021) concluyeron que las personas que exhibían una mayor mímica facial tenían niveles más elevados de empatía y, en mayor medida, compartían los estados emocionales ajenos.

No obstante, en poblaciones con conductas violentas, la investigación es más escasa. La literatura sugiere que los individuos con una mayor prevalencia de comportamientos violentos muestran una mímica emocional reducida, especialmente ante emociones negativas (De Wied et al., 2012; Fanti et al., 2016; Frick et al., 2014). Fanti et al. (2017) evaluaron el patrón de respuesta facial de emociones en individuos violentos empleando el software FaceReader, un software de codificación facial que categoriza las expresiones faciales de los individuos en emociones específicas. Como resultado, revelaron que individuos violentos con niveles bajos de empatía mostraban reacciones faciales reducidas de emociones negativas, como la tristeza, en respuesta a películas violentas. Sin embargo, la mímica emocional no se ha explorado en agresores de violencia de género. Por ello, el estudio de la expresión facial de emociones en esta población en respuesta al sufrimiento ajeno podría ser especialmente prometedor.

Capítulo 4. Conducta prosocial en agresores. Importancia de la perspectiva biopsicosocial

Por último, si bien es importante examinar los factores de vulnerabilidad para la perpetración de la violencia de género, el estudio de los factores de protección resulta imperativo, ya que de otro modo no es posible tener una comprensión integral de cómo prevenir este tipo de violencia. De hecho, se ha expuesto que los programas de intervención en agresores deben abordar los factores criminogénicos que contribuyen al desarrollo de la violencia y, a su vez, reforzar patrones de conducta adaptativos apoyándose en las fortalezas de los agresores (Kewley, 2017; Nee & Vernham, 2017). En este contexto, la empatía se ha asociado, no solo con el cese de conductas antisociales, sino también con el incremento de conductas prosociales (Day et al., 2010; Jolliffe & Farrington, 2004; Van Langen et al., 2014).

La conducta prosocial integra una amplia gama de conductas sociales positivas, como la cooperación o el altruismo, que favorecen el desarrollo de interacciones basadas en el bienestar (Pfattheicher et al., 2022). Tradicionalmente, se ha conceptualizado la conducta prosocial y la violencia como mutuamente excluyentes, sin embargo, esta hipótesis está lejos de ser concluyente (Llorca-Mestre et al., 2017). Actualmente, la conducta prosocial se ha relacionado, en mayor medida, con un funcionamiento efectivo de la empatía (Davis, 2015; Mayer et al., 2018; Moya-Albiol, 2018). Esta premisa desestigmatiza a la población violenta como incapaz de ser prosocial y pone el foco en el funcionamiento socioafectivo de los agresores como herramienta para promover patrones de interacción social saludables (Santirso et al., 2020; Ward & Durrant, 2021; Ward & Maruna, 2007). No obstante, la investigación dista mucho de conocer la relación específica entre la respuesta empática y la realización de conductas prosociales en esta población. Teniendo esto en cuenta, el estudio de la empatía y la conducta prosocial en agresores desde una perspectiva biopsicosocial se presenta como fundamental, ya que puede proporcionar una vía para prevenir e intervenir la violencia de género.

Se ha señalado que el sistema oxitocinérgico podría estar implicado en la aparición de conductas prosociales a través de funciones relevantes para la empatía (Hurlemann & Marsh, 2017; Walum & Young 2018). Varios estudios han informado que el aumento de OXTs está asociados con un aumento en el comportamiento prosocial, y esta relación parece depender de diferencias individuales en la capacidad empática (Barraza & Zak, 2009; 2013; Strang et al., 2017). Este punto de vista se ve apoyado por otros hallazgos que han mostrado que la administración de OXT incrementa la atención visual hacia señales sociales positivas (Domes et al., 2013) y promueve la comunicación social recíproca (Mayer et al., 2019). De hecho, la administración de OXT se ha asociado con mayores conductas prosociales, medidas a través de donaciones monetarias (Barraza et al., 2011; Marsh et al., 2015; Zak et al., 2007).

Según el modelo propuesto por Marsh et al. (2021), la OXT modula el funcionamiento de tres redes neuronales, parcialmente superpuestas, como son los circuitos relacionados con la saliencia estimular, la motivación social y el afecto negativo. Dependiendo de diversos factores individuales y contextuales, como la sensibilidad ante emociones ajenas, la OXT tendría el potencial para atenuar la respuesta a estresores sociales (Eckstein et al., 2015), facilitando una respuesta orientada a los demás (Liao et al., 2021) y promoviendo la formación y el mantenimiento de conductas de cuidado (Marsh et al., 2021).

Por lo tanto, la actividad de la OXT parece estar implicada en la formación y el mantenimiento de conductas prosociales a través de mecanismos basados en la empatía y el cuidado (ver Figura 3). Sin embargo, la OXT también puede evocar comportamientos antisociales (DeWall et al., 2014; Hurlemann & Marsh 2019; Shamay-Tsoory et al., 2009). Esto pueden ser el resultado de la variación individual en las percepciones de la amenaza social, las actitudes sociales y la respuesta a los estímulos emocionales (Guastella et al., 2008; Spengler et al., 2017).

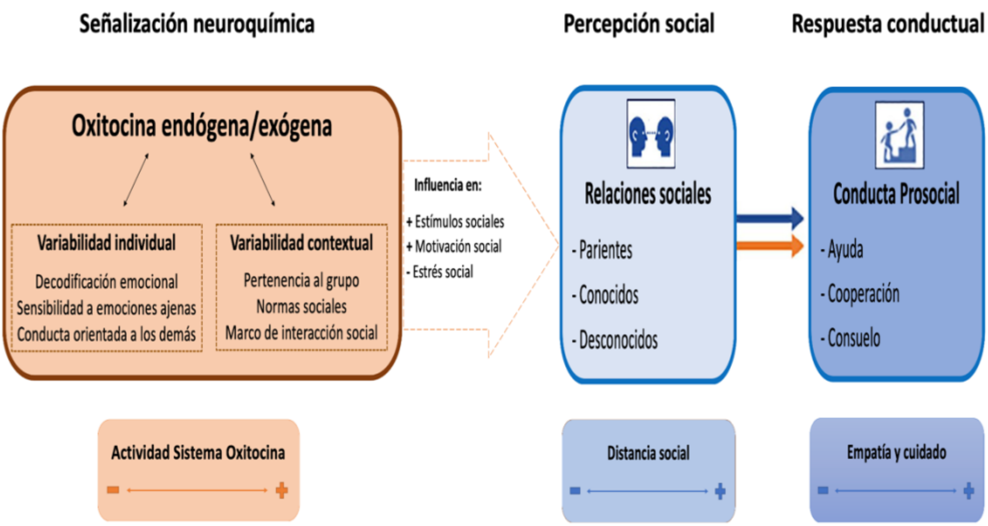

***Figura 3**. Modelo de la influencia de la OXT en la conducta prosocial. Adaptado de Marsh et al., (2021).*

Por otro lado, también se ha expuesto que la conducta prosocial tiene una relación con el SNA, que desempeña un papel esencial en el procesamiento emocional (Gilbert, 2015; Sonne & Gash, 2018). La investigación parece estar dividida en cuanto a si el SNS interfiere o apoya la prosocialidad. Existe evidencia de que un aumento en la activación simpática tras realizar una tarea de empatía se asocia con la conducta prosocial (Hein et al., 2011; Sze et al., 2012). Contrariamente, una mayor activación simpática, al visualizar escenas de películas tristes, también se ha relacionado con una menor prevalencia de conductas prosociales (Kalvin et al., 2016). Una posible explicación de estos resultados es que tanto un aumento exacerbado como una hipoexcitación podrían socavar la respuesta prosocial. Se ha sugerido que un aumento moderado en la activación simpática podría contribuir al impulso de responder a las necesidades de los demás, pero si esto motiva el acercamiento o la evitación puede depender de factores contextuales (como el marco social) e individuales (como la actividad parasimpática; Miller, 2018).

En los últimos años, se ha dado un creciente consenso sobre la influencia del SNP en la regulación emocional (Porges, 2007; 2017; Smith et al., 2020). Una actividad parasimpática moderadamente elevada y flexible parece contribuir a la regulación de la actividad del SNA para cumplir con las demandas emocionales y, así, responder de manera orientada a los demás. Específicamente, el SNP puede regular a la baja los sistemas de respuesta al estrés contribuyendo a una activación del SNS moderada, facilitando un acercamiento emocional adaptado lo que, a su vez, puede tener su implicación en la conducta prosocial (Miller, 2018). En población general se ha observado que mayores niveles de ASR (indicativos de mayor actividad parasimpática), después de tareas de inducción empática, se relacionaban con una mayor prevalencia de comportamientos prosociales (Oveis, 2009; Stellar et al., 2015). Asimismo, se ha descrito que las personas con una mayor capacidad para aumentar su actividad parasimpática presentaban una mayor propensión a la conducta prosocial (Bornemann et al., 2016). Por ello, podría postularse que el SNP facilita la implementación de la regulación necesaria para hacer frente a situaciones desafiantes y orientar la conducta a los demás.

En conclusión, estos resultados pueden implicar que para la realización de comportamientos prosociales se requiere de una interacción psicofisiológica compleja. Así, la actividad parasimpática podría ejercer influencia en el comportamiento prosocial a través de una función reguladora del SNS, que se activaría ante el sufrimiento ajeno (Gilbert, 2015; Porges, 2017; ver Figura 4).

Figura 4. *Modelo de la influencia del* del SNA *en la conducta prosocial. Adaptado de Miller, (2018).*

III. OBJETIVOS E HIPÓTESIS

Capítulo 5. Objetivos e hipótesis

Dada la gravedad y frecuencia de la violencia de género, la investigación ha centrado su atención en el estudio de los factores que predisponen y/o mantienen este tipo de violencia, con el fin de optimizar las herramientas disponibles para abordar y eliminar de manera integral y transversal esta problemática a largo plazo.

La inclusión de correlatos endocrinos y psicofisiológicos en el estudio de la empatía y el comportamiento prosocial en los agresores de violencia de género constituye un campo de investigación prometedor, aún poco explorado, que podría enriquecer el conocimiento sobre estas funciones socioafectivas y contribuir a optimizar las intervenciones de prevención e intervención de la violencia de género. Esta Tesis Doctoral se estructura en respuesta a esta necesidad de investigación.

5.1. Objetivo general

El objetivo general de la presente Tesis Doctoral es evaluar la respuesta endocrina, del SNA y de la expresión facial, así como la respuesta psicológica, a una tarea de inducción empática realizada mediante el visionado de videos diseñados para provocar emociones, y estudiar su relación con la realización de conductas prosociales en un grupo de agresores de violencia de género en comparación con hombres sin antecedentes penales.

5.2. Objetivos específicos e hipótesis

Con el propósito de abordar el objetivo general, esta investigación se compone de cuatro artículos científicos estrechamente interrelacionados.

En base a ellos, los objetivos específicos de esta Tesis Doctoral son analizar si existen diferencias entre un grupo de agresores de violencia de género y un grupo de hombres sin antecedentes penales en:

1. sus niveles endógenos de OXT en respuesta a una tarea de inducción empática, y explorar su relación con la respuesta psicológica autoinformada y la alexitimia.

2. sus niveles endógenos de OXT, T y C, así como en sus ratios, en respuesta a una tarea de inducción empática, y explorar su relación con la capacidad autoinformada de toma de perspectiva y de respuesta empática.

3. marcadores de la actividad simpática y parasimpática tras una tarea de inducción empática.

4. su patrón de respuesta facial tras una tarea de inducción empática, y explorar su relación con su respuesta emocional autoinformada y la capacidad de decodificación emocional.

5. la realización de una donación monetaria altruista, así como estudiar la relación de los correlatos endocrinos y psicofisiológicos tras la inducción empática con la posibilidad de la conducta prosocial.

En función de los objetivos planteados se hipotetiza que los agresores de violencia de género mostrarán, respecto a los hombres sin antecedentes de violencia:

1. un menor incremento en sus niveles de OXT en respuesta a la tarea de inducción empática (DeWall et al., 2014; Romero-Martínez, Sarrate-Costa et al., 2021). Además, hipotetizamos que, para toda la muestra, una menor respuesta emocional autoinformada y una elevada alexitimia estarán relacionadas con menores niveles de OXT tras la tarea (Crespi, 2016; Romero-Martínez, Lila et al., 2021).

2. niveles más bajos de OXT y C, y niveles más altos de T, así como menores ratios de OXT/T y OXT/C y una ratio T/C más elevada, en respuesta a la inducción empática (Geniole et al., 2020; Manigault et al., 2019; Romero-Martínez, Sarrate-Costa et al., 2021). Además, hipotetizamos que, para toda la muestra, una peor toma de perspectiva y un mayor distrés se relacionarán con menores niveles de OXT, C y mayores de T (Crespi, 2016; Mehta & Josephs, 2010).

3. una menor activación autonómica general (menor FC y FR), simpática (un PEP más largo y menor AED), y parasimpática (menores niveles de ASR) en respuesta a la tarea de inducción

empática (Godfrey & Babcock, 2020; Moreno et al., 2023; Romero-Martínez et al., 2022; Trahan & Babcock, 2019).

4. una menor prevalencia de expresiones faciales emocionales negativas en respuesta a la inducción empática (Fanti et al., 2016; 2017; Frick et al., 2014; De Wied et al., 2012). Además, hipotetizamos que, para toda la muestra, una menor prevalencia de expresiones faciales emocionales negativas estará relacionada con menores emociones negativas autoinformadas y una peor decodificación emocional (Hess & Fischer, 2022; Holland et al., 2021).

5. un nivel similar de donaciones monetarias. No obstante, se espera una mayor respuesta de los niveles endógenos de OXT, así como una mayor activación del SNS y del SNP, en aquellos sujetos que muestren una mayor conducta prosocial, independientemente de si pertenecen al grupo de agresores de violencia de género o de hombres sin antecedentes penales (Marsh et al., 2015; Mayer et al., 2018; Miller, 2018).

IV. MEMORIA DE TRABAJOS

Capítulo 6. Estudio 1.

Reduced salivary oxytocin after an empathic induction task in Intimate Partner Violence Perpetrators: importance of socio-affective functions and its impact on prosocial behavior.

Este estudio se encuentra publicado en:

Comes-Fayos, J., Blanco-Gandía, M. D. C., Moreno, I. R., Rodríguez-Arias, M., Lila, M., Sarrate-Costa, C., Romero-Martínez, A. & Moya-Albiol, L. (2022). Reduced salivary oxytocin after an empathic induction task in Intimate Partner Violence perpetrators: Importance of socio-affective functions and its impact on prosocial behavior. *Psychoneuroendocrinology*, 137, 105644. (*Anexo 1*).

1. Introduction

Intimate partner violence (IPV), defined as any act that results or may result in physical, sexual, or psychological harm to women in heterosexual relationships (World Health Organization [WHO], 2019), has emerged as a serious public health problem with high social, economic, and human costs (Vilariño et al., 2018). Research has focused many efforts on addressing IPV characteristics to develop comprehensive and effective intervention programs to prevent this type of violence (Santirso et al., 2020). For this purpose, the Biopsychosocial Model has stood out as an important explanatory approach that understands IPV as a multicausal variable and highlights the relevance of integrating psychosocial, affective, and biological aspects (Pinto et al., 2010); incorporating neuroscience methodology into models focused on psychosocial factors (Kelly & Wilson, 2020).

Impairments in socio-affective functions have recently been identified as an important factor in IPV (Brem et al., 2018) with many IPV perpetrators evidencing difficulties in identifying, describing, and/or expressing their own and others' feelings, deficits altogether defined as alexithymia (Romero-Martínez et al., 2020). This inability to recognize the emotional content appears to hinder both the adoption of another person's perspective and one's own emotional response, threatening the establishment of appropriate social interactions (Decety, 2010). Indeed, alexithymia traits have been linked to deficits in empathy (Lyvers et al., 2018) and to the frequency and severity of IPV (Strickland, 2017). Hence, from the Biopsychosocial Model perspective, the hypothalamic neuropeptide oxytocin

(OXT) could be of special interest for the study of IPV, as it plays an important role in social cognition (Patin & Hurlemann 2015).

Particularly, OXT has been linked to the salience of socio-affective information and the mediation of social reward sensitivity, processes that may be relevant for functions such as empathy, bonding, and prosocial behavior (Crespi, 2016; Shamay-Tsoory & Abu-Akel 2016). This hypothesis has been supported by converging evidence, mainly through the study of the behavioral effects of intranasal OXT administration (Geng et al., 2018). However, several authors have underlined the importance of complementing this research with the study of the endogenous OXT levels response to socio-affective stimuli (Hurlemann & Grinevich, 2018). Thus, these authors highlight the importance of research with naturally induced approaches that favor a more realistic understanding of the relationship between empathy and OXT, such as the study of the endogenous response of OXT to empathic induction tasks. In a first study, Barraza & Zak (2009) showed an increase in endogenous plasma OXT (pOXT) levels in a sample of college students (52% women) after watching a high-emotional content video of people in distress. They also observed a positive relationship between pOXT and the degree of empathy experienced, measured by the increase in their mood state. This result was reproduced in another study focusing on endogenous salivary OXT (sOXT), which also showed an increase in sOXT levels after the exposure to the same empathic induction task (Procyshyn et al., 2020) within a similar sample of college students (54% women).

In addition, sOXT has also been implicated in prosocial behaviors through the strengthening of trust and help behaviors (Hurlemann & Marsh, 2016). Marsh et al. (2015) found a relation between prosocial behavior and changes in endogenous sOXT. In their study, they found that male and female students who anonymously donated part of their experimental retribution to social charities had an increase in their sOXT levels. Besides, Barraza & Zak (2009) reported that participants who had a greater response to an empathic induction task, measured by increased pOXT and mood state response, donated more money to social charities. These findings led to the idea that interpersonal relationships involving prosocial behavior could be significantly modulated by sOXT through the empathic function.

However, the effect of OXT on social cognition differs substantially among individuals, depending on various factors such as prior difficulties in the socio-affective functioning (Hurlemann & Grinevich, 2018). Interestingly, research suggests that highly aggressive men, broadly associated with impairments in the socio-affective functions (Strickland et al., 2017), differ from the general population with respect to their sOXT system. Demirci et al. (2016) showed that basal pOXT levels correlated negatively with aggression and positively with self-reported empathy in boys with attention deficit and hyperactivity disorder. In another study, Levy et al. (2015) showed that callous-unemotional traits, which include lack of empathy, interpersonal callousness and restricted affect, were negatively correlated with sOXT levels in boys with behavioral problems. In this regard, IPV perpetrators have also reported high levels of alexithymia and serious difficulties in empathy. Yet, to the best of our knowledge, there are no studies that have focused on sOXT in response to an empathic induction task in IPV perpetrators, as well as its impact in the ulterior performance of prosocial behaviors.

Bearing all this in mind, this study aims to analyze the effects of an empathic induction task on endogenous sOXT levels of a group of IPV perpetrators compared to controls with no criminal history. We also seek to analyze the participant's mood state response to the empathic induction task as well as their capacity to perceive other people's emotions. Prior literature has provided evidence of an increase in endogenous sOXT and negative mood state after an empathic induction task (Barraza & Zak, 2009; Procyshyn et al., 2020). Hence, we expect to find an increase in the sOXT levels and in the negative mood state after the task for the entire sample (Procyshyn et al., 2020) with a weaker sOXT increase and a lower affective and cognitive empathy in IPV perpetrators, as difficulties in socio-affective functions and lower sOXT levels have been suggested in men with aggressive behaviors (Demirci et al., 2016; Levy et al., 2015). Additionally, we explore the relation between sOXT and the mood state response, emotional perception and alexithymia, as well as their predictive capabilities in the sOXT after the empathic induction task. In line with previous research, we presume that the endogenous sOXT response will be related to these psychological variables and that they will predict in both groups the sOXT response (Hurlemann & Grinevich, 2018). Finally, we investigate the difference in the performance of prosocial behavior between IPV and controls, as well as the difference in the sOXT levels after the task between those who perform prosocial behavior and those who do not. We expect a greater sOXT response in the prosocial subjects independently of their being IPV perpetrators or not (Marsh et al., 2015).

2. Method

2.1.Participants

From an initial total sample of 66 participants, two IPV perpetrators and two controls were excluded from the study because their sOXT levels exceeded the standard deviation of the total sample by 2.5 or more. The final sample consisted of 62 healthy male volunteers (30 IPV perpetrators and 32 controls). The IPV perpetrators were recruited among the participants of the CONTEXTO Program, a community-based psychoeducational intervention program, mandatory for men convicted of gender-based violence, carried out at the Department of Social Psychology of the University of Valencia, prior to the start of the intervention.

The IPV perpetrators were required to have a sentence for gender-based violence, suspended on the condition of attending an intervention program (Lila et al., 2018) and had to be free of any mental and/or neurological disorders, not have consumed substances for at least two hours before the study and have good writing and speaking skills in Spanish. All participants were informed about the study and agreed to participate voluntarily. The control group was completed with volunteers who presented similar anthropometric (age and/or body mass index) and socio-demographic (age, educational level, annual income, and/or marital status) characteristics to those of the IPV perpetrators, in addition to not having any previous criminal record. They were recruited in Valencia (Spain), establishing contact through advertisements posted on social networks. The participants were selected after performing an individualized phone interview.

All participants gave written informed consent and received a financial retribution of 40 euros at the end of the study. The experiment was conducted in accordance with the Declaration of Helsinki and was approved by the Ethics Committee of the University of Valencia (procedure number: H1538385543901).

2.2. Procedure

The procedure was carried out in one experimental session in the Psychobiology laboratories at the University of Valencia, where a constant temperature (21ºC) and humidity were maintained. The session always took place between 4:00 and 7:00 p.m. to control for variations in sOXT secretion (Amico et al., 1983) with an approximate duration of 2 hours (see Figure 5). First, the informed consent was signed and the anthropometric measurements taken. Then, the first questionnaires of the participant's mood state were completed (baseline) and the baseline sOXT was collected. Next, the participants were introduced to the empathic induction task and the anticipatory sOXT was taken.

Following the guidelines of Procyshyn et al. (2020), the empathic induction task was performed by means of watching a battery of emotion-eliciting videos validated for the Spanish population (Fernández-Megías et al., 2011; see *Annex 2*). Before watching, the participants were told to actively empathize with the main character of each scene (previously singled out) and were informed that they had to complete a questionnaire reporting the perceived emotional response in the characters. Four scenes (average 1' 21'') were selected from the battery based on their high arousal and negative affect (see Table 2). To avoid any possible biases due to the nature of the crime committed by the IPV perpetrators, we selected two scenes where male characters received violence and two scenes where violence was received by female characters. Each participant underwent the task, watching the scenes on a 75" screen. Following guidelines from previous studies (Schaefer et al., 2010), participants were asked to relax for one minute before watching each scene and had to complete the questionnaires right after every scene.

Once the empathic induction task was complete, the post-empathic sOXT was collected, the mood state questionnaire was again completed and the participants went through a recovery phase divided into 3 periods of 20 minutes in which the following 3 sOXT samples were collected: post 20', post 40' and post 60', respectively. At the end of the recovery period, information on socio-demographic variables, alexithymia and alcohol consumption was collected through the completion of questionnaires.

Film	Description	Length	Valence	Arousal
Leaving Las Vegas	A woman is sexually assaulted in a motel	2’	1,73	5,64
The Piano	A woman's hand is cut off with an axe	0’ 46’’	2,36	6,09
Schindler's List	A concentration camp commander shoots at prisoners from his balcony	1’ 16’’	1,55	5,73
American History X	A neo-Nazi kills a man	1’ 20’’	1,82	6,58

Table 2. *Study 1: Selected scenes for the empathic induction task. Valence was measured from 1 (negative valence) to 10 (positive valence). Arousal was measured from 1 (low arousal) to 10 (high arousal). Extracted from Fernández-Megías et al., (2011)*

Finally, once the recovery period ended, the mood state questionnaire was re-completed and a prosocial laboratory task was performed by replicating the Hare et al. (2010) assessment procedure. The procedure was based on three phases: (1) taking perspective of a context where a problem is presented, (2) evaluating the participant's potential impact on the resolution of the problem and (3) a factual opportunity to perform a helping behavior. First, we presented informative documents of six Non-Governmental Organizations (NGO; see *Annex 3*). Then, the participants were asked to assess the extent to which each NGO deserved help. To monitor the effect of possible personal contact with organizations, the degree of closeness to the NGO was assessed based on a 3-point Likert scale (1 - no closeness; 3 - active participation in the organization). Finally, participants were offered to help the NGO by means of a donation, emphasizing the voluntary nature of the donation. Once the donation was proposed, the participants had to write down in a document the amount donated and the NGO receiving the donation. To reduce a possible bias due to social desirability, the experimenters left the room while the participant decided whether to make the donation. As a result, the participants were divided into donors (participants who had donated at least 50% of their financial retribution) and not donors. The donation was taken from the economic retribution that the participants received.

Once the prosocial laboratory task ended, they were informed that they would receive the full remuneration. At the end, the participants were escorted and dismissed.

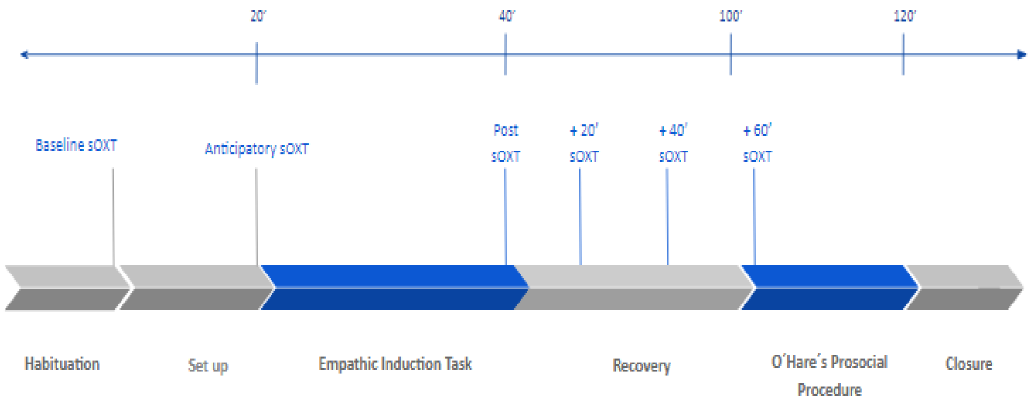

Figure 5*. Study 1: Experimental procedure. sOXT: Salivary Oxytocin*.

2.3. Measures

For the measurement of mood, the reduced version of the "Profile of Mood States" (POMS; see *Annex 4*), adapted to the Spanish population, was used (Fuentes et al., 1995; McNair et al., 1971). This version has 29 items with a total score indicating negative mood. The response format is a five-category Likert scale, which assigned values between 0 (none) and 4 (very much). This questionnaire was used for the measurement of the participant's mood state response after performing the empathic induction task, an indicator of affective empathy. Cronbach's α was .83 on the total score.

For the measurement of perceived emotional state in others, the Self-Assessment Manikins (SAM; Bradley & Lang, 1994; see *Annex 5*) was used. The SAM evaluates the affective valence (SAM-Val), which ranges from 9 (positive valence) to 1 (negative valence) and the arousal or activation (SAM-

Act), which ranges from 9 (elevated arousal) to 1 (reduced arousal). Each subscale is represented by 5 graphic figures with 4 intermediate points configuring the 9-point scale. This questionnaire was used for the measurement of the participant's perception and understanding of the characters' emotional state in the scenes, an indicator of cognitive empathy. Cronbach's α was .68.

The "Toronto Alexithymia Scale - 20 items" (TAS-20; Bagby, et al., 1994; see *Annex 6*) was used to measure the trait of alexithymia. The TAS-20 is a widely used self-report measure and has demonstrated adequate reliability and validity both in its original version and in the Spanish adaptation (Martínez-Sánchez, 1996) used in the present study. The TAS-20 contains 20 items with a response system based on a 5-point Likert scale ranging from 0 (strongly disagree) to 6 (strongly agree). Cronbach's α was .80.

The Spanish version (Guillamón et al., 1999; see *Annex 7*) of the "Alcohol Use Disorder Identification Test" (AUDIT; Saunders et al., 1993) was used to verify the amount and frequency of alcohol consumption in adults. Cronbach's α was .85

2.4. sOXT levels

For the collection of sOXT levels, we collected saliva samples from the participants using Salivettes (Sarstedt, Rommersdolf, Germany; see *Annex 8*). Six saliva samples were collected as follows: (1) baseline measurement, (2) anticipatory measurement of empathic induction, (3) post-empathic induction measurement and (4) three measures during the recovery period (at 20, 40 and 60 minutes). The saliva samples were frozen at -20°C immediately after collection and were kept in this state until analysis in the laboratory. The samples were centrifuged 5 min × 1,000 g and then, from each saliva sample, 1 ml of supernatant was stored and frozen at -40°C. The samples were lyophilized (Modulyo Freeze Dryers, Thermo Electron Corporation) for approximately 15 hours until they were dehydrated (Daughters et al., 2015). These samples were reconstituted in 250 µl of assay buffer, which produced a concentration four times higher than the original, allowing them to fall within the sensitivity range of the kit and be detectable on the standard curve. The sOXT levels were measured using the commercial Oxytocin EIA kit (Arbor Assays, Inc. Ann Arbor, MI; ref: K048). We followed the procedure described in previous studies from our laboratory (for a detailed description, see Bellosta-Batalla et al., 2020a; 2020b) and others (Lebowitz et al., 2016; MacLean et al., 2018). Remarkably, sOXT has been observed to correlate better than pOXT with concentrations in the cerebrospinal fluid (Martin et al., 2018). Neuropeptide cross-reactivity was reported by Arbor assays as <.001% and the detection limit was 11 pg/ml. Saliva samples were read at 450 nm and all samples were tested in duplicate. Inter-trial and inter-trial CV averaged less than 10%.

2.5. Data analyses

After evaluating the normality of the data by the Shapiro-Wilk test ($p < .05$), the non-normal data were transformed based on a natural logarithm. A Chi square was performed to compare socio-demographic data (marital status, level education and annual income) with the variable "group" (IPV perpetrators and controls) as an inter-subject factor. Additionally, independent means comparison *t*-tests were performed, with the variable "group" as an inter-subject factor, for anthropometric data, alcohol use, alexithymia, SAM scores and baseline sOXT.

To analyze the possible change in sOXT levels, a repeated measures analysis of variance (ANOVA) was performed with the variable "time" (baseline, anticipatory, post-empathic task, and recovery) as the intrasubject factor, and "group" as the inter-subject factor. Greenhouse-Geisser corrections for degrees of freedom were applied where appropriate. For significant results, partial eta-square was reported as a measure of effect size. Comparison *t*-tests were also performed for the magnitude of the sOXT levels, with "group" as an inter-subject factor. The magnitude of the sOXT levels was estimated for the empathic induction task by calculating the area under the curve with respect to the ground (AUCg), considering the baseline, anticipatory, post-empathic task and recovery measures. The magnitude of sOXT change with respect to the baseline was estimated by calculating the area under the curve with respect to the increase (AUCi). For the calculation of the AUCg and the AUCi, we used formulas derived from the trapezoidal rule, with AUCg collecting the entire area and AUCi taking the baseline as the reference point (Pruessner et al., 2003).

To analyze the possible change in mood state, a repeated measures ANOVA was used for repeated measurements with the variable "time" (pre- and post-empathic task and recovery) as the intrasubject factor and "group" as the inter-subject factor. Greenhouse-Geisser corrections for degrees of freedom were applied where appropriate. For significant results, partial eta-square was reported as a measure of effect size. Additionally, comparison *t*-tests were also performed for the total mood state response, with "group" as an inter-subject factor. The total mood state response was achieved by obtaining the difference between the total POMS scores prior to and following the empathic induction task.

Pearson's correlation coefficients were calculated to assess the relationships between AUCg and AUCi and the psychological variables (mood state response, emotional perception and alexithymia). Finally, a multiple linear regression model was constructed using the significant variables from Pearson's correlation as the independent variables and the magnitude of the sOXT levels (measured by AUCg) and the magnitude of the sOXT response (measured by AUCi) as the dependent variables. Additionally, a comparison of means was performed by using a two-factor ANOVA with the variables "group" and "donation" (donors vs no donors) as fixed factors and the AUCg and AUCi as the dependent variables. The observed power and effect size were also estimated.

Data analyses were conducted using IBM SPSS Statistics for Windows, Version 22.0 (Armonk, NY). Values of $p < .05$ were considered statistically significant. The average values are reported in the tables as mean ± standard deviation.

3. Results

3.1. Sociodemographic data and emotional perception scores

There were no significant differences between IPV perpetrators and controls in demographic variables, anthropometric characteristics or alcohol consumption. Nevertheless, the former presented higher scores in alexithymia (see Table 3). With regard to the SAM scores, IPV perpetrators perceived the characters with a lower affective arousal [*t* (42.8) = -2.11, *p* = .041] and with a more positive valence [*t* (33.8) = 2.16, *p* = .038] than controls.

	IPV (n = 30)	Controls (n = 32)	Student *t*	Cohen's *d*
Age (*M*, *SD*)	39.63 (10.27)	37.66 (13.37)	- .99	.17
BMI (*M*, *SD*)	26.40 (6.25)	25.38 (2.83)	- 1.58	.21
Alcohol consumption (*M*, *SD*)	7.43 (8.40)	5.64 (4.25)	1.02	.27
Alexithymia (*M*, *SD*)	40.83 (17.96)	29.34 (12.99)	2.87^{**}	.73
			Chi-Square	Cramer's *V*
Marital status (%)				
Married	53	50	.70	.03
Single/Divorced/Widowed	47	50		
Level of education (%)				
No studies	3	0	4.68	.20
Primary	40	28		
Upper secondary	43	38		
University	14	34		
Annual Income (%)				
Low Income	37	25	1.53	.46
Medium Income	53	56		
High Income	10	19		

Table 3. *Study 1: Means, standard deviation, percentages, and means comparisons for sociodemographic and psychological variables for both groups. IPV: Intimate Partner Violence; M: Mean; SD: Standard Deviation. Statistical significance* $^{*}p < .05$, $^{**}p < .01$.

3.2. sOXT response to the empathic induction task

After checking that there were no significant differences between groups in sOXT baseline levels [*t* (52, 5) = 1.114, *p* = .258], the conducted analysis found no significant "time" effect [*F* (5, 300) = .527, *p* = .756, η^2_p = .009] for the whole sample. Nevertheless, a significant "time x group" effect was found [*F* (5, 300) = 2.242, *p* = .048, η^2_p = .036], with IPV perpetrators showing lower levels of sOXT than controls at 40 minutes after the post-empathic induction task [IPV perpetrators, *M* = 4.42, *SD* = .91; control group, *M* = 4.90, *SD* =.55; *t* (46.8) = -2.48, *p* = .017; see Figure 6]. Furthermore, in the pairwise comparison, differences were found between the sOXT baseline levels and the sOXT post 40' levels [*M* = 4.55, *SD* =.66; *M* = 4.90, *SD* =.55; *t* (31) = -2.68, *p* = .012] and between the sOXT anticipatory levels and the sOXT post 40' levels [*M* = 4.61, *SD* =.66; *M* = 4.90, *SD* =.55; t (31) = -2.05, *p* = .048] only in the control group. Finally, the factor "group" was not significant [*F* (1, 60) = .646, *p* = .425, η^2_p = .011].

Additionally, IPV perpetrators differed in the magnitude of the sOXT response (AUCi) compared with controls [IPV perpetrators, *M* = -16.75, *SD* = 60.84; control group, *M* = 18.63, *SD* = 68.05; *t* (60) = -2.15, *p* = .035]. However, both groups did not differ in the total magnitude of the sOXT levels [AUCg; IPV perpetrators *M* = 462.35, *SD* = 53.61; control group, *M* = 474.19, *SD* = 35.99; *t* (50.3) = -1.01, *p* = .315].

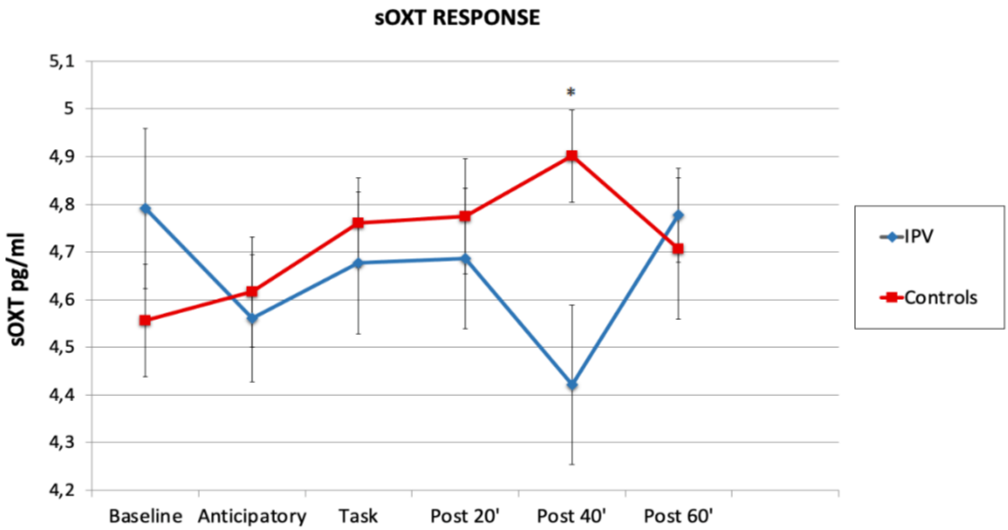

Figure 6*. sOXT response to the empathic induction task. IPV: Intimate Partner Violence; sOXT: Salivary Oxytocin; Pg/ml: Picograms per Milliliter; Statistical significance* $^{*}p < .05$.

3.3. Mood state response to the empathic induction task

With respect to mood state, a significant "time" effect [$\varepsilon = .737$, F (1.5, 87.7) = 12.990, $p < .001$, $\eta^2_p = .178$] was found. Specifically, the mood state total score increased significantly from the baseline to the post-empathic induction task [*M* = 99.95, *SD* = 15.9; *M* = 106.11, *SD* = 16.5, *t* (61) = -3.455, *p* = .001]. Afterwards, the mood state total score decreased again from the post-empathic induction task levels to the 60' recovery period [*M* = 106.11, *SD* = 16.5; *M* = 98.1, *SD* = 15.64, *t* (61) = -3.893, *p* < .001]. Furthermore, there was a significant "time × group" effect [ε = .737, F (1.5, 87.7) = 7.159, p = .001, η^2_p = .107], with IPV perpetrators showing a subdued mood state total score after the empathic induction task compared to the control group, indicating a lower increase of negative mood state in IPV perpetrators [M = 101.5, SD = 14.46; M = 110.4, SD = 17.36, t (61) = -2.179, p = .033; Figure 7]. There was no significant “group" effect for mood state [F (1, 60) = .264, p = .609, η^2_p = .004].

In addition, IPV perpetrators also differed in the mood state response to the empathic induction task when compared to controls [IPV perpetrators, M =.83, SD = 13.28; control group, M = 11.16, SD = 13.03; t (60) = -3.08, p = .003].

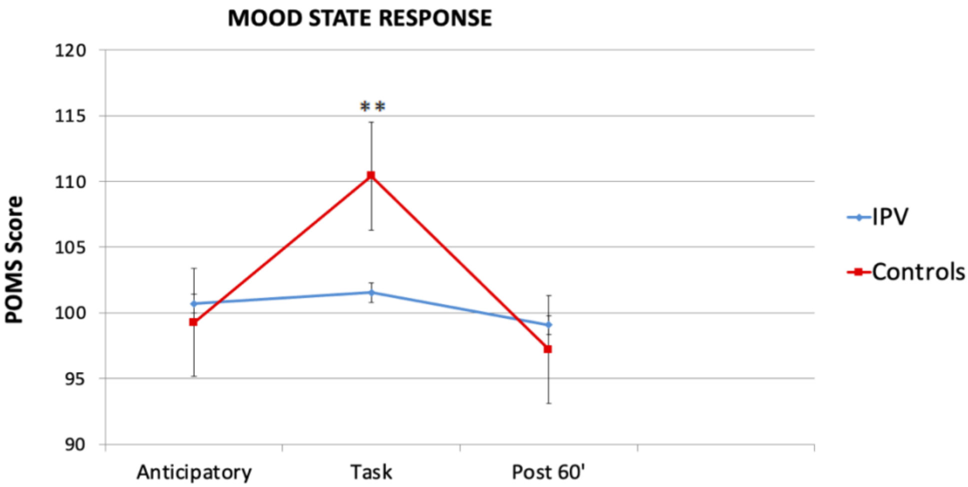

Figure 7. *Mood State response to the empathic induction task. POMS: Profile of Mood State; IPV: Intimate Partner Violence. Statistical significance* $^{*}p < .05$, $^{**}p < .01$.

3.4. Relation between sOXT and psychological variables

With respect to the relation between sOXT and the psychological responses, after controlling the group effect, a partial correlation analyses showed that there were no significant correlations between the sOXT AUCi and the mood state response (r = .073, p = .578), the perceived character's affective valence (r = -.062, p = .635), perceived character's affective arousal (r = .014, p = 914) or the TAS-20 scores (r = -.076, p =.561). Nevertheless, the sOXT AUCg was significantly correlated with the mood state response (r =.289, p = .024), the perceived character's affective arousal (r = .278, p = .030) and inversely with TAS-20 total score (r = -.348, p = .006) for the whole sample, but not with the perceived character's affective valence (r = .079, p = .543).

3.5. Predictive effects of the psychological variables on sOXT levels after the empathic induction task

We carried out a lineal regression model with the mood state response, the perceived character's affective arousal and the total score of the TAS-20 as predictor of sOXT AUCg. The model was significant [adj R^2 = .219, F (3, 61) = 6.700, p = .001]. The association was significant for the mood state response (β = .305, p = .010) and alexithymia (β = - .369, p = .003), but not for the perceived character's affective arousal (β = .134, p = .262).

3.6. Prosocial behavior and sOXT response to the empathic induction task

Finally, despite not finding a significant main effect of "group" on the sOXT AUCg [F (1, 62) = .590, p = .446, η^2_p = .010] or “group × donation” [F (1, 62) = .000, p = .992, η^2_p = .000], we did find a significant main effect of "donation" on the AUCg of the sOXT levels [F (1, 62) = 6.239, p = .015, η^2_p = .097]. Thus, donors differed in the AUCg when compared to non-donors [Donors, M = 510.32, SD = 43.77; and non-donors, M = 463.97, SD = 43.57; t (60) = 2.475, p = .015].

4. Discussion
4.1. Discussion of the main results

Our study pointed out differences in the sOXT response of IPV perpetrators to an empathic induction task with respect to a control group, showing lower sOXT levels specifically at 40 minutes after the empathic induction task, with a decreasing tendency of their sOXT levels following the task (AUCi). IPV perpetrators also perceived others' emotions as more positive and less intense and exhibited no change in their mood state after the task. For the whole sample, we observed a positive relationship between the AUCg of sOXT levels and the mood state response, the perceived affective arousal and a negative link with alexithymia. Afterwards, the regression model pointed out that the mood state response and alexithymia predicted the AUCg of sOXT levels also for the whole sample. Finally, we did not observe any differences when performing prosocial behaviors between IPV perpetrators and controls. However, a univariate ANOVA indicated that a greater AUCg of sOXT levels was found after the empathic induction task in subjects who engaged in prosocial behavior.

The main objective of this study was to analyze whether the response of IPV perpetrators to an empathic induction task, performed by means of watching emotion-eliciting videos, differed from the control group. Past research has shown that emotion-eliciting videos may induce empathy and there is evidence of a significant increase in endogenous sOXT after performing the task in the normative population (Barraza & Zak, 2009; Procyshyn et al., 2020). Thus, we expected an increase in sOXT levels throughout the sample in response to the task, but which would be attenuated in the case of IPV perpetrators, as it has been previously suggested that men with callous-unemotional traits and aggressive behaviors display lower sOXT levels (Demirci et al., 2016; Levy et al., 2015). Contrary to our expectations, there was no response in all the sOXT levels when we considered the entire sample. Nevertheless, we did observe an increase in sOXT levels from the pre-task periods to 40 minutes after the task, only in the control group. We also found lower sOXT levels 40 minutes after the task in IPV perpetrators compared to controls. Furthermore, we observed a decreasing trend in the AUCi from baseline to 60 minutes after the empathic induction task in IPV perpetrators, as opposed to the control group, who exhibited an increasing tendency.

Prior research has proposed that humans with aggressive behaviors such as patients with conduct disorder or borderline personality disorder differ from healthy young adults with respect to their sOXT system (Hurlemann & Grinevich, 2018). It has been hypothesized that reduced plasmatic peripheral and central OXT levels (which may reflect a "hypo-oxytocinergic state") could be related and even predict aggression (Malik et al., 2012). Our results could suggest a lack of sOXT response to the need for empathy in the IPV perpetrators, since the control group did show an increase, albeit subtle, in their sOXT levels 40 minutes after the task with an increasing trend, which was decreasing in the case of IPV perpetrators. Therefore, although these results should be viewed with caution, they do not run counter to the "hypo-oxytocinergic state hypothesis" in the violent population (Hurlemann & Grinevich, 2018). In fact, they may point toward a possible hypo-oxytocinergic response of this population to important functions of social cognition, such as empathy.

Secondly, we sought to explore the participant's mood state response to the empathic induction task, as well as their capacity to perceive other people's emotions. IPV perpetrators have been previously linked with difficulties in emotional perspective taking and higher personal distress (Covell et al., 2007). Therefore, we expected them to exhibit a diminished affective and cognitive approach to the character's emotional state. Congruently, IPV perpetrators did not show any change in their mood state from the pre-task to the post-task mood state total scores, contrary to the control group, which exhibited a worse mood comparable to the character's emotional state. Furthermore, IPV perpetrators also rated the character's emotional state as less intense and with a higher positive affect than the control group.

Past research has suggested that specific alterations in the ability to decode and experience emotions, and more generally affective and cognitive empathy difficulties, may prone IPV perpetrators to domestic violence (Romero-Martínez, Lila et al., 2021). Thus, IPV perpetrators have been seen to exhibit a different pattern of emotional processing, displaying lower activation when they were required to experience emotions in situations of IPV (Marín-Morales et al., 2021). In line with these studies, our findings may reflect a poor affective approach to the characters' emotional states (Barraza & Zak, 2009), suggesting difficulties when responding to the feelings of others (Marín-Morales et al., 2021). Additionally, IPV perpetrators' ratings could evidence difficulties in cognitive processes, such as making inferences about others' emotional states, as the subjects of the videos were people suffering violence and a particularly negative and intense perspective taking was expected. Altogether, these results appear to suggest difficulties with the perception of others' emotional states in the case of IPV perpetrators, as well as an impoverished mood state response to people undergoing negative emotions (Shamay-Tsoory, 2011), implying potential empathic impairments in IPV perpetrators.

In addition, we presumed that the endogenous sOXT response would be related to the psychological variables (Procyshyn et al., 2020). Contrary to our expectations, the AUCi of the sOXT levels was unrelated to the mood state response, the perception of others' emotional state or to alexithymia. However, the AUCg of sOXT levels did correlate with a greater response of their mood state, with a more intense perception of the character's emotional state and with lower alexithymia traits. These findings are of particular relevance, as they suggest a relationship between higher sOXT levels and a greater understanding of one's own emotions, a greater insight into the emotional state of others and a more accurate emotional response to that emotional state, not only in IPV perpetrators. Furthermore, our results seem to indicate that these psychological variables could be more related to the total levels of sOXT instead of the changes in sOXT, highlighting the possibility of an OXT threshold that may favor socio-affective functions such as empathy. However, the literature is scarce regarding sOXT and its response to socio-affective functions (Hurlemann & Grinevich, 2018).

Moreover, we aimed to explore the predictive capabilities of these psychological variables in sOXT after the empathic induction task. Consistently, the mood state response and alexithymia predicted the AUCg of sOXT levels for the whole sample. As noted, alexithymia traits imply poorer emotional processing and response, and these two functions, in turn, have been shown to be necessary for empathy (Lyvers et al., 2018). Thus, it seems logical that an adequate emotional response and comprehension potentially explains the sOXT levels following an empathic induction task, given its relevance in the socio-affective information salience. Therefore, the differences found in this study could be better understood due to the higher alexithymia scores reported in IPV perpetrators (Romero-Martinez, Lila et al., 2021). Prior research already provided evidence of a positive relationship between the mood state response and the changes experienced in the peripheral pOXT (Barraza & Zak, 2009). Also, an inverse relationship between alexithymia and pOXT levels has been observed (Schmelkin et al., 2017). Therefore, our findings seem to be consistent with this literature and suggest that changes in the mood state and alexithymia may predict the levels of sOXT after an empathic induction task.

Finally, we investigated the difference in the performance of prosocial behavior between IPV and the control group, as well as the difference in sOXT levels after the empathic induction task between those who perform prosocial behavior and those who do not. We anticipated finding a greater sOXT response in the most prosocial subjects independently of their being IPV perpetrators or not (Marsh et al., 2015). As expected, IPV and controls showed a similar prosocial behavior through the performance of a donation. However, the participants who performed a prosocial behavior exhibited a greater AUCg of sOXT levels after the empathic laboratory task than those who did not and no interaction effect between these two factors was found. Traditionally, violent behavior and prosocial behavior have been conceptualized as mutually exclusive (Marsh, 2019). Yet this hypothesis is far from conclusive (Llorca-Mestre et al., 2017) and, currently, prosocial behavior has been related to a greater extent to an effective functioning of empathy, while difficulties in empathy could be linked to violent behavior (Moya-Albiol, 2018). Hence, our results linked the occurrence of prosocial behaviors to higher sOXT levels. This outcome may be relevant, since sOXT levels have been connected to the understanding of one's own emotions and to an appropriate emotional response to others' emotions, highlighting the importance of these variables for the occurrence of prosocial behavior.

4.2. Limitations and future research

To the best of our knowledge, this is the first study focused on the sOXT response to a naturally-induced empathic task in IPV perpetrators. Nonetheless, following are some of its limitations. First, one limitation of our study is the relatively small sample size. This limitation may be due to the difficulty of access to the sample. Typically, men convicted of gender-based violence show strong initial resistance to the intervention and this translates into a refusal to participate in the experimental phase (Santirso et al., 2020), but further research is needed to replicate these findings in larger samples. A second limitation of our study may be the methodology used to elicit hormonal changes. Although recent studies have employed this empathic induction task to examine a sOXT response (Barraza & Zak, 2009; Procyshyn et al., 2020), some authors have indicated that empathic induction by social psychological methods could be characterized by a higher ecological validity (Cabral et al., 2018). However, several authors have claimed the efficacy of the empathic induction tasks through emotional videos (Gilman et al., 2017). Finally, another limitation of this study could be only analyzing sOXT, not taking into account other relevant hormones for the social cognition such as testosterone and cortisol (Procyshyn et al., 2020).

Further research is needed to elucidate the mechanisms that connect sOXT with socio-affective functions, encompassing not only the response to negative but also to positive affect. Furthermore, it would be pertinent to explore the interaction of OXT with other hormones important for social cognition, such as testosterone and cortisol, since hormonal action is highly complex. Finally, extending the results of this study to other violent populations would increase the knowledge about the specific therapeutic needs of each one of these populations. Therefore, given that difficulties in the socio-affective domain have been shown to be a convergent risk factor in IPV perpetrators, integrating the reinforcement of individual and contextual tools that enhance the correct functioning of empathy could increase the efficiency of intervention programs.

4.3. Conclusion

These results concur, from the Biopsychosocial Model perspective, that IPV perpetrators may exhibit difficulties when responding to an empathic induction task. In addition, it appears that IPV perpetrators do not have an inability to perform prosocial behaviors, but it is rather risk factors, such as an inadequate emotional response and a poor emotional comprehension, that may hinder the empathic function (Moya-Albiol & Romero-Martínez, 2020).

In sum, these results propose the existence of a bidirectional relationship between OXT and socio-affective functions, where OXT can change social behavior and, in turn, OXT levels can be changed in response to social stimuli. Thus, intervention programs, in line with the Good Lives model (Santirso et al., 2020), should focus not only on minimizing risk factors, but also on supporting protective factors (e.g., enhancing empathy), de-stigmatizing the violent population as incapable of being prosocial. In this sense, the analysis of sOXT seems pertinent for a holistic understanding of the empathic response; therefore, future research lines in this line seem relevant.

Capítulo 7. Estudio 2.

Hormonal Profile in Response to an Empathic Induction Task in Perpetrators of Intimate Partner Violence: Oxytocin/Testosterone Ratio and Social Cognition.

Este capítulo se encuentra publicado en:

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1. Introduction

According to the WHO (2019), IPV is a major public health challenge worldwide, encompassing a wide variety of violent behaviours and resulting in significant economic, social, and human costs. To prevent IPV, a growing number of studies have focused on the profile of IPV perpetrators, identifying various characteristics, such as anger management difficulties, impulsivity, sexism, substance abuse, childhood trauma or lack of community support, as particularly relevant to the severity and recidivism of IPV (Birkley & Eckhardt, 2015; Expósito-Álvarez et al., 2021; Vitoria-Estruch et al., 2018a). However, the need to approach IPV from a multidimensional biopsychosocial framework has been highlighted, bringing together the psychosocial factors of IPV with biological markers that provide data less susceptible to bias and manipulation than self-reported questionnaires (Blair, 2019; Malta et al., 2020; Puigvert et al., 2019; Rosell & Siever, 2015; Siegel, 2013).

Difficulties in empathy, defined as the ability to understand and share another person's emotional experience, seemed to play a key role in the maladaptive behavioral regulation of IPV perpetrators (Capaldi et al., 2012; Pinto et al., 2010). Indeed, impaired empathy has been linked to the occurrence of violent behaviours (Gantiva et al., 2021; Vachon et al., 2014), including IPV perpetration (Péloquin et al., 2011; Ulloa et al., 2016). Specifically, difficulties in understanding the thoughts and feelings of the partner could predispose someone to IPV by promoting affective distress when dealing with emotional conflicts (Clements et al., 2007; Covell et al., 2007; Leshem et al., 2019; Strickland et al., 2017). Furthermore, the comparison of IPV perpetrators with controls revealed that the former tends to present lower scores in perspective taking (ability to adopt the psychological point of view of others) and empathic concern (emotional response of compassion to others' suffering), and show higher personal distress (discomfort in reacting to the suffering of others) and show higher personal distress (discomfort in reacting to the emotions of others; Romero-Martínez et al., 2013; Romero-Martínez, Sarrate-Costa et al., 2021).

Nevertheless, the importance of using natural approaches in conjunction with self-report questionnaires has been emphasized when dealing with a complex construct, such as empathy (Dziobek, 2012; Murphy et al., 2020). Yet, in many cases, it is difficult to control empathy in its natural setting without altering the variables of the target situation. In this regard, emotion induction tasks help to evoke the required affective experience in an experimental situation through various methods (e.g., images, sounds, or both, among others; Barraza & Zak 2009; Procyshyn et al., 2020). In fact, these methods can be centered on one’s own or another’s affective state, enabling in situ characterization of empathy and gaining access to the natural study of other variables of interest, such as associated hormone levels (Comes-Fayos, Blanco-Gandía et al., 2022).

Changes in OXT, testosterone (T) and cortisol (C) endogenous levels could affect functions important for empathy, including socioaffective information processing, social affiliation, or stress management (Crespi, 2016; Dekkers et al., 2019; Fragkaki et al., 2018; Romero-Martínez, Blanco-Gandía et al., 2021). Accordingly, increases in endogenous OXT levels, both pOXT and sOXT, have been observed in a normative population following an empathic induction task performed through watching an emotion-eliciting video (Barraza & Zak 2009; Procyshyn et al., 2020). In particular, Barraza and Zak (2009) found that self-reported affective empathy predicted an increase in pOXT levels following the empathic induction task, whereas personal distress predicted a decrease in pOXT levels. Meanwhile, Procyshyn et al. (2020) found that increased sOXT, following the same empathic induction task, was related to improved perspective taking. In IPV perpetrators, a study concluded that IPV perpetrators presented lower sOXT levels than controls at a specific moment after an empathic induction task (Comes-Fayos, Blanco-Gandía et al., 2022). Thus, these results posit a positive relationship between OXT and socioaffective functions that facilitate empathy and suggest that the relationship between OXT and IPV could be mediated by difficulties in these functions.

Regarding T, Chen et al. (2018) found that baseline plasmatic T (pT) levels were negatively correlated with empathic concern and perspective-taking in a non-forensic population. Moreover, decreases in salivary T (sT) levels were observed in college students following an empathic induction task (Procyshyn et al., 2020). Baseline sT levels have also been negatively related to the ability to infer the thoughts and feelings of others in a role-playing paradigm (Ronay & Carney, 2013). Consistently, it has been observed that high baseline sT levels were associated with worse facial emotion recognition in IPV perpetrators (Romero-Martínez, González-Bono et al., 2013; Romero-Martínez et al., 2016c). All of this, taken together, suggests that T could be an important modulator of violent behavior through its buffering effects on the processing of socioaffective information.

In relation to C, it seems that C maintains a negative association with empathic-related variables, concretely, with emotion decoding abilities. Accordingly, endogenous C rises after hydrocortisone administration reduces the ability to correctly decode emotional facial expressions (Romero-Martínez, Sarrate-Costa et al., 2021). Regarding IPV, there is a gap in the scientific literature for assessing whether emotion induction tasks modified the C response in IPV perpetrators. In fact, only two studies have assessed their response to acute laboratory stressors (Romero-Martínez, González-Bono et al., 2013; Romero-Martínez, Blanco-Gandía et al., 2021). They concluded that IPV perpetrators showed a smaller salivary Cortisol (sC) response than controls after being submitted to an acute stressor, failing to find significant associations between empathic variables and sC levels.

To fully understand a phenomenon as complex as empathy or violence proneness, the interrelationships between the above-mentioned hormones should be incorporated. Accordingly, studies have shown facilitative effects of OXT and damping effects of T on the same cognitive and behavioral phenotypes. Specifically, comparable diametrical effects have been observed in empathy-relevant tasks, such as emotional recognition, theory of mind or self-reported empathy (Crespi, 2016). On the other hand, although C is the main stress hormone, OXT also responds under stressful situations (Kumsta et al., 2013). Evidence has been provided that intranasal administration of OXT decreases sC during an interpersonal challenge (Cardoso et al., 2014; Linnen et al., 2012), resulting in lower social stress, and enhanced empathic function. Nevertheless, a meta-analysis concluded that the relationship between the endogenous levels of both hormones tends to be positive but small (Brown et al., 2016). Conversely, the administration of

OXT, T and C on facial emotion recognition has been analyzed, concluding that emotional accuracy seemed to improve after increasing OXT, but decreased when T and/or C increased (Romero-Martínez, Sarrate-Costa et al., 2021).

Regarding T and C interaction, a higher sT/C ratio was predictive of lower empathy scores in healthy young adults (Zilioli et al., 2015). Furthermore, higher sT/C ratios have been associated with aggression rates within heterosexual couples (Manigault et al., 2019). In fact, it seems that IPV perpetrators tend to present higher sT/C ratios than controls in response to acute laboratory stressors (Romero-Martínez, González-Bono et al., 2013; Romero-Martínez, Blanco-Gandía et al., 2021). These results are consistent with the dual hormone hypothesis, which suggests that T is positively associated with aggression and negatively with empathy, particularly in individuals with low C levels (Mehta & Prasad, 2015). Unfortunately, there is a gap in the scientific literature for assessing the interaction between the three above-mentioned hormones in IPV perpetrators, specifically in response to emotion induction tasks.

Consequently, the present study pursues three major objectives. We first aim to compare self-reported empathy in IPV perpetrators and controls. Based on that stated in this field of research (Capaldi et al., 2012; Pinto et al., 2010), we expect to find worse perspective taking and lower empathic concern, as well as higher personal distress, in IPV perpetrators compared to the control group (Romero-Martínez, González-Bono et al., 2013).

Second, we intend to analyze differences in endogenous sOXT, sT, and sC levels, as well as the quotient between levels of the above-mentioned hormones (hormonal ratios), of a group of IPV perpetrators compared to controls following an empathic induction task. As previously discussed (Comes-Fayos, Blanco-Gandía et al., 2022; Crespi, 2016; Linnen et al., 2012; Procyshyn et al., 2020), we hypothesize that IPV perpetrators will display lower levels of sOXT and sC and higher levels of sT after the empathic induction task compared to the control group. Furthermore, IPV perpetrators will also show lower sOXT/T and sOXT/C ratios and higher sT/C ratios in response to this task than controls.

Finally, we also aim to explore whether the empathic abilities of each group explain their hormone levels following the empathic induction task. Due to the relationship between these hormones and empathy (Crespi, 2016; Romero-Martínez, Sarrate-Costa et al., 2021; Torres et al., 2018; Zilioli et al., 2015), we hypothesize that perspective-taking and empathic concern scores would especially predict the IPV perpetrators' hormonal levels in response to this task. Accordingly, the lower the empathic abilities of IPV perpetrators, the lower the sOXT response and the higher the sT/C ratio.

2. Method

2.1. Participants

From an initial total sample of 25 participants, one IPV perpetrator was excluded from the study because his hormonal levels exceeded the standard deviation of the total sample by 2.5 or more. Hence, the total sample consisted of 24 healthy male volunteers (12 IPV perpetrators and 12 controls).

IPV perpetrators were recruited among the participants of the CONTEXTO Program, a community-based psychoeducational intervention program (mandatory for men convicted of gender-based violence, with sentences of up to two years imprisonment), conducted at the Faculty of Psychology of the University of Valencia, before starting the intervention program. To be a part of this study, it was necessary that IPV perpetrators receive a suspended sentence for gender-based violence under the condition of attending the CONTEXTO intervention program. In addition, participants had to not have a diagnosis associated with a psychiatric, neurological or substance use disorder, and had to understand and speak fluent Spanish.

Participants of the control group were recruited in Valencia (Spain), establishing contact through advertisements on social networks. After conducting a telephone interview, the participants who met the requirements were selected (e.g., absence of mental disorders, and endocrine alterations). They were volunteers with similar sociodemographic (age, marital status, educational level and annual income) characteristics and BMI, as well as not having criminal records.

All participants were informed of the study and, voluntarily, gave their written informed consent. Upon completion of the study, all participants received a financial compensation of 40 euros. The experiment was performed in accordance with the Declaration of Helsinki and was approved by the Ethics Committee of the University of Valencia (procedure number: H1538385543901).

2.2. Procedure

The procedure was conducted in the laboratories of the Department of Psychobiology of the University of Valencia in a single session of approximately 2 h. The laboratory protocol was performed between 16:00 and 19:00 h, as sC levels are more stable within this period of time (Romero-Martínez et al., 2013). Additionally, the session was held in a room that was kept at a constant temperature (21 °C) and humidity. First, the informed consent was signed, sociodemographic and BMI variables were measured, and the empathy questionnaire was administered.

Afterwards, baseline hormonal levels were collected. The hormonal samples were always obtained following the same order: sOXT and sC first, followed by sT. Then, the empathic induction task instructions were provided to the participants and, immediately, the anticipatory sOXT, sC, and sT were collected. Immediately after completing the empathic induction task, the post-empathic sOXT, sC, and sT were taken. Three additional hormone samples were collected at +20 min, +40 min and +60 min. Finally, the participants were accompanied and dismissed.

2.3. Measures

Following the guidelines of previous studies (Barraza & Zak, 2009; Comes-Fayos, Blanco-Gandía et al., 2022; Procyshyn et al., 2020), the empathic induction task was carried out using a battery of emotion-provoking videos validated for the Spanish population (Fernández-Megías et al., 2011; see *Annex 2*). Because the procedure is focused on negative emotional content, four scenes where the main character was receiving violence were selected among the entire battery based on their high arousal and negative affect. The selection of these scenes was made considering the suggestions from Gracia et al. (2015) and Romero-Martínez et al. (2019b), who reported the existence of cognitive and affective alterations in IPV perpetrators when facing IPV audio–visual content. Hence, to avoid a gender bias, we combined two scenes where female characters received violence and two scenes where violence was received by male characters. Each participant underwent the empathic induction task by viewing the scenes (with a mean of 1’ 21’’) on a 75″ screen. Prior to the visualization of the scenes, participants were instructed to actively put themselves in the place of each main character (previously indicated). Following guidelines from Schaefer et al. (2010), participants were asked to relax for one minute before watching each scene.

For the measurement of empathy, the Spanish adaptation (Escrivá et al., 2004; *Annex 10*) of the interpersonal reactivity index (IRI; Davis, 1983) was used, which evaluates perspective taking (the tendency to spontaneously adopt the point of view of others), fantasy (the subject’s imaginative capacity to put themselves in fictitious situations), empathic concern (feelings of compassion, worry and affection in the face of the discomfort of others) and personal distress (feelings of anxiety and discomfort that the subject manifests when observing the negative experiences of others). The items were rated from 1 (does not describe me well) to 5 (describes me well). For this study, Cronbach's α was .77.

2.4. Hormonal levels

Saliva was directly collected from the mouth using Salivettes for OXT and C (Sarstedt, Rommelsdorf, Germany) and sterile glass tubes for T measurements (see *Annex 8*). In all cases, participants were informed about the need to follow the instructions for saliva sampling to obtain meaningful data, and samples were collected in the same order, OXT-C then T, and frozen at −20 °C until analysis.

sT levels were assessed by chemiluminescence immunoassays using testosterone saliva ELISA kits (Diagnostics Biochem Canada Inc., London, ON, Canada). Intra- and interassay coefficients of variation were 3.98% and 7.98%, respectively, indicating good reproducibility. On the other hand, sC levels were determined by radioimmunoassay using Coat-to-Count cortisol kits (DPC-Siemens Medical Solutions Diagnostics, Chennai, India) with 1.4 nmol/L sensitivity.

sOXT were measured using the commercial Oxytocin EIA kit (Arbor Assays, Inc., Ann Arbor, MI, USA; ref: K048). We followed the procedure described in previous studies (Bellosta-Batalla et al., 2020a; 2020b; Lebowitz et al., 2016; MacLean et al., 2018). The samples were centrifuged 5 min ×

1000 g and then, from each saliva sample, 1 mL of supernatant was stored and frozen at −40 °C. Then, the samples were lyophilized (Modulyo Freeze Dryers, Thermo Electron Corporation, Waltham, MA, USA) for approximately 15 h, until they were dehydrated (Daughters et al., 2015). These samples were reconstituted in 250 μl of assay buffer, yielding a concentration four times greater than the original, allowing them to fall within the sensitivity range of the kit and be detectable on the standard curve. Remarkably, it was appreciated that sOXT correlates better than pOXT with concentrations in the cerebrospinal fluid (Martin et al., 2018). Neuropeptide cross-reactivity was reported by Arbor assays as <.001% and the detection limit was 11 pg/mL.

All samples were analyzed in duplicate, and those from the same subject were included in the same assay. Although the criterion for measurement replication was a coefficient of variation between duplicates of 8%, the maximum intra- and inter-assay coefficients of variation obtained were 4.3% and 5.2%, respectively.

2.5. Data analyses

After checking the data for normality with the Shapiro–Wilk test ($p < .05$), the non-normal data were transformed based on a natural logarithm. Afterwards, *t*-tests were performed for assessing group (IPV perpetrators and controls) differences for anthropometric variables, empathy scores and baseline hormonal levels. Effect sizes for the between-group differences were calculated using Cohen's *d* (Cohen, 1992). A chi-squared analysis was also performed for marital status, level of education and annual income.

To reduce the number of comparisons between groups in hormonal variables, we decided to calculate the magnitude of response for each hormone as well as their ratios based on the formulas derived from the trapezoidal rule (Pruessner, 2003). Specifically, it was estimated by calculating the area under the curve with respect to the ground (AUCg) and the area under the curve with respect to the increase (AUCi). In addition, ratios were calculated using the AUC levels of each hormone. Multivariate analysis of variance (MANOVA) was performed for hormones AUCg and AUCi, with "group" as an inter-subject factor.

Finally, linear regression models were constructed to investigate whether the IRI subscales predicted the sOXT, sT and sC responses to the task, as well as the hormonal ratios (measured by AUCi and AUCg). We ran a hierarchical regression analysis with a hormonal response as the dependent variable and IRI subscales as predictors: scores on IRI scale in Step 1; group (dummy coded as 0 for IPV perpetrators and 1 for controls) in Step 2; and the two-way interactions (IRI subscales x group) in Step 3.

Data analyses were conducted using SPSS Statistics for Windows, version 26.0 (IBM Corp., Armonk, NY, USA). Values of $p < .05$ were considered statistically significant. The average values are reported in the tables as mean ± standard deviation.

3. Results

3.1. Sociodemographic data and empathy scores

There were no significant differences between IPV perpetrators and the control group in age, BMI or in sociodemographic variables (see Table 4). With respect to the IRI subscales, IPV perpetrators differed from controls in the perspective taking [IPV perpetrators, $M = 21.08$, $SD = 3.18$; control group, $M = 25.00$, $SD = 4.59$; t (22) = −2.430, $p = .024$, $d = .99$] and in the fantasy subscales [IPV perpetrators, $M = 18.42$, $SD = 5.05$; control group, $M = 23.33$, $SD = 4.03$; t (22) = −2.635, $p = .015$, $d = 1.07$], with IPV perpetrators exhibiting lower scores than controls in both cases. No differences were found in the empathic concern [IPV perpetrators, $M = 25.67$, $SD = 4.52$; control group, $M = 27.33$, $SD = 5.66$; t (22) = .800, $p = .434$, $d = .32$] or in the distress subscales [IPV perpetrators, $M = 15.83$, $SD = 4.39$; control group, $M = 15.75$, $SD = 4.45$; t (22) = .050, $p = .964$, $d = .02$].

3.2. sOXT, sT and sC

As shown in Table 5, the MANOVA performed for independent hormone levels reported that IPV perpetrators differed in their sOXT AUCi levels compared to controls [F (1, 23) = 4.848, $p = .038$; $\eta^2_p = .181$] revealing a lower sOXT AUCi value of IPV perpetrators compared to the control group. Furthermore, IPV perpetrators also differed in their sT AUCg [F (1, 23) = 4.726, $p = .041$; $\eta^2_p = .177$], showing higher sT AUCg value than the control group. No further differences were found between groups in the rest of the hormonal levels.

	IPV (n = 12)	Controls (n = 12)	Student *t*	Cohen's *d*
Age (*M*, *SD*)	35.17 (8.21)	40.25 (13.87)	- 1.09	.45
BMI (*M*, *SD*)	25.83 (3.66)	24.38 (3.33)	1.01	.41
			Chi-Square	Cramer's *V*
Marital status (%)				
Married	58	50	.17	.08
Single/Divorced/Widowed	42	50		
Level of education (%)				
No studies	0	0	3.14	.36
Primary	08	08		
Upper secondary	75	42		
University	17	50		
Annual Income (%)				
Low Income	17	25	2.01	.29
Medium Income	67	67		
High Income	16	08		

***Table 4**. Study 2: Means, standard deviations, percentages, and means comparisons for sociodemographic and psychological variables for both groups. IPV: Intimate Partner Violence; BMI: Body Mass Index; M: Mean; SD: Standard Deviation. Statistical significance $^{*}p < .05$, $^{**}p < .01$*

3.3. sOXT/T, sOXT/C and sT/C ratios

With respect to the hormonal ratios, IPV perpetrators differed in sOXT/T AUCi [F (1, 23) = 4.385, p = .048; η^2_p = .166] and sOXT/T AUCg values [F (1, 23) = 4.544, p = .044; η^2_p = .171] compared to controls, with IPV perpetrators showing lower sOXT/T AUCi and AUCg levels compared to the control group. Additionally, IPV perpetrators exhibited higher sT/C AUCg levels than the control group [F (1, 23) = 4.651, p = .042; η^2_p = .175]. Both groups did not differ in any other hormonal ratios (see Table 5).

	IPV (n = 12)	**Controls (n = 12)**	***F value***	***p***	**Effect Size**
sOXT AUCg *(M, SD)*	538.13 (41.40)	552.76 (40.91)	.758	.393	.03
sT AUCg *(M, SD)*	415.40 (34.79)	384.87 (34.03)	4.726	.041	.18
sC AUCg *(M, SD)*	139.25 (37.72)	146.84 (64.81)	.123	.729	.01
sOXT AUCi *(M, SD)*	-25.92 (79.30)	43.02 (73.99)	4.848	.038	.18
sT AUCi *(M, SD)*	-.43 (37.97)	-6.97 (27.29)	.235	.633	.01
sC AUCi *(M, SD)*	-6.59 (25.15)	6.92 (49.52)	.710	.409	.03
sOXT/T AUCg *(M, SD)*	110.89 (13.64)	126.13 (13.56)	4.544	.044	.17
sOXT/C AUCg *(M, SD)*	504.00 (355.38)	573.17 (560.18)	.130	.721	.01
sT/C AUCg *(M, SD)*	541.40 (251.29)	363.82 (139.62)	4.651	.042	.18
sOXT/T AUCi *(M, SD)*	-8.19 (20.88)	10.46 (21.07)	4.385	.048	.17
sOXT/C AUCi *(M, SD)*	12.81 (67.06)	19.18 (82.05)	.231	.654	.02
sT/C AUCi *(M, SD)*	6.19 (40.26)	13.95 (35.98)	.235	.633	.01

Table 5*. Means, standard deviations and t-test statistics for the hormonal AUCg and AUCi for all groups. IPV: Intimate Partner Violence; sOXT: Salivary Oxytocin; sT: Salivary Testosterone; sC: Salivary Cortisol; M: Mean; SD: Standard Deviation.*

3.4. Predictive capacity of empathy scores on hormonal levels during the task

3.4.1. sOXT, sT and sC

Only the perspective-taking subscale predicted 19.2% of the sOXT AUCi after the empathic induction task [β = .476, F (1, 23) = 6.45, p = .019] and 17.7% of the sOXT AUCg after the task [β = .461, F (1, 23) = 5.95, p = .023]. Additionally, the linear regression model showed that the perspective taking predicted the 19.2% of the sT AUCi to the empathic induction task [β = −.475, F (1, 23) = 6.401, p = .019]. None of the other IRI subscales significantly predicted hormonal AUC. Moreover, no group effect was observed in this regression analysis.

3.4.2. sOXT/T, sOXT/C and sT/C ratios

Regarding the hormonal ratio levels, the linear regression model indicated that only the IRI perspective taking score significantly predicted 19.3% of the sOXT/T AUCi [β = .477, F (1, 23) = 6.49, p = .018]. Additionally, it was seen that the IRI perspective taking score similarly predicted 20.3% of the sOXT/C AUCi [β = .488, F (1, 23) = 6.87, p = .016]. Furthermore, perspective taking predicted 31.8% of the sT/C AUCg [β = −.590, F (1, 23) = 11.74, p = .002]. No other significant models or group effects were found.

4. Discussion
4.1. Discussion of the main results

Our data revealed that IPV perpetrators exhibited lower scores in IRI perspective taking and fantasy subscales than controls. Furthermore, our data revealed that IPV perpetrators presented lower sOXT changes in their levels and higher total sT levels than the controls. They also presented lower sOXT/T change and total sOXT/T levels post-task, as well as higher total sT/C levels than the controls. Remarkably, the lower the perspective taking score, the lower the total sOXT levels and sOXT changes and the higher the sT increase were for the entire sample. Low perspective taking also predicted smaller sOXT/T and sOXT/C changes in the empathic induction task, and higher total sT/C levels for all participants.

Regarding the first aim, IPV perpetrators exhibited lower scores on specific IRI subscales, particularly, perspective taking and fantasy. This concurs with previous studies indicating that IPV perpetrators presented deficits in cognitive empathy (Romero-Martínez, González-Bono et al., 2013; Romero-Martínez, Sarrate-Costa et al., 2021) and linking them to IPV occurrence (Clements et al., 2007). Difficulties with perspective taking could hinder the recognition of the emotional experiences of others, increasing the likelihood of inappropriate responses in interpersonal situations (Covell et al., 2007). It has been argued that perspective taking skills enable the consideration of various meanings and motivations, which facilitates emotional regulation. Indeed, enhanced perspective taking has been proposed as a protective factor for IPV perpetration (Ramos et al., 2021). However, no differences were found between groups in empathic concern or personal distress, even though low empathic concern and high personal distress have been linked to perpetration of IPV through an inability to tolerate the negative emotions of others (Covell et al., 2007; Marín-Morales et al., 2021). Our results could be due to the susceptibility to bias (e.g., IPV perpetrators' low emotional self-perception) and manipulation (e.g., IPV's social desirability) of using a single self-report (Garaigordobil et al., 2015; Visschers et al., 2017). This outcome reinforces the importance of using empathic induction tasks as a complement to self-report questionnaires.

Secondly, we also aimed to compare the hormonal response (e.g., sOXT, sT, and sC levels and hormonal ratios) of IPV perpetrators and a control group following an empathy induction task. Lower changes in sOXT levels were observed in IPV perpetrators following an empathic induction task compared to controls. Past research pointed out that emotional videos may induce increases of OXT levels in non-violent healthy young adults of both genders (Barraza & Zak, 2009; Procyshyn et al., 2020). However, the differential functioning of OXT has been proposed in IPV perpetrators. For instance, a decrease in sOXT levels was reported in IPV perpetrators after an empathic induction task involving strangers, compared to the control group that increased their sOXT levels (Comes-Fayos, Blanco-Gandía et al., 2022). Another study found that intranasal administration of OXT increased IPV inclinations toward partners in violence-prone individuals (DeWall et al., 2014). Indeed, despite observing no change in sOXT levels in response to an acute cognitive stress task in either the IPV or the control group, Romero-Martinez, Blanco-Gandía et al. (2021) found that total sOXT levels were higher in IPV perpetrators. These results suggest that we cannot conclude that IPV perpetrators can be characterized by a generalized, diminished OXT functioning. In this sense, the importance of the task's emotional content and who it involves should be highlighted. Thus, further research is needed to clarify the role of OXT in IPV proneness.

In terms of sT, both groups did not differ in their levels of sT change after the task. This was in line with a previous study, which also failed to report sT changes in IPV perpetrators to an acute laboratory cognitive stressor (Romero-Martinez, Blanco-Gandía et al., 2021). However, these results contrast with the decrease in sT levels found by Procyshyn et al., (2020) after an empathic induction task. Additionally, Romero-Martínez, González-Bono et al., (2013) implemented a laboratory social stressor focused on IPV and found that IPV perpetrators had higher T levels post-task than controls. Nonetheless, although no difference in change in sT levels was observed, our results exhibited higher total sT levels in IPV perpetrators relative to the control group. This finding was relevant since various authors have negatively related the performance in empathic laboratory tasks and circulating T levels. Nitschke and Bartz (2020) reported that higher baseline sT levels were associated with worse performance on a naturalistic empathic accuracy task, in which participants dynamically track, in real time, the emotional state of others. In another study, Ronay and Carney (2013) found that basal pT levels were negatively associated with a behavioral measure of cognitive empathy. Accordingly, it might be theorized that elevated sT levels could affect socioaffective decoding, especially in IPV perpetrators. However, we underlined the importance of considering the content and type of task when interpreting the T levels in IPV (Eisenegger et al., 2011; Geniole et al., 2020).

Contrary to our expectations, no significant differences in sC were detected, even though both the change in sC levels and its overall levels were lower in IPV perpetrators. This could be due to the fact that the empathic induction task is not designed to induce stress. However, it should be noted that IPV perpetrators have been seen to display lower changes in sC levels in response to a stress-inducing task compared to controls (Romero-Martínez, González-Bono et al., 2013; Romero-Martínez, Sarrate-Costa et al., 2021). Hence, it is possible that the empathic induction task is related, to a greater extent, to the sOXT and sT response, not promoting a sufficient sC response to show differences between the groups. However, it is important to consider that many authors have hypothesized that individuals characterized by proneness to violence presented a hypoactivity of the hypothalamic–pituitary–adrenal (HPA) axis (Gowin et al., 2013; Hawes et al., 2009).

An important novelty of this study was the assessment of hormonal ratios and whether these ratios vary in response to an empathic induction task. Congruent with the above-reported results for hormone-independent levels, IPV perpetrators showed a lower change in their sOXT/T concentrations after the task, along with lower total sOXT/T levels. While the literature has provided evidence for opposing effects between these hormones in the social domain, highlighting a possible interaction between them (Cherki et al., 2021; Holtfrerich et al., 2016; Yao et al., 2018), to the best of our knowledge, this is the first study to evaluate the OXT/T ratio to an empathic induction task. Notably, our findings are consistent with and strengthen the steroid/peptide theory of the social bonds (S/P Theory), which suggests that a high level of OXT (facilitator of salience of socioaffective stimuli), combined with a low level of T (facilitator of salience of self-focused stimuli), would favor socioaffective functions, such as social bonding, perspective taking, or empathy (Van Anders et al., 2011; 2012; Gordon et al., 2017). Therefore, the difference in sOXT/T ratio levels between IPV perpetrators and the control group may indicate discrepancies in the way that they process socioaffective stimuli, which could lead to an alternative empathic experience, if any.

IPV perpetrators also showed higher total sT/C levels after the task compared to the control group. Greater T/C levels have previously predicted greater aggression towards one's partner in a non-offending sample (Manigault et al., 2019). Studies in IPV perpetrators have found higher levels of the sT/C ratio in response to social stress in this population compared to non-offender participants (Romero-Martínez, González-Bono et al., 2013), and link sT/C to antisocial traits (Romero-Martínez et al., 2016). In fact, a high T/C ratio has been proposed to predispose an individual to self-oriented dominance attitudes (Mehta & Josephs, 2010). Taken together, these findings reinforce our hypothesis of a different hormonal profile in IPV perpetrators when faced with an empathic induction task, with lower sOXT/T levels, related to poor socioaffective processing, and higher sT/C levels, related to a greater dominance.

Remarkably, both groups did not differ in their sOXT/C levels. A meta-analysis exposed that OXT levels may dampen C release only during challenging stress tasks that could heavily stimulate the HPA axis (Cardoso et al., 2014). This lack of significance may be due to the fact that our task is not designed to induce severe social stress. However, it should be noted that the change in sOXT/C levels and the total sOXT/C levels were lower in IPV perpetrators. Future research may value exploring the OXT/C ratio in relation to empathic distress in IPV perpetrators.

Finally, we intended to explore whether empathic abilities explained the hormone levels following the empathic induction task. As a result, the perspective-taking dimension of the IRI predicted a higher sOXT response to the task, as well as a lower sT response. Consistently, greater perspective taking was also predictive of a higher sOXT/T and sOXT/C changes and a lower change in sT/C levels in response to the empathic induction task. These findings are of particular relevance as they link understanding of another person's emotional state to an increase in sOXT after an empathic induction task. In contrast, this dimension of empathy appears, again, to be related to lower sT levels. It seems coherent that a better perception of the emotions of others was strongly related to an increase in the sOXT/T ratio, presumably through the counteracting influence of these hormones on the salience of socioaffective stimuli (Van Anders et al., 2012; Crespi, 2016). On the other hand, the predictive capacity of perspective taking with respect to the change in the sOXT/C levels could be partially explained through an attenuating effect of OXT on C when faced with the negative experiences of others (Brown et al., 2016; Cardoso et al., 2014), which may facilitate cognitive empathy. As a matter of fact, it has previously been observed that increased OXT predicts better cognitive accuracy following an emotional induction task, buffering C-response effects (Young-Kuchenbecker et al., 2021).

However, no other IRI dimension has shown a predictive capacity for hormone levels. This could be due to several reasons. First, difficulties have been recognized when linking the fantasy scale to empathy, being a controversial scale for several authors (Nomura et al., 2012; Su et al., 2005). Additionally, personal distress has been primarily linked with C (Engert et al., 2014), and our task caused no change in sC levels. Finally, although OXT has been proposed to be related in part to affective empathy (closely related to empathic concern), more emphasis has been placed on the ability to recognize and understand the emotions and motivations of others (which is included in the perspective-taking dimension; Hastings et al., 2014; Wolgast et al., 2020). It should be noted that no group effect was observed in the regression analyses. However, while it is true that these relationships between psychobiosocial markers were cross sectional throughout the sample, the perpetrators of IPV showed poorer perspective taking. Thus, our findings suggest that the ability to understand the situations of others could partially explain the concentration of certain hormones that are important for socioaffective processing (e.g., OXT, T and their ratio) following an empathic induction task, even in a violent population with lower empathic abilities, such as IPV perpetrators.

4.2. Limitations and future research

This study is not exempt from limitations, which are outlined as follows. First, a limitation of our study is the small sample size. This limitation is mainly due to the impossibility of collecting biological samples after the appearance of COVID-19. The COVID-19 pandemic has had and will have further consequences on biological research, and it is essential to be reminded of good practice for the management of biological samples for research, notably concerning the biosafety and security procedures (Hofman, 2020). This is compounded by the difficulty of access to the sample (Santirso et al., 2020; Martín-Fernández et al., 2022), which could be especially accentuated due to the psychobiological nature of this study. However, the study on hormones in this population is scarce, and having several hormonal determinations increases the value of the results obtained; however, further research is imperative to replicate these results in larger samples. A second limitation of our study might be the methodology used to induce empathy and elicit hormonal changes. This is a standardized task to induce negative valence emotions through the visualization of film scenes (Fernández-Megías et al., 2011). Therefore, this task is not specifically designed for empathic induction, although several studies have employed this task to induce empathy and examine OXT and T responses (Barraza & Zak, 2009; Procyshyn et al., 2020). Another relevant consideration is the interpretation of the ratios. From a methodological point of view, ratio distributions are complex (Sollberger & Ehlert, 2016). However, following authors' recommendations, we considered several strategies to strengthen the statistical approach of the ratios. Nonetheless, the interpretation of the ratio findings should be viewed with caution.

Future lines of research should replicate the results of this investigation in a larger sample. In addition, it would be of great interest to explore possible differences between IPV perpetrators and other types of offenders, helping to establish risk factors that may be transversal to violent behavior and specific risk factors according to the crime committed. Additionally, further research covering not only the response to negative effects, but also to positive effects, seems necessary. This would allow for a better understanding of the processing of positive emotions in IPV perpetrators. In this regard, it would be of great interest to address emotions associated with prosocial behavior, an important protective factor for violent behavior, such as compassion. Future research could also be conducted to analyze the empathic response of IPV perpetrators when focusing on aggressors rather than victims, and whether their empathic response could be related to the offender accountability. Finally, exploring the effects of IPV intervention programs on psychological and hormonal response following an empathic induction task could highlight the importance of adequate emotional processing for IPV prevention.

4.2. Conclusion

Our results seem to indicate that IPV perpetrators exhibit both biological and psychological markers related to empathy difficulties. Specifically, they show lower levels of sOXT over sT in response to an empathic induction task that predisposes subjects, presumably, to differential processing of socio-affective stimuli. This disparity may be based on self-oriented dominance attitudes. The interaction between OXT and T appears to be relevant for a holistic understanding of the empathic response, given that important socio-affective functions for empathy, such as perspective taking, have been related to a higher OXT/T ratio. Thus, future lines of research in this direction seem pertinent. All of this, together with lower self-reported empathy scores, may point to an abnormal empathic function that would act as a risk factor for IPV.

Taking this into account, our results suggest that addressing certain dimensions of empathy in intervention programs could influence hormonal markers related to reduced dominance attitudes, better anxiety management, and increased attention to social-affective stimuli, which could ultimately facilitate the modification of aggressive behavior patterns (Arce et al., 2020).

Capítulo 8. Estudio 3.

Weakened sympathetic response and lower parasympathetic activity in intimate partner violence perpetrators when empathizing: Influence of autonomous activation in affective approach and prosocial behavior.

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1. Introduction

IPV is a recognized public health problem that encompasses any act that may potentially result in physical, psychological, or sexual harm by a current or former intimate partner, in any form of relationship (Centers for Disease Control & Prevention, 2010; Miller & McCaw, 2019). According to WHO (2019), about 26% of women worldwide have experienced severe physical or sexual violence from a male intimate partner at least once in their lifetime, emerging as one of the demographic groups at the highest risk of experiencing IPV (Hardesty & Ogolsky, 2020). Therefore, IPV literature has invested substantial resources on understanding IPV perpetrators' characteristics in order to develop effective intervention programs to prevent this type of violence (Santirso et al., 2020). As a consequence, robust scientific evidence has been provided suggesting that autonomic nervous system (ANS) functioning might assist in complementing the profile of IPV perpetrators, which could be employed to characterize their therapeutic needs (Michonski & Babcock, 2009; Pinto et al., 2010; Romero-Martínez et al., 2014). However, there is still controversy regarding how ANS values are associated with IPV risk factors, and the importance of considering various ANS indexes in relation to specific violence-related features has been underlined (Murray-Close et al., 2017; Vitoria-Estruch et al., 2018b).

In an early study examining the psychophysiological response of IPV perpetrators, Gottman et al. (1995) found evidence supporting two categories of offenders based on psychophysiological reactivity to an acute laboratory stressor (marital conflict): The Type I perpetrator, linked to lower heart rate (HR) reactivity during the conflict task, high initial levels of aggression, hostility and antisocial traits, and Type II perpetrator, associated with higher HR reactivity and increasing levels of unrestrained aggression as the conflict task unfolded. Nevertheless, two follow-up studies failed to replicate this classification (Babcock et al., 2004; Meehan et al., 2001). The authors ascribed their failure to replicate these results to a methodological weakness present in Gottman's study, arguing that inadequate baseline recording likely diminished the reliability of the psychophysiological typology. Specifically, they highlighted that the baseline was too brief (i.e., 2 minutes) and was recorded while exploring the topics of each marital conflict. Also, these authors emphasized the difficulty of measuring autonomic activity solely through HR due to the multiple autonomic influences affecting this marker.

Hence, subsequent studies have focused on the functioning of multiple sympathetic nervous system (SNS) markers (associated with the fight-or-flight response and highly arousing negative emotions) and parasympathetic nervous system (PNS) markers (related to inhibition of SNS activity, a state of calm, and adjust socio-affective functioning) in response to violence-related stimuli, rather than establishing or replicating offender categories. This new research stream is based on the polyvagal theory, which proposes difficulties of the PNS in regulating the predominant alarm-type, fight-or-flight SNS activity in violent individuals (Porges, 2007; 2009). Also, ANS literature has employed the polyvagal approach as a means of understanding self-regulation, emotional processing and social engagement in violent individuals. Indeed, current research proposes that markers of diminished PNS activity (e.g., reduced heart rate variability), may be indicative of poor self-regulatory control that may potentially leads individuals to socio-affective maladjustment (Palix et al., 2022; Thayer et al., 2009).

Consequently, much of the psychophysiological research on IPV has concentrated on HR and respiratory rate (RR) (as two general markers of physiological activation), pre-ejection period (PEP) and skin conductance level (SCL) (as a cardiovascular and electrodermal marker of sympathetic activity), and respiratory sinus arrhythmia (RSA) (as a reliable cardiorespiratory biomarker of the PNS) (De Looff et al., 2022; Reyes del Paso et al., 2013). As a result, IPV perpetrators have consistently reported higher HR, RR and SCL values, shorter PEP levels (associated with increased sympathetic activity), and lower RSA levels (indicative of attenuated PNS) when recovering from acute stress (both neuropsychological and psychosocial stress, with self-perceived evaluative threat) compared to men with no criminal records (Romero-Martínez et al., 2014, 2022; Vitoria-Estruch et al., 2018b). This apparent sympathetic predominance in IPV perpetrators could be related to difficulties in distress regulation arising from high self-perceived stress situations, which could predispose to violent behavior. Contrary to the aforementioned results, decreases in HR and SCL levels during interpersonal conflict have also been observed in IPV perpetrators with higher rates of violence and distress (Babcock et al., 2005; Trahan & Babcock, 2019). These results highlight that the ANS activity of IPV perpetrators might differ according to a variety of violence-relevant factors, such as characteristics of the stressor (e.g., self-centered vs others-centered) and its subsequent emotional processing.

Indeed, impairments in socio-affective functions have been identified as a significant risk factor for IPV (Brem et al., 2018), with many IPV perpetrators reporting difficulties in identifying and expressing their own and others' emotions (Romero-Martinez, Lila et al., 2021). Several authors have postulated that deficits in empathy, the ability to understand and share another person's emotional experience might make IPV perpetrators prone to violence (Comes-Fayos, Romero-Martínez et al., 2022; Romero-Martínez et al., 2019a). Notably, a maladaptive emotional response to others' emotions (i.e., poor social engagement) has been exposed as a critical variable for IPV, as abnormalities in this domain have been strongly related to violent behaviors in IPV perpetrators (Godfrey et al., 2020; Sáez et al. 2022). In this regard, many researchers have claimed that ANS indexes should be taken into consideration (Glenn & Raine, 2014; Moya-Albiol et al., 2017), as emotionally charged stimuli, especially those with high negative arousal, rapidly initiate an ANS response (Obradović & Boyce, 2012). Therefore, objective markers of the ANS could provide relevant information about emotional processing in IPV perpetrators and how it influences their socio-affective processing and behavior (Balzarotti et al., 2017; Christopoulos et al., 2019).

Nevertheless, studies on the psychophysiological response of IPV perpetrators to emotional paradigms are relatively few. Godfrey & Babcock (2020) evaluated how facial emotion recognition ability may influence the psychophysiological response of a group of IPV perpetrators during a marital conflict task. A negative relationship was observed between violent behaviors during the task and SCL and RSA reactivity in IPV perpetrators with moderate to high emotion recognition ability. According to the authors, these findings could be due to cognitive factors related to the interpretation of perceived emotion rather than recognition, such as hypermentalization or misinterpretation of the intensity of another's negative emotion. Additionally, Babcock & Potthoff (2021) assessed the psychophysiological response of IPV perpetrators to an anger induction task (i.e., imagining that their partner is negatively judging them) in comparison to a control group. They found that IPV-prone men reported lower SCL than non IPV-prone men following the task. These findings may suggest a different ANS reactivity during the socio-affective processing of negative emotions. Yet, the authors emphasized that more research is needed to accurately interpret the findings regarding the emotional functioning of IPV perpetrators and their psychophysiological correlates. Actually, to the best of our knowledge, no study has examined the psychophysiological response of IPV perpetrators specifically to others' emotions, a key function relevant to behavioral regulation in offenders (Godfrey et al., 2020; Sáez et al. 2022).

Finally, there is a growing body of literature investigating protective factors in IPV, such as prosocial behavior (Boduszek et al., 2019; Comes-Fayos, Blanco-Gandía et al., 2022). Notably, prosocial behavior has been exposed to have a significant relationship with the ANS (Gilbert, 2017; Yu & Hao, 2022). Higher PNS activity has been associated with prosocial-relevant functions, such as increased social engagement (Shahrestani et al., 2014) or adaptive emotional processing (Geisler et al., 2013). In general population, increased RSA levels after watching people suffering have been linked to prosocial behaviors (Oveis, 2009; Stellar et al., 2015). Furthermore, individuals with higher RSA upregulation ability have reported increased prosocial behavior (Bornemann et al., 2016). On the other hand, it has also been found that higher cardiac reactivity to a distressing film, together with self-reported affective response, was associated with greater prosocial behavior (Sze et al., 2012; Yu & Hao, 2022). This aligns with the negative state relief model, which proposes that individuals could engage in prosocial behaviors when experiencing negative emotions, as helping others may provide a way to alleviate those highly arousing negative emotions (Cialdini et al., 1987; Erlandsson et al., 2016). Congruently, it appears that sympathetic activation in response to others' suffering has a major role in prosocial behavior, as it may underlie the motivation both to reduce the observer's arousal and to help others. These results may imply a complex psychophysiological interaction that enables an adjust emotional processing and social engagement, which may predispose to prosociality (Gilbert, 2017). Nonetheless, the study of prosocial behavior in IPV perpetrators and its psychophysiological correlates is still scarce.

Consequently, the present study pursues two major objectives. First, we aim to analyze the physiological responses of IPV perpetrators to an empathic induction task, compared to a group of men with no criminal records. Prior literature has found lower sympathetic activation (both cardiorespiratory and electrodermal) when facing other´s suffering in comparison to the non-forensic population (Babcock et al., 2005; Trahan & Babcock, 2019). Also, lower RSA activity has been related to violent behavior and IPV (Godfrey & Babcock, 2020; Romero-Martínez et al., 2022). Therefore, we expected that IPV perpetrators would present lower HR, RR and SCL, longer PEP values, as well as lower RSA levels than the control group, indicative of a buffered sympathetic and parasympathetic response. Secondly, we aim to explore the difference in the performance of prosocial behavior between IPV perpetrators and controls, including whether post-task psychophysiological levels predict the occurrence of prosocial behavior. Previous studies have found that higher HR and RSA levels were linked to increased prosocial behaviors after negative-valenced empathic induction tasks in general populations (Stellar et al., 2015; Sze et al., 2012; Yu & Hao, 2022). Nevertheless, socio-affective impairments have been consistently found in IPV perpetrators (Brem et al., 2018; Romero-Martínez, Lila et al., 2021). Thus, we expect that greater SNS and PNS responsiveness will predict the occurrence of prosocial behaviors, with a lower prevalence among IPV perpetrators due to socioaffective deficits (Godfrey et al., 2020; Mayer et al., 2018).

2. Method

2.1. Participants

From an initial sample of 100 male participants, one IPV perpetrator and one control were excluded from the study because their psychophysiological levels exceeded the standard deviation of the total sample by 2.5 or more. The final sample consisted of 98 healthy male volunteers (52 IPV perpetrators and 46 controls).

IPV perpetrators were recruited from the CONTEXTO Program, a community-based psychoeducational intervention program carried out at the Department of Social Psychology at the University of Valencia, mandatory for men convicted of IPV for up to 2 years (suspended on the condition of attending the intervention program; Lila et al., 2018). Requirements for participating included: having being sentenced for IPV, absence of mental and neurological disorders or severe cardiovascular disease; and having Spanish writing and speaking skills. All IPV perpetrators were equally offered participation prior to the start of the intervention program, and it was clarified that their refusal to participate would not affect their legal disposition. The control group was recruited in Valencia (Spain), establishing contact through advertisements posted on social networks. They were required to be male volunteers who met the inclusion criteria, with similar anthropometric and socio-demographic characteristics to those of the IPV perpetrators, in addition to not having any previous criminal record.

Prior to the experimental session, each interested individual received a phone call and underwent an ad hoc semi-structured clinical interview conducted by two trained psychologists in order to explore their medical history and detect possible psychopathological symptoms (e.g., depressive, manic, psychotic, and/or neurological symptoms). Furthermore, given the high prevalence of IPV registered in Spain (Government Delegation against Gender Violence, 2020) and to rule out severe IPV behaviors among the control group, the "Revised Conflict Tactics Scale" (Straus et al., 1996; see *Annex 12*) was also administered to both groups. In this regard, the control group did not exhibit severe IPV behaviors, according to the scores proposed by Straus et al. (1996; see supplementary Table 1).

Eligible candidates were informed about the requirements of the study and were asked to avoid psychoactive substances with influence on the cardiovascular system, and to abstain from physical exercise for at least two hours before the experiment. All participants voluntarily agreed to participate, gave written informed consent and received a financial retribution of 40 euros at the end of the study. The experiment was conducted in accordance with the Declaration of Helsinki and was approved by the Ethics Committee of the University of Valencia (procedure number: H1538385543901).

2.2. Procedure

The procedure was carried out in an individual session lasting approximately 120 minutes at the Psychobiology laboratories of the University of Valencia. Participants were accommodated in a room with constant temperature (21 ± 1 °C) and humidity. First, informed consent was signed and anthropometric measurements were taken. Next, the Vrije Universiteit Ambulatory Monitoring System (VU-AMS; see *Annex 13*) psychophysiological device (specified later) was placed. Based on previous studies on emotional processing and IPV, a 5-min baseline period was recorded (Behnke et al., 2022; Sarrate-Costa et al., 2023; Romero-Martínez et al., 2022).

Then, a validated battery of emotion-eliciting videos for the Spanish population (Fernández-Megías et al., 2011) was employed for the empathic induction task. From this battery, four violence-focused clips were selected based on their high arousal and negative affect (mean length of 1' 21"). Prior to visualization, the participants were told to actively empathize with the victim in each scene (previously indicated). Consistent with previous studies (Procyshyn et al., 2020; Schaefer et al., 2010), participants were required to relax for one minute before watching each scene (for more details, see Comes-Fayos, Romero-Martínez et al., 2022). After completion of the empathic induction task, participants underwent a 15-min psychophysiological recovery phase. Once the recovery period was over, information on sociodemographic variables was collected.

Next, the prosocial laboratory task was performed by making a charitable donation, replicating the protocol of Hare et al. (2010). The procedure was based on three phases: (1) presentation of problems subscribed to 6 NGOs (see *Annex 3*), (2) evaluation of the NGOs' impact on the problems, and (3) factual opportunity to perform helping behavior through a voluntary donation. The donation was extracted from the remuneration received by the participants (for more details, see Comes-Fayos, Blanco-

Gandía et al., 2022). To conclude, the psychophysiological electrodes were removed; the participants received their remuneration and were dismissed.

2.3. Measures

For the psychophysiological recording, we employed the VU-AMS to record participants’ cardiorespiratory and electrodermal signals. In order to register cardiorespiratory signals, seven pre-gelled electrodes were placed on the participant’s chest and back. For this purpose, EL503 electrodes (Biopac, USA) were used. Also, we employed Biopac TSD203 combined with isotonic electrode gel (GEL101) for skin conductance, which was recorded from the medial phalanges of the index and middle or ring fingers. A yellow connector and a blue lead wire connector with seven lead wires were used to record the SCL and ECG, respectively. An infrared interface cable connected the ambulatory recording device (VU-AMS5fs) to the monitoring computer. Data processing of the psychophysiological signals was performed with “Data Analysis and Management Software” (http://www.vu-ams.nl/vuams/software/). This program allowed automated scoring of each signal, including an improved artifact and R-peak detection that makes it possible to automatically remove artifacts. In accordance with the VU-DAMS v5.0 recommendation manual for ANS analysis, a supplementary visual inspection and manual correction of R-peak detection were conducted. During this process, the deviant interbeat intervals (IBI) were carefully examined, and any strongly divergent intervals, including ectopic beats and arrhythmic events, were removed.

The markers used to assess cardiorespiratory activation were HR in beats per minute (beat/m) and RR in breaths per minute (breath/m) as two general physiological activation markers (Obradović & Boyce, 2012). In the case of sympathetic activity, we employed the PEP, that is, the time interval that reflects cardiac contractility (Reyes del Paso et al., 2013). Moreover, we used the SCL, measured in micro-Siemens (μSi), as a marker of changes in emotional arousal. We employed two markers of sympathetic activity as numerous authors have highlighted that SNS scores will be most reliable when multiple parameters are taken into account (Laborde et al., 2017). In this regard, evidence has been provided indicating that PEP typically decreases and SCL increases during exposure to cognitive and physical stressors that are known to activate the SNS (Goedhart et al., 2008; Tomaka et al., 1994). Additionally, we included the RSA, a cardiorespiratory indicator highly related to vagal control (Taylor et al., 2022). Hence, increased RSA scores suggest higher PNS activity (Malik, 1996; Reyes del Paso et al., 2013). RSA scoring was calculated in milliseconds (msec) based on the peak-valley method (Grossman et al., 1990; de Geus et al., 1995) that uses the IBI time series together with the respiration signal acquired from the filtered dZ signal (0.1 - 0.4 Hz) to obtain the cardiac period variability associated with respiration. Thus, RSA is computed per respiratory cycle from the subtraction of the shortest IBI from the longest IBI, provided that the shortest IBI is part of an accelerating series within the inspiratory interval and the longest IBI of a decelerating series within the expiratory interval.

2.4. Data analyses

Data analyses were conducted by using IBM SPSS Statistics v25. After evaluating the normality of the data with the Shapiro-Wilk test ($p < .05$), the non-normal data (i.e., SCL and RSA levels) were transformed based on a logarithm transformation (log10). A Chi square was used to check for significant differences between the groups in regards to socio-demographic characteristics (marital status, education level, and annual income). Additionally, independent samples t-tests were performed for age, BMI and donation.

In order to achieve the first objective, the general ANS markers (HR and RR), the sympathetic parameters (PEP and SCL) and the parasympathetic marker (RSA) were compared using a repeated measures ANOVA, with 'period' (Baseline, Anticipatory, Post-task, and Recovery) as the within-subject factor and 'group' (IPV vs. controls) as the between-subject factor. The socio-demographic characteristics were controlled as potential covariates, and only BMI was found to be significant as a covariate for RSA levels, thus it was integrated into the ANOVA analyses. Post-hoc analyses were conducted with Bonferroni corrections for multiple comparisons when a significant interaction effect was found. For significant results, the partial eta-squared was reported as a measure of effect size (η_p^2). Additionally, *t*-tests were employed to assess group differences in change scores (the difference between periods, calculated chronologically), and in psychophysiological levels during each period.

Regarding the second objective, we ran a hierarchical regression analysis with quantity of donation as a dependent variable and the psychophysiological activity as predictors. For this purpose, we calculated the area under the curve (AUC) using the trapezoidal formula, which accounts for repeated measures over time, simplifies statistical analyses, comprises the available information, and reduces the need for multiple statistical comparisons, thus minimizing the correction of α-error probability (Pruessner et al., 2003). We employed the AUC with respect to the ground (AUCg) as a measure of "overall psychophysiological activation”, considering the baseline, anticipatory, post-empathic task, and recovery measures. Also, we estimated the AUC with respect to the increase (AUCi), taking the baseline as the reference point, as a measure of "psychophysiological change from baseline”. The resulting regression model comprised three steps: AUC levels in step 1, group (dummy coded as 0 for IPV perpetrators and 1 for controls) in step 2, and the two-way interactions (psychophysiological AUC levels x group) in step 3.

3. Results

3.1. Sociodemographic data and preliminary analyses

There were no significant differences between the groups in demographic variables or anthropometric characteristics (see Table 6). No significant differences between the groups were found in HR [t (96) = - 1.042, p = .300], RR [t (96) = .937, p = .351], PEP [t (96) = - .533, p = .596], SCL [t (96) = - .229, p = .819] or RSA [t (96) = - 1.692, p = .094] baseline levels.

	IPV (n = 52)	Controls (n = 46)	Student *t*	Cohen's *d*
Age (*M, SD*)	41.73 (12.69)	36.84 (12.24)	1.90	.47
BMI (*M, SD*)	25.24 (3.07)	24.44 (3.01)	1.29	.26
			Chi-Square	Cramer's *V*
Marital status (%)				
Married	42	60	3.37	.19
Single/Divorced/Widowed	58	40		
Level of education (%)				
No studies	7	0	6.99	.27
Primary	33	23		
Upper secondary	40	49		
University	20	28		
Annual Income (%)				
Low Income	36	25	1.24	.11
Medium Income	55	66		
High Income	9	9		

Table 6*. Study 3: Means, standard deviations, percentages, and means comparisons for sociodemographic and psychological variables for both groups. IPV: Intimate Partner Violence; BMI: Body Mass Index; M: Mean; SD: Standard Deviation. Statistical significance* $^{*}p < .05$, $^{**}p < .01$

3.2. Effectiveness of the empathic induction task to elicit changes in psychophysiological variables

In order to analyze whether the task was effective in eliciting a psychophysiological response in the whole sample, joint analyses were conducted with IPV and control groups combined (see Supplementary Table 2 for statistical data). Indeed, the effect of ‘period’ in the repeated measures analyses was significant for all variables apart from PEP (for all $p < .001$). Post-hoc analyses indicated that HR was higher during the anticipatory period than all the other periods ($p < .001$) and lower during the post-task and recovery periods than the anticipatory and baseline periods ($p < .001$); nevertheless, RR was higher during the post-task period than all of the other periods ($p < .001$). SCL was significantly higher during the recovery period than in all the other periods ($p < .001$), during the post-task period compared to the anticipatory and baseline periods ($p < .001$), and during the anticipatory period compared to the baseline period. Finally, RSA was higher during the anticipatory and recovery periods than during the post-task period ($p = .001$; $p = .045$, respectively).

3.3. Differences between IPV perpetrators and controls in their psychophysiological levels during the task

Also, we examined the between-group differences in the psychophysiological levels during the task (see Supplementary Table 2 for statistical data).

For HR, a significant ‘period x group’ effect was found [ε = .777, F (2.3, 223.7) = 5.316, p = .004, η^2_p = .052], as well as a trend toward significance for the ‘group’ factor [F (1, 96) = 3.626, p = .060, η^2_p = .036]. In this regard, IPV perpetrators exhibited a smaller HR increase from baseline to the anticipatory period (p < .001) than controls (see Table 7). As a result, IPV perpetrators reported lower HR levels in the anticipatory (p = .031), post-task (p = .034) and recovery (p = .038) periods when compared to controls (see Figure 8 and Table 8). Regarding RR, no significant ‘period x group’ or ‘group’ effect were found (see Figure 9 and Table 8).

For PEP, a significant effect of ‘period x group’ interaction was found [ε = .637, F (1.9, 183.5) = 4.429, p = .014, η^2_p = .044]. IPV perpetrators showed differences in anticipatory to post-task change score (p < .001) and post-task to recovery change score (p = .022). Specifically, IPV perpetrators exhibited a lengthening of their PEP levels during the post-task period, followed by a shortening back to recovery, whereas the control group displayed the opposite pattern (see Table 7). Consequently, IPV perpetrators reported longer post-task PEP levels (p = .041) than controls (see Figure 10 and Table 9).

Regarding SCL levels, a significant effect of ‘period x group’ interaction was also found [ε = .474, F (1.4, 137.7) = 9.592, p = .001, η^2_p = .091], and a tendency toward significance for the ‘group’ factor [F (1, 96) = 3.682, p = .058, η^2_p = .037]. IPV perpetrators exhibited a smaller SCL increase from baseline to anticipatory period (p < .001), and from anticipatory to post-task period (p = .045) than controls (see Table 7). Consequently, IPV perpetrators reported lower SCL post-task levels (p = .014) and lower SCL recovery levels (p = .003) compared to controls (see Figure 11 and Table 9).

In the case of RSA, there was no significant ‘period x group’ interaction, but a ‘group’ effect was observed. No group differences were found in change scores, but IPV perpetrators reported lower RSA anticipatory and recovery levels (p = .012; p = .002) compared to controls (see Figure 12 and Table 9).

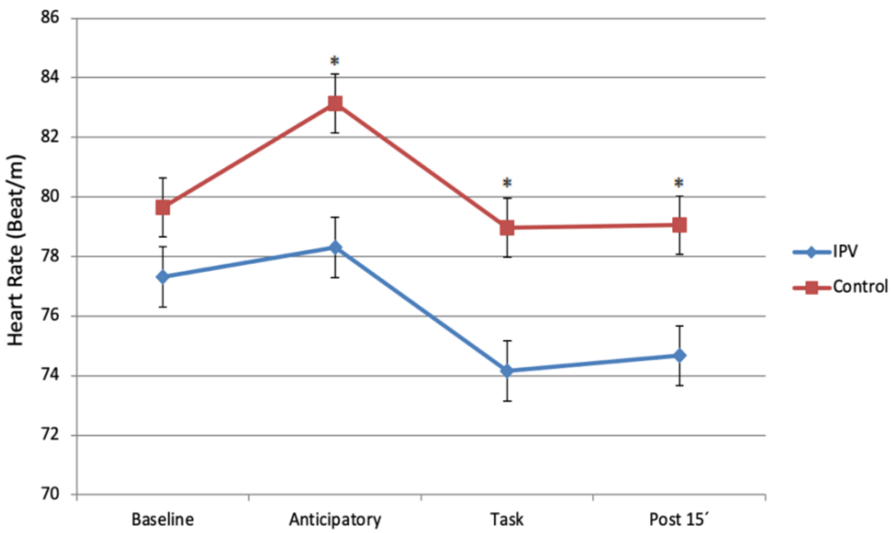

Figure 8*. HR response to the empathic induction task. HR: Heart Rate; IPV: Intimate Partner Violence; Statistical significance* $^{*}p < .05$, $^{**}p < .01$.

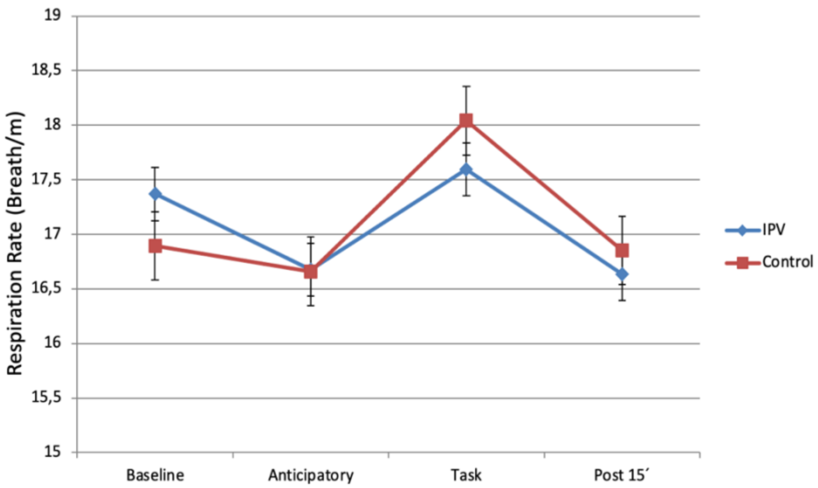

***Figure 9**. RR response to the empathic induction task. RR: Respiration Rate; IPV: Intimate Partner Violence; Statistical significance $^{*}p < .05$, $^{**}p < .01$.*

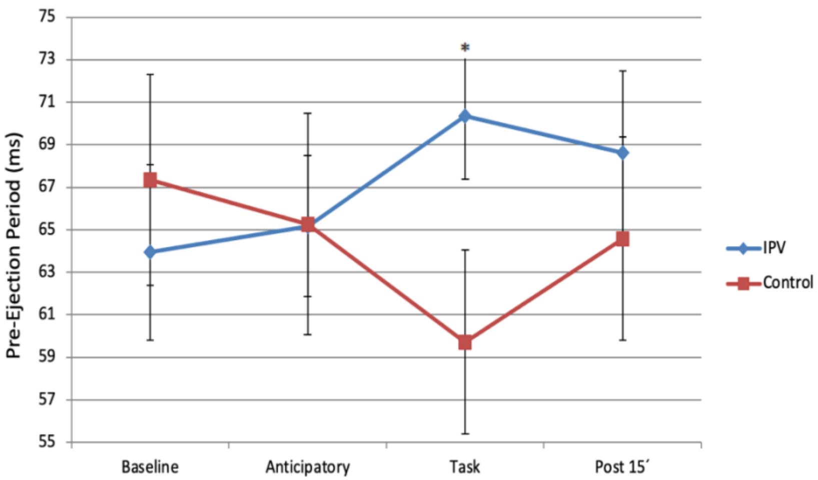

***Figure 10**. PEP response to the empathic induction task. PEP: Pre-ejection Period; IPV: Intimate Partner Violence; Statistical significance $^{*}p < .05$, $^{**}p < .01$.*

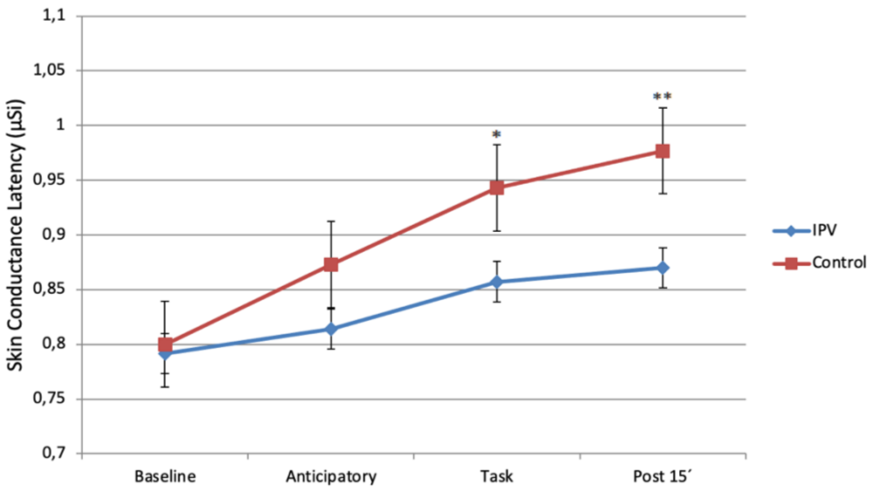

Figure 11. *SCL response to the empathic induction task. SCL: Skin Conductance Level; µSi: MicroSiemens; IPV: Intimate Partner Violence; Statistical significance* $^{*}p < .05$, $^{**}p < .01$.

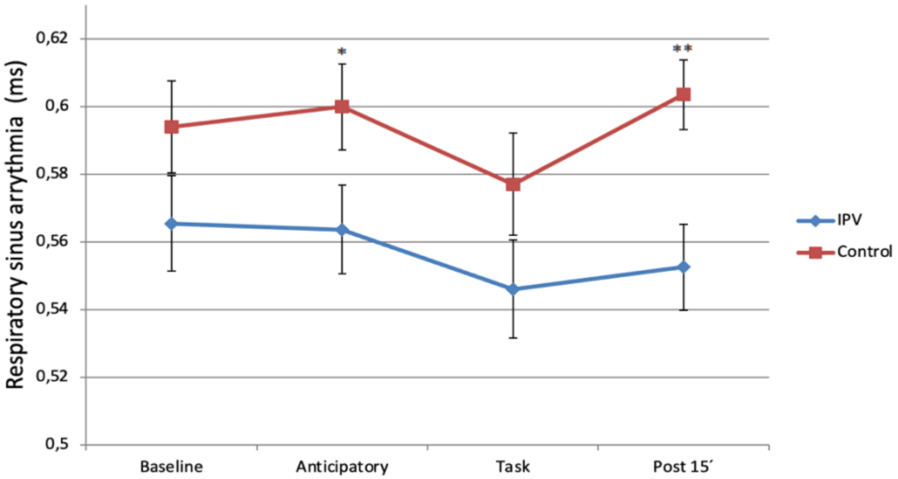

Figure 12. *RSA response to the empathic induction task. RSA: Respiratory Sinus Arrythmia; IPV: Intimate Partner Violence; Statistical significance* $^{*}p < .05$, $^{**}p < .01$.

	IPV (*n* = 52)		Controls (*n* = 46)		Student t	*p*	Effect Size	Statistical Power
	M (SD)	95% CI	M (SD)	95% CI				
HR Baseline-anticipatory	1.00 (2.10)	[.41, 1.58]	3.48 (3.01)	[2.59, 1.58]	-4.684	< .001	.96	.997
HR Anticipatory-post-task	-4.16 (3.49)	[-5.13, -3.18]	-4.18 (3.94)	[-5.35, -3.01]	-.035	.972	.01	.027
HR Post-task-recovery	.51 (2.67)	[-.23, 1.25]	.10 (3.66)	[-.99, 1.18]	-.647	.519	.13	.091
RR Baseline-anticipatory	-.69 (1.82)	[-1.20, -.18]	- .23 (1.56)	[-.70, .23]	-1.327	.188	.27	.270
RR Anticipatory-post-task	.92 (1.97)	[.37, 1.46]	1.38 (1.74)	[.87, 1.90]	-1.231	.221	.25	.232
RR Post-task-recovery	-.96 (1.81)	[-1.46, -.45]	-1.19 (1.74)	[-1.70, -.67]	.634	.528	.13	.094
PEP Baseline-anticipatory	1.23 (17.82)	[-3.77, 6.35]	-2.08 (22.66)	[-8.81, 4.65]	.809	.421	.16	.122
PEP Anticipatory-post-task	5.18 (15.16)	[.88, 9.49]	-5.55 (11.56)	[-8.98, -2.12]	3.901	< .001	.80	.978
PEP Post-task-recovery	-1.72 (17.16)	[-6.78, 2.93]	4.86 (9.15)	[2.15, 7.58]	-2.324	.022	.48	.672
SCL Baseline-anticipatory	.02 (.06)	[.01, .04]	.07 (.06)	[.05, .09]	-4.275	< .001	.83	.985
SCL Anticipatory-post-task	.03 (.07)	[.01, .05]	.12 (.30)	[.03, .21]	-2.022	.046	.41	.511
SCL Post-task-recovery	.01 (.05)	[-.01, .03]	.03 (.06)	[.02, .05]	-1.668	.099	.36	.428
RSA Baseline-anticipatory	-.01 (.08)	[-.03, .01]	.01 (.04)	[-.01, .02]	-1.436	.154	.32	.356
RSA Anticipatory-post-task	-.01 (.06)	[-.03, .01]	-.02 (.04)	[-.04, -.01]	1.497	.138	.20	.164
RSA Post-task-recovery	.01 (.07)	[-.01, .03]	.03 (.04)	[.01, .04]	-1.709	.091	.35	.421

Table 7. *Means, standard deviations and t-test statistics for the change score of psychophysiological levels during the experimental protocol for all groups. Intimate Partner Violence; HR: Heart Rate; RR: Respiratory Rate; PEP: Pre-ejection Period; SCL: Skin Conductance Levels; RSA: Respiratory Sinus Arrythmia; M: Mean; SD: Standard Deviation; CI: Confidence Interval.*

	IPV (n = 52)		Controls (n = 46)		Student t	p	Effect Size	Statistical Power
	M (SD)	**95% CI**	**M (SD)**	**95% CI**				
HR Basal	77.31 (10.61)	[73.96, 80.30]	79.65 (11.64)	[76.20, 83.11]	- 1.042	.300	.21	.180
HR Anticipatory	78.31 (10.70)	[74.91, 81.26]	83.14 (11.18)	[79.82, 86.46]	- 2.183	.031	.44	.586
HR Post-task	74.15 (10.64)	[70.69, 77.06]	78.96 (11.42)	[75.56, 82.35]	- 2.155	.034	.44	.575
HR Recovery	74.67 (10.45)	[71.22, 77.46]	79.05 (10.09)	[76.06, 82.05]	- 2.108	.038	.43	.559
RR Basal	17.37 (2.50)	[16.63, 18.12]	16.89 (2.40)	[16.18, 17.61]	.957	.341	.20	.161
RR Anticipatory	16.68 (2.34)	[15.93, 17.32]	16.66 (2.12)	[16.03, 17.29]	.038	.970	.01	.028
RR Post-task	17.59 (2.91)	[16.80, 18.56]	18.04 (2.42)	[17.32, 18.76]	- .818	.415	.17	.130
RR Recovery	16.64 (2.64)	[15.89, 17.46]	16.85 (2.37)	[16.15, 17.56]	- .429	.669	.08	.061

Table 8*. Means, standard deviations and t-test statistics for the HR and RR levels after the empathic induction task for all groups. Intimate Partner Violence; HR: Heart Rate; RR: Respiratory Rate; M: Mean; SD: Standard Deviation; CI: Confidence Interval.*

	IPV (*n* = 52)		Controls (*n* = 46)		Student *t*	*p*	Effect Size	Statistical Power
	M (SD)	95% CI	M (SD)	95% CI				
PEP Basal	63.94 (29.75)	[55.36, 73.40]	67.35 (33.66)	[57.36, 77.35]	- .533	.596	.11	.076
PEP Anticipatory	65.17 (23.97)	[57.88, 72.46]	65.27 (35.27)	[54.80, 75.74]	- .016	.987	.00	.026
PEP Post-task	70.35 (21.38)	[63.96, 76.95]	59.72 (29.50)	[50.97, 68.46]	2.061	.041	.41	.524
PEP Recovery	68.63 (27.80)	[60.31, 77.27]	64.58 (32.52)	[54.93, 74.24]	.665	.508	.13	.097
SCL Basal	.79 (.19)	[.74, .86]	.80 (.17)	[.75, .85]	- .229	.819	.06	.046
SCL Anticipatory	.81 (.20)	[.77, .86]	.87 (.16)	[.82, .92]	- 1.582	.117	.33	.377
SCL Post-task	.86 (.19)	[.82, .93]	.94 (.15)	[.90, .99]	- 2.491	.014	.47	.643
SCL Recovery	.87 (.19)	[.83, .94]	.98 (.15)	[.93, 1.02]	- 3.027	.003	.64	.892
RSA Basal	.57 (.08)	[.54, .59]	.59 (.08)	[.57, .62]	- 1.692	.094	.25	.412
RSA Anticipatory	.55 (.09)	[.53, .58]	.60 (.09)	[.58, .63]	- 2.566	.012	.53	.750
RSA Post-task	.55 (.09)	[.52, .57]	.58 (.08)	[.55, .60]	- 1.712	.090	.35	.422
RSA Recovery	.55 (.09)	[.53, .58]	.60 (.08)	[.58, .62]	- 3.126	.002	.59	.898

***Table 9**. Means, standard deviations and t-test statistics for the PEP, SCL and RSA levels after the empathic induction task for all groups. Intimate Partner Violence; PEP: Pre-ejection Period; SCL: Skin Conductance Level; RSA: Respiratory Sinus Arrythmia; M: Mean; SD: Standard Deviation; CI: Confidence Interval.*

3.4. Predictive effects of the psychophysiological levels on prosocial behavior

The regression analysis revealed that RSA AUCg explained 7% of the variance for quantity of donation [F (1, 97) = 7.96, β = .284, 95% CI = .028 to .158; t = 2.82, p = .006]. The inclusion of ‘group’ and the interaction between ‘group’ and ‘RSA AUCg’ in steps 2 and 3 did not significantly increase the amount of variance explained (change in R^2 = .019, p = .176, and change in R^2 = .024, p = .124, respectively). Accordingly, the higher the RSA AUCg levels, the greater the amount donated by the participants, regardless of group.

The PEP AUCi predicted 6.2% of the variance for quantity of donation [F (1, 97) = 7.37, β = -.267, 95% CI = .002 to .012; t = 2.65, p = .008]. The inclusion of ‘group’ in step 2 did not increase the amount of explained variance (change in R^2 = .010, p = .320); nevertheless, the interaction between ‘group’ and ‘PEP AUCi’ in step 3 significantly increased the 6.4% of explained variance (p = .009). In this regard, shorter PEP AUCi levels predicted a higher amount donated for the whole sample, although the explained variance increased if participants belonged to the control group.

Finally, the SCL AUCi also explained 4.6% of the quantity of donation [F (1, 97) = 5.63, β = .235, 95% CI = -.142 to -.005; t = -2.13, p = .020]. Additionally, while the inclusion of ‘group’ in step 2 did not significantly increase the amount of explained variance (change in R^2 = .024, p = .120), the interaction between ‘group’ and ‘SCL AUCi’ in step 3 increased the explained variance by 4.2% (p = .036). Consequently, higher

AUCi SCL levels predicted a higher amount donated for the whole sample. However, the variance explained also increased if participants belonged to the control group.

None of the other AUCg levels or AUCi levels significantly predicted the prosocial behavior.

4. Discussion

4.1. Discussion of the main results

Our data revealed significant differences between both groups in their ANS functioning following the empathic induction task. In terms of general markers of ANS activation, IPV perpetrators displayed a diminished increase in their HR levels from baseline to the anticipation period, resulting in consistently lower HR levels throughout the empathic task. Additionally, IPV perpetrators exhibited a less pronounced increase in SCL after the task, along with an elongation of their PEP levels (in contrast to the shortening PEP pattern exhibited by controls). These psychophysiological patterns may suggest a blunted sympathetic response to others' distress. As for PNS, no differential post-task response was observed, but IPV perpetrators exhibited lower overall RSA levels, potentially indicating parasympathetic hypoactivity within this population. Interestingly, after task completion, greater sympathetic activation and higher overall parasympathetic levels predicted a greater amount of donations for the entire sample.

Our main objective was to explore whether there were differences between IPV perpetrators and men with no criminal records in their physiological activity following an empathic induction task. First, we expected to find lower levels in IPV perpetrators in summative indexes of overall autonomic reactivity, which are influenced by both SNS and PNS activity (Obradović & Boyce, 2012; Umhau et al., 2002). As a result, lower HR levels were observed in IPV perpetrators during the anticipatory, post-task, and recovery periods compared to controls. Notably, both groups exhibited a significant difference in the change in HR levels only from the baseline to the anticipatory period. Specifically, IPV perpetrators reported a reduced increase in their HR during the anticipatory period, which may account for the differences observed in the subsequent periods. Indeed, higher activation during the anticipatory period has been associated with increased autonomic activation following highly distressing tasks (Gąsior et al., 2016; Vitoria-Estruch et al., 2018b). Furthermore, previous research exhibited increases in HR levels in general population when facing similar distressing film, linking their HR responsiveness to higher self-reported emotional contagion (Trautmann et al., 2018) and empathy (Steiger et al., 2019). Therefore, consistent with previous findings, our results provide evidence of lower HR levels in IPV perpetrators to others' distress (Babcock et al., 2005; Gottman et al., 2017), and emphasize the relevance of the anticipation period within the cardiovascular response pattern in this population. Regarding RR, no significant differences were found between groups during any period of the empathic induction task or in their change scores. Previous research has reported higher RR reactivity in IPV perpetrators following a cognitive stress task (Vitoria-Estruch et al., 2018b), whereas lower RR levels have been associated with high anger expression, exclusively in this population (Romero-Martínez et al., 2016d). Therefore, more studies are needed to elucidate the influence of interpersonal paradigms on the RR response of IPV perpetrators.

Secondly, as we anticipated, a weakened response to the empathic induction task was observed in the sympathetic-related indexes. Specifically, longer PEP levels were observed in IPV perpetrators compared to controls in the post-task period. While the control group exhibited a shortening in their PEP levels from the anticipatory to the post-task period and lengthening back to the recovery period, IPV perpetrators reported an opposite trend in their values. Furthermore, although an increase in SCL levels was found in both groups after the task, IPV perpetrators reported lower change scores in their SCL in the post-task and recovery periods compared to the control group. As we have previously discussed, it has been consistently posited that increased SNS activity in the presence of another's emotional distress can be understood as evidence of an engagement in that emotional state (Boucsein, 2012; Brown et al., 2021; Coutinho et al., 2014; Decety, 2011; Brosschot & Thayer, 2003). Therefore, the longer PEP levels and lower SCL in IPV perpetrators (representative of decreased sympathetic activation) could signify a lack of sensitization to another's distress, which has previously been postulated as a facilitating mechanism for aggression, especially during interpersonal conflicts (Babcock et al., 2005; Godfrey & Babcock, 2020). Notably, the differences in SNS activation were mainly observed once the aversive empathic stimulus was witnessed. These findings may imply that IPV perpetrators perceive the suffering of others as less aversive or threatening. This observation would support the hypothesis that there is a reduced activation of sympathetic fight-or-flight mechanisms in response to negative empathic stimuli from others.

As for the PNS, although lower RSA levels were reported in the anticipatory and recovery periods of the IPV perpetrators, no different response was observed to the task (i.e., no differences in the RSA change scores). These results point to lower overall RSA levels in IPV perpetrators, rather than an alternative response pattern. In this regard, higher RSA levels have been previously found in general populations following a comparable empathic induction task (Di Bello et al., 2020; Stellar et al., 2020). Notably, in the study by Stellar, the RSA levels were correlated with the participants' self-reported empathy in response to others' suffering. Additionally, congruent with our results, Moreno et al., (2023) demonstrated lower overall levels of RSA in IPV perpetrators during a similar emotional induction task compared to a control group. These authors emphasized that an optimal PNS activity is crucial for empathy, as it could influence significant functions related to social engagement (Shahrestani et al., 2014) or adaptive emotional processing (Geisler et al., 2013). Therefore, the lower RSA levels we found in IPV perpetrators could reflect a hypoactive PNS that may potentially lead to a poor engagement capacity. Notably, in our study, IPV perpetrators showed lower levels of RSA throughout the task. These results may reflect difficulties in mobilizing general parasympathetic resources, regardless of their attenuated sympathetic response after the task (Moreno et al., 2023). However, these results should be interpreted with caution, as it has been emphasized that respiratory parameters may confound the relationships between RSA and cardiac vagal tone (Reyes del Paso et al., 2013), thus highlighting the need for further research.

Our second objective focused on exploring the performance of prosocial behavior in both groups, including whether post-task psychophysiological levels predicted the occurrence of prosocial behavior. As a result, IPV and controls exhibited a similar donation pattern. However, individuals who reported higher sympathetic and parasympathetic activity after the task reported greater prosocial behavior. Specifically, higher overall RSA levels, as well as shorter PEP and higher SCL responsiveness to the task, were predictors of greater monetary donation for all participants. Notably, belonging to the control group increased the predictive value of the SNS response in prosocial behavior. Consistent with our results, there is evidence that increased sympathetic responses to a negative-valenced empathic task are associated with enhanced prosocial behavior (Sze et al., 2012; Yu & Hao, 2022). As previously stated, an increase in sympathetic activity when observing others suffer could suggest an adjust negative affective response (Brown et al., 2021; Decety, 2011); and helping others may provide a way to alleviate those negative affect (Cialdini et al., 1987; Erlandsson et al., 2016). On the other hand, greater PNS activation following emotional tasks has also been related to higher prevalence of prosocial behaviors (Bornemann et al., 2016; Oveis, 2009; Stellar et al., 2015). Overall, greater PNS activity may influence prosocial-relevant functions, such as down-regulating the SNS (Gilbert, 2017; Porges, 2017) or increasing the engagement in social interactions (Geisler et al., 2013). These results reinforce the hypothesis of a complex interaction between the SNS and PNS for a functional engagement with the emotional state of others, which may ultimately predispose to the performance of prosocial behaviors (Gilbert, 2017). Concerning the group effect, socio-affective deficits in IPV perpetrators might account for the increased variance among controls (Brem et al., 2018; Comes-Fayos, Blanco-Gandía et al., 2022; Mayer et al., 2018).

4.2. Limitations and future research

However, this study is not without limitations, which are outlined as follows. First, the robustness of our study may be compromised by the absence of control videos with neutral valence or the lack of self-reported empathy questionnaire. Despite this, it is noteworthy to highlight that the clips employed in our task have proven effective in separately eliciting negative affect (Fernández-Megías et al., 2011) and have been associated with empathy-relevant functions (Comes-Fayos, Romero-Martínez et al., 2022). Moreover, several studies have employed a comparable design to assess emotional psychophysiological correlates (Stellar et al. 2020; Sze et al., 2012). Second, numerous statistical analyses have been performed, potentially raising the risk of Type I error. Also, our study counts with a moderate sample size, which could reduce the external validity of our results in large populations. It is true that psychophysiological studies in IPV perpetrators are scarce due to the difficulty of accessing offenders (Santirso et al., 2020); which may increase the value of the results obtained (Romero-Martínez et al., 2020). Still, further research is needed to replicate these results in larger samples, taking into account the aforementioned methodological considerations. Finally, we include IPV perpetrators as a homogeneous group in our analysis, but IPV encompasses diverse underlying factors, such as personality traits or violence severity. Yet, it is worth mentioning that maladaptive socioaffective functioning has been identified as a core factor that cuts across IPV perpetration (Brem et al., 2018).

Future lines of research should replicate the results of this investigation in a larger sample. Additionally, it is also imperative to ascertain whether these findings exhibit homogeneity among IPV perpetrators (e.g., by considering personality modulating factors and/or the severity of the violence) or if they could be generalized to other offenders. Specifically, it would be of interest to expound the present design to other samples, such as IPV perpetrators with severe prison sentences, men convicted of other crimes and female offenders. Likewise, more research covering emotional and empathic processing to positive-valenced and neutral stimuli is needed. This would help to understand possible differences between IPV perpetrators and nonviolent individuals in the psychophysiological response pattern (e.g., sympathetic response to positively valenced stimuli) when observing diverse affective stimuli. A deeper understanding of the processing of positive emotions in IPV perpetrators may shed light on an important protection factor applicable to both prevention and intervention. Finally, exploring the impact of IPV intervention programs on the psychophysiological response to an empathic induction task, as well as its long-term stability, could highlight the importance of specifically addressing emotional processing in psychosocial intervention with IPV perpetrators.

4.3. Conclusion

In conclusion, our study reveals that IPV perpetrators presented different ANS functioning to others suffering. Most notably, we argue that a weakened sympathetic response to the task and a hypoactive parasympathetic general activity could reflect difficulties when engaging in other's negative emotions. Recent studies indicate that IPV programs that address validated risk factors of IPV and adhere to the principles of risk-need-responsivity report increased efficacy (Eckhardt et al., 2013; Travers et al., 2021). Our findings are consistent with and further extend the understanding of emotional processing as particularly relevant factor in IPV (Brem et al., 2018; Ulloa & Hammett, 2016). Therefore, strategies for IPV intervention programs could benefit from including specific socio-affective components such as emotional decoding or the development of interoceptive skills (Füstös et al., 2013; Moreno et al., 2023). Furthermore, it appears that IPV perpetrators do not show an inability to engage in prosocial behaviors, but rather that prosocial behavior would relate to autonomic activity to affective stimuli.

This is in line with the Good Lives model (Santirso et al., 2020), which stresses that intervention programs should focus not only on minimizing manifest risk factors, but also on supporting protective factors, de-stigmatizing offenders as exclusively antisocial individuals. Bearing all this in mind, the analysis of psychophysiological activation to emotional stimuli seems relevant for a holistic understanding of IPV.

Supplementary Material

	IPV (n = 52)	Control (n = 46)	Student t	Cohen's d
CTS-2 Subscales – Minor scores				
Physical Assault *(M, SD)*	.83 (1.17)	.02 (.14)	4.941**	.97
Psychological Aggression *(M, SD)*	2.10 (1.55)	3.40 (1.41)	1.864	.37
Sexual Coercion *(M, SD)*	.46 (.64)	.31 (.62)	1.178	.24
Injuries *(M, SD)*	.58 (.80)	.02 (.14)	4.923**	.97
CTS-2 Subscales – Severe scores				
Physical Assault *(M, SD)*	.31 (.83)	.00 (.00)	2.675**	.52
Psychological Aggression *(M, SD)*	.62 (.80)	.00 (.00)	5.575**	1.09
Sexual Coercion *(M, SD)*	.06 (.31)	.00 (.00)	1.352	.27
Injuries *(M, SD)*	.42 (.75)	.00 (.00)	4.067**	.80
CTS-2 – Major violence				
Severity of physical violence *(M, SD)*	2.33 (4.72)	.00 (.00)	3.556**	.70

***Supplementary Table 1**. Study 3: Mean comparisons of CTS-2 prevalence scores in both groups. CTS-2: Revised Conflict Tactic Scale, IPV: Intimate Partner Violence; M: Mean; SD: Standard Deviation. Statistical significance $^{*}p < .05$, $^{**}p < .01$.*

	IPV (n = 52)				Control (n = 46)						
	Baseline	*Anticipatory*	*Post-task*	*Recovery*	*Baseline*	*Anticipatory*	*Post-task*	*Recovery*	**Period**	**Period x Group**	**Group**
	M (SD)	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*			
HR	*77.31 (10.61)*	*78.31 (10.70)*	*74.15 (10.64)*	*74.67 (10.45)*	*79.65 (11.64)*	*83.14 (11.18)*	*78.96 (11.42)*	*79.05 (10.09)*	$F(2.3, 223.7) = 55.478$; $p = < .001$; $\eta_p^2 = .366$	$F(2.3, 223.7) = 5.316$; $p = .004$; $\eta_p^2 = .052$	$F(1, 96) = 3.626$; $p = .060$; $\eta_p^2 = .036$
RR	*17.37 (2.50)*	*16.68 (2.34)*	*17.59 (2.91)*	*16.64 (2.64)*	*16.89 (2.40)*	*16.66 (2.12)*	*18.04 (2.42)*	*16.85 (2.37)*	$F(3, 288) = 16.482$; $p = < .001$; $\eta_p^2 = .147$	$F(3, 288) = 2.318$; $p = .076$; $\eta_p^2 = .024$	$F(1, 96) = .009$; $p = .924$; $\eta_p^2 = .000$
PEP	*63.94 (29.75)*	*65.17 (23.97)*	*70.35 (21.38)*	*68.63 (27.80)*	*67.35 (33.66)*	*65.27 (35.27)*	*59.72 (29.50)*	*64.58 (32.52)*	$F(1.9, 183.5) = .238$; $p = .778$; $\eta_p^2 = .002$	$F(1.9, 183.5) = 4.429$; $p = .014$; $\eta_p^2 = .044$	$F(1, 96) = .268$; $p = .606$; $\eta_p^2 = .003$
SCL	*.79 (.19)*	*.81 (.20)*	*.86 (.19)*	*.87 (.19)*	*.80 (.17)*	*.87 (.16)*	*.94 (.15)*	*.98 (.15)*	$F(1.4, 137.7) = 70.125$; $p = < .001$; $\eta_p^2 = .422$	$F(1.4, 137.7) = 9.592$; $p = .001$; $\eta_p^2 = .091$	$F(1, 96) = 3.682$; $p = .058$; $\eta_p^2 = .037$
RSA	*.57 (.08)*	*.55 (.09)*	*.55 (.09)*	*.55 (.09)*	*.59 (.08)*	*.60 (.09)*	*.58 (.08)*	*.60 (.08)*	$F(2.8, 250) = 11.195$; $p = < .001$; $\eta_p^2 = .111$	$F(2.8, 250) = .971$; $p = .402$; $\eta_p^2 = .011$	$F(1, 96) = 4.538$; $p = .036$; $\eta_p^2 = .048$

***Supplementary Table 2**. Mean Scores and Standard Deviations of the Total Sample in the Psychophysiological Measures at Baseline, Anticipatory, Post-task and Recovery and Repeated Measures ANOVA for the 'Period', 'Period x Group' and 'Group' effects. IPV: Intimate Partner Violence; HR: Heart Rate; RR: Respiratory Rate; PEP: Pre-ejection period; SCL: Skin conductance latency; RSA: Respiration sinus arrhythmia; M: Mean; SD: Standard Deviation*.

Capítulo 9. Estudio 4.

Lower sadness and high happiness facial prevalence to others' suffering in intimate partner violence perpetrators: Influence of emotional decoding deficits.

Este estudio se encuentra bajo segunda revisión en:

Comes-Fayos, J., Romero-Martínez, Á., Lila, M., Martínez, M. & Moya-Albiol, L. (Under Review). Low sadness and high happiness facial prevalence to others' suffering in Intimate Partner Violence perpetrators: influence of emotional decoding deficits. Current Psychology. Manuscript ID: CUPS-D-23-04280R1.

1. Introduction

Over the past decades, research has dedicated significant efforts to uncovering the main risk factors for IPV perpetration (Capaldi et al., 2012). As a result, the affective domain has been recognized as a pivotal factor for IPV and its diverse manifestations (Birkley & Eckhardt, 2015; Expósito-Álvarez et al., 2023). Many IPV perpetrators report difficulties in identifying and expressing their own emotions, deficits defined as alexithymia (Romero-Martínez, Lila et al., 2021; Strickland et al., 2017). Furthermore, there is evidence of poor emotional regulation among this population (Marín-Morales et al., 2022), which has been associated with maladjusted internalization of their negative emotions (Maloney et al., 2023; Shorey et al., 2012). Accordingly, IPV perpetrators have shown an increased tendency to express anger externally and a reduced anger control during self-perceived distress situations (Birkley & Eckhardt, 2015; Sesar et al., 2018). Notably, these patterns of emotional processing have been associated with deficiencies in empathy, which involve the ability to understand and share another person's emotional experience (Capaldi et al., 2012; Ulloa & Hammett, 2016), two interrelated functions that facilitate social adjustment (Decety, 2015). Consequently, several authors have posited that empathic deficits could explain, at least partially, the difficulties observed in the behavioral regulation in this population (Godfrey et al., 2020; Leshem et al., 2019) and the increased risk of IPV (Romero-Martínez et al., 2022).

In this regard, sharing another person's emotional experience has been identified as a particularly important function for the adjustment of the socioaffective domain (Stevens & Taber, 2021). Indeed, an inadequate emotional response, whether absent or exacerbated, towards people experiencing negative emotions could evidence a poor engagement with others' feelings (Shamay-Tsoory, 2011). In IPV perpetrators, lower empathic concern (i.e., emotional response of compassion to others' suffering) have been described compared to controls (Romero-Martínez, Lila et al., 2021). Comes-Fayos, Blanco-Gandía et al. (2022) observed in IPV perpetrators an absent self-reported emotional response when witnessing others' suffering, unlike the non-violent group, which exhibited an increase in their negative mood state. Godfrey et al., (2020) also found that a reduced self-reported emotional response to others' emotions was strongly linked to IPV perpetration. In fact, these authors observed a significant relationship between IPV and deficits in both empathy-related functions (i.e., to understand and share another person's emotional experience). However, their findings suggested that IPV inhibition might be more closely related to an adaptive emotional engagement than to the ability to cognitively adopt another person's perspective.

Nevertheless, studies focused on the emotional response of IPV perpetrators from a biopsychosocial perspective are scarce, especially the assessment of their affective response pattern to others' suffering. This fact is striking, given the high prevalence of biases in the affective domain among this population (e.g., low emotional self-perception, high social desirability or intentional manipulation; Romero-Martínez, Lila et al., 2021; Visschers et al., 2017). Therefore, there is an increasing emphasis on combining the psychosocial assessment of socioaffective functions in perpetrators with neuroscience techniques that provide data less susceptible to bias and manipulation (Pinto et al., 2010; Verdejo-Román et al., 2019). In this regard, the pattern of emotional facial response to the emotions of others could be of special interest for the study of IPV, as it plays an important role in social cognition and is less susceptible to biases and manipulation (Hess & Fischer, 2022).

Emotional facial expressions are conceived as biological primed automatic responses to external emotional cues involved in communication (Ekman, 1993), and they have been associated with neural processes important for emotional responsiveness to others' emotions (Hess & Fischer, 2022). It has been postulated that individuals emotionally mimic when engaged in emotional processing tasks, suggesting that facial expressions may reflect individual affective response to emotional cues in social interactions (Seibt et al., 2015). In a general population study, an aligned facial response pattern towards others' negative emotions was observed in individuals with higher levels of affective empathy (Rymarczyk et al., 2016). In a recent meta-analysis, Holland et al. (2021) found a significant, albeit weak, relationship between facial mimicry and empathy. Although these authors stress some methodological requirements to robust this relationship, they conclude that people who exhibited greater facial mimicry tended to have higher empathy dispositions, and reported sharing others' emotional states to a greater degree.

In violent populations, the research is more limited and focuses mainly on adolescents with conduct problems and adults with callous-unemotional traits, characterized by a deficient affect and a disregard for others' feelings. The literature suggests that individuals with a higher prevalence of violent behaviors may exhibit reduced emotional mimicry when exposed to others experiencing negative emotions (Fanti et al., 2016; De Wied et al., 2012). Specifically, studies carried out with facial electromyography (EMG), a muscle measurement methodology, pointed to a deficit in general unpleasantness facial expression in response to others' negative emotions among adolescents with conduct problems (Frick et al., 2014). In this line, De Wied et al. (2012) reported that violent adolescents exhibited lower facial responsiveness during a negative-valenced empathic induction task, along with other psychological markers of reduced emotional responsiveness (i.e., lower self-reported empathy). In adults, another EMG study also found a reduced general unpleasantness facial expression in violent individuals with callous-unemotional traits in response to violent films (Fanti et al., 2016).

Adding to this work, Fanti et al. (2017) assessed the emotional facial response pattern among violent individuals with callous-unemotional traits employing a multi-method design that combined facial EMG and the FaceReader software, a facial coding software that categorizes individuals' facial expressions into six basic emotions. As a result, the FaceReader analyses revealed that individuals with high callous-unemotional traits displayed reduced facial reactions of sadness and disgust in response to violent films. Notably, these findings were accompanied by a decrease in task-unpleasant expression recorded by the facial EMG methodology, suggesting a correspondence in the results derived from both methodologies. These authors connected the restricted display of negative facial responses with low concern towards the negative feelings of victims of violence. Taking this into account, it could be hypothesized that reduced emotional mimicry exists among violent individuals, which might reflect a restricted emotional response pattern. However, to the best of our knowledge, no study has addressed the emotional facial expression in IPV perpetrators in the context of witnessing others' suffering, which may be particularly relevant to further understanding of socioaffective functioning in this population.

Notably, the importance of accurately recognizing emotions, also known as emotional decoding, has been underscored as a preliminary step to adjusting emotional responses (Feldman et al., 1991; Hess & Kafetsios, 2022), holding particular significance in making inferences about others' mental states and helping to modulate our affective responses (Decety & Moriguchi, 2007). In the general population, the Reading the Mind in the Eyes Test (RMET; Baron-Cohen et al., 2001), a well-established instrument that assesses the ability to decode emotions expressed through human eyes, has been associated with various empathy-related constructs, such as mentalizing (Samur et al., 2018), empathic accuracy (Djikic et al., 2013), and interpersonal sensitivity (Fong et al., 2013). In IPV perpetrators, lower RMET scores and impairments in emotional decoding have been consistently reported, with particularly poor recognition of fear and sadness (Babcock et al., 2008; Nyline et al., 2018; Romero-Martínez et al., 2016). Indeed, the impairment in emotional decoding has been linked to greater IPV acceptance and recidivism (Romero-Martínez et al., 2019b; 2022). It has been theorized that deficits in the emotional decoding of IPV perpetrators would impede an adequate understanding of others' contextual needs, hindering conflict resolution through conciliatory strategies (Romero-Martínez et al., 2022; Sun et al., 2015). A possible explanation is that deficits in emotional decoding processes might affect IPV perspective taking by diminishing how accurately they can understand others' emotional state (Holland et al., 2021), which may result in difficulties when responding to the feelings of others.

Hence, the objective of this study was threefold. First, we aimed to examine the emotional facial response pattern, as well as self-reported emotions, of IPV perpetrators in response to a violence-focused empathic induction task compared to a control group. Watching people suffering is expected to induce specific negative emotions; however, a reduced self-reported emotional responsiveness to others' emotions has been suggested in IPV perpetrators (Comes-Fayos, Blanco-Gandía et al., 2022; Godfrey et al., 2020). Also, violent individuals exhibited reduced emotional facial responsiveness when exposed to others' suffering (Fanti et al., 2017; De Wied et al., 2012). Therefore, IPV perpetrators were expected to exhibit fewer self-reported negative emotions and reduced facial expressions of negative emotions when exposed to violence. Second, we intended to explore whether participants' registered emotional facial expressions were related to self-reported emotions. We expect that a higher prevalence of negative emotional facial expressions will be related to greater self-reported negative emotions, based on the previously established relationship between facial mimicry and emotional empathy (Holland et al., 2021). Finally, we aimed to explore differences in emotional decoding between IPV perpetrators and controls and investigate if emotional decoding predicted the affective facial responding during the task. Based on previous conclusions, we would presume worse emotional decoding in IPV perpetrators (Nyline et al., 2018; Romero-Martínez et al., 2016). Additionally, we expect low emotional decoding to predict the buffered emotional mimicry (Sun et al., 2015). It is also worth noting that group belonging would play a significant role in this scenario.

2. Method

2.1. Participants

The sample consisted of 103 healthy males (55 IPV perpetrators and 48 controls). IPV perpetrators were recruited from the CONTEXTO Program at the University of Valencia, a community-based intervention program for men convicted for gender-based violence for up to 2 years (suspended under mandatory program attendance; Lila et al., 2018). Requirements for IPV perpetrators included: having being sentenced for IPV, the absence of mental or neurological disorders; and having Spanish writing and speaking skills. The assessment of IPV criminal records was carried out through the data provided by the Spanish General Secretariat of Penitentiary Institutions. Recruitment was completed prior to the intervention program, with the assurance that their refusal to participate would not affect their legal disposition.

The control group was recruited In Valencia (Spain) through social media advertisements. The eligibility criteria for the control group comprised being male with comparable sociodemographic characteristics to the IPV perpetrators (i.e., age, educational level, annual income, and/or marital status, see Table 1), meeting the aforementioned inclusion criteria, and having no criminal records. Furthermore, in order to eliminate potential IPV behaviors in the control group, the CTS-2 (Straus et al., 1996; see *Annex 12*) was administered to both groups. As a result, the control group did not exhibit any moderate to severe IPV behavior, as determined by the standards set by Straus et al. (1996; see supplementary Table 3).

Before the experimental session, each participant underwent an *ad hoc* semi-structured clinical interview conducted by two trained psychologists to explore their medical history and detect possible psychopathological or neurological symptomatology. The experiment was conducted in accordance with the Declaration of Helsinki and was approved by the Ethics Committee of the University of Valencia (procedure number: H1538385543901). All participants were informed about the study, voluntarily agreed to participate, gave written informed consent and received a financial retribution of 40 euros at the end of the study.

2.2.Procedure

The procedure was carried out in a two-hour session in the Psychobiology laboratories of the University of Valencia, with a constant temperature (21 ± 1°C) and humidity. First, the informed consent was signed and a questionnaire on participant'' baseline mood state was completed (i.e., the State-Trait Anxiety Inventory [STAI]). Then, the Noldus FaceReader 6.1 software was programmed for the online recording of participant'' facial expressions. For this purpose, the participants were asked to set a neutral expression to calibrate the facial emotion recording software, correcting for person-specific biases towards a certain facial expression and/or lighting conditions. Once calibrated, the online facial recording of the participants was initiated.

Afterwards, a Spanish validated battery of emotion-inducing videos (Fernández-Megías et al., 2011; *Annex 2*) was employed for the empathic induction task. For the creation and subsequent validation in the Spanish population of this battery of emotion-inducing clips, the scenes described in previous studies in the English and French populations were employed (Rottenberg et al., 2007; Schaefer et al., 2010). From this battery, four violence-focused clips were selected based on their high negative affect (see Supplementary Table 4). Also, due to recommendations from several studies that point to differential processing in IPV perpetrators when processing IPV-specific content, we selected two scenes of IPV and two scenes of general violence (Gracia et al., 2015; Romero-Martínez et al. 2019b). Prior to visualization, participants were instructed to actively empathize with the victim in each scene, as indicated previously. Once the empathic induction task was initiated, participants were required to complete the self-report emotion questionnaire right after each scene. Additionally, after completion of the self-report questionnaire, participants had to relax for one minute before viewing the next scene (for more details, refer to Comes-Fayos, Blanco-Gandía et al., 2022).

After completing the task, participants underwent a 15-min recovery phase. Once the recovery was over, information on sociodemographic variables was collected (i.e., age, marital status, level of education, annual income, and geographical region of birth). Afterwards, the emotional decoding task (i.e., the RMET) was administered. To conclude, the participants received their remuneration and were dismissed (see Figure 13).

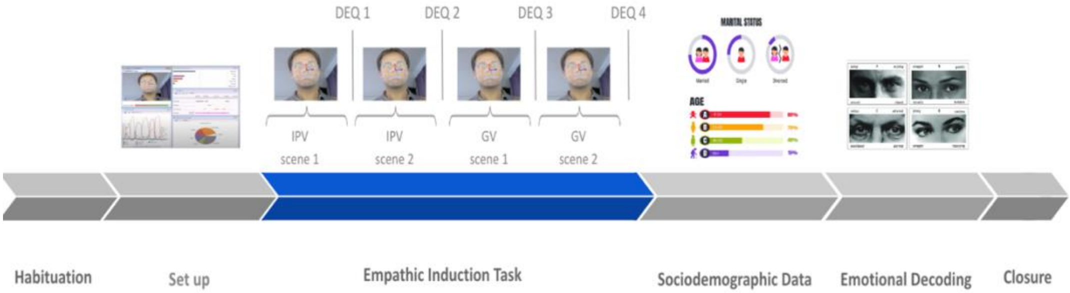

Figure 13*. Study 4: Experimental procedure. The experimental protocol was divided into five blocks.* ***Block I****: A habituation phase aimed at acclimatizing participants to the experimental environment.* ***Block II****: The setup phase. The Noldus FaceReader 6.1 software was programmed for the online recording of participant" facial expressions. Additionally, the "State-Trait Anxiety Inventor" questionnaire was administered to register participant" baseline mood states.* ***Block III****: The administration of the empathic induction task, performed through violence-focused emotion-eliciting videos.* ***Block IV****: After a 15-minute recovery period, sociodemographic data were collected.* ***Block V****: The "Reading the Mind in the Eyes Test" was employed to acquire scores for emotional decoding. IPV: Intimate partner violence; GV: General violence; DEQ: Discrete Emotions Questionnaire. Images adapted from FaceReader [Photograph], by Noldus Information Technology, 2012, Horizon (https://horizon.ac.uk).*

2.3. Measures

To register participants' emotional facial expressions, we employed the Noldus FaceReader 6.1 software (Noldus Information Technology, 2015; see *Annex 14*). The FaceReader 6.1 is a program for facial analysis that can detect the emotional valence and identify Ekman' six basic emotions: sadness, anger, disgust, fear, surprise and happiness (as well as a neutral state). FaceReader can recognize facial expressions with an accuracy of 90%, correcting for person-specific biases such as the person's gender, age, ethnicity, the amount of facial hair and whether the person is wearing glasses or not. FaceReader classifies faces in three consecutive steps: (1) "Face finding" (the position of the face is found using a specific algorithm developed for finding faces in images), (2) "Face modeling" (a model-based method is used to synthesize an artificial face model that will serve as a foundation for analyzing and integrating individual'' facial gestures) and (3) "Face classification" (the actual classification of the facial expressions, based on the six basic emotions described by Ekman). Emotional facial expressions were calculated for each scene of the empathic induction task based on the number of seconds a specific emotion was registered in the FaceReader 6.1 software.

The Discrete Emotions Questionnaire (DEQ) is a categorical self-report instrument designed to examine specific emotions (see *Annex 15*). It is an adapted version of the "Post-Film Questionnaire" employed in the study conducted by Rottenberg et al. (2007). The questionnaire consists of 18 items, corresponding to different emotional labels, including: amusement, anger, anxiety, confusion, satisfaction, disgust, fear, guilt, happiness, interest, joy, tenderness, pride, sadness, embarrassment, surprise, unhappiness, and shame. In order to avoid an increase in type 1 error and to homogenize the self-reported emotions with those registered in the FaceReader software, Ekman's six basic emotions (sadness, anger, disgust, fear, surprise and happiness) will be taken into account (Ekman, 1993). Additionally, tenderness will also be considered due to its relevance to empathy (Kalawski, 2010). A Likert scale ranging from 1 (no emotion) to 7 (most intense emotion) scores the self-perceived emotion for each scene. Cronbach's α was .94.

For the evaluation of the emotional decoding, the RMET is a facial emotion recognition task that assesses the ability to decode emotions based on the eye region of the face photographs (Baron-Cohen et al., 2001; see *Annex 16*). Participants are presented with 36 black-and-white photographs of both men and women and are asked to attribute their mental state by selecting one of four words that best describe their emotional state. Each photograph focused exclusively on the individual's eye region and was surrounded by four single-word emotional state descriptors (e.g., nervous, guilty), one at each corner. One of these descriptors was aligned with the mental state depicted in the photograph, while the remaining descriptors served as distractors. Participants had a single attempt, and could take as much time as required for each item. Scores are calculated based on the total number of correct choices across all 36 photographs. Cronbach's α was .62 for the total score.

Finally, the STAI is a validated questionnaire used to measure both trait and state anxiety (Spielberger et al., 1983; see *Annex 17*). In the present study, we employed the questionnaire form focused on "state anxiety" (hereafter referred to as STAI-S). The STAI-S consists of 20 items, with instructions that require participants to indicate their anxiety-related at a specific moment. Each item is rated on a 4-point scale. Scores on the STAI-S range from a minimum of 20 to a maximum of 80, and scores are typically categorized as follows: "no or low anxiety" (20-37), "moderate anxiety" (38-44), and "high anxiety" (45-80). Cronbach's α was .89 for the STAI-S total score.

2.4.Data analyses

After testing the normality of the data with the Shapiro-Wilk test ($p < .05$), the data for recorded emotional facial expressions and self-reported emotions were transformed using a square root transformation. Afterwards, *t*-tests were performed for assessing group (IPV perpetrators and controls) differences for age, state anxiety, registered emotional facial expressions, self-reported emotions and emotional decoding scores. To further explore participant'' emotional response to the task, analyses of recorded emotional facial expressions and self-reported emotions were conducted for the entire empathic induction task and splitting the task into IPV versus general violence scenes. A chi-squared analysis was also performed for marital status, education and income of participants. Cohen's *d* and Cramer's *V* were used as the effect size measure for t-test and chi-square analyses (values of .10, .30, and .50 were considered small, moderate, and large effect sizes, respectively; Cohen, 1988). Additionally, Pearson's correlation coefficients were calculated to assess the relationship between registered emotional facial expressions and self-reported emotions for all participants. This is intended to provide insight into the relationship between the two measures of emotional response. Finally, a linear regression model was constructed by jointly using the total scores of RMET and group (dummy coded as 0 for IPV perpetrators and 1 for controls) as the independent variables and the registered facial expressions as the dependent variable. Data analyses were conducted using IBM SPSS Statistics for Windows, version 28.0 (Armonk, NY). Values of $p < .05$ were considered statistically significant. The average values are reported in the tables as mean ± Standard deviation.

3. Results

3.1. Sociodemographic data and baseline mood state

There were no significant differences between groups in age [t (101) = 1.680, p = .096; d = .33], marital status (χ^2 = 3.547, p = .060; V = .19), level of education (χ^2 = 5.856, p = .119; V = .24), annual income (χ^2 = 1.708, p = .426; V = .13), or geographical region of birth (χ^2 = 2.045, p = .563; V = .14) (see Table 10). No significant differences were found in STAI-S scores between groups [t (101) = .593, p = .555; d = .33; IPV perpetrators, M =34.58, SD = 9.75; control group, M = 33.56, SD = 7.33].

	IPV (n = 55)	Controls (n = 48)	*Student t*	*Cohen's d*
Age (*M, SD*)	41.58 (12.58)	37.40 (12.45)	1.68	.33
			Chi-Square	Cramer's *V*
Marital status (%)				
Married	42	60	3.55	.19
Single/Divorced/Widowed	58	40		
Level of education (%)				
No studies	7	0	5.86	.24
Primary	33	23		
Upper secondary	40	46		
University	20	31		
Geographical Region of Birth (%)				
Spain	85	90	2.05	.13
Europe (excluding Spain)	2	4		
South America	11	6		
Africa	2	0		
Annual Income (%)				
Low Income	36	26	1.71	.14
Medium Income	55	58		
High Income	9	16		

Table 10. *Study 4: Means, standard deviations, percentages, and means comparisons for sociodemographic data for both groups. IPV: Intimate Partner Violence; M: Mean; SD: Standard Deviation. Statistical significance* $^{*}p < .05$.

3.2. Registered emotional facial expression

The analysis performed for facial expressions revealed that IPV perpetrators reported lower registration of sad expressions (p < .001) and higher registration of happy expressions (p < .001), compared to controls. Also, there was a trend towards a significance to higher prevalence of angry expressions in IPV perpetrators (p = .062; see Figure 14). When facing IPV scenes, IPV perpetrators also differed in their sad (p < .001) and happy expressions (p < .001), as well as a tendency in angry expression (p = .066), with IPV perpetrators reporting a lower prevalence of sad expressions and higher prevalence of happy and angry expressions than controls. As for general violence scenes, analysis revealed similar results with lower prevalence of sad expressions (p < .001) and higher prevalence of happy expressions (p < .001) in IPV perpetrators compared to controls (Table 11).

3.3.Self-reported emotional state

As for self-reported emotions, IPV perpetrators differed in their self-report level of sadness (p = .047), anger (p = .004), disgust (p = .024), and tenderness (p = .045), revealing lower self-report emotional levels after the task, compared to the control group (see Table 12). When facing IPV scenes, IPV perpetrators exhibited lower levels of sadness (p = .045), anger (p = .016), and tenderness (p = .035) compared to controls. With respect to general violence, lower levels of self-reported anger (p = .002) and disgust (p = .019), as well as a trend toward significance in self-reported sadness (p = .061), were also found in IPV perpetrators in comparison to controls (see Table 12).

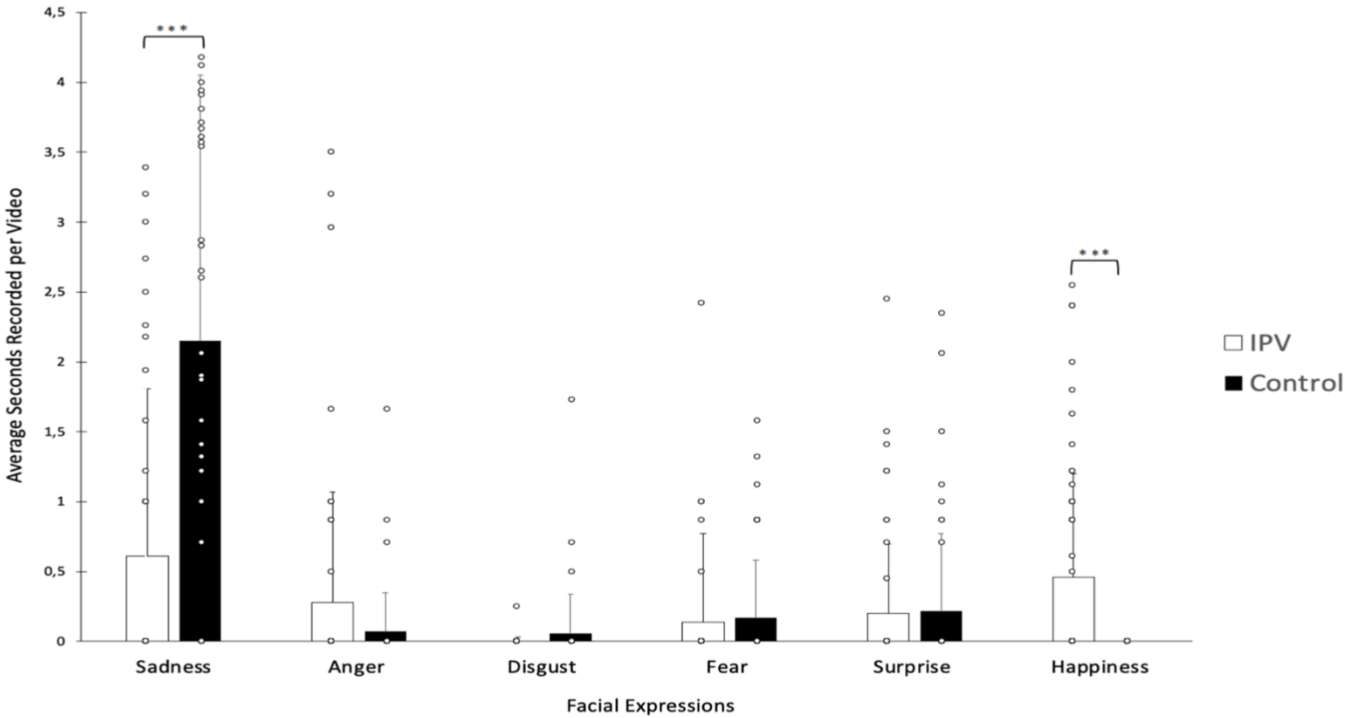

***Figure 14**. Mean comparisons for registered emotional facial expression for both groups; IPV: Intimate Partner Violence; Statistical significance $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.*

	IPV (n = 55)	Control (n = 48)	Student t	Cohen's d	Statistical Power
Empathic induction task					
Sad facial expression *(M, SD)*	.61 (1.20)	2.15 (1.90)	- 4.847**	.97	.998
Angry facial expression *(M, SD)*	.28 (.79)	.07 (.28)	1.896	.35	.454
Disgust facial expression *(M, SD)*	.00 (.03)	.06 (.28)	- 1.416	.30	.315
Fear facial expression *(M, SD)*	.14 (.63)	.17 (.41)	- .306	.07	.470
Surprise facial expression *(M, SD)*	.20 (.50)	.22 (.55)	- .228	.04	.390
Happy facial expression *(M, SD)*	.46 (.74)	.00 (.00)	4.668**	.88	.996
IPV scenes					
Sad facial expression *(M, SD)*	.53 (1.36)	1.89 (2.08)	- 3.871**	.77	.972
Angry facial expression *(M, SD)*	.26 (.76)	.05 (.27)	1.869	.37	.482
Disgust facial expression *(M, SD)*	.01 (.05)	.06 (.34)	- 1.121	.21	.171
Fear facial expression *(M, SD)*	.13 (.56)	.15 (.42)	- .234	.04	.040
Surprise facial expression *(M, SD)*	.13 (.41)	.18 (.56)	- .561	.10	.074
Happy facial expression *(M, SD)*	.45 (.84)	.00 (.00)	3.965**	.76	.978
General violence scenes					
Sad facial expression *(M, SD)*	.48 (1.09)	2.01 (2.11)	- 4.536**	.91	.995
Angry facial expression *(M, SD)*	.19 (.85)	.06 (.30)	1.088	.20	.184
Disgust facial expression *(M, SD)*	.00 (.00)	.04 (.20)	- 1.430	.28	.283
Fear facial expression *(M, SD)*	.11 (.70)	.14 (.42)	- .187	.05	.045
Surprise facial expression *(M, SD)*	.19 (.59)	.15 (.56)	- .329	.07	.054
Happy facial expression *(M, SD)*	.29 (.72)	.00 (.00)	2.961**	.57	.848

***Table 11**. Mean comparisons for registered emotional facial expression for both groups. IPV: Intimate Partner Violence; M: Mean; SD: Standard Deviation. Statistical significance $^{*}p < .05$, $^{**}p < .01$.*

	IPV (n = 55)	Control (n = 48)	Student t	Cohen's d	Statistical Power
Empathic induction task					
Self-reported sadness *(M, SD)*	1.89 (.54)	2.09 (.47)	- 2.015*	.40	.520
Self-reported anger *(M, SD)*	2.14 (.52)	2.38 (.28)	- 3.006**	.57	.843
Self-reported disgust *(M, SD)*	2.23 (.46)	2.41 (.30)	- 2.302*	.46	.663
Self-reported fear *(M, SD)*	1.81 (.54)	1.97 (.50)	- 1.548	.31	.345
Self-reported surprise *(M, SD)*	1.74 (.50)	1.85 (.46)	- 1.222	.23	.213
Self-reported happiness *(M, SD)*	1.03 (.12)	1.01 (.03)	1.166	.23	.222
Self-reported tenderness *(M, SD)*	1.21 (.33)	1.39 (.53)	- 2.040*	.41	.529
IPV scenes					
Self-reported sadness *(M, SD)*	1.85 (.58)	2.07 (.48)	- 2.032*	.41	.558
Self-reported anger *(M, SD)*	2.15 (.51)	2.35 (.29)	- 2.460*	.48	.700
Self-reported disgust *(M, SD)*	2.22 (.54)	2.38 (.37)	- 1.830	.35	.425
Self-reported fear *(M, SD)*	1.78 (.55)	1.91 (.55)	- 1.172	.24	.223
Self-reported surprise *(M, SD)*	1.71 (.54)	1.87 (.44)	- 1.700	.32	.381
Self-reported happiness *(M, SD)*	1.04 (.19)	1.02 (.06)	.617	.14	.084
Self-reported tenderness *(M, SD*	1.21 (.41)	1.42 (.54)	- 2.139*	.44	.594
General violence scenes					
Self-reported sadness *(M, SD)*	1.90 (.60)	2.11 (.54)	- 1.883	.37	.464
Self-reported anger *(M, SD)*	2.11 (.58)	2.40 (.33)	- 3.124**	.61	.886
Self-reported disgust *(M, SD)*	2.21 (.51)	2.41 (.33)	- 2.384*	.47	.667
Self-reported fear *(M, SD)*	1.82 (.62)	2.01 (.51)	- 1.749	.33	.400
Self-reported surprise *(M, SD)*	1.73 (.59)	1.81 (.56)	- .711	.14	.105
Self-reported happiness *(M, SD)*	1.01 (.08)	1.00 (.00)	1.302	.08	.151
Self-reported tenderness *(M, SD)*	1.21 (.41)	1.38 (.56)	- 1.794	.35	.411

Table 12. *Mean comparisons for self-reported emotional state for both groups. IPV: Intimate Partner Violence; M: Mean; SD: Standard Deviation. Statistical significance* $^{*}p < .05$, $^{**}p < .01$.

3.4. Relationships between self-reported emotions and registered facial emotions

With regard to the relationship between the self-reported emotional state and the registered emotional facial expression during the task, after controlling the group effect, a partial correlation analysis showed that there was a significant correlation between sad facial expressions and self-reported sadness (*r* = .256, *p* = .010), self-reported fear (*r* = .211, *p* = .034), self-reported tenderness (*r* = .253, *p* = .011). There was no other significant correlation.

3.5.Relationships between self-reported emotions and registered facial emotions

IPV perpetrators differed from controls in their RMET total scores [*t* (101) = - 3.581, *p* = .001, *d* =.71], with IPV perpetrators exhibiting lower scores than controls (IPV perpetrators, *M* =19.58, *SD* = 3.95; control group, *M* = 22.38, *SD* = 3.95).

Regarding the regression analysis, the RMET total score and the group variable predicted 11.8% of the variance for sad facial expression during the empathic induction task (*adj* R^2 =.118, *F* (2, 102) = 7.801, *p* = .001). The association was no significant for the RMET total score (β = .061, *p* = .539). However, a significant association was found for the group variable (β = .342, *p* = .001), indicating that belonging to the control group predicted the appearance of sad facial expressions.

Additionally, the model predicted 14.5% of variance for happy facial expressions during the task (*adj* R^2 =.145, *F* [2, 102] = 9.627, *p* = .000). The association was significant for the RMET total score (β = - .262, *p* = .008) and the variable group (β = - .230, *p* = .020), suggesting that both lower RMET total score and belonging to the IPV group and predicted happy facial expressions in the task.

4. Discussion

4.1. Discussion of the main results

Research has indicated that difficulties in emotional processing have important implications for IPV behaviors. The results of the present study show that IPV perpetrators manifested a distinctive emotional response pattern during an empathic induction task, characterized by lower display of sadness and a higher display of happiness in their facial expressions, along with a reduced self-reported emotional intensity. Furthermore, the lower prevalence of sadness facial expression during the task was associated with lower self-reported sadness, fear and tenderness, regardless of group. Notably, both poorer emotional decoding and IPV group belonging predicted lower prevalence of sadness facial expression and higher prevalence of happiness expression during the task.

Regarding our first objective, we aimed to investigate the registered emotional facial expressions and self-reported emotions of IPV perpetrators during an empathic induction task in comparison to a control group. Supporting our hypothesis, we observed a reduced tendency to display sad facial expressions and a heightened inclination to happy facial expressions among IPV perpetrators when viewing the scenes of violence. These findings are consistent with a potential misaligned emotional facial response pattern in IPV perpetrators to others' suffering. According to Ekman's emotion theory, experiencing specific emotions corresponds to certain patterns of facial expression responses (Ekman, 1993). In this regard, it has been described that individuals engage in automatic facial mimicry when observing the expressions of others (Hess & Blairy, 2001), and that adjusted facial mimicry is positively associated with affective empathy (Holland et al., 2021). Indeed, current findings have strengthened the perspective of emotional mimicry as a primarily affiliative response to an external emotional signal, predisposing individuals to adaptive social interaction (Drimalla et al., 2019; Hess & Fischer, 2013). Therefore, the restricted display of sad expressions in the face of others' pain, as well as the prevalence of expressions of happiness, might indicate a discrepancy in the emotional response when observing others' negative emotions in this population, which, in turn, could hinder their socioaffective and behavioral regulation (Kyranides et al., 2022). It is noteworthy that IPV perpetrators showed a tendency to anger facial expressions in IPV scenes. Interestingly, angry facial expressions to others' negative emotions have been related to poor emotion regulation rather than to empathic disposition (Fanti et al., 2017). This aligns with prior research indicating a greater tendency to express anger and hostility in IPV perpetrators (Birkley & Eckhardt, 2015), as well as a distinct emotional processing patterns when confronted with IPV-related content (Gracia et al., 2015).

Both groups also differed in their self-report emotion response. Compared with controls, IPV perpetrators were found to exhibit lower self-reported levels of negative-valenced emotions (including sadness, anger and disgust) and positive-valenced emotions (such as tenderness) among IPV perpetrators during the task. Significantly, the findings remained consistent when comparing IPV and general violence, with some observed distinctions, such as a decreased self-reported tenderness towards IPV scenes, which might be expected considering the nature of the crime of the participants. Prior research had previously documented a lack of self-reported emotional responsiveness to others' suffering in IPV perpetrators (Comes-Fayos, Blanco-Gandía et al., 2022; Romero-Martínez, Lila et al., 2021). However, studies conducted on general population samples have reported a high prevalence of self-reported negative and positive emotions (similar to those assessed in our study) following emotional videos, relating the emotional response to empathic disposition (Barraza & Zak, 2009). Indeed, emotional empathy has been proposed to require the generation of an emotional response that aligns with what is observed in another person (Shamay-Tsoory, 2011). Halawski (2010) specifically related the observation of others' suffering to the experience of sadness and tenderness. According to this author, sadness may be congruent with the perceived negative state, while tenderness may provide an other-oriented emotional component. Notably, there is a divergence in the results associated with the anger response to the task. While a tendency toward angry facial expressions was registered in IPV perpetrators during the IPV scenes, they reported lower self-reported anger throughout the entire task. These results could be grounded in two emotional patterns previously found among IPV perpetrators: an increased tendency to express anger externally during distressing situations (Birkley and Eckhardt, 2015; Sesar et al., 2018) and a high prevalence of alexithymic traits (Romero-Martínez, Lila et al., 2021; Strickland et al., 2017). Indeed, this alexithymic symptomatology would be also consistent with the overall impoverished self-reported emotional responsiveness to others' suffering found in IPV perpetrators.

In addition, the sad facial expressions were positively correlated with self-reported sadness, fear and tenderness, regardless of group. As previously stated, the importance of sadness and tenderness has been particularly emphasized for an adjusted affective empathy (Halawski, 2010; Shamay-Tsoory, 2011). On the other hand, the facial expression of sadness has also been associated with both empathy and compassion (Baránková et al., 2019; Drimalla et al., 2019). Hence, it seems particularly relevant that, in the context of an empathic induction task, the most notable association was observed between these variables, indicating that a consistent correspondence between self-reported sadness and tenderness and facial expressions of sadness may serve as an indication of emotional responsiveness. In contrast, no significant relationship was found between happy facial expressions and self-reported emotions, although a higher prevalence of this expression was observed in IPV perpetrators. One possible explanation for the absence of this relationship could be the susceptibility of self-reported questionnaires to bias (e.g., social desirability or manipulation), which could prevent the recognition of happiness in the presence of others' suffering (Romero-Martínez et al., 2016a; Visschers et al., 2017). However, further investigation on the subject is required.

Finally, we intended to explore differences in emotional decoding between groups and investigate if emotional decoding predicted the facial responding to the task. As expected, IPV perpetrators exhibited lower RMET scores compared to the control group. This result is in line with previous studies, indicating the presence of deficits in emotional decoding in IPV perpetrators, especially when recognizing others' facial expressions (Babcock et al., 2008; Nyline et al., 2018; Romero-Martínez et al., 2016a). The social information processing theory has provided a framework for how social cues may be decoded in IPV contexts (Murphy, 2013). Adaptive social behavior relies on effective emotional decoding that enables interpretation of others' behavior, which helps formulate a coherent response in order to achieve healthy relational goals. Thus, dysfunctional processing of social information, including a reduced ability to recognize others' facial expressions, could partly explain the reduced ability to address conflict through conciliatory mechanisms, predisposing to IPV (Romero-Martínez et al., 2019b; 2022).

Congruently, having worse RMET scores and belonging to the IPV group predicted lower sadness facial expressions and higher happy expressions. Facial emotion recognition is thought to influence emotional empathy through its perceptual inputs and inferential processes (Holland et al., 2021). Consequently, deficiencies in emotional decoding are likely to imply poor emotional processing and responding (Feldman et al., 1991; Hess & Kafetsios, 2022). Thus, it seems logical that inadequate emotional interpretation of emotional cues (poor emotional decoding) potentially accounted for a mismatched emotional facial response during the empathic induction task, which may be indicative of maladaptive emotional responsiveness. In parallel, prior research has provided evidence that an inappropriate affective response to others' emotions is strongly linked to IPV (Godfrey et al., 2020). In fact, it has been underscored that a deficit in emotional decoding processes, together with other criminogenic characteristics of IPV perpetrators, may result in difficulties when responding to the feelings of others (Romero-Martínez et al., 2016a). Therefore, our findings seem to be consistent with this literature and suggest that the distinct facial response pattern found in this study could be better understood due to the lower emotional decoding scores reported in IPV perpetrators (Murphy, 2013; Nyline et al., 2018).

4.2. Limitations and future research

This study provides novel information about the emotional response pattern of IPV perpetrators. However, it is not without limitations, which are outlined as follows. First, the methodology employed to induce empathy does not account for control videos or an empathy-related questionnaire, which could reduce the validity of our findings. Despite this, it is noteworthy to highlight that the clips employed in our task have proven effective in separately eliciting negative affect (Fernández-Megías et al., 2011). Moreover, a comparable design has previously been employed to assess the participants' response to negative emotional stimuli, including facial expressions registration (Stellar et al., 2020). Secondly, participants were instructed to complete the RMET task at the conclusion of the experimental protocol. While it is true that Block IV (i.e., the recovery period and sociodemographic data collection) falls between both tasks, the empathic induction may potentially influence the RMET performance. Therefore, the findings regarding emotional decoding should be approached with due caution. Another limitation might be the inclusion of IPV perpetrators as a unique group. IPV is a heterogeneous behavior with several potential mediators, including personality traits or the severity of violence. However, socioaffective functioning has been recognized as a core, cross-cutting factor for IPV (Birkley & Eckhardt, 2015; Expósito-Álvarez et al., 2023). Even so, further research is needed to replicate these results in diverse samples of IPV perpetrators. Finally, our experimental design lacks a multi-method approach that integrates facial EMG. EMG is a traditional measurement for studying emotional facial response in violent populations (Fanti et al., 2015; De Wied et al., 2012). However, FaceReader is a reliable facial coding software that accurately records emotional facial expressions and strongly correlates with EMG outputs (Fanti et al., 2017).

In future research, it would be valuable to replicate the current results by using EMG in conjunction with other physiological indicators of emotional reactivity, such as autonomic nervous system activity, and employing empathic induction stimuli that integrate positive and neutral affective stimuli. Due to the inherent limitations of each method, adopting a multimodal assessment approach to an empathic induction task will offer a more comprehensive understanding of variations in emotional response patterns among IPV perpetrators. Additionally, it is also necessary to demonstrate whether these results are cross-cutting for all IPV perpetrators and whether they could be extended to other offenders. It would be particularly valuable to expand the current design to include additional samples, such as IPV perpetrators with severe prison sentences, men convicted of other crimes and female offenders. Finally, exploring the impact of IPV intervention programs on their affective response to an empathic induction task, as well as its long-term stability, could provide a deeper understanding of the impact of addressing emotional processing in IPV risk and recidivism.

Finally, this study may have important applications for practice. It has been underscored that intervention programs that address well-established IPV risk factors report greater efficacy (Eckhardt et al., 2013). Our findings are consistent and broaden the understanding of maladaptive emotional processing as a potential criminogenic factor in IPV perpetrators (Brem et al., 2018; Spencer et al., 2022), with a particular emphasis on poor emotional engagement and decoding. By delving into the emotional processing patterns of IPV perpetrators, valuable insights can be obtained to develop strategies in IPV intervention programs. These strategies could include actions such as raising awareness of the impact of inappropriate emotional responses or enhancing emotional decoding skills. This approach would be in line with the Good Lives Model (Santirso et al., 2020), which stresses that intervention programs should focus not only on minimizing manifest risk factors, but also on supporting protective factors.

4.3. Conclusion

In conclusion, the results of the current study suggest that IPV perpetrators display a misaligned facial expression pattern, and stated less prevalence of self-reported emotionality, when viewing other people suffering. Hence, our results highlight an alternative affective response among IPV perpetrators that does not accurately reflect the observed affective state of others. Considering these findings, the variation in their facial expressions could be relevant when adapting interventions. For example, IPV perpetrators could benefit from interventions that emphasize emotional processing, focusing on adjusting their emotional response and enhancing their emotional decoding abilities. Ultimately, enhancing socioaffective functioning may serve as a mechanism to reduce the incidence of IPV.

Supplementary Material

	IPV (n = 55)	Control (n = 48)	Student t	Cohen's d
CTS-2 Subscales - Minor scores				
Physical Assault *(M, SD)*	.82 (1.16)	.02 (.14)	4.751**	.97
Psychological Aggression *(M, SD)*	2.09 (1.54)	1.54 (1.41)	1.871	.37
Sexual Coercion *(M, SD)*	.46 (.64)	.30 (.62)	1.177	.25
Injuries *(M, SD)*	.58 (.80)	.02 (.14)	4.740**	.98
CTS-2 Subscales - Severe scores				
Physical Assault *(M, SD)*	.30 (.83)	.00 (.00)	2.569**	.51
Psychological Aggression *(M, SD)*	.61 (.79)	.00 (.00)	5.355**	1.09
Sexual Coercion *(M, SD)*	.06 (.31)	.00 (.00)	1.299	.27
Injuries *(M, SD)*	.42 (.75)	.00 (.00)	3.906**	.79
CTS-2 - Major violence				
Severity of physical violence *(M, SD)*	2.33 (4.72)	.00 (.00)	3.415**	.70

Supplementary Table 3. *Study 4: Mean comparisons of CTS-2 prevalence scores in both groups. CTS-2: Revised Conflict Tactic Scale, IPV: Intimate Partner Violence; M: Mean; SD: Standard Deviation. Statistical significance* $^{*}p < .05$, $^{**}p < .01$.

Film	Description	Length	Valence	Arousal
Leaving Las Vegas	A woman is sexually assaulted in a motel	2’	1,73	5,64
The Piano	A woman's hand is cut off with an axe	0’ 46’’	2,36	6,09
Schindler's List	A concentration camp commander shoots at prisoners from his balcony	1’ 16’’	1,55	5,73
American History X	A neo-Nazi kills a man	1’ 20’’	1,82	6,58

Supplementary Table 4*. Study 4: Selected scenes for the empathic induction task. Valence was measured from 1 (negative valence) to 10 (positive valence). Arousal was measured from 1 (low arousal) to 10 (high arousal). Extracted from Fernández-Megías et al., (2011)*

V. DISCUSIÓN

Capítulo 10. Discusión y perspectivas futuras

10.1. Discusión general.

El objetivo general de la presente Tesis Doctoral fue estudiar los niveles endocrinos y del SNA, así como la expresión facial, en agresores de violencia de género al empatizar, y examinar su relación con la conducta prosocial. La empatía se ha expuesto como una función socioafectiva compleja que predispone el cese de conductas violentas y el incremento de conductas prosociales (Jolliffe & Farrington, 2004; Moya-Albiol, 2018; Van Langen et al., 2014). No obstante, existe poca investigación que evalúe la empatía en esta población desde el marco del modelo biopsicosocial y mediante un enfoque multidimensional. Para alcanzar este objetivo, se llevaron a cabo cuatro estudios que analizaron la respuesta endocrina, psicofisiológica y psicológica frente a una inducción empática, consistente en el visionado de escenas de individuos sufriendo violencia, y su relación con la realización de donaciones monetarias en agresores de violencia de género, en comparación con un grupo de hombres sin antecedentes penales.

Los resultados del Estudio 1 revelaron una respuesta diferencial en los niveles de OXT entre los agresores y el grupo de control. En el grupo control, se produjo un incremento de la OXT tras la tarea, en línea con investigaciones previas con metodologías similares (Barraza & Zak, 2009; Procyshyn et al., 2020), alcanzando sus niveles máximos 40 minutos después de la inducción empática. Contrariamente, los agresores de violencia de género exhibieron una respuesta opuesta, manifestando menores niveles de OXT tras la tarea, alcanzando sus niveles más bajos 40 minutos después de la inducción empática. Dado que la OXT se ha relacionado con una mayor saliencia de la información social (Crespi, 2016; Ma et al., 2016), los menores niveles de OXT observados en los agresores de violencia de género podrían indicar una menor saliencia de la información social al observar a personas sufriendo violencia. Junto con los resultados de la OXT, se observó un aumento del estado de ánimo negativo autoinformado en el grupo control después de la inducción empática, mientras que el grupo de agresores no reportó ningún cambio, mostrando, además, puntuaciones más elevadas de alexitimia. Notablemente, una mayor alexitimia, combinada con la ausencia de cambio en el estado de ánimo, explicaron los menores niveles de OXT después de la tarea en toda la muestra. Los rasgos de alexitimia implican una comprensión y expresión emocional empobrecidas, funciones que se han demostrado que son cruciales para para un buen funcionamiento empático, tanto en agresores como en la población general (Cuff et al., 2016; Lyvers et al., 2018). De este modo, parece lógico que una menor comprensión y expresión emocional expliquen los niveles de OXT después de la inducción empática en toda la muestra, dada su relevancia en el procesamiento de la información socioafectiva (Shamay-Tsoory & Abu-Akel, 2016).

Respecto a los niveles de OXT, T y C, así como sus ratios, los hallazgos del Estudio 2 también reportaron una disminución de la OXT tras la tarea en el grupo de agresores, desde sus niveles basales hasta los niveles posteriores a la tarea, en comparación con el grupo control, que mostró un aumento. Estos resultados son coherentes y refuerzan los observados en el Estudio 1. Asimismo, se observaron mayores niveles totales de T en los agresores que, junto a la disminución de OXT, podrían sugerir un patrón endocrino diferencial en esta población al intentar empatizar. Mientras que la OXT se ha vinculado con la saliencia de estímulos socioafectivos, mayores niveles de T se han asociado con dificultades en la toma de perspectiva (Crespi, 2016; Ronay & Carney, 2013), una función en la que los agresores también exhibieron peores puntuaciones que los controles. Respecto a los niveles de C, no se observaron diferencias significativas. Una posible explicación podría ser que la tarea está diseñada para inducir empatía en lugar de estrés, centrándose en terceras personas y relacionándose, en mayor medida, con la OXT y la T. Esta afirmación se ve respaldada por los resultados de las ratios hormonales. En los agresores de violencia de género, se observó una disminución de la OXT/T tras la tarea, en contraste con el aumento observado en el grupo control, y exhibieron mayores niveles totales de T/C, un marcador vinculado con una menor empatía (Zilioli et al., 2015). En suma, para toda la muestra, mayores puntuaciones en la toma de perspectiva predijeron un aumento de la OXT y la OXT/T tras la tarea, así como una disminución de la T y la T/C. Por lo tanto, se ofrece evidencia adicional sobre la relación entre estos marcadores endocrinos y funciones facilitadoras de la empatía, como la toma de perspectiva.

Los resultados del Estudio 3 han expuesto diferencias en varios marcadores del SNA en respuesta a la tarea entre ambos grupos. Los agresores de violencia de género mostraron un menor incremento de la FC desde sus niveles basales hasta el periodo previo a la tarea, resultando en una menor FC a lo largo de la inducción empática. Este resultado es significativo ya que un incremento de la FC ante escenas de alto contenido emocional se ha vinculado con la empatía en población general (Steiger et al., 2019; Trautmann et al., 2018). Además, una mayor actividad del SNA en períodos preparatorios se ha asociado con un mayor incremento posterior en la actividad simpática y parasimpática (Vitoria-Estruch et al., 2018b). De manera coherente, el grupo de agresores exhibió una menor respuesta simpática durante la inducción empática, caracterizada por PEP más largos, en contraste con los PEP más cortos observados en los controles, acompañados de un menor incremento en la AED. Una mayor actividad del SNS ante el malestar ajeno se ha vinculado con el acercamiento emocional (Boucsein, 2012; Brown et al., 2021), por lo que la actividad simpática observada en los agresores podría ser indicativa de una menor activación al observar a terceras personas sufriendo violencia. Por otro lado, en cuanto a la actividad parasimpática, los agresores reportaron niveles más bajos de ASR en el periodo previo a la tarea y en el periodo de recuperación, aunque no durante la tarea en sí. Estos resultados sugieren una menor actividad parasimpática general en los agresores de violencia de género, en lugar de un patrón de respuesta alternativo al presenciar el sufrimiento ajeno. En este sentido, mayores niveles de ASR se han relacionado con la conducta orientada a los demás (Miller, 2018) y, a su vez, con una mayor empatía (Di Bello et al., 2020; Stellar et al., 2020).

Complementariamente, los resultados del Estudio 4 han expuesto un patrón distintivo en la expresión facial de emociones por parte de los agresores de violencia de género durante la tarea. El grupo de agresores mostró una menor prevalencia de expresiones faciales de tristeza y una mayor prevalencia de expresiones faciales de alegría en comparación con el grupo control. Se ha sugerido que las personas que exhiben una mímica facial ajustada, es decir, una expresión facial alineada con las emociones observadas, presentan niveles más elevados de empatía (Holland et al., 2021).

De este modo, el menor registro de expresiones de tristeza en los agresores de violencia de género frente a víctimas de violencia, así como las expresiones de alegría, podrían indicar una discrepancia en la respuesta emocional al observar el sufrimiento ajeno. De hecho, el grupo de agresores también informó de una tristeza y ternura autoinformadas reducidas, lo cual se asoció con un menor registro de expresiones faciales de tristeza durante la inducción empática, independientemente del grupo. Finalmente, es importante destacar que el grupo de agresores mostró una peor capacidad de decodificación emocional, y que dificultades en esta habilidad predijeron una menor prevalencia de expresiones faciales de tristeza y una mayor prevalencia de expresiones de alegría durante la inducción empática. Teniendo esto en cuenta, los resultados del Estudio 4 sugieren una falta de mímica facial en los agresores de violencia de género al observar a otras personas sufriendo violencia. Asimismo, la menor mímica facial se relacionó con una menor respuesta emocional autoinformada y una peor decodificación emocional.

Por último, estudiamos el desempeño de la conducta prosocial a través de una tarea de donación monetaria en el grupo de agresores y el grupo control, y su relación con los niveles endocrinos y psicofisiológicos al empatizar. Los resultados del Estudio 1 y el Estudio 3 mostraron donaciones similares en ambos grupos. Sin embargo, aquellas personas que donaron exhibieron un patrón endocrino y psicofisiológico específico durante la inducción empática. En concreto, mayores niveles de OXT, una reducción del PEP y un aumento de la AED, y mayores niveles de ASR. Estos correlatos biológicos fueron los que predijeron una mayor donación monetaria para todos los participantes. Hay evidencias de que un aumento en los niveles de

OXT (Barraza & Zak 2009; Marsh et al., 2015), en la actividad del SNS (Sze et al., 2012; Yu & Hao, 2022) y en la actividad del SNP (Bornemann et al., 2016; Oveis, 2009; Stellar et al., 2015) al empatizar se asocia con una mayor prevalencia de conductas prosociales. Como se ha expuesto, estos marcadores juegan un papel importante en el procesamiento de los estímulos sociales y de la respuesta emocional ante el sufrimiento ajeno (Brown et al., 2021; Crespi, 2016; Decety, 2011; Gilbert, 2015; Porges, 2017). Por este motivo, nuestros hallazgos son especialmente relevantes ya que afianzan la relación entre estos marcadores endocrinos y psicofisiológicos con la conducta prosocial (Marsh et al., 2021; Miller, 2018), y lo hacen de forma independiente al grupo de pertenencia.

10.2 Discusión teórica de los resultados.

En conjunto, los resultados de esta Tesis Doctoral contribuyen al conocimiento sobre los correlatos psicobiológicos de los agresores de violencia de género al intentar empatizar con terceras personas sufriendo violencia. Los déficits en la empatía podrían ser uno de los factores de riesgo que predisponga al ejercicio de la conducta violenta, al dificultar la inhibición de comportamientos perjudiciales para otros (Moya-Albiol, 2010; 2018; Van Langen et al., 2014). Fundamentándonos en esta premisa, se valoran los resultados obtenidos, los cuales profundizan en funciones relevantes para la empatía desde varios niveles, como se expone a continuación

A nivel psicológico, los agresores exhibieron niveles especialmente elevados de alexitimia, dificultades en la toma de perspectiva y una decodificación emocional limitada. Además, los agresores informaron de una emocionalidad negativa reducida al observar personas sufriendo violencia. El grupo control, por el contrario, manifestó un empeoramiento en su estado de ánimo y una mayor tristeza y ternura ante el sufrimiento ajeno. Como se ha expuesto, la empatía incluye elementos cognitivos y afectivos. Para un buen funcionamiento empático, es crucial comprender el estado emocional ajeno y generar una respuesta emocional similar a la percibida, aunque no idéntica (Cuff et al., 2016). Estos resultados sugieren dificultades en los procesos tanto cognitivos como afectivos de la empatía en los agresores de violencia de género. Por lo tanto, apoyan las investigaciones anteriores que han propuesto alteraciones específicas en funciones socioafectivas relevantes para la empatía en esta población (Clements et al., 2007; Covell et al., 2007; Romero-Martínez et al., 2016a; 2016b; Romero-Martínez Lila, et al., 2021).

A nivel endocrino, los agresores de violencia de género exhibieron una disminución en sus niveles de OXT y OXT/T, así como mayores niveles de T y T/C, marcadores hormonales que se han vinculado con una menor empatía (Barraza & Zak, 2009; Procyshyn et al., 2020; Zilioli et al., 2015). Coherentemente, esta respuesta endocrina se relacionó con déficits en la toma de perspectiva, una menor respuesta emocional y mayores niveles de alexitimia. Nuestros hallazgos son congruentes con la hipótesis que propone que menores niveles de OXT, combinados con un alto nivel de T, dificultaría procesos relevantes para la empatía, como la saliencia de estímulos sociales, la capacidad de hacer inferencias de la perspectiva ajena o el acercamiento afectivo (van Anders et al., 2011; 2012; Gordon et al., 2017). Además, apoyan la literatura que ha vinculado una mayor T/C con la violencia de género (Manigault et al., 2019; Romero-Martínez et al., 2016c; Romero-Martínez, González-Bono et al., 2013) y la relacionan con déficits socioafectivos (Mehta & Josephs, 2010; Zilioli et al., 2015). De especial relevancia es que la relación entre factores psicológicos y endocrinos fuera consistente para toda la muestra. Esto sugiere que el patrón de respuesta endocrina se relacionaría con el buen o mal funcionamiento de las funciones socioafectivas y, a su vez, respalda la teoría de la saliencia social de la OXT, que indica que la actividad del sistema oxitocinérgico depende de variables individuales como la capacidad de inferir estados ajenos, la decodificación emocional o la sensibilidad ante estímulos afectivos (Shamay-Tsoory & Abu-Akel, 2016).

A nivel psicofisiológico, los agresores exhibieron una menor respuesta del SNS y menores niveles totales del SNP al observar a personas sufriendo violencia respecto al grupo control. Este patrón psicofisiológico contrasta con la literatura existente sobre el SNA y la empatía. El incremento en la actividad simpática al observar el malestar ajeno se ha vinculado con el acercamiento emocional (Brown et al., 2021; Stellar et al., 2020), y mayores niveles de actividad parasimpática se han asociado con una mayor regulación emocional y conductas orientadas a los demás (Miller, 2018; Palix et al., 2022). En este contexto, el patrón psicofisiológico del grupo de agresores parece indicar una actividad del SNA que dificulta la respuesta empática. De acuerdo a la literatura, la actividad del SNA observada en los agresores de violencia de género seria indicativa de una menor sensibilidad ante el malestar ajeno, lo que podría dificultar una conducta orientada a los demás y, en última instancia, a la empatía. Este hallazgo es coherente con estudios previos en agresores de violencia de género que han evidenciado menores niveles en su actividad simpática y parasimpática y los vinculan con dificultades en diversas funciones socioafectivas como la regulación de la ira, los conflictos interpersonales o la compasión (Babcock & Potthoff, 2021; Godfrey & Babcock, 2020; Moreno et al., 2023; Sarrate-Costa et al., 2023). Por tanto, nuestros resultados apoyan la hipótesis de una activación autonómica reducida en esta población durante el procesamiento socioafectivo. En nuestro caso, ante el sufrimiento ajeno.

A nivel del patrón facial de emociones, en comparación con el grupo control, el grupo de agresores registró menos expresiones faciales de tristeza y más expresiones faciales de alegría ante el sufrimiento ajeno. Se ha postulado que las expresiones faciales reflejan la respuesta afectiva a señales emocionales (Hess & Fischer, 2022; Seibt et al., 2015), estableciéndose una conexión entre la mímica facial y un mayor grado de empatía (Holland et al., 2021; Rymarczyk et al., 2016). De acuerdo con esta premisa, el grupo control, al exhibir una mayor mímica facial ante el sufrimiento ajeno parece compartir, en mayor medida, los estados emocionales de las víctimas. En contrapartida, la literatura ha sugerido que individuos con más comportamientos violentos muestran una mímica emocional reducida, especialmente ante las emociones negativas de los demás (Fanti et al., 2016; 2017; Frick et al., 2014). De este modo, el patrón en la expresión facial de emociones de los agresores de violencia de género ante la inducción empática apoyaría los hallazgos relativos a otras poblaciones con conductas violentas. Además, se ha expuesto que una menor mímica facial podría sugerir dificultades en funciones socioafectivas específicas que contribuirían a una baja empatía. En este sentido, la relación entre una pobre decodificación emocional y una mímica facial desajustada sería congruente con esta afirmación, vinculando las dificultades en la decodificación emocional, una mímica facial reducida y una pobre empatía.

Por último, respecto a la conducta prosocial, el grupo de agresores y el grupo control mostraron la misma prevalencia de conductas de donación. Este hallazgo contradice la conceptualización de las personas violentas como incapaces de ser prosociales (Llorca-Mestre et al., 2017). De hecho, la realización de conductas prosociales, a través de donaciones, se asoció a mayores niveles de los correlatos biológicos de la respuesta empática, como una mayor OXT, mayor respuesta del SNS y mayores niveles de la actividad del SNP. Según el modelo de Marsh et al. (2021), fundamentado en la teoría de la saliencia social de la OXT (Shamay-Tsoory & Abu-Akel, 2016), la OXT parece mediar en la conducta prosocial a través de circuitos relacionados con el procesamiento de los estimulos socioafectivos, dependiendo de diversos factores individuales, como la sensibilidad a emociones ajenas o la conducta orientada a los demás. Esto es particularmente relevante, dado que estas funciones están estrechamente relacionadas con la actividad del SNA (Miller, 2018), y las personas que exhibieron una mayor actividad del SNS y del SNP durante la inducción empática también exhibieron una mayor prevalencia de conductas prosociales. De acuerdo a las teorías actuales, parece coherente hipotetizar que la conducta prosocial se relaciona con una mayor respuesta empática (Davis, 2015; Moya-Albiol, 2018). Así, nuestros hallazgos apoyan la relación entre los presentes correlatos psicobiológicos de la respuesta empática y el incremento de las conductas prosociales (Marsh et al., 2021). Sin embargo, es pertinente señalar la compleja interacción necesaria entre factores biológicos y psicosociales para predisponer al desempeño de comportamientos prosociales.

Los resultados de esta Tesis refuerzan la relevancia del modelo biopsicosocial a la hora de explorar los factores de riesgo y protección de la violencia de género. En conjunto con la interrelación de factores expuestos por el modelo ecológico (Heise, 1998, 2011) y el modelo piramidal (Bosch-Fiol & Ferrer-Pérez, 2013, 2019), el patrón de funcionamiento psicobiológico observado en los agresores al intentar empatizar los podría predisponer a relacionarse con el entorno en ciertos términos, constituyendo un factor de riesgo para el ejercicio de la violencia (Moya-Albiol & Romero-Martínez, 2020). Además, se destaca que el hecho de ser agresor de violencia de género no influyó en la capacidad de mostrar conductas prosociales; más bien, se relacionó con correlatos biológicos asociados con la empatía. Por ello, teniendo en cuenta los resultados obtenidos, sugerimos que un enfoque de intervención centrado en la empatía podría ser útil para reducir la incidencia de la violencia de género.

10.3. Implicaciones clínicas y de intervención psicosocial

La importancia de esta Tesis Doctoral recae en la aportación del modelo biopsicosocial. En concreto, se ha identificado un patrón endocrino y psicofisiológico en agresores de violencia de género relacionado con la empatía y la conducta prosocial, respaldado por medidas psicológicas. Estos hallazgos amplían nuestro entendimiento sobre estos factores de riesgo y protección de la violencia de género. A continuación, se presentan algunas implicaciones derivadas de los resultados encontrado en la presente Tesis:

- Los resultados expuestos contribuyen al campo de la neurocriminología, disciplina que estudia la relación bidireccional entre la neurobiología y la conducta criminal (Moya-Albiol et al., 2017; Moya-Albiol & Romero-Martínez, 2020). Aumentar el conocimiento sobre estos agresores tiene múltiples aplicaciones en la neurocriminología, como optimizar la prevención primaria, estimar el riesgo de reincidencia o evaluar los tratamientos aplicados. Asimismo, dicho conocimiento puede ser utilizado por criminólogos y trabajadores sociales para orientar las necesidades del proceso judicial en base a las características específicas de esta población.

- El estudio desde una perspectiva neurocientífica, junto a los factores sociales y psicológicos, es esencial para comprender a los agresores de violencia de género. Los factores biológicos no pueden determinar, por sí solos, la violencia de género, pero sí forman parte de la interrelación de factores que contribuyen al ejercicio de la violencia (Pinto et al., 2010). Esta perspectiva ofrece información sobre mecanismos subyacentes que contribuyen a la violencia de género mediante biomarcadores menos susceptibles a sesgos y manipulación (Moya-Albiol & Romero-Martínez, 2020).

- Los agresores de violencia de género exhiben dificultades en procesos esenciales para la empatía, una función que se ha postulado como un factor protector contra la conducta violenta (Moya-Albiol, 2010; 2018). Por ello, es relevante que los programas de intervención dirigidos a estos agresores evalúen los procesos socioafectivos relacionados con la empatía. Esto permitirá una comprensión más profunda de posibles déficits en la empatía y facilitará su adecuado abordaje (Cuff et al., 2016).

- Los procedimientos de inducción empática, en combinación con instrumentos validados, que integran factores psicológicos, endocrinos y psicofisiológicos parecen pertinentes para una comprensión holística de la respuesta empática (Barraza & Zak 2009; Procyshyn et al., 2020; Stellar et al., 2015). Se ha propuesto que este procedimiento incrementa la validez ecológica de los resultados (Dziobek, 2012), por lo que futuras líneas de investigación y evaluación deben considerar este protocolo.

- Los tratamientos psicológicos llevados a cabo con los agresores de violencia de género deben abordar factores de riesgo basados en la evidencia. Hemos expuesto que estos agresores presentan déficits en funciones relevantes para la empatía, tales como la saliencia de estímulos sociales, la toma de perspectiva, la decodificación emocional, la sensibilidad ante emociones ajenas, así como la identificación y expresión emocional. En consecuencia, las estrategias de los programas de intervención podrían beneficiarse de la inclusión de estos componentes socioafectivos (Füstös et al., 2013; Moreno et al., 2023).

- Los agresores de violencia de género no han diferido de los hombres sin antecedentes de violencia en la prevalencia de conductas prosociales, más bien se relacionó con marcadores psicobiológicos asociados con la respuesta empática. Teniendo esto en cuenta, en línea con el Modelo de Buenas Vidas (Fortune, 2018; Santirso et al., 2020), los programas de intervención en agresores deberían centrarse no sólo en minimizar los factores de riesgo, sino también en apoyar los factores de protección, desestigmatizando a la población violenta como incapaz de ser prosocial.

- En conjunto, fomentar la empatía y la conducta prosocial es esencial en todas las etapas de prevención: en la primaria, reduciendo la probabilidad de ejercicio de violencia; en la secundaria, al promover dichas habilidades en hombres con mayor riesgo de violencia para prevenir su ocurrencia; y en la terciaria, mediante el tratamiento psicológico de agresores de violencia de género, con el objetivo de disminuir la reincidencia y favorecer la rehabilitación y reinserción de los agresores.

10.4. Limitaciones y fortalezas del estudio

Los resultados de esta Tesis Doctoral deben ser considerados dentro de algunas limitaciones. En primer lugar, la solidez de nuestro estudio podría verse comprometida por la ausencia de escenas de control con valencia neutral o positiva. A pesar de esto, es relevante señalar que las escenas utilizadas han demostrado ser eficaces para evocar un estado emocional negativo de manera independiente (Fernández-Megías et al., 2011). Además, diversos estudios han empleado un diseño similar para evaluar la empatía mediante correlatos endocrinos, autonómicos y expresiones faciales emocionales (Barraza & Zak, 2009; Fanti et al., 2017; Procyshyn et al., 2020; Stellar et al., 2020). En segundo lugar, nuestro estudio presenta un tamaño muestral modesto y variable, lo que podría influir en la validez de nuestros resultados. Esta limitación se debe principalmente a la dificultad de acceso a la muestra (Santirso et al., 2020; Lila & Gilchrist, 2023), agravada por la susceptibilidad de los a ser evaluados y por la naturaleza psicobiológica de este estudio. Además, la aparición del COVID-19 ha dificultado la recolección de determinadas muestras biológicas, ralentizando la investigación biológica en aras de respetar los procedimientos de bioseguridad (Hofman, 2020). Sin embargo, el tamaño muestral fue calculado en base a artículos previos que evaluaban la actividad endocrina y psicofisiológica en agresores, y los cuatro estudios cuentan con suficiente poder estadístico. En tercer lugar, se han llevado a cabo un elevado número de análisis estadísticos en relación al número de participantes, lo que podría aumentar la probabilidad de cometer el error tipo I. En cuarto lugar, hemos incluido a los agresores de violencia de género como un único grupo. La violencia de género es un comportamiento heterogéneo con diversos mediadores potenciales, que incluyen rasgos de personalidad o la gravedad de la violencia. A pesar de ello, es pertinente señalar que las dificultades en funciones socioafectivas han sido reconocidas como un factor transversal en esta población (Birkley & Eckhardt, 2015; Brem et al., 2018; Expósito-Álvarez et al., 2023; Maloney et al., 2023). Por último, una limitación vinculada con el estudio con población forense es que los antecedentes penales no proporcionan una descripción exhaustiva de la historia de la violencia ejercida. En consecuencia, estos antecedentes podrían no reflejar de manera precisa los actos violentos cometidos. Esta limitación afecta tanto al grupo de agresores como al grupo de control. Para mitigar este sesgo en la medida de lo posible, empleamos el CTS-2 (Strauss et al., 1996), que registra la historia de conductas violentas, pero debemos ser cautos en la generalización de los resultados. En conjunto, aunque los resultados del presente estudio aportan información significativa sobre los correlatos psicobiológicos de la empatía y la conducta prosocial en agresores de violencia de género, deben replicarse en muestras más grandes y diversas, teniendo en cuenta las consideraciones metodológicas mencionadas.

No obstante, también queremos resaltar las fortalezas de esta Tesis Doctoral. Uno de los principales puntos fuertes es la incorporación de un protocolo de evaluación de la empatía desde una perspectiva biopsicosocial y multidimensional, integrando una medición naturalmente inducida junto a cuestionarios autoinformados. Se ha expuesto que este procedimiento de evaluación de la empatía contribuye a incrementar la validez ecológica de los resultados (Barraza & Zak 2009; Dziobek, 2012; Procyshyn et al., 2020; Stellar et al., 2015). En segundo lugar, es importante señalar que las diferencias en la actividad endocrina, psicofisiológicas o en el patrón de expresiones faciales no pueden ser atribuidas a sesgos como la baja autopercepción emocional, la elevada deseabilidad social o la manipulación intencionada, muy presentes en esta población (Garaigordobil-Landazabal & Peña-Sarrionandia, 2015; Visschers et al., 2017). De este modo, al combinar la evaluación psicosocial de la empatía con sus correlatos biológicos, nuestros resultados son menos susceptibles a sesgos y manipulación (Moya-Albiol & Romero-Martínez, 2020). Por último, aunque reconocemos que los estudios centrados en la respuesta endocrina y psicofisiológica pueden y deben mejorar, resulta imprescindible resaltar que son investigaciones pioneras, siendo de los primeros estudios en incorporar el análisis de los factores psicobiológicos al estudio de la empatía en agresores de violencia de género. Por este motivo, la presente tesis contribuye a profundizar en las características intrínsecas de estos agresores, con el fin último de optimizar las herramientas disponibles, tanto teóricas como clínicas y legales, para abordar la violencia de género de manera integral y sostenible a largo plazo.

10.5. Futuras líneas de investigación

De la presente Tesis, se derivan las siguientes perspectivas futuras:

- Ampliar nuestros resultados en una muestra más extensa, utilizando los correlatos psicobiológicos de esta investigación, junto con otros biomarcadores relevantes para la empatía, como la vasopresina (Caldwell, 2017; Rigney et al., 2022). Debido a las limitaciones inherentes de cada método, adoptar un enfoque de evaluación multimodal de la empatía ofrecerá una comprensión más completa de los patrones de respuesta de los agresores de violencia de género

- Estudiar los correlatos psicobiológicos de la empatía en respuesta a estímulos de valencia afectiva positiva y su relación con comportamientos prosociales en los agresores de violencia de género. Una comprensión más profunda de los mecanismos subyacentes al procesamiento de emociones positivas en esta población podría arrojar luz sobre un importante factor de protección, aplicable tanto a la prevención como a la intervención.

- Explorar la relevancia de la cercanía y relevancia del vínculo con la persona observada en la respuesta empática. La inclusión de esta variable podría ampliar nuestro entendimiento sobre la influencia de los marcadores endocrinos y psicofisiológicos en la respuesta empática (Marsh et al. 2021; Miller, 2018).

- Evaluar la homogeneidad de nuestros hallazgos en diversas muestras de agresores de violencia de género, al considerar la gravedad de la violencia ejercida, los rasgos de personalidad o el consumo de sustancias, entre otros factores. Esto permitirá una mayor individualización de las propuestas de intervención según los factores de riesgo más prevalentes en esta población.

- Extender estas investigaciones de esta Tesis Doctoral a otras poblaciones forenses, tanto hombres como mujeres, con condenas por otros delitos. Esto facilitará la identificación de factores de riesgo que puedan ser comunes al comportamiento violento en general o específicos según el delito cometido, incrementando así el conocimiento sobre las necesidades terapéuticas de cada población forense.

- Finalmente explorar el impacto de los programas de intervención en agresores de violencia de género en biomarcadores relevantes para la empatía, tanto a corto como a largo plazo. Este enfoque nos daría información sobre el impacto de abordar las funciones socioafectivas de los agresores en los programas de intervención y si tiene relación con la reincidencia de la violencia de género.

VI. CONCLUSIONES

En base a los resultados obtenidos en la presente Tesis Doctoral, podemos extraer las siguientes conclusiones:

1. Los agresores de violencia de género muestran un patrón endocrino diferente al de los hombres sin antecedentes de violencia al intentar empatizar con personas sufriendo violencia, caracterizado por una disminución en sus niveles de OXT y mayores niveles de T, lo que se ha vinculado con dificultades en procesos socioafectivos como la identificación emocional, la toma de perspectiva o la respuesta emocional.

2. Los agresores de violencia de género muestran una respuesta simpática atenuada y una menor activación del SNP ante el sufrimiento ajeno en comparación con los hombres sin antecedentes de violencia, un patrón psicofisiológico indicativo de una activación del SNA reducida ante emociones negativas ajenas.

3. Los resultados encontrados respecto al patrón facial de emociones exponen una mímica facial reducida en los agresores de violencia de género respecto a hombres sin antecedentes de violencia, exhibiendo mayores expresiones de alegría al observar personas sufriendo violencia, y esta respuesta podría explicarse por una capacidad limitada para decodificar las emociones ajenas.

4. Los agresores de violencia de género manifiestan, a través de cuestionarios autoinformados, dificultades en la toma de perspectiva, una reducida capacidad para decodificar emociones ajenas, elevados niveles

de alexitimia y una falta de respuesta emocional al sufrimiento ajeno en comparación con los hombres sin antecedentes de violencia.

5. No se observaron diferencias entre grupos en la realización de conductas prosociales. Independientemente del grupo de pertenencia, la conducta prosocial se relacionó con los correlatos psicobiológicos de la respuesta empática, como mayores niveles de OXT, un mayor incremento en la respuesta simpática y mayores niveles totales de actividad parasimpática ante el sufrimiento ajeno.

6. La violencia de género es un fenómeno multicausal que precisa de una aproximación holística e integral que aborde todos los elementos implicados. Por ello, es importante considerar, junto a los factores socioculturales y psicológicos, los factores de carácter biológico, incluyendo el funcionamiento endocrino y psicofisiológico de los agresores.

VII. **BIBLIOGRAFÍA**

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VIII. ANEXOS

Anexo 1. Publicación estudio 1.

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Reduced salivary oxytocin after an empathic induction task in Intimate Partner Violence perpetrators: Importance of socio-affective functions and its impact on prosocial behavior

J. Comes-Fayos [a], M.C. Blanco-Gandía [b], I.R. Moreno [a], M. Rodríguez-Arias [a], M. Lila [c], C. Sarrate-Costa [a], A. Romero-Martínez [a], L. Moya-Albiol [a,*]

[a] Department of Psychobiology, University of Valencia, Valencia, Spain
[b] Department of Psychology and Sociology, University of Zaragoza, Teruel, Spain
[c] Department of Social Psychology, University of Valencia, Valencia, Spain

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ABSTRACT

Intimate Partner Violence (IPV) has been linked to difficulties in socio-affective functions. Nevertheless, the underlying psychobiological mechanisms that might be responsible for them remain unclear. Oxytocin (OXT) stands out as an important hormone that may favor the salience of social information, due to its relevance in empathy and prosocial behavior. Thus, the study of salivary OXT (sOXT) may provide further information about potential impairments in social cognition in IPV perpetrators. This study analyzed the effects of an empathic induction task, performed through negative emotion-eliciting videos, on endogenous sOXT levels, mood state, and emotional perception in 30 IPV perpetrators compared to 32 controls. Additionally, we explored their performance on prosocial behavior after the empathic induction task, using Hare's donation procedure. Lower sOXT levels were found in IPV perpetrators after the task compared to controls, along with a general decreasing tendency in their sOXT levels. Additionally, IPV perpetrators exhibited no change in their mood state and perceived others' emotions as more positive and less intense. Moreover, the mood state response and alexithymia traits, respectively, positively and negatively predicted the sOXT levels after the empathic induction task in the entire sample. Finally, we did not observe a lower appearance of prosocial behaviors in IPV perpetrators; however, higher sOXT levels after the empathic induction task were found in subjects who donated when considering the whole sample. In sum, IPV perpetrators exhibited differences in their sOXT levels when empathizing, compared to controls, with alexithymia and the emotional response potentially explaining the sOXT levels after the task. Furthermore, prosocial behavior was more related to these sOXT levels than to IPV. As our knowledge about the emotional processing of IPV perpetrators increases, we will be better able to develop and include coadjutant treatments in current psychotherapeutic programs, in order to focus on their emotional needs, which, in turn, would reduce the future risk of recidivism.

1. Introduction

Intimate partner violence (IPV), defined as any act that results or may result in physical, sexual, or psychological harm to women in heterosexual relationships (World Health Organization, 2019), has emerged as a serious public health problem with high social, economic, and human costs (Vilariño and Arce, 2018). Research has focused on addressing IPV characteristics in order to develop comprehensive and effective intervention programs to prevent this type of violence (Santirso et al., 2020). For this purpose, the Biopsychosocial Model is an important explanatory approach that views IPV as a multi-causal variable and highlights the relevance of integrating psychosocial, affective, and biological aspects (Pinto et al., 2010), incorporating neuroscience methodology into models focused on psychosocial factors (Kelly and Wilson, 2020).

Impairments in socio-affective functions have recently been identified as an important factor in IPV (Brem et al., 2018; Romero-Martínez et al., 2013), with many IPV perpetrators showing difficulties in

* Correspondence to: Department of Psychobiology, University of Valencia, Avda. Blasco Ibáñez, 21, Valencia 46010, Spain.
E-mail address: Luis.Moya@uv.es (L. Moya-Albiol).

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identifying, describing, and/or expressing their own and others' feelings, deficits that are defined as alexithymia (Romero-Martínez et al., 2020). This construct has been directly implicated in difficulties in social cognition processing, specifically in recognizing others' emotions (Di Tella et al., 2020; Romero-Martínez et al., 2019c). This inability to recognize and/or regulate emotional inner states might underlie poor understanding of others' thoughts and emotions (perspective taking) (Grynberg et al., 2010; Lyvers et al., 2018). This impaired processing of socio-affective stimuli could result in difficulties in responding to or sharing emotions with others, as well as considerable affective distress when dealing with social interactions, which would make them feel overwhelmed (Finkel and Hall, 2018; Leshem et al., 2019; Strickland et al., 2017). Therefore, these serious difficulties have been pointed out as mechanisms that partially explain the reduction in adaptive social functioning and the risk of IPV maintenance and recidivism (Romero-Martínez et al., 2016a, 2019b, 2019d).

From the Biopsychosocial Model perspective, the hypothalamic neuropeptide oxytocin (OXT) could be of special interest for the study of IPV because it plays an important role in social cognition (Patin and Hurlemann, 2015). Particularly, OXT has been linked to the salience of socio-affective information, facilitating emotional decoding processes and the mediation of social reward sensitivity, processes that may be relevant for functions such as empathy, bonding, and prosocial behavior (Crespi, 2016; Shamay-Tsoory and Abu-Akel, 2016). Research in this field has focused on the study of the relationship between endogenous basal levels of OXT and psychological traits that are important for social cognition and empathy, or it has examined the behavioral effects of intranasal administration of OXT (Geng et al., 2018; Hurlemann and Grinevich, 2018). However, several authors have highlighted the importance of complementing this research with the study of endogenous OXT levels in response to socio-affective stimuli (Hurlemann and Grinevich, 2018). These authors emphasize the importance of research with naturally induced approaches that favor a more realistic understanding of the relationship between empathy and OXT, such as the study of the endogenous OXT response to empathic induction tasks. In a first study, Barraza and Zak (2009) showed an increase in endogenous plasma OXT (pOXT) levels in a sample of college students (52% women) after watching a video with high emotional content of people in distress. They also observed a positive relationship between pOXT and the degree of empathy experienced, measured by the increase in their mood state. This result was reproduced in another study on endogenous salivary OXT (sOXT) that also showed an increase in sOXT levels after exposure to the same empathic induction task (Procyshyn et al., 2020) in a similar sample of college students (54% women).

In addition, sOXT has also been implicated in prosocial behaviors through the strengthening of trust and helping behaviors (Hurlemann and Marsh, 2016). Marsh et al. (2015) found a relationship between prosocial behavior and changes in endogenous sOXT. In their study, they found that male and female students who anonymously donated part of their experimental retribution to social charities had an increase in their sOXT levels. Moreover, Barraza and Zak (2009) reported that participants who had a greater response to an empathic induction task, measured by increased pOXT and positive mood state response, donated more money to social charities. These findings led to the idea that interpersonal relationships involving prosocial behavior could be significantly modulated by sOXT through the empathic function.

However, the effect of OXT on social cognition can differ substantially, with some authors establishing a complex pattern where the social context and individual differences moderate both central and peripheral OXT release (DeWall et al., 2014). Specifically, research suggests that highly aggressive men differ from the general population with respect to their OXT system, linking lower OXT levels in this population to deficits in socio-affective functions (Demirci et al., 2016; Levy et al., 2015). Unfortunately, these studies did not assess group differences in baseline OXT levels. Even though a previous study failed to report baseline sOXT level differences between IPV perpetrators and controls (Romero-Martínez et al., 2021), they did not assess whether baseline sOXT levels were related to socio-affective alterations (e.g., alexithymia, empathy, prosocial behavior…) in IPV perpetrators. However, to the best of our knowledge, there are no studies that have considered the influence of these socio-affective difficulties in the sOXT response to an empathic induction task in both IPV perpetrators and in non-violent men.

Therefore, the main objective of this study was fourfold. First, this study aimed to analyze whether there are differences between IPV perpetrators and controls in their baseline sOXT levels and alexithymia traits. We first hypothesized that, in line with previous research (Hurlemann and Grinevich, 2018; Romero-Martínez et al., 2019c, 2021), the groups would not differ in their baseline sOXT levels. Moreover, we also expected that IPV perpetrators would present higher alexithymia traits than controls. Second, we also aimed to assess whether there are differences between IPV perpetrators and controls on their endogenous sOXT levels and negative mood state in response to an empathic induction task. Accordingly, prior literature has found increases in endogenous sOXT and negative mood state following an empathic induction task in a normative population (Barraza and Zak, 2009; Procyshyn et al., 2020). Nonetheless, IPV perpetrators tend to present important alterations in perceiving the affective state of others and higher alexithymia traits (Romero-Martínez et al., 2016a, 2019c, 2020). Therefore, we hypothesized that IPV perpetrators would present a buffered sOXT response. Conversely, we expected an increase in sOXT levels and a worsening of mood after the task in controls.

Third, we also aimed to explore whether negative mood state, emotional perception after the emotion induction task, and/or alexithymia predict sOXT changes in response to the task. Based on previous conclusions in this field (Hurlemann and Grinevich, 2018; Romero-Martínez et al., 2016a, 2019b, 2020; Shamay-Tsoory and Abu-Akel, 2016), we would expect low emotional perception and high alexithymia traits to predict the buffered sOXT response in IPV perpetrators, whereas high emotional perception and worse mood would predict sOXT changes in controls.

Four, we also investigated the difference in the performance of prosocial behavior between IPV and controls, as well as the difference in the sOXT levels after the task between those who perform prosocial behavior and those who do not. We expected a greater sOXT response in the prosocial subjects, independently of whether they were IPV perpetrators or not (Marsh et al., 2015).

2. Methods

2.1. Participants

From an initial total sample of 66 participants, two IPV perpetrators and two controls were excluded from the study because their sOXT levels exceeded the standard deviation of the total sample by 2.5 or more. The final sample consisted of 62 healthy male volunteers (30 IPV perpetrators and 32 controls). The IPV perpetrators were recruited from the participants in the CONTEXTO Program, a community-based psychoeducational intervention program that is mandatory for men convicted of gender-based violence. The study was carried out at the Department of Social Psychology at the University of Valencia prior to the start of the intervention.

The IPV perpetrators were required to have a sentence for gender-based violence that had been suspended on the condition that they attend an intervention program (Lila et al., 2018). They had to be free of any mental and/or neurological disorders, not have consumed substances for at least two hours before the study and have good writing and speaking skills in Spanish. The assessment of the IPV perpetrators' history of violence was based on information provided by judicial and probation system professionals (e.g., previous violence against other people", physical, psychological, and/or sexual IPV perpetration, criminal previous records…), as well as information provided by the participant. Furthermore, participants also completed the Conflict Tactic Scale 2 (CTS-2) (Straus et al., 1996) validated in Spanish (Muñoz-Rivas et al., 2007) during individual interviews. Our sample included participants with episodes of physical and/or psychological violence.

The control group was composed of volunteers who presented similar anthropometric (age, and/or body mass index) and socio-demographic (age, educational level, annual income, and/or marital status) characteristics to those of the IPV perpetrators, in addition to not having any previous criminal record. Additionally, they had to score below 1 on the CTS-2 (Muñoz-Rivas et al., 2007; Straus et al., 1996). They were recruited in Valencia (Spain), and contact was made through advertisements posted on social networks. The participants were selected after performing an individualized phone interview. Prior to the experimental phase, each participant was interviewed by two clinical psychologists trained in the treatment of IPV to screen for psychopathology and/or personality disorders. Inter-rater agreement between the two qualitative interviewers had to be above.80 for the psychopathological and personality dimensions evaluated. All participants were informed about the study, voluntarily agreed to participate, gave their written informed consent, and received a financial retribution of 40 euros at the end of the study.

The experiment was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of the University of Valencia (procedure number: H1538385543901).

2.2. Procedure

The procedure was carried out in one experimental session in the Psychobiology laboratories at the University of Valencia, where a constant temperature (21°C) and humidity were maintained. The session always took place between 4:00 and 7:00 p.m. with an approximate duration of 2 h. First, the informed consent was signed, and the anthropometric were measurements taken. Then, the first questionnaires on the participants' mood state were completed (baseline), and baseline sOXT was collected. Next, the participants were introduced to the empathic induction task, and anticipatory sOXT was taken.

Following the guidelines of Procyshyn et al. (2020), the empathic induction task consisted of watching a battery of emotion-eliciting videos validated for the Spanish population (PIE) (Fernández-Megías et al., 2011). Before watching, the participants were told to actively empathize with the main character of each scene (previously singled out), and they were informed that they had to complete a questionnaire reporting the perceived emotional response of the characters. Four scenes (averaging 1' 21") were selected from the battery based on their high arousal and negative affect (see Table 1). The selection of these scenes was based on the recommendations proposed in Gracia et al. (2015) and Romero-Martínez et al. (2019a, 2019b, 2019c, 2019d, 2019e). These studies pointed to the existence of alterations in the processing of socio-cognitive and emotional stimuli in IPV perpetrators when processing clips with specifically IPV content. Thus, we selected two scenes where male characters received violence and two scenes where violence was received by female characters. Each participant performed the empathic induction task, watching the scenes on a 75'' screen. Following guidelines from previous studies (Schaefer et al., 2010), participants were asked to relax for one minute before watching each scene, and they had to complete the questionnaires right after every scene.

After the empathic induction task was over, post-empathic sOXT was collected, the mood state questionnaire was filled out again, and the participants went through a recovery phase divided into three 20-minute periods in which the following three sOXT samples were collected: post 20', post 40', and post 60', respectively. During the recovery period, questionnaires were completed to collect information on socio-demographic variables, alexithymia, and alcohol consumption.

Finally, once the recovery period had ended, the mood state questionnaire was filled out again, and a prosocial laboratory task was performed that consisted of making a charitable donation, replicating the Hare et al. (2010) assessment procedure. The suitability of this task (e.g., charitable donations) for measuring altruism-motivated prosocial behavior in normative populations has been shown (Böckler et al., 2016; Huang et al., 2021; Tusche et al., 2016; Waytz et al., 2012). Furthermore, the occurrence of these prosocial behaviors has been related to a greater response to an empathic induction task in a normative population (Tusche et al., 2016), suggesting that individuals with more prosocial behaviors appear to exhibit a greater propensity for empathizing. The procedure was divided into three phases: (1) taking perspective of a context where a problem is presented, (2) evaluating the participant's potential impact on the resolution of the problem, and (3) an opportunity to perform a helping behavior. First, we presented informative documents about six Non-Governmental Organizations (NGO). Then, the participants were asked to assess the extent to which each NGO deserved help. To monitor the effect of possible personal contact with the organizations, the degree of closeness to the NGO was assessed on a 3-point Likert scale (1 - no closeness; 3 - active participation in the organization). Finally, participants were given the opportunity to help the NGO by means of a donation, emphasizing the voluntary nature of the donation. Once the donation had been proposed, the participants had to write down in a document the amount donated and the NGO that received the donation. To reduce a possible bias due to social desirability, the experimenters left the room while the participant decided whether to make the donation. As a result, the participants were divided into donors (participants who had donated at least 50% of their financial retribution) and non-donors. The donation was taken from the economic retribution the participants received. Once the prosocial laboratory task had ended, they were informed that they would receive the full remuneration. At the end, the participants were escorted out of the laboratory and dismissed. (Fig. 1).

Table 1
Selected scenes for the empathic induction task.

Film	Description	Length	Valence	Arousal
Leaving Las Vegas	A female character is sexually assaulted in a motel	2′	1,73	5,64
The Piano	A pianist's hand is cut off with an axe	0′46′′	2,36	6,09
Schindler's List	A concentration camp commander shoots at prisoners from his balcony	1′16′′	1,55	5,73
American History X	A neo-Nazi kills a man	1′20′′	1,82	6,58

Note: Video clips are from the battery of films with emotion-inducing capacity validated for the Spanish population (Fernández-Megías et al., 2011). Valence was measured from 1 (negative valence) to 10 (positive valence). Arousal was measured from 1 (low arousal) to 10 (high arousal).

2.3. Measures

To measure mood, the reduced version of the "Profile of Mood States" (POMS), adapted to the Spanish population, was used (Fuentes et al., 1995; McNair et al., 1971). This version has 29 items with a total score indicating negative mood. The response format is a five-category Likert scale with values between 0 (none) and 4 (very much). A total score was calculated by adding all the negative scales (tension, depression, anger, vigor, and fatigue) and subtracting vigor. Cronbach's α was.83 for the total score.

To measure perceived emotional state in others, the Self-Assessment Manikins (SAM) (Bradley and Lang, 1994) was used. The SAM evaluates the affective valence (SAM-Val), which ranges from 9 (positive valence) to 1 (negative valence), and arousal or activation (SAM-Act), which ranges from 9 (high arousal) to 1 (low arousal). Each subscale is represented by 5 graphic figures with 4 intermediate points, making up the

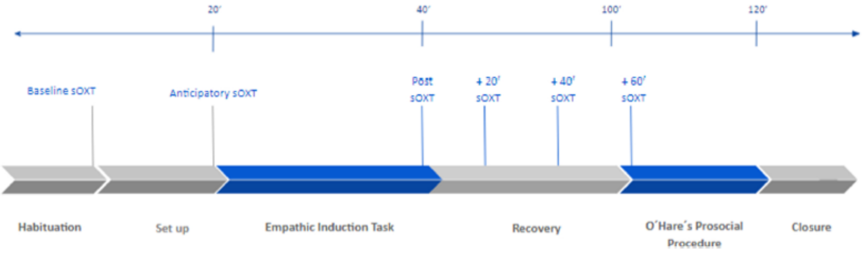

Fig. 1. Experimental procedure.

9-point scale. This questionnaire was used to measure the participant's perception and understanding of the characters' emotional state in the scenes, which is an indicator of cognitive empathy. Cronbach's α was.68 for the total score.

The "Toronto Alexithymia Scale - 20 items" (TAS-20; Bagby et al., 1994) was used to measure the trait of alexithymia. The TAS-20 is a widely used self-report measure that has demonstrated adequate reliability and validity in its original version and in the Spanish adaptation (Martínez-Sánchez, 1996) used in the present study. The TAS-20 contains 20 items with a response system based on a 5-point Likert scale ranging from 0 (strongly disagree) to 6 (strongly agree). Cronbach's α was.80.

The Spanish version (Guillamón et al., 1999) of the "Alcohol Use Disorder Identification Test" (AUDIT) (Saunders et al., 1993) was used to verify the amount and frequency of alcohol consumption in adults. Cronbach's alpha was.85.

2.4. sOXT levels

To collect the oxytocin levels, we took saliva samples from the participants directly from the mouth using Salivettes (Sarstedt, Rommersdolf, Germany). Six saliva samples were collected as follows: (1) baseline measurement, (2) anticipatory measurement of empathic induction, (3) post-empathic induction measurement, and (4) three measures during the recovery period (after 20, 40, and 60 min). The saliva samples were frozen at − 20 °C immediately after collection and kept in this state until analysis in the laboratory. Saliva samples were initially lyophilized (Modulyo Freeze Dryers, Thermo Electron Corporation) for approximately 15 h until they were dehydrated (Daughters et al., 2015). Following the manufacturer's instruction for centrifugation, the samples were centrifuged 5 min × 1000 g and then, from each saliva sample, 1 ml of supernatant was stored and frozen at − 40 °C. Then, these samples were reconstituted in 250 µl of assay buffer, which produced a concentration four times higher than the original. The result of this extraction procedure ensured that simple concentrations within the assay were above the assay sensitivity level and detectable on the linear portion of the standard curve (Carter et al., 2007). The sOXT levels were measured using the commercial Oxytocin EIA kit (Arbor Assays, Inc. Ann Arbor, MI; ref: K048). We followed the procedure described in previous studies from our laboratory (for a detailed description, see Bellosta-Batalla et al., 2020a, 2020b; Romero-Martínez et al., 2021) and others (Lebowitz et al., 2016; MacLean et al., 2018). Remarkably, sOXT has been observed to correlate better than pOXT with concentrations in the cerebrospinal fluid (Martin et al., 2018). Neuropeptide cross-reactivity was reported by Arbor assays as < 0.001% and the detection limit was 11 pg. / ml. Saliva samples were read at 450 nm, and all samples were tested in duplicate. Inter-trial and inter-trial CV averaged less than 10%.

2.5. Data analysis

After evaluating the normality of the data with the Shapiro-Wilk test ($p < .05$), the non-normal data were transformed based on a Nephemerian logarithm (logn). A Chi square was performed to compare socio-demographic data (marital status, education level, and annual income), with the "group" variable (IPV perpetrators and controls) as an inter-subject factor. Additionally, independent means comparison *t*-tests were performed, with the "group" variable as an inter-subject factor for anthropometric data, alcohol use, alexithymia, SAM scores, and baseline sOXT.

To analyze the possible change in sOXT levels, repeated-measures ANOVAs were performed with the variable "time" (baseline, anticipatory, post-empathic task, and recovery) as the intra-subject factor, and "group" as the inter-subject factor. Greenhouse-Geisser corrections for degrees of freedom were applied where appropriate. For significant results, partial eta-square was reported as a measure of effect size. Comparison *t*-tests were also performed for the magnitude of the sOXT levels, with "group" as an inter-subject factor. The magnitude of the sOXT levels was estimated for the empathic induction task by calculating the area under the curve with respect to the ground (AUCg), considering the baseline, anticipatory, post-empathic task, and recovery measures. The magnitude of sOXT change with respect to the baseline was estimated by calculating the area under the curve with respect to the increase (AUCi). For the calculation of the AUCg and the AUCi, we used formulas derived from the trapezoidal rule, with AUCg collecting the entire area and AUCi taking the baseline as the reference point (Pruessner et al., 2003).

To analyze the possible change in mood state, a repeated-measures ANOVA was used for repeated measurements with the variable "time" (pre- and post-empathic task and recovery) as the intra-subject factor and "group" as the inter-subject factor. Greenhouse-Geisser corrections for degrees of freedom were applied where appropriate. For significant results, partial eta-square was reported as a measure of effect size. Additionally, the change score was measured as the difference between the post-empathic induction task and baseline. Group differences were calculated by employing *t*-tests. Pearson's correlation coefficients were calculated to assess the relationships between the psychological variables (change score for the negative mood state response, emotional perception, and alexithymia) and sOXT AUCg and AUCi. Finally, a multiple linear regression model was constructed using the significant variables from Pearson's correlation as the independent variables and the magnitude of the sOXT levels (measured by AUCg) and/or the magnitude of the sOXT response (measured by AUCi) as the dependent variables.

Additionally, a comparison of means was performed by using a two-factor Analysis of Variance (ANOVA), with the variables "group" and "donation" (donors vs no donors) as fixed factors and the AUCg and AUCi as the dependent variables. The observed power and effect size were also estimated.

Data analyses were conducted using IBM SPSS Statistics for

Windows, Version 22.0 (Armonk, NY). Values of $p < .05$ were considered statistically significant. The average values are reported in the tables as mean ± SE.

3. Results

3.1. Participant characteristics

There were no significant differences between IPV perpetrators and controls in demographic variables, anthropometric characteristics, and/or alcohol consumption. Nevertheless, the former presented higher scores on alexithymia (see Table 2).

3.2. Emotional perception scores

With regard to the SAM scores, IPV perpetrators perceived the characters with a lower affective arousal ($t(42.8) = -2.11$, $p = .041$) and a more positive valence ($t(33.8) = 2.16$, $p = .038$) than controls.

3.3. sOXT response to the empathic laboratory task

After checking that there were no significant differences between groups in sOXT baseline levels ($t(52, 5) = 1.114$, $p = .258$), the analysis did not find a significant "time" effect ($F(5, 300) = 0.527$, $p = .756$, $\eta 2p = .009$) for the whole sample. Nevertheless, a significant "time x group" effect was found [$F(5, 300) = 2.242$, $p = .048$, $\eta 2p = .036$], with IPV perpetrators only showing lower levels of sOXT than controls 40 min after the post-empathic induction task (IPV perpetrators, $M = 4.42$, $SE = 0.91$; control group, $M = 4.90$, $SE = 0.55$; $t(46.8) = -2.48$, $p = .017$) (see Fig. 2).

Additionally, IPV perpetrators differed in the magnitude of the sOXT response (AUCi) compared to controls (IPV perpetrators, $M = -16.75$, $SE = 60.84$; control group, $M = 18.63$, $SE = 68.05$; $t(60) = -2.15$, $p = .035$), with IPV perpetrators presenting lower sOXT AUCi than controls. However, the two groups did not differ in the total magnitude of the sOXT levels (AUCg) (IPV perpetrators $M = 462.35$, $SE = 53.61$; control group, $M = 474.19$, $SE = 35.99$; $t(50.3) = -1.01$, $p = .315$).

Table 2
Means, standard deviations, percentages, and means comparisons for socio-demographic and psychological variables for all groups.

	IPV ($n = 30$)	Controls ($n = 32$)	*t*-test independent samples
Age (*M, SD*)	39.63 (10.27)	37.66 (13.37)	-0.99
BMI (*M, SD*)	26.40 (6.25)	25.38 (2.83)	- 1.58
Alcohol consumption (*M, SD*)	7.43 (8.40)	5.64 (4.25)	1.02
Alexithymia (*M, SD*)	40.83 (17.96)	29.34 (12.99)	2.87 * *
			Chi-Square
Prosocial Behavior (%)	23	19	.89
Donation	77	81	
No donation			
Marital status (%)	53	50	.70
Married	47	50	
Single/Divorced/Widowed			
Level of education (%)	3	0	4.68
No studies	40	28	
Primary	43	38	
Upper secondary/vocational training	14	34	
University			
Annual Income (%)	37	25	1.53
Low Income	53	56	
Medium Income	10	19	
High Income			

Note: IPV: Intimate Partner Violence; Statistical significance *$p < .05$, **$p < .01$

3.4. Mood state response to the empathic induction task

With regard to mood state, a significant "time" effect ($\varepsilon = 0.737$, $F(1.5, 87.7) = 12.990$, $p = .000$, $\eta^2_p = .178$) was found. Specifically, the mood state total score increased significantly from baseline to the post-empathic induction task ($M = 99.95$, $SE = 15.9$; $M = 106.11$, $SE = 16.5$, $t(61) = -3.455$, $p = .001$). Afterwards, the mood state total score decreased again from the post-empathic induction task levels to the 60' recovery period ($M = 106.11$, $SE = 16.5$; $M = 98.1$, $SE = 15.64$, $t(61) = -3.893$, $p = .000$). Furthermore, there was a significant "time × group" effect ($\varepsilon = 0.737$, $F(1.5, 87.7) = 7.159$, $p = .001$, $\eta^2_p = .107$), with IPV perpetrators showing low negative mood state after the empathic induction task compared to the control group ($M = 101.5$, $SE = 14.46$; $M = 110.4$, $SE = 17.36$, $t(61) = -2.179$, $p = .033$) (Fig. 3).

Regarding change scores (post-empathic induction task minus baseline), IPV perpetrators also differed in the mood state response to the empathic induction task compared to controls (IPV perpetrators, $M = 0.83$, $SE = 13.28$; control group, $M = 11.16$, $SE = 13.03$; $t(60) = -3.08$, $p = .003$), with IPV perpetrators presenting smaller changes in negative mood state than controls.

3.5. Relationships between the psychological variables and sOXT levels

With regard to the relationship between the psychological variables and sOXT, after controlling the group effect, partial correlation analysis showed that there were no significant correlations between the negative mood state response ($r = 0.073$, $p = .578$), the perceived character's affective valence ($r = -0.062$, $p = .635$), the perceived character's affective arousal ($r = 0.014$, $p = 914$), or the TAS-20 scores ($r = -0.076$, $p = .561$) and the sOXT AUCi levels. Nevertheless, the mood state response ($r = 0.289$, $p = .024$), the perceived character's affective arousal ($r = 0.278$, $p = .030$), and the TAS-20 total score ($r = -0.348$, $p = .006$) correlated significantly with the sOXT AUCg levels for the whole sample, but not with the perceived character's affective valence ($r = 0.079$, $p = .543$).

3.6. Predictive effects of the psychological variables on sOXT levels after the empathic laboratory task

We carried out a linear regression model with the negative mood state response (change score), the perceived character's affective arousal, and the total score on the TAS-20 as predictors of sOXT AUCg. As a result, the model predicted 21.9% of the sOXT AUCg after the empathic induction task (adj $R^2 = .219$, $F(3, 61) = 6.700$, $p = .001$). The association was significant for the negative mood state response ($\beta = 0.305$, $p = .010$) and alexithymia ($\beta = -0.369$, $p = .003$). Specifically, the higher the change in the negative mood state response and the lower the alexithymia traits, the higher the levels of sOXT. However, no significant association was found for perceived affective character arousal ($\beta = 0.134$, $p = .262$).

3.7. Prosocial behavior and response to the empathic laboratory task

Finally, despite not finding a significant main effect of "group" on the AUCg [$F(1, 62) = 0.590$, $p = .446$, $\eta^2_p = .010$] or "group × donation" [$F(1, 62) = 0.000$, $p = .992$, $\eta^2_p = .000$], we did find a significant main effect of "donation" on the AUCg of the sOXT levels [$F(1, 62) = 6.239$, $\eta^2_p = .015$, $n = 0.097$]. Thus, donors showed higher sOXT AUCg levels after the empathic induction task compared to non-donors (Donors, $M = 510.32$, $SE = 43.77$; and non-donors, $M = 463.97$, $SE = 43.57$; $t(60) = 2.475$, $p = .015$).

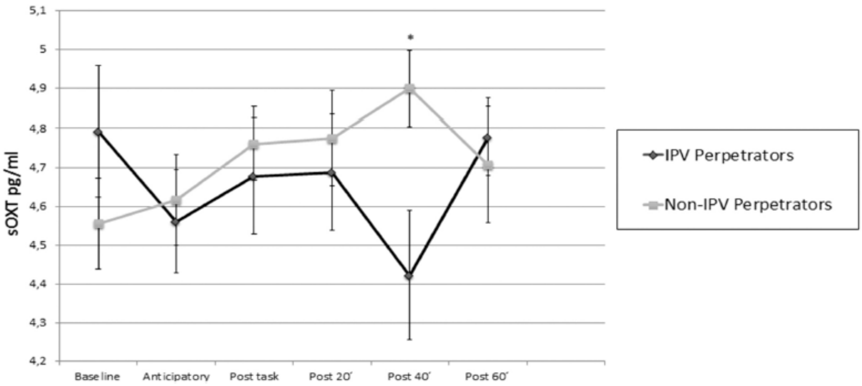

Fig. 2. sOXT response to the empathic induction task. ***Note:*** IPV: Intimate Partner Violence; Statistical significance $^*p < .05$, $^{**}p < .01$.

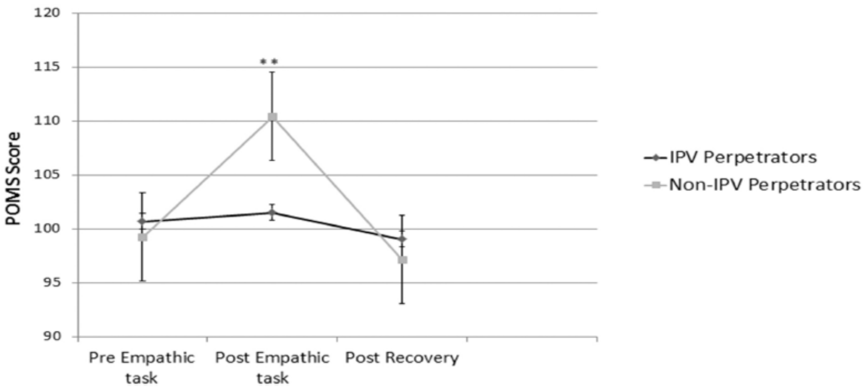

Fig. 3. Mood state response to the empathic induction task. ***Note:*** IPV: Intimate Partner Violence; Statistical significance $^*p < .05$, $^{**}p < .01$.

4. Discussion

4.1. Discussion of the main results

Our study revealed differences in the sOXT response of IPV perpetrators to an empathic induction task compared to a control group, showing lower sOXT levels specifically 40 min after the empathic induction task, with a decreasing tendency in their sOXT levels after the task (AUCi). IPV perpetrators also perceived others' emotions as more positive and less intense and exhibited no change in their mood state after the task. For the whole sample, we observed a positive relationship between the AUCg of sOXT levels and the mood state response and perceived affective arousal, and a negative relationship with alexithymia. Afterwards, the regression model showed that the mood state response and alexithymia also predicted the AUCg of sOXT levels for the whole sample. Finally, we did not observe any differences in performing prosocial behaviors between IPV perpetrators and controls. However, a univariate ANOVA indicated that a greater AUCg of sOXT levels was found after the empathic induction task in subjects who engaged in prosocial behavior.

The first main objective of this study was to analyze whether IPV perpetrators and controls differ on baseline sOXT levels and alexithymia traits. As we expected based on previous literature (Hurlemann and Grinevich, 2018; Romero-Martínez et al., 2019c, 2021), the groups did not differ on their baseline sOXT levels, but IPV perpetrators presented higher alexithymia than controls. It is also relevant to note that, contrary to our expectations, IPV perpetrators seemed to exhibit higher baseline sOXT levels than the control group, although the results were not statistically significant.

The second objective of this study was to analyze whether the sOXT response of IPV perpetrators to an empathic induction task differed from the response of the control group. Past research has related higher sOXT levels to enhanced social cognition, and evidence has been provided for an increase in sOXT following an empathic induction task in normative populations (Barraza and Zak, 2009; Procyshyn et al., 2020). However, difficulties with socio-affective functions and lower sOXT levels have been suggested in men with aggressive behaviors (Demirci et al., 2016; Levy et al., 2015). Thus, we expected an increase in sOXT levels throughout the sample in response to the task, but this increase would be attenuated in the case of IPV perpetrators. Contrary to our expectations, there was no response in any of the sOXT levels when we considered the entire sample. Nevertheless, we observed an increase in sOXT levels from the pre-task periods to 40 min after the task only in the control group, and we found lower sOXT levels 40 min after the task in IPV perpetrators compared to controls. Furthermore, we observed a decreasing trend in the AUCi from baseline to 60 min after the empathic induction task in IPV perpetrators, in contrast to the control group, which exhibited an increasing tendency.

Prior research has proposed that humans with aggressive behaviors differ from healthy young adults with respect to their sOXT system (Hurlemann and Grinevich, 2018). It has been hypothesized that reduced peripheral and central OXT levels (which may reflect a "hypo-oxytocinergic state") could be related to and even predict aggression due to difficulties in processing socio-affective information (Malik et al., 2012). Our results could suggest a lack of sOXT response after an empathic induction task in IPV perpetrators, given that the control group showed an increase, albeit subtle, in their sOXT levels 40 min after the task, with an increasing trend, whereas it was decreasing in IPV perpetrators. This peak value of sOXT after exposure to an empathic induction task seems congruent with previous studies in this field. In this regard, the use of different laboratory tasks (e.g., to running, sexual self-stimulation, breastfeeding, video-exposure, among others) in normative populations revealed a maximum peak in sOXT from 15 to 90 min after these tasks (de Jong et al., 2015; Ooishi et al., 2017; Procyshyn et al., 2020). However, another study pointed out an immediate change in pOXT levels after exposure to video content (Barraza and Zak, 2009). Moreover, Procyshyn et al. (2020) also found an immediate increase in sOXT after video exposure, and so further research is needed to clarify the variations in sOXT in response to specific tasks. Notably, IPV perpetrators showed higher basal sOXT levels. Indeed, a growing number of studies have indicated that high OXT levels may activate negative cognitions in individuals with an anxious attachment style (Bartz et al., 2010), a predominant attachment style in IPV perpetrators (Genest and Mathieu, 2014). In this regard, Levy et al. (2015) found that an anxious attachment style was more related to a fight or flight model, broadly related to aggression, rather than a "tend-and-befriend" model, an OXT-based model related to empathic responses in times of elevated distress (Taylor et al., 2000). Therefore, although these results should be viewed with caution, they do not run counter to the "hypo-oxytocinergic state hypothesis" in the violent population (Hurlemann and Grinevich, 2018). In fact, they may point to a possible hypo-oxytocinergic response to important socio-affective functions of social cognition, such as empathy, in this population.

Additionally, we sought to explore the participants' negative mood state response to the empathic induction task, as well as their capacity to perceive other people's emotions. IPV perpetrators have previously been linked to difficulties in emotional perspective taking and higher personal distress (Covell et al., 2007). Therefore, we expected them to exhibit a diminished affective and cognitive approach to the character's emotional state. Congruently, IPV perpetrators did not show any change in their mood state from pre-task to post-task mood state total scores, unlike the control group, which exhibited worse mood comparable to the character's emotional state. Furthermore, IPV perpetrators also rated the character's emotional state as less intense and with higher positive affect than the control group.

Past research has suggested that specific alterations in the ability to decode and experience emotions may make IPV perpetrators prone to domestic violence (Romero-Martínez et al., 2019c). In this regard, IPV perpetrators have been seen to exhibit a different pattern of emotional processing, displaying lower activation when they were required to experience emotions in situations of IPV (Marín-Morales et al., 2021). In line with these studies, our findings may reflect a poor affective approach to the characters' emotional states (Barraza and Zak, 2009), suggesting difficulties when responding to the feelings of others (Marín-Morales et al., 2021). Additionally, IPV perpetrators' ratings could indicate difficulties in cognitive processes, such as making inferences about others' emotional states, given that the subjects of the videos were people experiencing violence, and a particularly negative and intense perspective taking was expected. Together, these results appear to suggest difficulties with the perception of others' emotional states in the case of IPV perpetrators, as well as an impoverished mood state response to people undergoing negative emotions (Shamay-Tsoory, 2011), indicating potential empathic impairments in IPV perpetrators.

Regarding the third objective of this study, we proposed that the sOXT response would be related to the socio-affective variables (Procyshyn et al., 2020). Contrary to our expectations, the AUCi of the sOXT levels was unrelated to the mood state response, the perception of others' emotional state, or alexithymia. However, the AUCg of sOXT levels did correlate with a greater mood state response, with a more intense perception of the character's emotional state and lower alexithymia traits. These findings are of particular relevance because they suggest a relationship between higher sOXT levels and a greater understanding of one's own emotions, greater insight into the emotional state of others, and a more accurate emotional response to that emotional state, not only in IPV perpetrators. Furthermore, our results seem to indicate that these psychological variables could be more related to the total levels of sOXT rather than to changes in sOXT, highlighting the possibility of an OXT threshold that may favor socio-affective functions such as empathy. However, the literature on sOXT and its response to socio-affective functions is scarce (Hurlemann and Grinevich, 2018).

We also aimed to explore the predictive capabilities of these psychological variables in sOXT after the empathic induction task. Consistently, the mood state response and alexithymia predicted the AUCg of sOXT levels for the whole sample. As noted, alexithymia traits imply poorer emotional processing and response, and these two functions, in turn, have been shown to be necessary for empathy (Lyvers et al., 2018). Thus, it seems logical that an adequate emotional response and comprehension potentially explains lower sOXT levels after an empathic induction task, given its relevance in the salience of socio-affective information, and it suggests that the differences found in this study could be better understood based on the higher alexithymia scores reported in IPV perpetrators (Romero-Martínez et al., 2019a, 2019b, 2019c, 2019d, 2019e). Prior research provided evidence of a positive relationship between the mood state response and the changes experienced in peripheral pOXT (Barraza and Zak, 2009). Moreover, an inverse relationship between alexithymia and pOXT levels has been observed (Schmelkin et al., 2017). Therefore, our findings seem to be consistent with this literature, and they suggest that changes in the mood state and alexithymia may predict the levels of sOXT after an empathic induction task.

Finally, we investigated the difference in the performance of prosocial behavior between the IPV group and the control group, as well as the difference in sOXT levels after the empathic induction task between those who perform prosocial behavior and those who do not. We expected to find a greater sOXT response in the most prosocial subjects, regardless of whether they were IPV perpetrators or not (Marsh et al., 2015). As expected, IPV and controls showed similar prosocial behavior when making a donation. However, the participants who performed a prosocial behavior exhibited a greater AUCg of sOXT levels after the empathic laboratory task than those who did not, and no interaction effect between these two factors was found. Traditionally, violent behavior and prosocial behavior have been conceptualized as mutually exclusive (Marsh, 2019). However, this hypothesis is far from conclusive (Llorca-Mestre et al., 2017), and, currently, prosocial behavior has been related more to an effective functioning of empathy, whereas difficulties in empathy could be linked to violent behavior (Moya-Albiol, 2018; Romero-Martínez et al., 2019a, 2019b, 2019c, 2019d, 2019e). Hence, our results link the occurrence of prosocial behaviors to higher sOXT levels. This outcome may be relevant because sOXT levels have been related to understanding one's own emotions and to an appropriate emotional response to others' emotions, highlighting the importance of these variables in the occurrence of prosocial behavior.

4.2. Limitations and future research

To the best of our knowledge, this is the first study to focus on the sOXT response to a naturally induced empathic task in IPV perpetrators. Nonetheless, it has some limitations. First, a limitation of our study is the relatively small sample size. This limitation may be due to the difficulty of having access to the sample. Typically, men convicted of gender-based violence show strong initial resistance to the intervention, and this translates into a refusal to participate in the experimental phase (Santirso et al., 2020). A second limitation of our study may be the methodology used to elicit hormonal changes. Although recent studies have employed this empathic induction task to examine sOXT responses (Barraza and Zak, 2009; Procyshyn et al., 2020), some authors have indicated that empathic induction using social psychological methods could be characterized by higher ecological validity (Cabral et al., 2018). However, others have defended the efficacy of empathic induction tasks using emotional videos (Gilman et al., 2017). Moreover, it should be kept in mind that some authors have proposed that emotion recognition deficits in IPV perpetrators are limited to intimate partners (Marshall and Holtzworth-Munroe, 2010), whereas other studies revealed that IPV perpetrators presented a generalized emotion decoding ability impairment (Romero-Martínez et al., 2016b, 2019c). Therefore, these results are congruent or not with models such as the tend-and-befriend theoretical model or polyvagal theory. Another limitation could be the absence of a baseline measure of empathic abilities to assess their role when participants cope with this laboratory procedure (e.g., sOXT changes and/or levels). Finally, another limitation could be the fact that other relevant hormones for social cognition, such as testosterone and cortisol, were not taken into account (Procyshyn et al., 2020).

Further research is needed to elucidate the mechanisms that connect sOXT with socio-affective functions, encompassing not only the response to negative affect, but also to positive affect. In addition, it would be necessary to add measurements of sOXT after the prosocial laboratory task to provide more information about the possible differences between sOXT levels in individuals who exhibited prosocial behaviors and those who did not. Furthermore, it would be pertinent to explore the interaction of OXT with other hormones that are important for social cognition, such as testosterone and cortisol, because hormonal action is highly complex. Finally, extending the results of this study to other violent populations would increase the knowledge about the specific therapeutic needs of each of these populations. Therefore, given that difficulties in the socio-affective domain have been shown to be a convergent risk factor in IPV perpetrators, integrating the reinforcement of individual and contextual tools that enhance the correct functioning of empathy could increase the efficiency of intervention programs for men convicted of gender violence.

4.3. Conclusion

These results show, from the Biopsychosocial Model perspective, that IPV perpetrators may exhibit difficulties when responding to an empathic induction task. In addition, it appears that IPV perpetrators do not have an inability to perform prosocial behaviors, but risk factors such as an inadequate emotional response and poor emotional comprehension may hinder the empathic function (Moya-Albiol and Romero-Martínez, 2020). In sum, these results propose the existence of a bidirectional relationship between OXT and socio-affective functions, where OXT can change social behavior and, in turn, OXT levels can be changed in response to social stimuli. Thus, intervention programs, along the lines of the Good Lives model (Santirso et al., 2020), should focus not only on minimizing risk factors, but also on supporting protective factors (e.g., enhancing empathy), de-stigmatizing the violent population as incapable of being prosocial. In this regard, the analysis of sOXT seems pertinent for a holistic understanding of the empathic response; therefore, future research in this line seems relevant.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Anexo 2. Batería de películas para inducir emociones validada en población española.

Tabla 1

Batería final con las 57 escenas de películas con las 7 emociones: neutra, diversión, ternura, asco, ira, miedo y tristeza

Emoción	Film	Descripción	SAM Val	SAM Act	SAM Dom	CED Divers	CED Asco	CED Ira	CED Miedo	CED Ternura	CED Tristeza
Neutra	Sticks	Unas barras de colores van moviéndose por la pantalla	4,57	3,46	7,20	1,77	1,03	1,43	1,00	1,14	1,00
	Blue 2	Un hombre ordena papeles y una mujer camina por un jardín	4,85	3,31	7,08	1,23	1,00	1,08	1,23	1,38	1,46
	Blue (3)	Una mujer sube por unas escaleras mecánicas	4,92	2,69	7,92	1,31	1,00	1,00	1,23	1,38	1,00
	El amante	Marguerite sube a un coche, baja y camina hasta una casa	5,44	2,81	7,75	1,56	1,00	1,00	1,13	1,31	1,00
Diversión	Cuando Harry encontró a Sally	Sally simula un orgasmo en una cafetería	7,70	5,60	6,35	5,53	1,00	1,38	1,00	2,95	1,00
	Algo pasa con Mary 1	Ben Stiller lucha con un pequeño perro	6,94	4,38	6,56	5,27	1,27	1,53	1,20	2,93	1,67
	Benny y Joone	Benny juega en la barra de una cafetería	7,54	4,46	6,38	5,00	1,08	1,00	1,08	2,15	1,00
	Cena de idiotas	Compleja escena de humor	6,54	4,38	6,46	4,64	1,00	1,43	1,00	1,71	1,29
	Dos tontos muy tontos	Malentendidos entre los protagonistas y chicas en bikini	6,63	3,75	8,13	4,60	1,07	1,33	1,00	2,13	1,07
	Algo pasa con Mary 2	Mary confunde esperma con gomina para el pelo	6,43	4,57	6,36	4,57	2,86	1,07	1,00	1,64	1,00
	Los visitantes	Dos hombres vestidos al estilo medieval atacan un coche	6,33	4,27	7,07	4,27	1,00	1,27	1,27	1,20	1,20
	Un pez llamado Wanda	Un hombre desnudo es sorprendido	6,38	4,23	5,92	3,69	1,31	1,00	1,00	2,08	1,00
Ternura	Ghost	La escena del barro	7,64	5,64	5,00	4,07	1,07	1,43	1,07	6,00	1,71
	La vida es bella 4	Un padre traduce erróneamente el mensaje de un militar para no asustar al hijo	6,50	4,36	5,71	3,93	1,07	3,64	1,29	5,50	4,29
	La vida es bella 3	Una madre y su hijo se reúnen después de estar separados y sin esperanzas de verse nunca más	6,71	5,47	5,93	2,00	1,14	2,21	1,79	5,43	4,57
	La vida es bella 2	En un campo de concentración, un padre y su hijo hablan a su esposa por la megafonía	6,07	4,38	5,92	1,92	1,62	2,46	1,77	5,38	4,54
	Forrest Gump	Forrest se encuentra con su hijo, que no sabía que existía	6,75	3,88	5,81	1,81	1,00	1,13	1,00	5,19	3,06
	Cuando un hombre ama a una mujer	Una pareja habla románticamente en una piscina	6,31	3,69	7,08	1,85	1,00	1,08	1,15	5,00	2,62
	El club de los poetas muertos 2	Un grupo de alumnos se suben a los pupitres para manifestar su solidaridad con un profesor despedido	7,12	5,94	5,18	1,91	1,00	1,62	1,00	4,79	3,82
	E.T.	E.T. parece estar muriéndose	4,80	4,60	6,40	1,60	1,50	1,90	1,20	4,00	3,90

	León el profesional	León y Matilda se separan para siempre	3,36	6,18	5,91	1,27	1,18	3,36	3,45	3,55	4,27
Asco	Pink Flamingos	Una mujer se come los excrementos de un perro	2,17	4,50	4,92	2,00	6,33	1,67	1,08	1,00	1,75
	Trainspotting 2	Un chico rebusca en el interior de un water muy sucio	2,90	5,10	6,20	3,08	6,25	1,25	1,50	1,00	1,00
	Hellraiser	Un monstruo va creciendo desde el suelo	3,00	4,67	5,92	2,00	5,25	1,33	2,83	1,17	1,25
	Seven 3	La policía encuentra el cadáver de un hombre atado	2,80	4,50	6,40	2,44	5,22	2,11	3,89	1,00	3,22
	El dentista	Una mujer con la lengua cortada intenta advertir a un hombre de que está en peligro	2,00	5,67	7,08	1,00	4,42	1,58	2,75	1,00	2,00
	Amputación	Escena de cirugía real	1,64	5,18	5,09	1,00	4,05	1,18	1,73	1,09	1,27
	Salvar al soldado Ryan	Desembarco en la playa con soldados masacrados	2,15	5,92	6,00	1,17	3,67	2,75	3,33	1,00	3,50
	Silencio de los corderos 1	Examen forense de un cadáver	2,90	4,00	6,80	2,30	2,90	1,50	2,00	1,30	1,90

Nota: se muestran las puntuaciones en las diferentes subescalas de cada fragmento de película. Para la escala SAM: SAM-Val (Valencia afectiva), SAM-Act (Arousal o activación), SAM-Dom (Dominancia). Para el Cuestionario de Emociones Discretas (CED), las puntuaciones en las etiquetas más representativas de aquellas emociones básicas estudiadas: CED Diversión (CED Divers), CED Asco, CED Ira/Enojo, CED Miedo, CED Amor/ Ternura y CED Tristeza.

Tabla 2

Batería final con las 57 escenas de películas con las 7 emociones: neutra, diversión, ternura, asco, ira, miedo y tristeza

Emoción	Film	Descripción	SAM Val	SAM Act	SAM Dom	CED Divers	CED Asco	CED Ira	CED Miedo	CED Ternura	CED Tristeza
Ira	Lista de Schindler 2	El comandante de un campo de concentración dispara y mata desde su balcón a los prisioneros	1,55	5,73	5,18	1,18	3,91	5,36	2,91	1,36	5,18
	Sleepers	Abuso sexual de unos niños en un centro de menores	2,38	6,25	5,88	1,00	4,33	5,11	2,33	2,67	4,89
	American History X	Un neo-nazi mata a un hombre aplastando su cabeza	1,82	6,58	2,75	1,08	4,25	5,08	4,17	1,08	4,67
	En el nombre del padre	El protagonista es forzado a confesar bajo amenazas y violencia	3,00	6,75	3,83	1,00	1,92	4,75	2,25	1,75	4,25
	Leaving Las Vegas	Una prostituta es violada en un motel	1,73	5,64	5,91	1,27	2,55	4,73	2,00	1,73	4,45
	Cry Freedom	En una manifestación la policía mata a gente de color	2,00	6,80	4,70	1,00	2,40	4,20	3,10	2,20	5,60
	Lista de Schindler 3	Matanza de judíos en un ghetto	2,09	5,45	5,82	1,00	3,00	4,17	2,42	1,17	4,50
	Ocurrió cerca de su casa	El protagonista amenaza con un arma a una anciana para que muera del susto ya que sufre del corazón	2,00	5,30	5,30	1,55	3,55	4,00	2,64	2,18	3,55
	El Piano	Le cortan la mano a la pianista con un hacha	2,36	6,09	6,18	1,17	3,25	3,67	2,83	1,92	4,17
	Seven 1	Al final de la película, Kevin Spacey le dice a Brad Pitt que ha decapitado a su mujer embarazada	4,10	5,80	6,40	1,90	1,60	2,40	2, 40	1,30	1,70

Miedo	Scream 2	Persecución en un instituto	3,88	6,63	3,88	2,50	1,38	2,25	4,63	1,25	1,50
	El proyecto de la bruja de Blair	Escena final en la que los protagonistas aparentemente mueren	2,89	7,22	5,00	1,33	1,00	1,33	4,56	1,00	1,44
	El exorcista	Un sacerdote intenta curar a una niña poseída por el diablo	1,89	6,67	4,89	1,11	4,00	2,33	4,11	1,00	2,44
	Silencio de los corderos 2	La protagonista baja a un sótano en persecución del sospechoso	3,82	6,45	5,00	1,73	2,09	2,09	3,82	1,00	2,00
	Seven 2	La policía encuentra un hombre torturado en una cama	2,56	4,89	5,67	1,78	5,22	1,89	3,67	1,00	2,89
	El resplandor	Un niño va por un pasillo y entra en una habitación	4,42	5,08	5,67	1,08	1,00	1,08	3,58	1,42	1,25
	Misery	Annie (Kathy Bates) le rompe los tobillos a Paul	2,08	6,83	4,58	1,08	2,83	3,00	3,50	1,00	2,58
	Copycat	Un policía es atrapado por el asesino en un baño público	3,20	5,70	4,50	1,60	1,90	2,20	3,00	1,20	2,60
Tristeza	City of angels	Maggie (Meg Ryan) muere en los brazos de Seth (Nicolas Cage)	3,75	4,63	6,38	1,50	1,13	3,38	1,50	5,38	5,63
	Lista de Schindler 1	Cadáveres son trasladados en un campo de concentración	2,11	6,67	4,33	1,50	2,78	5,56	3,00	2,22	5,56
	Campeón	Muerte del boxeador delante de su hijo pequeño	3,08	4,92	6,15	1,15	1,62	1,69	1,77	4,08	5,46
	Mentes peligrosas	La profesora dice a sus alumnos que un compañero ha muerto	4,08	4,92	5,67	1,17	1,00	2,83	1,33	2,58	5,25
	Mundo perfecto	Butch (Kevin Costner) es abatido a tiros al final de la película.	3,91	6,00	4,55	1,55	1,73	4,27	1,18	4,55	5,09
	La vida es bella 1	Muerte del protagonista (Roberto Benigni)	3,88	5,13	6,75	1,38	1,75	3,50	2,63	3,88	4,88
	Philadelphia	Los protagonistas escuchan ópera en el salón y uno de ellos describe el dolor y la pasión que expresa la obra	5,09	4,55	5,73	1,45	1,00	1,18	1,36	3,73	4,73
	La vida soñada de los ángeles	Una de las protagonistas se suicida lanzándose desde un balcón	2,80	5,20	5,80	1,10	1,00	2,50	2,10	2,60	4,60
	Pena de muerte	El protagonista es ejecutado mediante una inyección letal	2,50	6,40	3,50	1,00	3,20	4,90	2,30	1,50	4,30
	El club de los poetas muertos 1	Un adolescente se suicida	3,44	5,22	6,44	1,30	1,10	1,80	2,60	1,90	3,70

Nota: se muestran las puntuaciones en las diferentes subescalas de cada fragmento de película. Para la escala SAM: SAM-Val (Valencia afectiva), SAM-Act (Arousal o activación), SAM-Dom (Dominancia). Para el Cuestionario de Emociones Discretas (CED), las puntuaciones en las etiquetas más representativas de aquellas emociones básicas estudiadas: CED Diversión (CED Divers), CED Asco, CED Ira/Enojo, CED Miedo, CED Amor/ Ternura y CED Tristeza.

Extraído de Fernández-Megías et al. (2011).

Anexo 3. Listado de ONGs incluidas en el protocolo de evaluación de la conducta prosocial.

Accionatura

Asociación Española Contra el Cáncer (AECC)

aecc
Contra el Cáncer

NUESTRA MISIÓN

Trabajamos unidos para educar en salud, apoyar y acompañar a las personas enfermas y sus familias, y financiar proyectos de investigación que permitirán un mejor diagnóstico y tratamiento del cáncer.

En Acciónatura trabajamos en proyectos de recuperación y conservación de la biodiversidad en diversos ámbitos, impulsamos la creación de una red de espacios naturales protegidos a través de la compra y alquiler de fincas, o de acuerdos de custodia, y desarrollamos iniciativas de sensibilización. Hacemos que la conservación de los valores naturales sea compatible con su uso público y su aprovechamiento educativo, y promovemos el ecoturismo como instrumento para el desarrollo.

QUIÉNES SOMOS

Somos una organización sin ánimo de lucro formada por pacientes, familiares, voluntarios, colaboradores y profesionales. Desarrollamos nuestra actividad en toda España.

QUÉ HACEMOS

Lideramos el esfuerzo de la sociedad española para disminuir el impacto causado por el cáncer y mejorar la vida de las personas.

EDUCAMOS EN SALUD | APOYAMOS Y ACOMPAÑAMOS | FOMENTAMOS LA INVESTIGACIÓN

VER LÍNEAS DE ACTUACIÓN >

Cáritas española

Acción social

Fundamentamos nuestra acción en la acogida y acompañamiento a las personas vulnerables y excluidas.

Promovemos el empoderamiento de las personas para que defiendan sus derechos humanos en los tres ámbitos del desarrollo integral: necesidades básicas, sentido de la vida y participación social.

Cooperación internacional

Cáritas reafirma la Dimensión Universal de la Caridad que no conoce fronteras y llega a las personas más empobrecidas del planeta, siempre a través de las iglesias locales y las Cáritas hermanas con las que trabajamos.

Greenpeace

Somos una organización ecologista y pacifista internacional, económica y políticamente independiente, que no acepta donaciones ni presiones de gobiernos, partidos políticos o empresas.

Greenpeace utiliza la acción directa no violenta para atraer la atención pública hacia los problemas globales del medio ambiente e impulsar las soluciones necesarias para tener un futuro verde y en paz.

55 países

Greenpeace está presente en 55 países de Europa, América, Asia, África y el Pacífico.

+115.000

Socios/as en España.

3,2 millones

De socios/as en todo el mundo.

Trabajamos para

- Detener el cambio climático.
- Proteger la biodiversidad en todas sus formas.
- Prevenir la contaminación y el abuso de los océanos, las tierras, el aire y el agua dulce.
- Promover la paz, el desarme mundial y la no violencia.

Greenpeace es una organización medioambiental global que consta de Greenpeace Internacional y de oficinas nacionales y regionales en 55 países. Estas oficinas realizan de manera independiente las estrategias globales de campaña dentro de su contexto local y buscan el apoyo financiero necesario de socios/as y donantes para financiar este trabajo.

Para asegurar una adecuada coordinación, existe una oficina internacional en Ámsterdam que trabaja en estrecha colaboración con las 55 oficinas nacionales y con los barcos, parte fundamental de la organización.

Dentro de la estructura de Greenpeace se ha establecido un mecanismo de toma de decisiones en el que tienen participación distintos sectores de la organización, lo que permite tomar decisiones consensuadas y rápidas, y evitar que ninguna persona o sector de Greenpeace pueda tomar decisiones unilaterales que no estén avaladas por la mayoría de la organización.

UNICEF

unicef

for every child

unicef

Somos apasionados

En UNICEF trabajamos para que todos los niños del mundo puedan disfrutar de ser niños sin preocuparse de nada más. En más de 190 países, defendemos los derechos de la infancia por encima de todo, con pasión, dedicación y rigor.

Somos lo que hacemos

Salud

Que todos los niños crezcan sanos para disfrutar de todos sus derechos

Educación

Que todos los niños puedan estudiar para mejorar su futuro

Protección

Que ningún niño sufra ningún tipo de abuso o explotación

Somos globales, somos locales

Trabajadores, voluntarios, socios y donantes contribuimos, desde el **Comité Español de UNICEF**, al trabajo de la organización en todo el mundo.

Queremos **mejorar la vida de los niños y niñas** fuera y dentro de nuestras fronteras, donde también trabajamos para que se cumplan todos sus derechos.

Nos sostiene y empuja la solidaridad de la sociedad española con la causa de la infancia y estamos convencidos de que, todos juntos, tenemos la fuerza necesaria para **cambiar la vida de miles, millones de niños**.

World Wide Fund España (WWF)

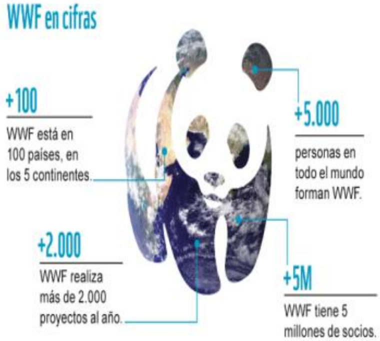
Somos la mayor organización para defender nuestro planeta

WWF España forma parte de la red de WWF, la mayor organización internacional **independiente** dedicada a la **defensa de la naturaleza y el medio ambiente.**

Fundada en 1961, hoy trabajamos en más de 100 países y contamos con el apoyo de cerca de **5 millones de miembros en todo el mundo.**

Nuestra misión es conservar la naturaleza, sus hábitats y especies, y luchar contra las amenazas sobre la vida en la Tierra.

Para alcanzar nuestra misión, trabajamos con todas nuestras fuerzas, **pasión y creatividad**, en defensa de la naturaleza y las personas.



Anexo 4. Profile of Mood States (POMS).

POMS

Indique cómo se siente en este momento, utilizando la siguiente escala

Nada	Un poco	Moderadamente	Bastante	Muchísimo
0	1	2	3	4

1. Intranquilo	0 1 2 3 4
2. Enérgico	0 1 2 3 4
3. Desamparado	0 1 2 3 4
4. Furioso	0 1 2 3 4
5. Sin fuerzas	0 1 2 3 4
6. Deprimido	0 1 2 3 4
7. Lleno de energía	0 1 2 3 4
8. Inquieto	0 1 2 3 4
9. Molesto	0 1 2 3 4
10. Agotado	0 1 2 3 4
11. Agitado	0 1 2 3 4
12. Luchador	0 1 2 3 4
13. Desdichado	0 1 2 3 4
14. Irritable	0 1 2 3 4
15. Cansado	0 1 2 3 4
16. Amargado	0 1 2 3 4
17. Animado	0 1 2 3 4
18. Nervioso	0 1 2 3 4
19. Enfadado	0 1 2 3 4
20. Exhausto	0 1 2 3 4
21. Tenso	0 1 2 3 4
22. Vigoroso	0 1 2 3 4
23. Triste	0 1 2 3 4
24. Enojado	0 1 2 3 4
25. Fatigado	0 1 2 3 4
26. Infeliz	0 1 2 3 4
27. Activo	0 1 2 3 4
28. Relajado	0 1 2 3 4
29. De mal genio	0 1 2 3 4

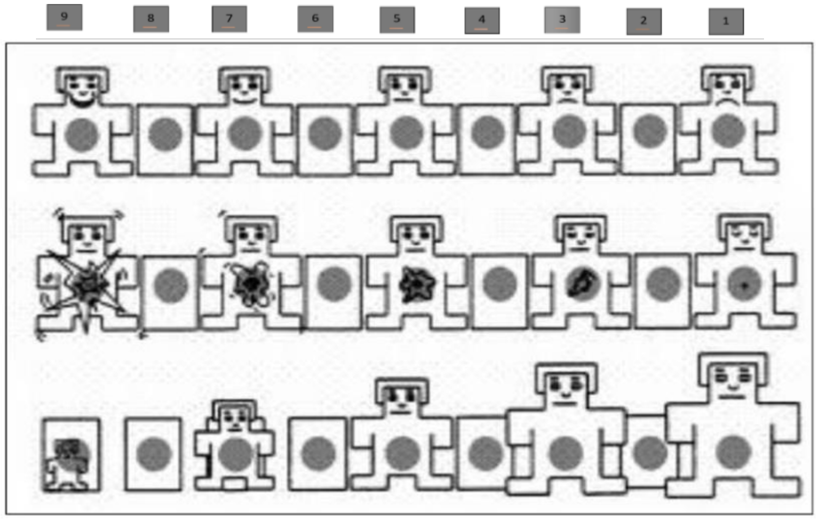
Extraído de Fuentes et al. (1995).

Anexo 5. Self-Assessment Manikins (SAM).

Video 1: Lo que ha sentido la protagonista

Descripción: Mujer rubia vestida de negro

RODEA CON UN CÍRCULO TU RESPUESTA



Emoción Negativa
Emoción Positiva

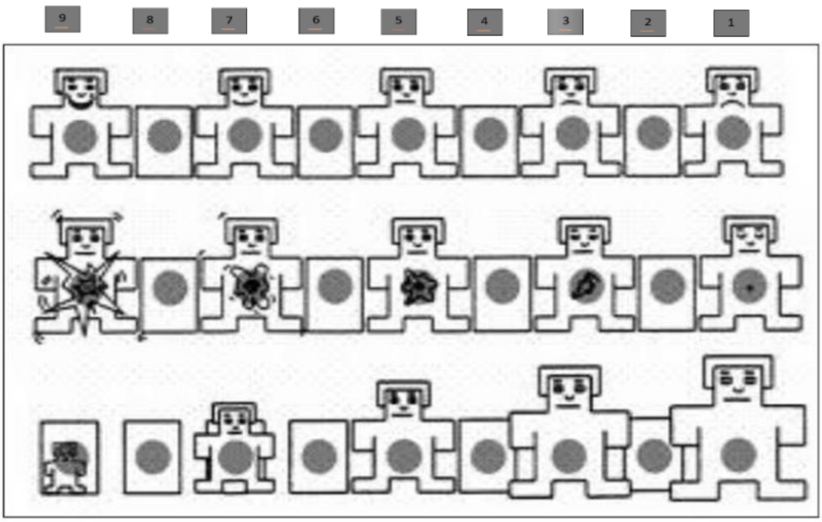
Intensidad de
la Emoción

Control sobre
la Emoción

Video 2: Lo que ha sentido la protagonista

Descripción: Mujer morena

RODEA CON UN CÍRCULO TU RESPUESTA



Emoción Negativa
Emoción Positiva

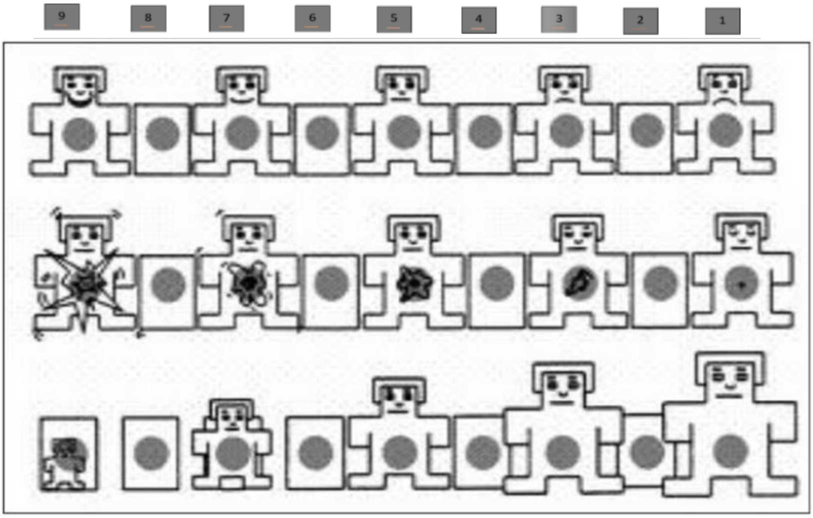
Intensidad de
la Emoción

Control sobre
la Emoción

Video 3: Lo que han sentido los protagonistas

Descripción: Judíos del campo de concentración

RODEA CON UN CÍRCULO TU RESPUESTA



Emoción Negativa
Emoción Positiva

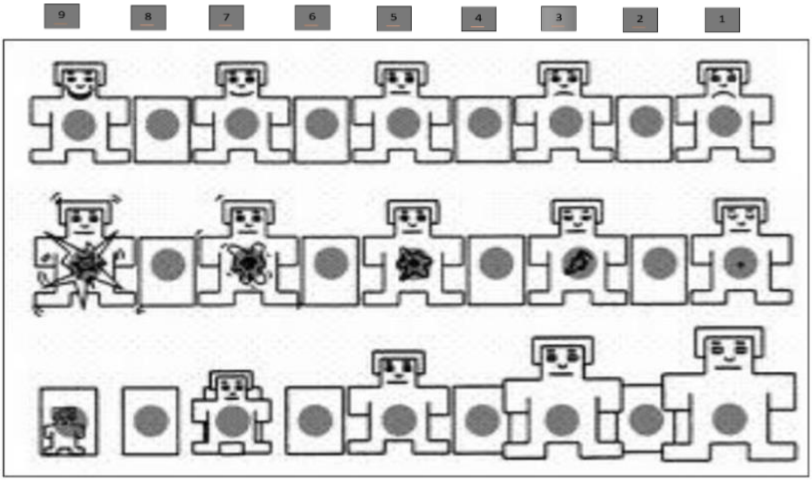
Intensidad de
la Emoción

Control sobre
la Emoción

Video 4: Lo que ha sentido el protagonista

Descripción: Hombre negro al que agreden

RODEA CON UN CÍRCULO TU RESPUESTA



Emoción Negativa
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la Emoción

Adaptado de Bradley & Lang, (1994).

Anexo 6. Toronto Alexithymia Scale (TAS-20)

Te agradeceríamos respondieras a una serie de cuestiones respecto a cómo te sientes. Elige la opción que consideres correcta o se acerque más a lo que piensas al respecto.

1 Muy en desacuerdo	**2 En desacuerdo**	**3 Ligeramente en desacuerdo**	**4 Ligeramente de acuerdo**	**5 De acuerdo**	**6 Muy de acuerdo**

AL1.	A menudo estoy confundido con las emociones que estoy sintiendo.	1	2	3	4	5	6
AL2.	Me es difícil encontrar las palabras correctas para expresar mis sentimientos.	1	2	3	4	5	6
AL3.	Tengo sensaciones físicas que incluso ni los doctores entienden.	1	2	3	4	5	6
AL4.	Soy capaz de expresar mis sentimientos fácilmente.	1	2	3	4	5	6
AL5.	Prefiero pensar bien acerca de un problema en lugar de solo mencionarlo	1	2	3	4	5	6
AL6.	Cuando me siento mal no sé si estoy triste, asustado o enojado.	1	2	3	4	5	6
AL7.	A menudo estoy confundido con lo que siento en mi cuerpo.	1	2	3	4	5	6
AL8.	Prefiero dejar que las cosas pasen solas, sin preguntarme por qué suceden así.	1	2	3	4	5	6
AL9.	Tengo sentimientos que casi no puedo identificar.	1	2	3	4	5	6
AL10	Estar en contacto con las emociones es muy importante.	1	2	3	4	5	6
AL11	Me es difícil expresar lo que siento acerca de las personas.	1	2	3	4	5	6
AL12	La gente me dice que exprese más mis sentimientos.	1	2	3	4	5	6
AL13	No sé qué pasa dentro de mí.	1	2	3	4	5	6
AL14	A menudo no sé por qué estoy enojado.	1	2	3	4	5	6
AL15	Prefiero hablar con la gente de sus actividades diarias mejor que de sus sentimientos.	1	2	3	4	5	6
AL16	Prefiero ver programas de TV simples pero entretenidos, que programas difíciles de entender	1	2	3	4	5	6

AL17	Me es difícil expresar mis sentimientos más profundos incluso a mis mejores amigos	1	2	3	4	5	6
AL18	Puedo sentirme cercano a alguien, incluso en momentos de silencio.	1	2	3	4	5	6
AL19	Encuentro útil examinar mis sentimientos para resolver problemas personales.	1	2	3	4	5	6
AL20	Analizar y buscar significados profundos a películas, espectáculos o entretenimientos, disminuye el placer de disfrutarlos.	1	2	3	4	5	6

Extraído de Bagby et al. (1994).

Anexo 7. Alcohol Use Disorder Identification Test (AUDIT)

1.	¿Con qué frecuencia consumes bebidas alcohólicas?	Nunca (0) Una o menos veces al mes (1) 2 a 4 veces al mes (2) 2 o 3 veces a la semana (3) 4 o más veces a la semana (4)
2.	¿Cuántas bebidas alcohólicas consumes normalmente cuando bebes?	1 o 2 (0) 3 o 4 (1) 5 o 6 (2) 7 a 9 (3) 10 o más (4)
3.	¿Con qué frecuencia te tomas 6 o más bebidas alcohólicas en un solo día?	1 o 2 (0) 3 o 4 (1) 5 o 6 (2) 7 a 9 (3) 10 o más (4)
4	¿Con qué frecuencia, en el curso del último año, has sido incapaz de parar de beber una vez que habías empezado?	Nunca (0) Menos de una vez al mes (1) Mensualmente (2) Semanalmente (3) A diario o casi a diario (4)
5	¿Con qué frecuencia, en el curso del último año, no pudiste atender tus obligaciones porque habías bebido?	Nunca (0) Menos de una vez al mes (1) Mensualmente (2) Semanalmente (3) A diario o casi a diario (4)
6	¿Con qué frecuencia, en el curso del último año, has necesitado beber en ayunas para recuperarte después de haber bebido mucho el día anterior?	Nunca (0) Menos de una vez al mes (1) Mensualmente (2) Semanalmente (3) A diario o casi a diario (4)
7	¿Con qué frecuencia, en el curso del último año, has tenido remordimientos o sentimientos de culpa después de haber bebido?	Nunca (0) Menos de una vez al mes (1) Mensualmente (2) Semanalmente (3) A diario o casi a diario (4)
8	¿Con qué frecuencia, en el curso del último año, no has podido recordar lo que sucedió la noche anterior porque habías estado bebiendo?	Nunca (0) Menos de una vez al mes (1) Mensualmente (2) Semanalmente (3) A diario o casi a diario (4)

9	Tú o alguna otra persona, ¿habéis resultado heridos porque habías bebido?	Nunca (0) Menos de una vez al mes (1) Mensualmente (2) Semanalmente (3) A diario o casi a diario (4)
10	¿Algún familiar, amigo, médico o profesional sanitario han mostrado preocupación por tu consumo de alcohol, o te han sugerido que dejes de beber?	No (0) Sí, pero no en el último año (2) Sí, en el último año (4)

Extraído de Guillamón et al. (1999).

Anexo 8. Recogida de hormonas en saliva. Ejemplo: Cortisol

Salivette® Cortisol

Instrucciones de uso

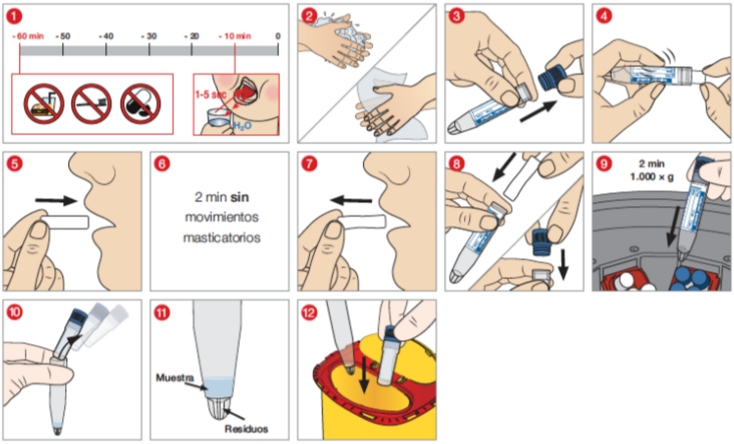
Debido a su gran importancia clínica, el cortisol es uno de los analitos más importantes que se pueden determinar en saliva.

La **Salivette® Cortisol** (ref. 51.1534.500) está especialmente desarrollada para la determinación de cortisol en saliva.

La **Salivette® Cortisol** se distingue de las demás versiones gracias a su **tapón azul**. La etiqueta adherida permite anotar los datos del paciente y la hora de obtención. Está demostrado que con la Salivette® Cortisol, la tasa de recuperación es cercana al 100 %, independientemente de la concentración de cortisol, del volumen de saliva o del método de medición utilizado. Además, la torunda de fibra sintética, **biocompatible**, y de dimensiones estables, destaca por una excelente capacidad de absorción y una liberación de saliva prácticamente completa en las condiciones de centrifugado recomendadas.

Es un requisito importante una alta tasa de recuperación de saliva tras el centrifugado para poder analizar de forma fiable, incluso pequeñas cantidades de saliva. Para la determinación de cortisol, se necesitan aproximadamente 50 µl de saliva.

Instrucciones de uso de la Salivette® Cortisol



- La toma de la muestra de saliva debe realizarse como **mínimo 60 minutos después del cepillado de los dientes, una comida (ingesta de alimentos líquidos / sólidos), la toma oral de medicamentos y 10 minutos** después de enjuagar la boca con **agua para evitar la contaminación de la saliva por sustancias interferentes.**
- La torunda absorbente debe **permanecer en la boca (p. ej., en el vestíbulo bucal) durante 2 minutos sin que se realicen movimientos masticatorios.** La cantidad mínima de saliva a obtener será de 500 µl. En caso de una formación de saliva extremadamente baja, se dejará la torunda en la boca durante más tiempo.

Muestra de saliva: El tiempo y la temperatura de almacenamiento dependen de la vida útil de los parámetros a investigar. Por lo tanto, y debido al crecimiento bacteriano en la saliva que comienza después de unas horas a Ta, se recomienda centrifugar y analizar la Salivette® en las 4 horas siguientes a la toma de la muestra o almacenarla directamente en la nevera hasta su posterior procesamiento.

⚠ **El producto no debe utilizarse en niños menores de 3 años ni en pacientes con mayor riesgo de deglución.**

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SARSTEDT S.A.U. · Camí de Can Grau, 24 · Pol. Ind. Valldoriolf · 08430 La Roca del Vallès · Tel: +34 93 846 4103 · Fax: +34 93 846 3978

Anexo 9. Publicación estudio 2.

International Journal of *Environmental Research and Public Health*

MDPI

Article

Hormonal Profile in Response to an Empathic Induction Task in Perpetrators of Intimate Partner Violence: Oxytocin/Testosterone Ratio and Social Cognition

Javier Comes-Fayos [1], Ángel Romero-Martínez [1], Isabel Rodríguez Moreno [1], María Carmen Blanco-Gandía [2], Marta Rodríguez-Arias [1], Marisol Lila [3], Concepción Blasco-Ros [1], Sara Bressanutti [1] and Luis Moya-Albiol [2,*]

1 Department of Psychobiology, University of Valencia, 46010 Valencia, Spain; javier.comes@uv.es (J.C.-F.); angel.romero@uv.es (Á.R.-M.); isabel.rodriguez-moreno@uv.es (I.R.M.); marta.rodriguez@uv.es (M.R.-A.); concepcion.blasco@uv.es (C.B.-R.); sarabressanutti@gmail.com (S.B.)

2 Department of Psychology and Sociology, University of Zaragoza, 50009 Zaragoza, Spain; mcblancogandia@unizar.es

3 Department of Social Psychology, University of Valencia, 46010 Valencia, Spain; marisol.lila@uv.es

* Correspondence: luis.moya@uv.es

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Abstract: Empathy deficits have been proposed to be an important factor for intimate partner violence (IPV). IPV perpetrators have shown a differential change in salivary oxytocin (sOXT), testosterone (sT), and cortisol (sC), following empathic and stress tasks, compared to non-violent men. However, the influence of empathic deficits in those hormones after an emotion-induction task in IPV perpetrators remains unclear. We analyzed the effects of an empathic induction task on endogenous sOXT, sT and sC levels, as well as their hormonal ratios, in IPV perpetrators (n = 12), and compared them to controls (n = 12). Additionally, we explored the predictive capacity of empathy-related functions (measured with the interpersonal reactivity index) in the hormonal responses to the task. IPV perpetrators presented lower sOXT changes and higher total sT levels than controls after the task, lower sOXT/T change and total sOXT/T levels, as well as higher total sT/C levels. Notably, for all participants, the lower the perspective taking score, the lower the total sOXT levels and sOXT changes and the higher the sT changes were. Low perspective taking also predicted smaller sOXT/T and sOXT/C changes in the empathic induction task, and higher total sT/C levels for all participants. Therefore, our results could contribute to furthering our ability to focus on new therapeutic targets, increasing the effectiveness of intervention programs and helping to reduce IPV recidivism in the medium term.

Keywords: emotion induction; empathy; oxytocin; perspective taking; oxytocin–testosterone ratio; testosterone–cortisol ratio

1. Introduction

According to the World Health Organization [1], intimate partner violence (IPV) is a major public health challenge worldwide, encompassing a wide variety of violent behaviors and resulting in significant economic, social, and human costs. To prevent IPV, a growing number of studies have focused on the profile of IPV perpetrators, identifying various characteristics, such as anger management difficulties, impulsivity, sexism, substance abuse, childhood trauma, or lack of community support, as particularly relevant with regards to the severity and recidivism of IPV [2–4]. However, the need to approach IPV from a multidimensional biopsychosocial framework has been highlighted, bringing together the psychosocial factors of IPV with biological markers that provide data that are less susceptible to bias and manipulation than self-reported questionnaires [5–9].

Difficulties in empathy, defined as the ability to understand and share another person's emotional experience, seemed to play a key role in the maladaptive behavioral regulation of IPV perpetrators [10,11]. Indeed, impaired empathy has been linked to the occurrence of violent behaviors [12,13], including IPV perpetration [14,15]. Specifically, difficulties in understanding the thoughts and feelings of the partner could predispose someone to IPV by promoting affective distress when dealing with emotional conflicts [16–19]. Furthermore, the comparison of IPV perpetrators with controls revealed that the former tends to present lower scores in perspective taking (ability to adopt the psychological point of view of others) and empathic concern (emotional response of compassion to the suffering of others) and show higher personal distress (discomfort in reacting to the emotions of others) [20,21].

Nevertheless, the importance of using natural approaches in conjunction with self-report questionnaires has been emphasized when dealing with a complex construct, such as empathy [22,23]. Yet, in many cases, it is difficult to control empathy in its natural setting without altering the variables of the target situation. In this regard, emotion induction tasks help to evoke the required affective experience in an experimental situation through various methods (e.g., images, sounds, or both, among others) [24,25]. In fact, these methods can be centered on one's own or another's affective state, enabling in situ characterization of empathy and gaining access to the natural study of other variables of interest, such as associated hormone levels [26].

Changes in oxytocin (OXT), testosterone (T) and cortisol (C) endogenous levels could affect functions important for empathy, including socioaffective information processing, social affiliation, or stress management [27–30]. Accordingly, increases in endogenous OXT levels, both in plasma (pOXT) and saliva (sOXT), have been observed in a normative population following an empathic induction task performed through watching an emotion-provoking video [24,25]. In particular, Barraza and Zak [24] found that self-reported affective empathy predicted an increase in pOXT levels following the empathic induction task, whereas personal distress predicted a decrease in pOXT levels. Meanwhile, Procyshyn et al. [25] found that increased sOXT, following the same empathic induction task, was related to improved perspective taking. In IPV perpetrators, a study concluded that IPV perpetrators presented lower sOXT levels than controls at a specific moment after an empathic induction task [26]. Thus, these results posit a positive relationship between OXT and socioaffective functions that facilitate empathy and suggest that the relationship between OXT and IPV could be mediated by difficulties in these functions.

Regarding T, Chen et al. [31] found that baseline plasmatic T (pT) levels were negatively correlated with empathic concern and perspective-taking in a non-forensic population. Moreover, decreases in salivary T (sT) levels were observed in college students following an empathic induction task [25]. Baseline sT levels have also been negatively related to the ability to infer the thoughts and feelings of others in a role-playing paradigm [32]. Consistently, Romero-Martínez et al. [20,33] obtained that high baseline sT levels were associated with worse facial emotion recognition in IPV perpetrators. All of this, taken together, suggests that T could be an important modulator of violent behavior through its buffering effects on the processing of socioaffective information.

In relation to C, it seems that C maintains a negative association with empathic-related variables, concretely, with emotion decoding abilities. Accordingly, endogenous C rises after hydrocortisone administration reduces the ability to correctly decode emotional facial expressions [21]. Regarding IPV, there is a gap in the scientific literature for assessing whether emotion induction tasks modified the C response in IPV perpetrators. In fact, only two studies have assessed their response to acute laboratory stressors [20,30]. In this sense, they concluded that IPV perpetrators showed a lower sC response than controls after being submitted to an acute laboratory stressor, failing to find significant associations between empathic variables and sC levels in them [20].

To fully understand a phenomenon as complex as empathy or violence proneness, the interrelationships between the above-mentioned hormones should be incorporated. Accordingly, studies have shown facilitative effects of OXT and damping effects of T on the same cognitive and behavioral phenotypes. Specifically, comparable diametrical effects have been observed in empathy-relevant tasks, such as emotional recognition, theory of mind or self-reported empathy [27]. On the other hand, although C is the main stress hormone, OXT also responds under stressful situations [34]. Evidence has been provided that intranasal administration of OXT decreases sC during an interpersonal challenge [35,36], resulting in lower social stress, which has been linked to enhanced empathic function. Nevertheless, a meta-analysis concluded that the relationship between the endogenous levels of both hormones tends to be positive but small [37]. Conversely, the administration of OXT, T and C on facial emotion recognition has been analyzed, concluding that emotional accuracy seemed to improve after increasing OXT, but decreased when T and/or C increased [21].

Regarding T and C interaction, a higher sT/C ratio was predictive of lower empathy scores in healthy young adults [38]. Furthermore, higher sT/C ratios have been associated with aggression rates within heterosexual couples [39]. In fact, it seems that IPV perpetrators tend to present higher sT/C ratios than controls in response to acute laboratory stressors [20,30]. These results are consistent with the dual hormone hypothesis, which suggests that T is positively associated with aggression and negatively with empathy, particularly in individuals with low C levels [40]. Unfortunately, there is a gap in the scientific literature for assessing the interaction between the three above-mentioned hormones in IPV perpetrators, specifically in response to emotion induction tasks.

Consequently, the present study pursues three major objectives. We first aim to compare self-reported empathy in IPV perpetrators and controls. Based on that stated in this field of research [10,11], we expect to find worse perspective taking and lower empathic concern, as well as higher personal distress, in IPV perpetrators compared to the control group [20].

Second, we intend to analyze differences in endogenous sOXT, sT, and sC levels, as well as the quotient between levels of the above-mentioned hormones (hormonal ratios), of a group of IPV perpetrators compared to controls following an empathic induction task. As stated before in this field of research [25–27,36,41], we hypothesize that IPV perpetrators will display lower levels of sOXT and sC and higher levels of sT after the empathic induction task compared to the control group. Furthermore, IPV perpetrators will also show lower sOXT/T and sOXT/C ratios and higher sT/C ratios in response to this task than controls.

Finally, we also aim to explore whether the empathic abilities of each group explain their hormone levels following the empathic induction task. Due to the relationship between these hormones and empathy [21,27,38,42], we hypothesize that perspective-taking and empathic concern scores would especially predict the IPV perpetrators' hormonal levels in response to this task. Accordingly, the lower the empathic abilities of IPV perpetrators, the lower the sOXT response and the higher the sT/C ratio.

2. Materials and Methods

2.1. Participants

From an initial total sample of 25 participants, one IPV perpetrator was excluded from the study because his hormonal levels exceeded the standard deviation of the total sample by 2.5 or more. Hence, the total sample consisted of 24 healthy male volunteers (12 IPV perpetrators and 12 controls).

IPV perpetrators were recruited among the participants of the CONTEXTO Program, a community-based psychoeducational intervention program (mandatory for men convicted of gender-based violence, with sentences of up to two years imprisonment), conducted at the Faculty of Psychology of the University of Valencia, before starting the intervention program. To be a part of this study, it was necessary that IPV perpetrators receive a suspended sentence for gender-based violence under the condition of attending the CONTEXTO intervention program. In addition, participants had to not have a diagnosis associated with a psychiatric, neurological or substance use disorder, and had to understand and speak fluent Spanish [3].

Participants of the control group were recruited in Valencia (Spain), establishing contact through advertisements on social networks. After conducting a telephone interview, the participants who met the requirements were selected (e.g., absence of mental disorders, and endocrine alterations). They were volunteers with similar sociodemographic (age, marital status, educational level and annual income) characteristics and body mass index (BMI), as well as not having criminal records.

All participants were informed of the study and, voluntarily, gave their written informed consent. Upon completion of the study, all participants received a financial compensation of EUR 40.

The experiment was performed in accordance with the Declaration of Helsinki and was approved by the Ethics Committee of the University of Valencia (procedure number: H1538385543901).

2.2. Procedure

The procedure was conducted in the laboratories of the Department of Psychobiology of the University of Valencia in a single session of approximately 2 h. The laboratory protocol was performed between 16:00 and 19:00 h, as sC levels are more stable within this period of time [20]. Additionally, the session was held in a room that was kept at a constant temperature (21 °C) and humidity. First, the informed consent was signed, sociodemographic and BMI variables were measured, and the empathy questionnaire was administered.

Afterwards, baseline hormonal levels were collected. The hormonal samples were always obtained following the same order: sOXT and sC first, followed by sT. Then, the empathic induction task instructions were provided to the participants and, immediately, the anticipatory sOXT, sC, and sT were collected. Immediately after completing the empathic induction task, the post-empathic sOXT, sC, and sT were taken. Three additional hormone samples were collected at +20 min, +40 min and +60 min. Finally, the participants were accompanied and dismissed.

2.3. Measures

2.3.1. Empathic Induction Task

Following the guidelines of previous studies [24–26], the empathic induction task was carried out using a battery of emotion-provoking videos validated for the Spanish population (PIE) [43]. Because the procedure is focused on negative emotional content, four scenes where the main character was receiving violence were selected among the entire battery based on their high arousal and negative affect. The selection of these scenes was made considering the suggestions from Gracia et al. [44] and Romero-Martínez et al. [45], who reported the existence of cognitive and affective alterations in IPV perpetrators when facing IPV audio–visual content. Hence, to avoid a gender bias, we combined two scenes where female characters received violence and two scenes where violence was received by male characters. Each participant underwent the empathic induction task by viewing the scenes (with a mean of 1′ 21″) on a 75″ screen. Prior to the visualization of the scenes, participants were instructed to actively put themselves in the place of each main character (previously indicated). Following guidelines from Schaefer et al. [46], participants were asked to relax for one minute before watching each scene.

2.3.2. Empathy Questionnaire

For the measurement of empathy, the Spanish adaptation [47] of the interpersonal reactivity index (IRI) [48] was used, which evaluates perspective taking (the tendency to spontaneously adopt the point of view of others), fantasy (the subject's imaginative capacity to put themselves in fictitious situations), empathic concern (feelings of compassion, worry and affection in the face of the discomfort of others) and personal distress (feelings of anxiety and discomfort that the subject manifests when observing the negative experiences of others). The items were rated from 1 (does not describe me well) to 5 (describes me well). For this study, Cronbach's alpha was 0.77.

2.3.3. Hormonal levels

Saliva was directly collected from the mouth using Salivettes for OXT and C (Sarstedt, Rommelsdorf, Germany) and sterile glass tubes for T measurements. In all cases, participants were informed about the need to follow the instructions for saliva sampling to obtain meaningful data and samples were collected in the same order, OXT-C then T, and frozen at –20ºC until analysis.

Salivary T levels were assessed by chemiluminescence immunoassays using testosterone saliva ELISA kits (Diagnostics Biochem Canada). Intra- and interassay coefficients of variation were 3.98% and 7.98%, respectively, indicating good reproducibility. On the other hand, salivary C levels were determined by radioimmunoassay using Coat-to-Count cortisol kits (DPC-Siemens Medical Solutions Diagnostics) with 1.4 nmol/L sensitivity.

Salivary OXT were measured using the commercial Oxytocin EIA kit (Arbor Assays, Inc. Ann Arbor, MI; ref: K048). We followed the procedure described in previous studies [49-52]. The samples were centrifuged 5 min × 1,000 g and then, from each saliva sample, 1 ml of supernatant was stored and frozen at -40 ° C. Then, the samples were lyophilized (Modulyo Freeze Dryers, Thermo Electron Corporation) for approximately 15 hours, until they were dehydrated [53]. These samples were reconstituted in 250 µl of assay buffer, yielding a concentration four times greater than the original, allowing them to fall within the sensitivity range of the kit and be detectable on the standard curve. Remarkably, it has been appreciated that sOXT correlates better than pOXT with concentrations in the cerebrospinal fluid [54]. Neuropeptide cross-reactivity was reported by Arbor assays as <0.001% and the detection limit was 11 pg / ml.

All samples were analyzed in duplicate and those from the same subject were included in the same assay. Although the criterion for measurement replication was a coefficient of variation between duplicates of 8%, the maximum intra- and inter-assay coefficients of variation obtained were 4.3% and 5.2%, respectively.

2.4. Data analysis

After checking the data for normality with the Shapiro-Wilk test ($p < .05$), the non-normal data were transformed based on a Napierian Logarithm (logn). Afterwards, t-tests were performed for assessing group (IPV perpetrators and controls) differences for anthropometric variables, empathy scores and baseline hormonal levels. Effect sizes for the between-group differences were calculated using Cohen's d [55]. A chi-squared analysis was also performed for marital status, level of education and annual income.

To reduce the number of comparisons between groups in hormonal variables, we decided to calculate the magnitude of response for each hormone as well as their ratios based on the formulas derived from the trapezoidal rule [56]. Specifically, it was estimated by calculating the area under the curve with respect to the ground (AUCg) and the area under the curve with respect to the increase (AUCi). In addition, ratios were calculated using the AUC levels of each hormone.

Multivariate analysis of variance (MANOVA) was performed for hormones AUCg and AUCi, with "group" as an inter-subject factor.

Finally, linear regression models were constructed to investigate whether the IRI subscales predicted the sOXT, sT and sC responses to the task, as well as the hormonal ratios, (measured by AUCi and AUCg). We ran a hierarchical regression analysis with hormonal response as dependent variable and IRI subscales as predictors: scores on IRI scale in Step 1; group (dummy coded as 0 for IPV perpetrators and 1 for controls) in Step 2; and the two-way interactions (IRI subscales x group) in Step 3.

Data analyses were conducted using IBM SPSS Statistics for Windows, version 26.0 (Armonk, NY). Values of $p < .05$ were considered statistically significant. The average values are reported in the tables as mean ± Standard deviation (SD).

3. Results

3.1. Participant characteristics and empathy scores

There were no significant differences between IPV perpetrators and the control group in age, BMI and/or demographic variables. With respect to the IRI subscales, IPV perpetrators differed from controls in perspective taking ($t(22) = -2.430$, $p = .024$, $d = .99$) and in the fantasy subscales ($t(22) = -2.635$, $p = .015$, $d = 1.07$), with IPV perpetrators exhibiting lower scores than controls in both cases (see table 1).

Table 1. Means, standard deviations, percentages, and means comparisons for socio-demographic and psychological variables for all groups.

	IPV (*n* = 12)	Controls (*n* = 12)	Chi-Square	
Marital status (%)				
Married	58	50	0.17	
Single/Divorced/Widowed	42	50		
Level of education (%)				
Primary	08	08	3.14	
Upper secondary	75	42		
University	17	50		
Annual Income (%)				
Low income	17	25	8.01	
Medium income	67	67		
High income	16	08		
	IPV (*n* = 12)	**Controls (*n* = 12)**	**t-test independent samples**	**Cohen's d**
Age *(M, SD)*	35.17 (8.11)	40.25 (13.87)	-1.09	.45
BMI *(M, SD)*	25.83 (3.66)	24.38 (3.33)	1.01	.41
IRI Perspective Taking *(M, SD)*	21.08 (3.18)	25.00 (4.59)	-2.43*	.99
IRI Empathic Concern *(M, SD)*	25.67 (4.52)	27.33 (5.66)	0.80	.32
IRI Personal Distress *(M, SD)*	15.83 (4.39)	15.75 (4.45)	0.05	.02
IRI Fantasy *(M, SD)*	18.42 (5.05)	23.33 (4.03)	-2.64*	1.07

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

3.2. Hormonal response to the empathic laboratory task

3.2.1. sOXT, sT and sC

As shown in Table 2, the MANOVA performed for independent hormone levels reported that IPV perpetrators differed in their sOXT AUCi levels compared to controls [$F(1, 23) = 4.848$, $p = .038$; $\eta 2p = .181$] revealing a lower sOXT AUCi value of IPV perpetrators compared to the control group. Furthermore, IPV perpetrators also differed in their sT AUCg [$F(1, 23) = 4.726$, $p = .041$; $\eta 2p = .177$], showing higher sT AUCg value than the control group. No further differences were found between groups in the rest of the hormonal levels.

3.2.2. sOXT/T, sOXT/C and sT/C ratios

With respect to the hormonal ratios, IPV perpetrators differed in sOXT/T AUCi [$F(1, 23) = 4.385$, $p = .048$; $\eta 2p = .166$] and sOXT/T AUCg values [$F(1, 23) = 4.544$, $p = .044$; $\eta 2p = .171$] compared to controls, with IPV perpetrators showing lower sOXT/T AUCi and higher sT/C AUCg levels than the control group [F (1, 23) = 4.651, p = .042; η2p = .175]. Both groups did not differ in any other hormonal ratios (see Table 2).

Table 2. Means, standard deviations, percentages, and means comparisons for the hormonal AUCg and AUCi for all groups.

	IPV (*n* = 12)	**Controls (*n* = 12)**	***F* values**	**Cohen's *d***
sOXT AUCg *(M, SD)*	538.13 (41.40)	552.76 (40.91)	.758	.36
sT AUCg *(M, SD)*	415.40 (34.79)	384.87 (34.03)	4.726*	.89
sC AUCg *(M, SD)*	139.25 (37.72)	146.84 (64.81)	.123	.14
sOXT AUCi *(M, SD)*	- 25.92 (79.30)	43.02 (73.99)	4.848*	.90
sT AUCi *(M, SD)*	- 0.43 (37.97)	- 6.97 (27.29)	.235	.20
sC AUCi *(M, SD)*	- 6.59 (25.15)	6.92 (49.52)	.710	.34
sOXT/T AUCg (M, SD)	110.89 (13.64)	126.13 (13.56)	4.544*	.87
sOXT/C AUCg *(M, SD)*	504.00 (355.38)	573.17 (560.18)	.130	.07
sT/C AUCg (M, SD)	541.40 (251.29)	363.82 (139.62)	4.651*	.88
sOXT/T AUCi *(M, SD)*	-8.19 (20.88)	10.46 (21.07)	4.385*	.86
sOXT/C AUCi *(M, SD)*	12.81 (67.06)	19.18 (82.05)	.231	.48
sT/C AUCi *(M, SD)*	6.19 (40.26)	13.95 (35.98)	.235	.53

Note. sOXT: Salivary Oxytocin; sT; Salivary Testosterone; sC: Salivary Cortisol; M: Mean; SD: Standard Deviation. Statistical significance *p < .05, **p < .01

3.3. Predictive effects of the IRI subscales on hormonal levels after the empathic induction task

3.3.1. sOXT, sT and sC

Only the perspective taking subscale predicted 19.2% of the sOXT AUCi after the empathic induction task (β = .476, F (1, 23) = 6.45, p = .019) and 17.7% of the sOXT AUCg after the task (β = .461, F (1, 23) = 5.95, p = .023). Additionally, the linear regression model showed that the perspective taking predicted the 19.2% of the sT AUCi to the empathic induction task (β = -.475, F (1, 23) = 6.401, p = .019). None of the other IRI subscales significantly predicted hormonal AUC. Moreover, no group effect was observed in this regression analysis.

3.2.2. sOXT/T, sOXT/C and sT/C ratios

Regarding the hormonal ratio levels, the linear regression model indicated that only the IRI perspective taking score significantly predicted 19.3% of the sOXT/T AUCi (β = .477, F (1, 23) = 6.49, p = .018). Also, it was seen that the IRI perspective taking score similarly predicted 20.3% of the sOXT/C AUCi (β = .488, F (1, 23) = 6.87, p = .016). Furthermore, perspective taking predicted 31.8% of the sT/C AUCg (β = -.590, F (1, 23) = 11.74, p = .002). No other significant models or group effects were found.

4. Discussion

Our data revealed that IPV perpetrators exhibited lower scores in IRI perspective taking and fantasy subscales than controls. Furthermore, our data revealed that IPV perpetrators presented lower sOXT changes in their levels and higher total sT levels than controls. They also presented lower sOXT/T change and total sOXT/T levels post-task, as well as higher total sT/C levels than controls. Remarkably, the lower the perspective taking score, the lower the total sOXT levels and sOXT changes and the higher the sT increase for the entire sample. Low perspective taking also predicted smaller sOXT/T and sOXT/C changes in the empathic induction task, and higher total sT/C levels for all participants.

Regarding the first aim, IPV perpetrators exhibited lower scores on specific IRI subscales, particularly, perspective taking and fantasy. This is in line with previous studies indicating that IPV perpetrators presented deficits in cognitive empathy functions [20-21] and linking them to IPV occurrence and severity [16]. Difficulties with perspective taking could hinder the recognition of others' emotional experiences, increasing the likelihood of inappropriate responses in interpersonal situations [17]. It has been argued that perspective taking skills enable the consideration of various meanings and which facilitates emotional regulation. Indeed, enhanced perspective taking has been proposed as a protective factor for IPV perpetration [57]. However, no differences were found between groups in empathic concern or personal distress, even though low empathic concern and high personal distress have been linked to perpetration of IPV through an inability to tolerate the negative emotions of others [17,20,58]. Our results could be due to the susceptibility to bias (e.g., IPV perpetrators' low emotional self-perception) and manipulation (e.g., IPV's social desirability) of using a single self-report [6,59,60]. This outcome reinforces the importance of using empathic induction tasks as a complement to self-report questionnaires.

Secondly, we also aimed to compare the hormonal response (e.g., sOXT, sT, and sC levels and hormonal ratios) of IPV perpetrators and a control group following an empathy induction task. Lower changes in sOXT levels were observed in IPV perpetrators following an empathic induction task compared to controls. Past research pointed out that emotional videos may induce increases of OXT levels in non-violent healthy young adults of both genders [24,25]. However, the differential functioning of OXT has been proposed in IPV perpetrators. For instance, a decrease in sOXT levels was reported in IPV perpetrators after an empathic induction task involving strangers, compared to the control group that increased their sOXT levels [26]. Another study found that intranasal administration of OXT increased IPV inclinations toward partners in violence-prone individuals [61]. Indeed, despite observing no change in sOXT levels in response to an acute cognitive stress task in either the IPV or the control group, Romero-Martinez et al. [30] found that total sOXT levels were higher in IPV perpetrators. These results suggest that we cannot conclude that IPV perpetrators can be characterized by a generalized, diminished OXT functioning. In this sense, the importance of the task's emotional content and who it involves should be highlighted. Thus, further research is needed to clarify the role of OXT in IPV proneness.

In terms of sT, both groups did not differ in their levels of sT change after the task. This was in line with a previous study, which also failed to report sT changes in IPV perpetrators to an acute laboratory cognitive stressor [30]. However, these results contrast with the decrease in sT levels found by Procyshyn et al. [25] after an empathic induction task. Additionally, Romero-Martínez et al. [20] implemented a laboratory social stressor focused on IPV and found that IPV perpetrators had higher T levels post-task than controls. Nonetheless, although no difference in change in sT levels was observed, our results exhibited higher total sT levels in IPV perpetrators relative to the control group. This finding was relevant since various authors have negatively related the performance in empathic laboratory tasks and circulating T levels. Nitschke and Bartz [62] reported that higher baseline sT levels were associated with worse performance on a naturalistic empathic accuracy task, in which participants dynamically track, in real time, the emotional state of others. In another study, Ronay and Carney [32] found that basal pT levels were negatively associated with a behavioral measure of cognitive empathy. Accordingly, it might be theorized that elevated sT levels could affect socioaffective decoding, especially in IPV perpetrators. However, we underlined the importance of considering the content and type of task when interpreting the T levels in IPV [33,63,64].

Contrary to our expectations, no significant differences in sC were detected, even though both the change in sC levels and its overall levels were lower in IPV perpetrators. This could be due to the fact that the empathic induction task is not designed to induce stress. However, it should be noted that IPV perpetrators have been seen to display lower changes in sC levels in response to a stress-inducing task compared to controls [20,30]. Hence, it is possible that the empathic induction task is related, to a greater extent, to the sOXT and sT response, not promoting a sufficient sC response to show differences between the groups. However, it is important to consider that many authors have hypothesized that individuals characterized by proneness to violence presented a hypoactivity of the hypothalamic–pituitary–adrenal (HPA) axis [65,66].

An important novelty of this study was the assessment of hormonal ratios and whether these ratios vary in response to an empathic induction task. Congruent with the above-reported results for hormone-independent levels, IPV perpetrators showed a lower change in their sOXT/T concentrations after the task, along with lower total sOXT/T levels. While the literature has provided evidence for opposing effects between these hormones in the social domain, highlighting a possible interaction between them [67–69], to the best of our knowledge, this is the first study to evaluate the OXT/T ratio to an empathic induction task. Notably, our findings are consistent with and strengthen the steroid/peptide theory of the social bonds (S/P Theory), which suggests that a high level of OXT (facilitator of salience of socioaffective stimuli), combined with a low level of T (facilitator of salience of self-focused stimuli), would favor socioaffective functions, such as social bonding, perspective taking, or empathy [41,70,71]. Therefore, the difference in sOXT/T ratio levels between IPV perpetrators and the control group may indicate discrepancies in the way that they process socioaffective stimuli, which could lead to an alternative empathic experience, if any.

IPV perpetrators also showed higher total sT/C levels after the task compared to the control group. Greater T/C levels have previously predicted greater aggression towards one's partner in a non-offending sample [39]. Studies in IPV perpetrators have found higher levels of the sT/C ratio in response to social stress in this population compared to non-offender participants [20], and link sT/C to antisocial traits [33]. In fact, a high T/C ratio has been proposed to predispose an individual to self-oriented dominance attitudes [72]. Taken together, these findings reinforce our hypothesis of a different hormonal profile in IPV perpetrators when faced with an empathic induction task, with lower sOXT/T levels, related to poor socioaffective processing, and higher sT/C levels, related to a greater dominance.

Remarkably, both groups did not differ in their sOXT/C levels. A meta-analysis exposed that OXT levels may dampen C release only during challenging stress tasks that could heavily stimulate the HPA axis [35]. This lack of significance may be due to the fact that our task is not designed to induce severe social stress. However, it should be noted that the change in sOXT/C levels and the total sOXT/C levels were lower in IPV perpetrators. Future research may value exploring the OXT/C ratio in relation to empathic distress in IPV perpetrators.

Finally, we intended to explore whether empathic abilities explained the hormone levels following the empathic induction task. As a result, the perspective-taking dimension of the IRI predicted a higher sOXT response to the task, as well as a lower sT response. Consistently, greater perspective taking was also predictive of a higher sOXT/T and sOXT/C changes and a lower change in sT/C levels in response to the empathic induction task. These findings are of particular relevance as they link understanding of another person's emotional state to an increase in sOXT after an empathic induction task. In contrast, this dimension of empathy appears, again, to be related to lower sT levels. It seems coherent that a better perception of the emotions of others was strongly related to an increase in the sOXT/T ratio, presumably through the counteracting influence of these hormones on the salience of socioaffective stimuli [27,70]. On the other hand, the predictive capacity of perspective taking with respect to the change in the sOXT/C levels could be partially explained through an attenuating effect of OXT on C when faced with the negative experiences of others [35,37], which may facilitate cognitive empathy. As a matter of fact, it has previously been observed that increased OXT predicts better cognitive accuracy following an emotional induction task, buffering C-response effects [73].

However, no other IRI dimension has shown a predictive capacity for hormone levels. This could be due to several reasons. First, difficulties have been recognized when linking the fantasy scale to empathy, being a controversial scale for several authors [74,75]. Additionally, personal distress has been primarily linked with C [76], and our task caused no change in sC levels. Finally, although OXT has been proposed to be related in part to affective empathy (closely related to empathic concern), more emphasis has been placed on the ability to recognize and understand the emotions and motivations of others (which is included in the perspective-taking dimension) [77,78]. It should be noted that no group effect was observed in the regression analyses. However, while it is true that these relationships between psychobiosocial markers were cross sectional throughout the sample, the perpetrators of IPV showed poorer perspective taking. Thus, our findings suggest that the ability to understand the situations of others could partially explain the concentration of certain hormones that are important for socioaffective processing (e.g., OXT, T and their ratio) following an empathic induction task, even in a violent population with lower empathic abilities, such as IPV perpetrators.

This study is not exempt from limitations, which are outlined as follows. First, a limitation of our study is the small sample size. This limitation is mainly due to the impossibility of collecting biological samples after the appearance of COVID-19. The COVID-19 pandemic has had and will have further consequences on biological research, and it is essential to be reminded of good practice for the management of biological samples for research, notably concerning the biosafety and security procedures [79]. This is compounded by the difficulty of access to the sample [80,81], which could be especially accentuated due to the psychobiological nature of this study. However, the study on hormones in this population is scarce, and having several hormonal determinations increases the value of the results obtained; however, further research is imperative to replicate these results in larger samples. A second limitation of our study might be the methodology used to induce empathy and elicit hormonal changes. This is a standardized task to induce negative valence emotions through the visualization of film scenes [43]. Therefore, this task is not specifically designed for empathic induction, although several studies have employed this task to induce empathy and examine OXT and T responses [24,25]. Another relevant consideration is the interpretation of the ratios. From a methodological point of view, ratio distributions are complex [82]. However, following authors' recommendations, we considered several strategies to strengthen the statistical approach of the ratios. Nonetheless, the interpretation of the ratio findings should be viewed with caution.

Future lines of research should replicate the results of this investigation in a larger sample. In addition, it would be of great interest to explore possible differences between IPV perpetrators and other types of offenders, helping to establish risk factors that may be transversal to violent behavior and specific risk factors according to the crime committed. Additionally, further research covering not only the response to negative effects, but also to positive effects, seems necessary. This would allow for a better understanding of the processing of positive emotions in IPV perpetrators. In this regard, it would be of great interest to address emotions associated with prosocial behavior, an important protective factor for violent behavior, such as compassion. Future research could also be conducted to analyze the empathic response of IPV perpetrators when focusing on aggressors rather than victims, and whether their empathic response could be related to the offender accountability. Finally, exploring the effects of IPV intervention programs on psychological and hormonal response following an empathic induction task could highlight the importance of adequate emotional processing for IPV prevention.

5. Conclusions

Our results seem to indicate that IPV perpetrators exhibit both biological and psychological markers related to empathy difficulties. Specifically, they show lower levels of sOXT over sT in response to an empathic induction task that predisposes subjects, presumably, to differential processing of socio-affective stimuli. This disparity may be based on self-oriented dominance attitudes. The interaction between OXT and T appears to be relevant for a holistic understanding of the empathic response, given that important socio-affective functions for empathy, such as perspective taking, have been related to a higher OXT/T ratio. Thus, future lines of research in this direction seem pertinent. All of this, together with lower self-reported empathy scores, may point to an abnormal empathic function that would act as a risk factor for IPV. Taking this into account, our results suggest that addressing certain dimensions of empathy in intervention programs could influence hormonal markers related to reduced dominance attitudes, better anxiety management, and increased attention to social-affective stimuli, which could ultimately facilitate the modification of aggressive behavior patterns [83].

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Data Availability Statement: The data presented in this study are available on request from the corresponding author. The data are not publicly available due to the presence of sensitive information from convicted persons.

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Anexo 10. Interpersonal Reactivity Index (IRI)

Las siguientes afirmaciones se refieren a pensamientos y sentimientos en diversas situaciones. Para cada afirmación indique en qué grado esta le describe a usted escogiendo la respuesta según la afirmación planteada.

1	2	3	4	5
Le describe Poco				**Le describe Mucho**

1	Sueño despierto y fantaseo, con cierta regularidad, sobre cosas que podrían pasarme.	1	2	3	4	5
2	Frecuentemente tengo sentimientos de compasión y preocupación respecto a gente menos afortunada que yo.	1	2	3	4	5
3	En algunas ocasiones encuentro difícil ver las cosas desde el punto de vista de las otras personas.	1	2	3	4	5
4	No suelo sentir mucha lástima por las otras personas cuando tienen problemas.	1	2	3	4	5
5	Me siento realmente involucrado con los sentimientos de los personajes de una novela.	1	2	3	4	5
6	En las situaciones de emergencia me siento aprensivo y a punto de enfermar.	1	2	3	4	5
7	Generalmente soy objetivo cuando veo una película o representación teatral y no suelo sentirme completamente inmerso en ellas.	1	2	3	4	5
8	Intento contemplar la posición de todo el mundo antes de tomar una decisión.	1	2	3	4	5
9	Cuando veo a una persona de quien se aprovechan, me siento un tanto protector hacia ella.	1	2	3	4	5
10	A veces me siento indefenso cuando estoy en medio de una situación con mucha carga emocional.	1	2	3	4	5
11	A veces intento comprender mejor a mis amigos imaginando cómo se deben ver las cosas desde su punto de vista.	1	2	3	4	5
12	Llegar a sentirme extremadamente involucrado en un buen libro o película es bastante raro para mí.	1	2	3	4	5
13	Cuando veo que alguien se ha hecho daño suelo mantener la calma.	1	2	3	4	5
14	Las desgracias de las otras personas no me suelen perturbar demasiado.	1	2	3	4	5

15	Si estoy convencido de tener la certeza sobre algo no suelo perder demasiado tiempo escuchando argumentaciones de otras personas.	1	2	3	4	5
16	Después de ver una representación teatral o una película me he sentido como si hubiese sido uno de los personajes.	1	2	3	4	5
17	Me asusta encontrarme en una situación emocional tensa.	1	2	3	4	5
18	A veces no siento demasiada lástima cuando veo que tratan a una persona de forma injusta.	1	2	3	4	5
19	Suelo ser bastante efectivo al enfrentarme a situaciones de emergencia.	1	2	3	4	5
20	Frecuentemente me siento afectado por cosas que veo que pasan.	1	2	3	4	5
21	Creo que cada situación presenta dos caras e intento contemplar las dos.	1	2	3	4	5
22	Me describiría a mí mismo como una persona con bastante buen corazón.	1	2	3	4	5
23	Cuando veo una buena película me pongo fácilmente en el lugar del personaje principal.	1	2	3	4	5
24	Suelo perder el control durante las situaciones de emergencia.	1	2	3	4	5
25	Cuando alguien me hace enfadar, suelo intentar ponerme por un momento en su lugar.	1	2	3	4	5
26	Cuando leo una historia interesante en un relato o novela, me imagino cómo me sentiría yo si los acontecimientos en la historia me sucedieran a mí.	1	2	3	4	5
27	Cuando en una situación de emergencia veo que alguien necesita urgentemente ayuda me siento al borde del colapso nervioso.	1	2	3	4	5
28	Antes de criticar a alguien intento imaginar cómo me sentiría yo si estuviera en su lugar.	1	2	3	4	5

Extraído de Escrivá et al. (2004).

Anexo 11. Correo de aceptación del estudio 3.

Índex | Inici | Ajuda | Miss. ant. | Miss. seg. | Contestar | Contestar a tots | Reenviar | Guardar adreça | Esborrar | Eixir

Usuari: cofaja (INBOX)

Missatge 4598/4774 (9K).

Marques: √

Assumpte: AB-23-051.R2 - Decision

Per a: javier.comes@uv.es, Javier.Comes@uv.es, isabel.rodriguez-moreno@uv.es, Marisol.lila@uv.es, marisol.lila@uv.es, Angel.Romero@uv.es, angel.romero@uv.es, Luis.Moya@uv.es, luis.moya@uv.es

De: Thomas Denson <onbehalfof@manuscriptcentral.com>

Data: Wed, 8 Nov 2023 05:02:53 +0000

08-Nov-2023

Dear Dr. Comes-Fayos,

I have now received two reviews of your revised manuscript ID AB-23-051.R2 entitled "Weakened sympathetic response and lower parasympathetic activity in Intimate Partner Violence perpetrators when empathizing: Influence of autonomous activation in affective approach and prosocial behavior" which you resubmitted to Aggressive Behavior. These reviews, from two experts in the field, are attached to this e-mail.

I am pleased to tell you that the latest revision of your manuscript " Weakened sympathetic response and lower parasympathetic activity in Intimate Partner Violence perpetrators when empathizing: Influence of autonomous activation in affective approach and prosocial behavior" is now acceptable for publication in Aggressive Behavior. It is a very nice paper that should be of interest to our readers. I congratulate you on its acceptance.

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Thank you for your fine contribution.

Sincerely,
Dr. Thomas Denson
t.denson@unsw.edu.au
Aggressive Behavior

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Referee(s)' Comments to Author:

Reviewing: 1

Comments to the Author
The authors have done well throughout the review process to attend to and revise any content mentioned in comments made by the reviewers. The authors have addressed the lone comment I had in the previous revision of the manuscript, and I believe the paper is now ready for publication.

[Miss. ant.] [Miss. seg.] [Esborrar]

Anexo 12. Revised Conflict Tactic Scale (CTS-2).

No importa lo bien que se lleve una pareja, hay momentos en que discuten, se sienten molestos con la otra persona, quieren diferentes cosas, o simplemente tienen riñas o peleas porque están de mal humor, cansados o por otra razón. Las parejas también tienen muchas maneras diferentes de arreglar sus diferencias. Esta es una lista de cosas que pueden ocurrir cuando tenéis diferencias. Por favor, señala cuantas veces hiciste esas cosas en el pasado año, y cuantas veces las hizo tu pareja. Si tú o tu pareja no habéis hecho ninguna de estas cosas durante el año pasado, pero han sucedido antes, marca el "7" en tu hoja de respuestas para esa pregunta. Si nunca ha pasado, marca un "0" en tu hoja de respuestas.

1	**2**	**3**	**4**	**5**	**6**	**7**	**0**
Una vez el año pasado	Dos veces el año pasado	De 3 a 5 veces el año pasado	De 6 a 10 veces el año pasado	De 11 a 20 veces el año pasado	Más de 20 veces el año pasado	Nunca el año pasado, pero ha ocurrido antes	Nunca ha ocurrido

Marque con un círculo el número correspondiente a la opción elegida.

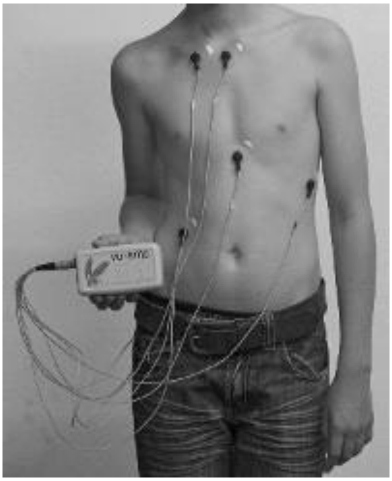
1. Mostré a mi pareja que me preocupaba por ella incluso cuando discutíamos	1	2	3	4	5	6	7	0
2. Mi pareja me mostró que se preocupaba por mí incluso cuando discutíamos	1	2	3	4	5	6	7	0
3. Le expliqué las razones de un desacuerdo a mi pareja	1	2	3	4	5	6	7	0
4. Mi pareja me explicó sus razones en un desacuerdo	1	2	3	4	5	6	7	0
5. Insulté a mi pareja	1	2	3	4	5	6	7	0
6. Mi pareja me hizo esto a mi	1	2	3	4	5	6	7	0
7. Le tiré algo a mi pareja que le pudo hacer daño	1	2	3	4	5	6	7	0
8. Mi pareja me hizo esto a mí	1	2	3	4	5	6	7	0
9. Le retorcí el brazo o agarré del pelo a mi pareja	1	2	3	4	5	6	7	0
10. Mi pareja me hizo esto a mí	1	2	3	4	5	6	7	0
11. Tuve una torcedura, moratón, o algún corte pequeño a causa de una pelea con mi pareja	1	2	3	4	5	6	7	0
12. Mi pareja tuvo una torcedura, moratón o	1	2	3	4	5	6	7	0

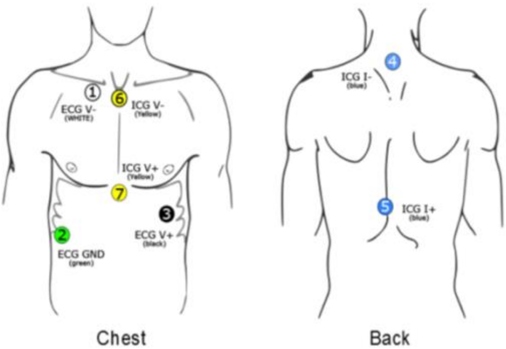
pequeño corte a causa de una pelea conmigo								
13. Mostré respeto por los sentimientos de mi pareja sobre una cuestión	1	2	3	4	5	6	7	0
14. Mi pareja mostró respeto por mis sentimientos sobre una cuestión	1	2	3	4	5	6	7	0
15. Hice que mi pareja practicara el sexo sin un condón	1	2	3	4	5	6	7	0
16. Mi pareja me hizo esto a mí	1	2	3	4	5	6	7	0
17. Empujé a mi pareja	1	2	3	4	5	6	7	0
18. Mi pareja me hizo esto a mí	1	2	3	4	5	6	7	0
19. Usé la fuerza (como golpear, forcejear o usar un arma) para hacer que mi pareja mantuvierasexo oral o anal conmigo	1	2	3	4	5	6	7	0
20. Mi pareja me hizo esto a mí	1	2	3	4	5	6	7	0
21. He usado un cuchillo o pistola contra mi pareja	1	2	3	4	5	6	7	0
22. Mi pareja me hizo esto a mí	1	2	3	4	5	6	7	0
23. Quedé inconsciente de un golpe en una pelea con mi pareja	1	2	3	4	5	6	7	0
24. Mi pareja quedó inconsciente de un golpe en una pelea conmigo	1	2	3	4	5	6	7	0
25. Llamé feo/a o gordo/a a mi pareja	1	2	3	4	5	6	7	0
26. Mi pareja me llamó feo/a o gordo/a	1	2	3	4	5	6	7	0
27. Golpeé a mi pareja con algo que pudo hacerle daño	1	2	3	4	5	6	7	0
28. Mi pareja me hizo esto a mí	1	2	3	4	5	6	7	0
29. Destrocé algo que pertenecía a mi pareja	1	2	3	4	5	6	7	0
30. Mi pareja me hizo esto a mí	1	2	3	4	5	6	7	0
31. Visité a un médico a causa de una pelea con mi pareja	1	2	3	4	5	6	7	0
32. Mi pareja visitó a un médico a causa de una pelea conmigo	1	2	3	4	5	6	7	0
33. Agarré por el cuello a mi pareja	1	2	3	4	5	6	7	0
34. Mi pareja me hizo esto a mí	1	2	3	4	5	6	7	0
35. Le grité a mi pareja	1	2	3	4	5	6	7	0
36. Mi pareja me hizo esto a mí	1	2	3	4	5	6	7	0
37. Empujé a mi pareja contra una pared	1	2	3	4	5	6	7	0

Extraído de Strauss et al. (1996).

Anexo 13. Vrije University – Ambulatory Monitoring System (VU-AMS).

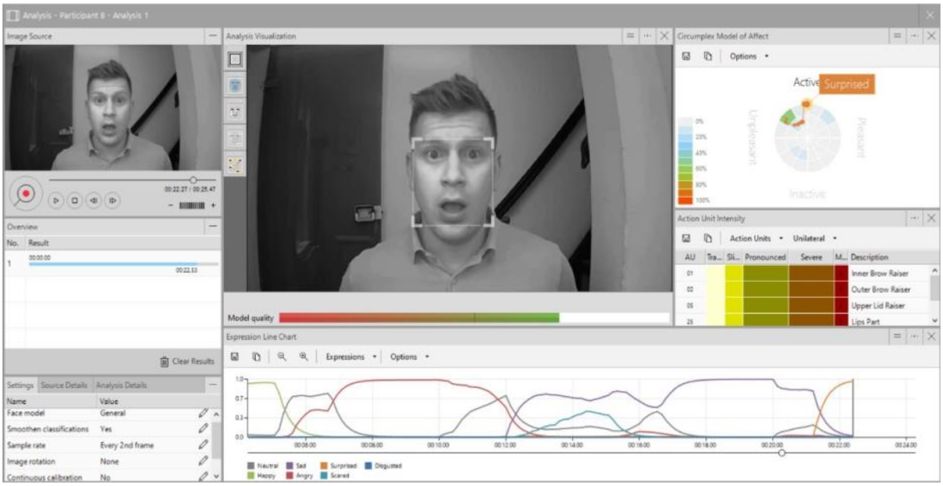
Con el fin de registrar las señales cardiorrespiratorias, se emplearon siete electrodos pre-engrasados en el pecho y la espalda del participante. Además, se utilizó el Biopac TSD203 junto con gel de electrodos isotónico (GEL101) para la conductancia de la piel, que se registró desde las falanges mediales del índice y medio o anular. Un cable de interfaz infrarroja conectó el dispositivo al ordenador de monitoreo.





Anexo 14. Face Reader 6.1.

El FaceReader 6.1 es un programa de análisis facial que puede detectar la valencia emocional e identificar las seis emociones básicas de Ekman: tristeza, ira, asco, miedo, sorpresa y felicidad, así como un estado neutral).



Images adapted from FaceReader [Photograph], by Noldus Information Technology, 2012, Horizon (https://horizon.ac.uk).

Anexo 15. Discrete Emotions Questionnaire (DEQ).

Las siguientes preguntas se refieren a como se sentía mientras veía el videoclip. Informe exactamente lo que sintió mientras lo veía y no lo que crea que debería haber sentido.

Según la siguiente escala, puntúe del 0 al 7 la mayor cantidad de cada emoción sentida mientras veía el videoclip:

1	*2*	*3*	*4*	*5*	*6*	*7*
Nada, ninguna emoción	...	...	Algo de emoción	...	...	Mucha emoción, muy intensa

Teniendo en cuenta la escala anterior, rodee con un círculo la intensidad sentida de cada emoción:

Diversión	1_2_3_4_5_6_7	Interés	1_2_3_4_5_6_7
Ira/enojo	1_2_3_4_5_6_7	Alegría	1_2_3_4_5_6_7
Ansiedad	1_2_3_4_5_6_7	Amor/ternura	1_2_3_4_5_6_7
Confusión	1_2_3_4_5_6_7	Orgullo	1_2_3_4_5_6_7
Satisfacción	1_2_3_4_5_6_7	Tristeza	1_2_3_4_5_6_7
Asco	1_2_3_4_5_6_7	Bochorno	1_2_3_4_5_6_7
Miedo	1_2_3_4_5_6_7	Sorpresa	1_2_3_4_5_6_7
Culpabilidad	1_2_3_4_5_6_7	Infelicidad	1_2_3_4_5_6_7
Felicidad	1_2_3_4_5_6_7	Azoramiento	1_2_3_4_5_6_7

Otras 1__2__3__4__5__6__7 Explique de que emoción se trata:___________

Extraído de Rottenberg et al. (2007).

Anexo 16. Reading the Mind in the Eyes Test (RMET).

A continuación, encontrarás 36 fotografías de los ojos de personas reales donde se expresan diferentes estados emocionales. Alrededor de cada imagen aparecen cuatro adjetivos que pueden describir lo que la persona está pensando o sintiendo. Debes subrayar solo aquel que mejor se ajuste a lo que la persona está pensando o sintiendo. La primera imagen sirve de ejemplo.

EJEMPLO

Celoso Asustado

Arrogante Odio

1

Entusiasmado Reconfortante

Irritado Aburrido

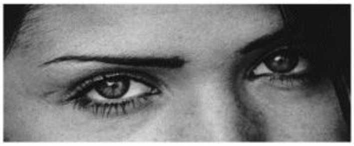
2

Aterrado Compungido

Arrogante Enojado

3

Bromista Agitada



Deseo Convencida

4

Bromista Insistente

Entretenido Relajado

5

Irritado Sarcástico

Preocupado Simpático

6

Horrorizada Fantasiosa

Impaciente Alarmada

7

Disculpante Simpático

Intranquilo Decaído

8

Abatido
Relajado

Tímido
Excitado

9

Enojada
Hostil

Aterrorizada
Acongojada

10

Prudente
Insistente

Aburrido
Horrorizado

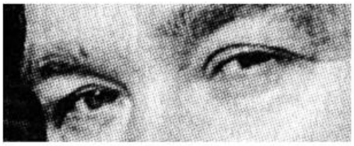
11

Aterrado
Entretenido

Arrepentido
Seductor

12

Indiferente
Abochornado



Escéptico
Decaído

13

Contundente
Expectante

Amenazante
Severo

14

Irritado
Decepcionado

Deprimido
Acusar

15

Pensativa
Agitada

Ilusionada
Entretenida

16

Irritado
Meditativo

Ilusionado
Compasivo

17

Insegura
Afectuosa

Entusiasmada
Horrorizada

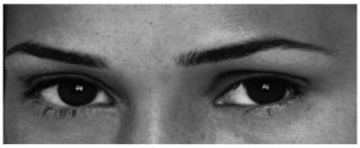
18

Contundente Entretenida

Horrorizada Aburrida

19

Arrogante Agradecida



Sarcástica Vacilante

20

Imponente Simpático

Culpable Aterrorizado

21

Abochornada Fantasiosa

Confundida Asustada

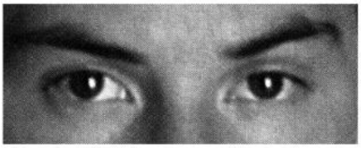
22

Acongojada Agradecida

Insistente Suplicante

23

Satisfecho Disculpante



Desafiante Curioso

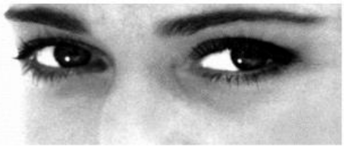
24

Caviloso Irritado

Excitado Hostil

25

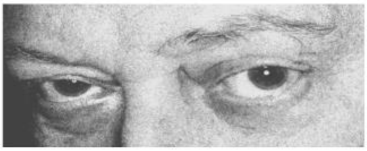
Asustada Incrédula



Abatida Interesada

26

Alarmado Timido



Hostil Ansioso

27

Bromista Prudente

Arrogante Tranquilizadora

28

Interesada | Bromista

Afectuosa | Satisfecha

29

Impaciente | Horrorizada

Irritada | Reflexiva

30

Agradecida | Seductora

Hostil | Decepcionada

31

Avergonzada | Segura

Entusiasmada | Decaída

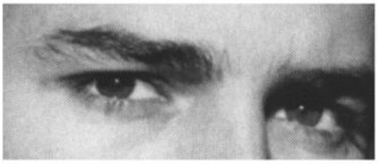
32

Serio | Horrorizado

Aturdido | Alarmado

33

Abochornado | Culpable



Fantasioso | Inquieto

34

Horrorizada | Desconcertada

Recelosa | Aterrada

35

Confusa | Nerviosa

Insistente | Pensativa

36

Avergonzado | Nervioso

Desconfiado | Indeciso

Extraído de (Baron-Cohen et al., 2001

Anexo 17. State-Trait Anxiety Inventory (STAI)

Indique cómo se siente en este momento, utilizando la siguiente escala

Nada	Algo	Bastante	Mucho
0	1	2	3

1	Me siento calmado	1	2	3
2	Me siento seguro	1	2	3
3	Estoy tenso	1	2	3
4	Estoy contrariado	1	2	3
5	Me siento cómodo (estoy a gusto)	1	2	3
6	Me siento alterado	1	2	3
7	Estoy preocupado ahora por posibles desgracias futuras	1	2	3
8	Me siento descansado	1	2	3
9	Me siento angustiado	1	2	3
10	Me siento confortable	1	2	3
11	Tengo confianza en mí mismo	1	2	3
12	Me siento nervioso	1	2	3
13	Estoy desasosegado	1	2	3
14	Me siento muy “atado” (como oprimido)	1	2	3
15	Estoy relajado	1	2	3
16	Me siento satisfecho	1	2	3
17	Estoy preocupado	1	2	3
18	Me siento aturdido y sobreexcitado	1	2	3
19	Me siento alegre	1	2	3
20	En este momento me siento bien	1	2	3

Extraído de Spielberg et al. (1983).