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Facultad de Humanidades y
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ACTIVIDAD FÍSICA, BULLYING Y CYBERBULLYING EN NIÑOS Y ADOLESCENTES. ANÁLISIS DE ASOCIACIÓN Y RIESGO EN VARIABLES DE APRENDIZAJE

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TESIS DOCTORAL CON MENCIÓN INTERNACIONAL

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PHYSICAL ACTIVITY, BULLYING AND CYBERBULLYING IN CHILDREN AND ADOLESCENTS. ASSOCIATION AND RISK ANALYSIS ON LEARNING VARIABLES

PRESENTADA POR:

ALBA RUSILLO MAGDALENO

DIRIGIDA POR:

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ALBERTO RUIZ ARIZA

JAÉN, 2025

A todas las personas que me han acompañado en este camino,

familia, amigos, compañeros, GRACIAS por ayudarme a estar aquí.

"La Sinfonía Incompleta"

En un reino lejano, el talentoso violinista Arion buscaba crear la melodía más hermosa, pero siempre sentía que algo faltaba. Un día en la plaza del pueblo un anciano le dijo: "Tu música es maravillosa, pero le falta armonía. Una sola voz no puede crear la sinfonía que buscas. Necesitas la ayuda de otros músicos" Arion reunió a los mejores músicos del reino y aunque al principio fue difícil coordinarse, con el tiempo lograron crear una sinfonía magnífica.

El día del gran concierto, la plaza del pueblo se llenó de espectadores ansiosos por escuchar la obra maestra. Cuando la orquesta comenzó a tocar, la multitud quedó maravillada. La música resonaba con una belleza y una complejidad que conmovían profundamente a todos los presentes. La sinfonía, que antes parecía incompleta, ahora era una obra de arte completa y armoniosa.

Cada instrumento tenía su momento para brillar, pero todos trabajaban en conjunto para crear algo que ninguno podría haber logrado por sí solo

"Cuando sientas que no puedes más, recuerda por qué empezaste"

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CERTIFICA:

Que la Tesis Doctoral con mención internacional titulada *"Actividad física, bullying y cyberbullying en niños y adolescentes. Análisis de asociación y riesgo en variables de aprendizaje"* que presenta Dña. ALBA RUSILLO MAGDALENO al superior juicio del Tribunal que designe la Universidad de Jaén, ha sido realizada bajo nuestra dirección durante los años 2021-2025, siendo expresión de la capacidad técnica e interpretativa de su autor en condiciones tan aventajadas que le hacen merecedora del Título de Doctora, siempre y cuando así lo considere el citado Tribunal.

En Jaén a 10 de febrero de 2025

Fdo. Emilio J. Martínez López

Prof. Dr. Alberto Ruiz Ariza
Profesor Titular de Universidad
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En Jaén a 10 de febrero de 2024 Fdo. Alberto Ruiz Ariza

La doctoranda Dña. Alba Rusillo Magdaleno, ha realizado la presente Tesis Doctoral Internacional como beneficiaria de un contrato de Formación de Profesorado Universitario (FPU) del Ministerio de Ciencia, Innovación y Universidades del Gobierno de España (FPU20/03217).

ÍNDICE DE CONTENIDOS (INDEX OF CONTENTS)

BECAS, PREMIOS Y ESTANCIAS DE INVESTIGACIÓN [RESEARCH GRANTS, AWARDS AND RESEARCH STAYS]

Durante el desarrollo de la presente Tesis Doctoral se han obtenido una serie de becas, premios y estancias de investigación que se detallan a continuación:

1. → **Título:** Beca de Colaboración con Departamentos Universitarios en el Departamento de Didáctica de la Expresión Musical, Plástica y Corporal de la Universidad de Jaén.
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La presente memoria de Tesis Doctoral está compuesta por los siguientes artículos científicos:

I. **Rusillo-Magdaleno, A.,** Moral-García, J.E., Brandão-Loureiro, V., & Martínez-López, E.J. (2024). Influence and Relationship of Physical Activity before, during and after the School Day on Bullying and Cyberbullying in Young People: A Systematic Review. *Education Sciences, 14*(10), https://doi.org/10.3390/educsci14101094 (JCR: 2,5, *Q1 Education & Educational Research*).

II. **Rusillo-Magdaleno, A.,** Suárez-Manzano, S., Moral-García, J.E., & Ruiz-Ariza, A. (2024). Asociación de la práctica de Actividad Física semanal con bullying y cyberbullying en chicos y chicas de 10 a 16 años. *Retos: Nuevas Tendencias en Educación Física, Deporte y Recreación, 59*(1), https://doi.org/10.47197/retos.v59.107358 (JCR: 1,2, *Q3 Hospitality, Leisure, Sport & Tourism;* SJR*: 0,383, Q2 Education*).

III. **Rusillo-Magdaleno, A.,** Martínez-Redecillas, T., de la Torre-Cruz, M.J., & Ruiz-Ariza, A. (2024). Bullying and Cyberbullying. High Risk for Learning, Planning and Procrastination. *Submitted*.

IV. **Rusillo-Magdaleno, A.,** de la Torre-Cruz, M.J., Ruiz-Ariza, A., & Suárez-Manzano, S. (2024). Association of high levels of bullying and cyberbullying with test anxiety in boys and girls aged 10 to 16 years. Education Sciences, 14(9), https://doi.org/10.3390/educsci14090999 (JCR: 2,5, *Q1 Education & Educational Research*).

V. Moral-García, J.E., **Rusillo-Magdaleno, A.,** Patiño-Villada, F.A., & Martínez-López, E.J. (2024). Bullying and cyberbullying are associated with

inappropriate use of the internet, cell phones and videogames in children and adolescents. *Submitted*.

VI. **Rusillo-Magdaleno, A.,** Solas-Martínez, J.L., Ramírez-Espejo, P., Ruiz-Ariza, A. (2024). Asociación de la actividad física con aplicaciones móviles y redes en jóvenes de 10 a 16 años. EmásF, Revista Digital de Educación Física, 15(90) (Métricas Dialnet: 0,27, *Q2 Educación*).

RESUMEN

Los beneficios de la práctica de Actividad Física (AF) en la salud física y psicológica de los jóvenes han sido ampliamente estudiados en la literatura científica. Sin embargo, problemas más específicos como la relación de la práctica de AF con bullying y cyberbullying, así como su influencia en el aprendizaje, han sido aún poco investigados.

El objetivo general de la presente Tesis Doctoral ha sido examinar la asociación entre la práctica de AF y las conductas de acoso, bullying y cyberbullying (tanto victimización como agresión), con diversas variables asociadas al aprendizaje, bienestar, ansiedad, uso de aplicaciones y dispositivos móviles en niños y adolescentes. Para todo ello, se han llevado a cabo estudios de revisión sistemática y asociación en Educación Primaria y Secundaria.

Para la consecución de este objetivo general se requirieron una serie de estudios específicos que finalmente se tradujeron en seis artículos agrupados en cuatro temáticas afines: i) Relación de la práctica de AF con el bullying y cyberbullying (Papers I, II); ii) Asociación de variables psicológicas como bullying y cyberbullying con variables de aprendizaje, bienestar y ansiedad (Papers III, IV); iii) Asociación del bullying y cyberbullying con utilización de dispositivos electrónicos (Paper V); iv) Asociación de la AF con variables de aplicaciones móviles y redes (Paper VI).

Los principales resultados de la Tesis sugieren que: a) Los programas de AF aplicados en distintos momentos de la jornada diaria han demostrado efectividad en la reducción de la victimización por acoso y la mejora de comportamientos relacionados, así como en el alivio de factores psicológicos adversos derivados del bullying. En relación con lo anterior, los estudios de asociación entre AF y el bullying y cyberbullying hallaron que los chicos físicamente activos muestran un nivel mayor de agresión por bullying. En cuanto al cyberbullying, los resultados de victimización y agresión en función del nivel de AF semanal parece que no afecta en las chicas, sin embargo, los estudiantes físicamente activos presentaron tanto menores niveles de victimización como de agresión. b) Los resultados de asociación entre variables de bullying y cyberbullying con variables

de aprendizaje, bienestar, ansiedad, utilizaciones de aplicaciones y dispositivos móviles han mostrado que tanto las victimas como agresores de bullying y cyberbullying presentan un aprendizaje más superficial, tienen valores más bajos en planificación y tienden a retrasar las tareas de clase. Las chicas víctimas de bullying se ven afectadas en mayor medida que los chicos y presentan el doble de riesgo que las no víctimas hacia la procrastinación. Los datos muestran, además, que la victimización del cyberbullying tiene un mayor impacto negativo en el aprendizaje que el tradicional bullying. En el caso del cyberbullying, los efectos negativos que sufren los agresores sobre las variables de aprendizaje son más acusados aún. Las víctimas de bullying y cyberbullying tienen respuestas fisiológicas y cognitivas significativamente más elevadas y, en el caso del cyberbullying, también se incrementan los comportamientos de evitación. Además, tanto víctimas como agresores sufren un alto riesgo de ansiedad ante los exámenes, siendo más acusado en víctimas de cyberbullying, particularmente en términos de respuestas fisiológicas y cognitivas. c) Víctimas y agresores de bullying y cyberbullying presentan una mayor propensión al uso prolongado de Internet, teléfono móvil y videojuegos con porcentajes significativamente elevados en chicas en comparación con los chicos. A su vez, las víctimas o agresores de cyberbullying tienen el doble de posibilidad de tener elevados niveles en estas variables que en el bullying tradicional. d) Los jóvenes con bajos niveles de práctica de AF muestran mayor tiempo de empleo de aplicaciones móviles como WhatsApp, YouTube y buscadores que aquellos estudiantes con altos niveles de práctica de AF. Sin embargo, los jóvenes con alto nivel de práctica de AF emplean mayor tiempo en aplicaciones de compra online.

Los resultados de la presente Tesis doctoral ponen de manifiesto la relevancia de la práctica de AF en la prevención del bullying y cyberbullying, evidenciando su papel en la mejora del bienestar psicológico y académico, así como en la reducción del uso excesivo de dispositivos electrónicos en niños y adolescentes dentro del contexto escolar.

SUMMARY

The benefits of the practice of physical activity (PA) on the physical and psychological health of young people have been widely studied in the scientific literature. However, more specific problems such as the relationship of PA practice with bullying and cyberbullying, as well as its influence on learning, have still been little investigated.

The overall objective of this doctoral thesis was to examine the association between PA practice and bullying and cyberbullying behaviors (both victimization and aggression), with several variables associated with learning, well-being, anxiety, use of applications and mobile devices in children and adolescents. For all this, systematic review and association studies have been carried out in primary and secondary education.

To achieve this general objective, a series of specific studies were required that finally resulted in six articles grouped into four related topics: i) Relationship of PA practice with bullying and cyberbullying (Papers I, II); ii) Association of psychological variables such as bullying and cyberbullying with variables of learning, well-being and anxiety (Papers III, IV); iii) Association of bullying and cyberbullying with the use of electronic devices (Paper V); iv) Association of PA with variables of mobile applications and networks (Paper VI).

The main results of the Thesis suggest that: a) PA programs applied at different times of the daily day have shown effectiveness in reducing bullying victimization and improving related behaviors, as well as alleviating adverse psychological factors derived from bullying. In relation to the above, studies of the association between PA and bullying and cyberbullying found that physically active boys show a higher level of bullying aggression. As for cyberbullying, the results of victimization and aggression as a function of the level of weekly PA do not seem to affect girls; however, physically active students presented lower levels of victimization and aggression. b) The results of the association between bullying and cyberbullying variables with variables of learning, well-being, anxiety, use of applications and mobile devices have shown that both victims and aggressors of bullying and cyberbullying present more superficial learning, have lower values in planning and tend to delay class tasks. Girls who are victims of bullying are

affected to a greater extent than boys and are twice as likely as non-victims to procrastinate. The data also show that cyberbullying victimization has a greater negative impact on learning than traditional bullying. In the case of cyberbullying, the negative effects suffered by aggressors on learning variables are even more pronounced. Victims of bullying and cyberbullying have significantly higher physiological and cognitive responses and, in the case of cyberbullying, avoidance behaviors are also increased. In addition, both victims and aggressors suffer a high risk of test anxiety, being more pronounced in victims of cyberbullying, particularly in terms of physiological and cognitive responses. c) Victims and aggressors of bullying and cyberbullying have a higher propensity to prolonged use of the Internet, cell phones and video games with significantly higher percentages in girls compared to boys. In turn, victims or aggressors of cyberbullying are twice as likely to have high levels of these variables than in traditional bullying. d) Young people with low levels of PA practice show greater time spent using mobile applications such as WhatsApp, YouTube and search engines than those students with high levels of PA practice. However, young people with a high level of PA practice spend more time on online shopping applications.

The results of this doctoral thesis show the relevance of PA practice in the prevention of bullying and cyberbullying, evidencing its role in improving psychological and academic well-being, as well as in reducing the excessive use of electronic devices in children and adolescents in the school context.

ABREVIATURAS [ABBREVIATIONS]

A continuación, se muestra un listado de abreviaturas en orden alfabético usadas en los diferentes apartados de la presente Tesis Doctoral. Las empleadas en los artículos científicos se han identificado según conviene en cada uno de ellos de forma específica.

Abreviaturas en castellano		**Abbreviations in english**	
AF	Actividad Física	**PA**	Physical Activity
OMS	Organización Mundial de la Salud	**WHO**	World Health Organization
UNESCO	Organización de las Naciones Unidas para la Educación, la Ciencia y la Cultura	**UNESCO**	United Nations Educational Scientific and Cultural Organization
EF	Educación Física	**PE**	Physical Education
IMC	Índice de Masa Corporal	**BMI**	Body Mass Index

INTRODUCCIÓN

Actividad Física: Breve acercamiento sobre los beneficios en la salud física y psicológica

La Actividad Física (AF) comprende todos aquellos movimientos que incrementan el gasto energético y que son producidos por los músculos esqueléticos (Piggin, 2020). Según la Organización Mundial de la Salud (OMS, 2022), esta actividad no se limita exclusivamente al ejercicio, sino que también incluye el juego, el trabajo físico, las tareas domésticas y otras formas de movimientos recreativos o de ocio. Las recomendaciones de AF proporcionadas por la OMS varían en función de la edad. Para personas adultas se sugiere entre 150 y 300 minutos semanales de AF de intensidad moderada o entre 75 y 150 minutos si la actividad es de intensidad vigorosa. Para niños y adolescentes, las recomendaciones especifican, al menos, 60 minutos diarios de AF de intensidad moderada a vigorosa, priorizando actividades aeróbicas (OMS, 2022).

En la actualidad, son múltiples los beneficios que aporta la práctica de AF en la salud. De forma general, existe consenso en que la práctica sistemática de AF facilita el control de peso reduciendo significativamente el sobrepeso y/u obesidad (Oppert et al., 2023; Soares et al., 2023), reduce el riesgo de enfermedades cardiovasculares (Cillekens et al., 2022; Patnode et al., 2022), minimiza el riesgo de enfermedades crónicas como la diabetes tipo 2 (Kanaley et al., 2022), reduce el riesgo de cáncer de mama y colon (Chang & Chiu, 2023; Goldschimidt et al., 2023) así como el de padecer enfermedades coronarias (Cleven et al., 2020; Roberts et al., 2021). Particularmente, en la población infantil, además de beneficiar el desarrollo físico normal, la práctica de AF regular mejora la densidad ósea (Faienza et al., 2020; Proia et al., 2021), optimiza la función cardiopulmonar y muscular (Kao et al., 2020; Zhao et al., 2024) y, en general, contribuye a una mejor salud metabólica y cardiovascular (Kao et al., 2020; Thyfault & Bergouignan, 2020). Adicionalmente, los efectos beneficiosos de la AF también se extienden significativamente a la salud mental (Andermo et al., 2020). Se ha demostrado que la práctica de AF reduce los niveles de estrés, ansiedad y depresión (González-Valero et al., 2023; Singh et al., 2023), y mejora el estado de ánimo y la estabilidad emocional (Huang et al., 2023). Las endorfinas liberadas durante la AF producen una sensación de bienestar y euforia, lo

que puede reducir el estrés y aumentar la felicidad (Crombie et al., 2018). Además, la AF contribuye a un mejor rendimiento cognitivo (You et al., 2023) y ofrece beneficios significativos en la resiliencia psicológica (Kim et al., 2023).

En base a lo expuesto anteriormente, es importante analizar cómo, en contraste con los beneficios ampliamente reconocidos de la AF, comportamientos como el bullying y el cyberbullying afectan negativamente la salud psicológica de los jóvenes. Estos problemas emergen como desafíos significativos en el ámbito escolar, con profundas implicaciones para el bienestar emocional, la estabilidad psicológica y el desarrollo personal de los estudiantes.

El bullying y cyberbullying. Causas, tipos y consecuencias para la salud psicológica de los jóvenes

El acoso escolar, comúnmente conocido como bullying, constituye una forma de violencia física, verbal y/o psicológica que se manifiesta entre pares dentro del entorno educativo. Este tipo de hostigamiento o intimidación suele extenderse a través del tiempo, deteriorando significativamente la calidad de vida y el rendimiento académico de los jóvenes (Nain, 2023). Según la Organización de las Naciones Unidas para la Educación, la Ciencia y la Cultura (UNESCO, 2019), el bullying escolar implica un comportamiento agresivo intencionado y repetido que ocurre en una relación de poder desigual, donde el agresor busca infligir dolor o incomodidad a la víctima. Dentro del contexto educativo, el bullying promueve un entorno hostil, acarreando efectos negativos en el alumnado como ansiedad o aislamiento (Cerezo, 2002). Dentro del bullying, existen diversos tipos que se pueden clasificar en función de las formas en que se manifiestan (Kennedy, 2020) (Figura 1). Según este último autor, el bullying físico incluye golpes, empujones o cualquier otro contacto que pueda causar daño corporal, el bullying verbal, por otro lado, comprende insultos, burlas o amenazas. Finalmente, el bullying psicológico o emocional involucra la exclusión social, la propagación de rumores y otras formas de intimidación que afectan la autoestima y el bienestar emocional del individuo (Kennedy, 2020). En la misma línea, los roles del bullying se dividen en tres categorías principales: las víctimas, los agresores y los observadores (Páez-Esteban et al., 2020) (Figura 1). Las víctimas generalmente exhiben un comportamiento pasivo, en contraste, los acosadores se dividen

en dos tipos: activos y pasivos (Laninga-Wijnen et al., 2023; Revuelta-Domínguez et al., 2023; Santoyo & Frías, 2014). A diferencia de las víctimas, los acosadores muestran una notable seguridad en sí mismos (Laninga-Wijnen et al., 2023; Revuelta-Domínguez et al., 2023; Santoyo & Frías, 2014), frecuentemente ocupan posiciones de liderazgo en sus grupos (Santoyo & Frías, 2014) y reportan sentir emociones de alegría o cólera mientras llevan a cabo situaciones de bullying (Pedditzi et al., 2022).

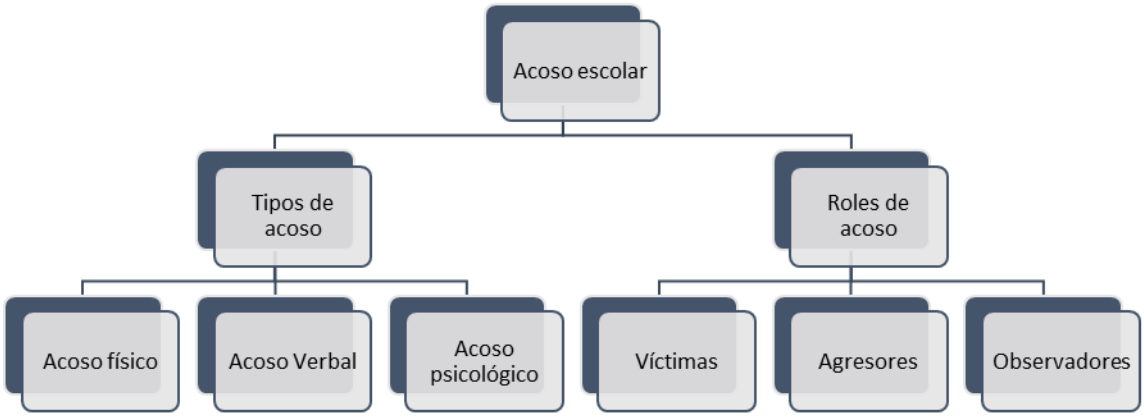

Figura 1. Representación del acoso escolar, tipos y roles.

La causalidad del bullying puede ser diversa. Por un lado, pueden influir factores individuales como baja autoestima, necesidad de dominación, dificultades familiares o falta de empatía (Silva et al., 2020). Por otro lado, los aspectos socioculturales como la normalización de la violencia, estructuras escolares que promueven la competitividad desmedida, así como la falta de supervisión adulta también contribuyen a la prevalencia de este comportamiento agresivo entre pares (Shannon, 2013).

El bullying alcanza su mayor prevalencia en la educación secundaria, especialmente entre jóvenes de 12 a 15 años, una etapa marcada por intensos cambios físicos, emocionales y sociales (Fischer et al., 2020). Durante esta fase, los estudiantes experimentan inseguridades y buscan establecer su estatus social, a veces mediante comportamientos de intimidación (Dietrich & Ferguson, 2020).

Tras comprender el bullying en sus múltiples formas, reconocer los roles dentro de estas dinámicas e identificar las causas de las que pueden resultar estos comportamientos,

resulta de gran relevancia examinar cómo contextos específicos, como la práctica de AF, puede tanto perpetuar como mitigar estos patrones de comportamiento. La AF, se ha valorado beneficiosa por su capacidad de fortalecer la salud y el bienestar (Mahindru et al., 2023), también refleja y potencia las estructuras de poder y las dinámicas sociales que pueden dar lugar al bullying (Green et al., 2024; Orunbayey, 2023). Adicionalmente, con un enfoque pedagógico adecuado, la AF puede transformarse en una herramienta valiosas para contrarrestar el bullying (Chen et al., 2023b), fomentando la inclusión, el respeto mutuo y la colaboración (Chen et al., 2023b). Este doble papel que juega la AF en las escuelas lleva a reconsiderar cómo se aborda el deporte y la EF, y cómo se puede integrar estas prácticas y estrategias en la prevención del bullying (Chen et al., 2023b), promoviendo así un entorno escolar más seguro y acogedor para todos los estudiantes.

Por otra parte, el ciberacoso, también conocido como cyberbullying, se define como un comportamiento agresivo y deliberado, llevado a cabo de forma repetitiva a través de medios electrónicos contra una víctima (Martínez-Soto & Ibabe, 2023). Este fenómeno incluye diversas características, tales como el anonimato del agresor, la capacidad de alcanzar a la víctima en cualquier lugar y momento, y la potencial viralidad de los actos de acoso (Ramadan, 2023). Los tipos de cyberbullying incluyen el hostigamiento (mensajes ofensivos o amenazantes), la difamación (difusión de rumores falsos), el robo de identidad (hacerse pasar por otra persona para causar daño), la exclusión deliberada de actividades en línea, y el cyberbullying visual (envío de imágenes o videos comprometidos) (Palade & Pascal, 2023). Los roles en el cyberbullying se dividen principalmente en agresores, víctimas y espectadores, siendo estos últimos cruciales en la dinámica del bullying al tener el poder de intervenir o amplificar el daño al apoyar al agresor (Revuelta-Domínguez et al., 2023). Santoyo & Frías (2014) clasifican al agresor como activos o pasivos y lo describen como aquel individuo que adquieren una percepción de mayor poder cuando lideran grupos e inflige daño y maltrato a uno o varios compañeros. Pedditzi et al. (2022) identificaron sentimientos opuestos entre agresores y víctimas, ya que los agresores sentían felicidad o ira durante el acto de maltrato hacia sus pares y las víctimas o espectadores, expusieron sentirse tristes o no pudieron identificar sus emociones en dichos eventos.

El cyberbullying difiere del bullying tradicional en varios aspectos clave. Mientras que el bullying tradicional suele ocurrir en entornos físicos y limitados, como la escuela, el cyberbullying puede suceder en cualquier momento y lugar, a través de diversas plataformas digitales (Ramadan, 2023). El anonimato que permite el cyberbullying puede incrementar la agresividad del agresor, al disminuir la percepción de consecuencias inmediatas (Boichuk et al., 2023). Además, el impacto del cyiberbullying puede ser más prolongado y amplio debido a la capacidad de difusión viral de los contenidos digitales (Palade & Pascal, 2023). Esta diferencia también se refleja en la respuesta emocional de las víctimas, quienes pueden sentir una mayor indefensión y desesperanza (Peebles, 2014).

Por un lado, al igual que en el bullying, las causas que pueden preceder al fenómeno del cyberbullying son multifacéticas, incluyendo factores individuales, familiares y sociales (Arató et al., 2022; Guo et al., 2021). Entre los factores individuales destacan la baja autoestima, la necesidad de poder y control, y la falta de habilidades sociales (Arató et al., 2022). En el contexto familiar, la falta de supervisión tecnológica parental y una comunicación deficiente pueden contribuir significativamente al cyberbullying (Arató et al., 2022). Socialmente, la presión de los pares y la normalización del comportamiento agresivo en línea juegan un papel crucial (Guo et al., 2021). Por otro lado, las consecuencias del cyberbullying también son múltiples (Gohal et al., 2023; Saltz et al., 2020). A nivel físico y psicológico, las víctimas pueden experimentar ansiedad, depresión, y en casos extremos, ideación suicida (Saltz et al., 2020). En el ámbito académico, el rendimiento académico puede verse afectado gravemente, incluyendo disminución del mismo, aumento del absentismo escolar y abandono escolar (Gohal et al., 2023).

En España, la prevalencia del cyberbullying entre niños y adolescentes es alarmante. Estudios recientes indican que aproximadamente el 24% de los estudiantes han sido víctimas de cyberbullying al menos una vez (Benítez-Sillero et al., 2021a). La probabilidad de cyberbullying es mayor en etapas clave de transición, como el paso de la primaria a la secundaria, debido a los cambios en las dinámicas sociales y la presión por adaptarse a nuevos entornos (López-Meneses et al., 2020). Además, el aumento del uso de dispositivos electrónicos y redes sociales contribuye significativamente a la exposición al cyberbullying (Benítez-Sillero et al., 2021a).

Por tanto, se considera el cyberbullying como una problemática compleja que afecta notablemente el bienestar de los niños y adolescentes (Parmar & Dutt, 2024). Y, por tanto, es crucial abordar esta cuestión de manera holística, incluyendo la educación, para mitigar sus efectos y prevenir su ocurrencia.

Consecuencias del bullying y cyberbullying en el aprendizaje escolar

El bullying y el cyberbullying afectan a diversas variables de aprendizaje dentro del ámbito educativo y generan elevadas cotas de ansiedad ante situaciones de estrés como los exámenes (Zaglodina & Pankratova, 2021). Tanto el bullying como el cyberbullying, tienen un impacto significativo en el rendimiento académico de los estudiantes (Torres et al., 2020). Estudios recientes han demostrado que las víctimas de bullying y cyberbullying presentan niveles de aprendizaje inferiores en comparación con sus compañeros no victimizados (Touloupis & Athanasiades, 2022). Los agresores también suelen mostrar un rendimiento académico deficiente, aunque en algunos casos pueden tener un rendimiento académico superior debido a factores como la manipulación y el control sobre sus víctimas (Escortell et al., 2020). En relación con el cyberbullying, se ha observado que los estudiantes que participan en comportamientos de acoso digital, ya sea como víctimas o agresores, tienden a tener un menor rendimiento académico debido al estrés y la ansiedad asociados con estas experiencias (Cañas et al., 2020). Este estrés afecta negativamente a su capacidad para concentrarse y participar en actividades académicas (Lin et al., 2020).

El bullying y el cyberbullying no solo afectan el rendimiento académico general, sino que también influyen en variables específicas de aprendizaje (Torres et al., 2020). La investigación ha mostrado que bullying y cyberbullying pueden disminuir la capacidad de los estudiantes para obtener un aprendizaje profundo, que implica una comprensión y aplicación más significativa del conocimiento (Aparisi et al., 2021) debido a la constante exposición a estrés y ansiedad que estos fenómenos generan (Cañas et al., 2020). Este estado emocional negativo impacta las funciones cognitivas superiores necesarias para una comprensión y aplicación significativa del conocimiento, lo que es esencial para el aprendizaje profundo (Aparisi et al., 2021). Adicionalmente, los estudiantes victimizados tienden a enfocarse en el aprendizaje superficial, que se centra en la memorización sin

comprensión profunda, como una estrategia de afrontamiento ante el estrés (Heiman et al., 2019). La carga emocional y la sensación de inseguridad y desprotección crean un entorno de aprendizaje desfavorable, donde la concentración y la motivación se ven severamente afectadas (Simion, 2023).

En lugar de involucrarse en procesos de pensamiento crítico y análisis profundo, los estudiantes victimizados recurren al aprendizaje superficial como una estrategia de afrontamiento (Cava et al., 2021). Este tipo de aprendizaje permite a los estudiantes cumplir con los requisitos académicos mínimos mientras lidian con el estrés constante (Whiting et al., 2021). Este enfoque de supervivencia académica es menos demandante cognitivamente y proporciona una falsa sensación de control en medio de la turbulencia emocional causada por el bullying y cyberbullying (Delgado et al., 2019).

Por otro lado, el bullying y el cyberbullying afectan negativamente la toma de decisiones y la planificación de tareas (Aparisi et al., 2021; Esquivel et al., 2023) debido a varias razones interrelacionadas. El impacto emocional y psicológico significativo, incluyendo ansiedad, depresión y baja autoestima, reduce su capacidad para concentrarse y tomar decisiones informadas, afectando las funciones ejecutivas necesarias para la organización y planificación (Esquivel et al., 2023). El estrés crónico afecta las funciones ejecutivas del cerebro, esenciales para la toma de decisiones y la planificación (Palomares-Ruiz et al., 2021), mientras que las interrupciones en el aprendizaje debido a la preocupación constante por el bullying y cyberbullying deterioran las habilidades organizativas (Delgado et al., 2019). Finalmente, los problemas de salud mental como la depresión y la ansiedad resultan en una falta de interés en actividades académicas y dificultad para gestionar el tiempo y las responsabilidades escolares, perpetuando un ciclo de bajo rendimiento académico y estrés continuo (Savani et al., 2023). Las víctimas suelen experimentar dificultades significativas en la organización y la gestión del tiempo, lo que a menudo resulta en la procrastinación de tareas académicas (Palomares-Ruiz et al., 2021) debido a la autoeficacia académica comprometida y la percepción negativa de sus habilidades disminuyen su motivación y aumentan la procrastinación (Aparisi et al., 2021). Este ciclo de procrastinación y bajo rendimiento se perpetúa debido a la baja autoestima y el aumento de la ansiedad, lo que refuerza un patrón negativo de comportamiento académico (Amran & Zulkifli, 2020).

Las consecuencias del bullying y el cyberbullying en las variables de aprendizaje son profundas y duraderas (Livazović & Ham, 2019). Los estudiantes que experimentan bullying y/o cyberbullying tienden a tener una menor satisfacción con su vida escolar y una peor percepción de su autoeficacia académica (Aparisi et al., 2021).

Esta insatisfacción y falta de confianza pueden llevar a una mayor tasa de abandono escolar y a un bajo rendimiento académico continuo (Amran & Zulkifli, 2020). Además, la experiencia de ser víctima de bullying y cyberbullying correlacionada con un mayor nivel de ansiedad y estrés, puede llevar a problemas de salud mental como la depresión y la ansiedad generalizada (Esquivel et al., 2023). Estos problemas de salud mental no solo afectan el rendimiento académico, sino que también interfieren con el desarrollo social y emocional del estudiante (Awadalla et al., 2020).

Bullying, cyberbullying y adiccion a internet

El bullying y cyberbullying que sufren los jóvenes también tiene influencia en los hábitos y comportamientos cotidianos, incluyendo el uso de internet (Fermani et al., 2023). La adicción a internet se define por el uso compulsivo y excesivo de las tecnologías digitales, interrumpiendo las actividades diarias y las responsabilidades personales (Trigo, 2021). Entre las principales causas de esta adicción en estudiantes de primaria y secundaria se encuentran la búsqueda de validación social, la necesidad de pertenencia y la evasión de problemas emocionales o sociales que enfrentan en su entorno inmediato (Cao, 2023).

El vínculo entre el bullying y cyberbullying y la adicción a internet es complejo y multifacético. La literatura sugiere que los estudiantes que experimentan acoso escolar, ya sea físico o cibernético, tienen un mayor riesgo de desarrollar adicciones a internet (Siavashnasab et al., 2023; Tsimtsiou et al., 2018). Esto se debe en parte a que los jóvenes que padecen bullying buscan en el mundo digital un refugio donde pueden encontrar apoyo emocional y una sensación de pertenencia que les falta en su entorno físico (Hellfeldt et al., 2020). Además, el uso de internet puede convertirse en una herramienta para evadir la realidad dolorosa del bullying diario (Jaskulska et al., 2022). El cyberbullying, al igual que el bullying tradicional, puede provocar sentimientos de desesperanza, ansiedad y depresión (Eyuboglu et al., 2021). Estos sentimientos pueden

impulsar a los jóvenes a pasar más tiempo en línea, buscando consuelo y validación en comunidades virtuales (Sikorska et al., 2021). Esta conducta puede, a su vez, exacerbar los síntomas de adicción a internet, creando un ciclo vicioso difícil de romper (Marciano et al., 2020).

Las consecuencias de la adicción a internet en estudiantes que sufren bullying o cyberbullying son variadas y pueden agravar los problemas emocionales y sociales existentes (Albikawi, 2023). Estos estudiantes pueden experimentar una disminución en su rendimiento académico, aislamiento social, así como un aumento en la ansiedad y depresión, debido a la falta de concentración y el tiempo excesivo dedicado a actividades en línea (Albikawi, 2023; Chen et al., 2023a). La dependencia excesiva de internet puede dificultar aún más la capacidad de estos jóvenes para desarrollar relaciones interpersonales saludables y resolver conflictos de manera constructiva (Marciano et al., 2020). Adicionalmente, el excesivo tiempo en línea puede agravar problemas de salud mental preexistentes (Nguyen et al., 2022). Los jóvenes que pasan muchas horas en línea a menudo reportan niveles más altos de estrés y sentimientos de soledad, lo que puede llevar a un deterioro adicional de su bienestar emocional (Méndez et al., 2019a).

Como en apartados anteriores, además de considerar la AF como una estrategia potencialmente efectiva para mitigar los efectos negativos del bullying también puede disminuir la adicción a internet (Cheng et al., 2023a). Participar en actividades deportivas puede ofrecer a los estudiantes una válvula de escape positiva para el estrés y las emociones negativas, reduciendo así su dependencia de internet como mecanismo de afrontamiento (Méndez et al., 2019a).

Papel de la actividad física en los comportamientos de bullying y cyberbullying de niños y adolescentes

Se ha constatado que la práctica regular de AF tiene un impacto significativo en la reducción de comportamientos de bullying y cyberbullying entre niños y adolescentes (García-Hermoso et al., 2020). Diversos estudios han mostrado que la participación en AF no solo mejora la salud física y mental, sino que también puede disminuir la incidencia de comportamientos agresivos (Giandonato et al., 2021; Teferi, 2020). Un estudio

específico en Canadá reveló que cumplir con las recomendaciones de AF y tiempo de pantalla se asocia con menores probabilidades de ser víctima o perpetrador de bullying escolar y cyberbullying (Sampasa-Kanyinga et al., 2020). A nivel físico, esto puede deberse a que durante la práctica de AF se liberan endocannabinoides y opioides endógenos como encefalinas, endorfinas y dinorfinas, que mejoran el funcionamiento del Sistema Nervioso Central y promueven un equilibrio entre la quinurenina neurotóxica y el ácido quinurénico neuroprotector, reduciendo comportamientos disruptivos (Cortés-Cortés et al., 2019; Crombie et al., 2018; Pedersen, 2019). Estos cambios fisiológicos pueden mejorar el estado de ánimo y fomentar una mayor resiliencia emocional, lo que se traduce en una mejor gestión de conflictos y una reducción en la incidencia del bullying.

La tipología del deporte también juega un papel crucial en el padecimiento de bullying (Nery et al., 2019; Vveinhardt & Fominiene, 2022). Deportes de equipo, como el fútbol o baloncesto, que fomentan la cooperación y la cohesión grupal, se consideran beneficiosos para la mejora de comportamientos de bullying y cyberbullying (Trajković et al., 2020). Sin embargo, esta tipología debido a la presión y competitividad por parte del equipo, puede reportar mayor prevalencia que los deportes individuales (Vveinhardt & Fominiene, 2022). Por el contrario, deportes con un enfoque individual pueden, en algunos casos, exacerbar comportamientos agresivos, especialmente si no se gestionan adecuadamente las dinámicas de competencia (Pourabdol et al., 2020).

Además de la tipología de deporte, la intensidad con la que se practica AF también influye en la incidencia de comportamientos de bullying y cyberbullying (Kirklewski et al., 2023). Investigaciones indican que una mayor intensidad de ejercicio se asocia con una reducción en la prevalencia de bullying y cyberbullying (Kirklewski et al., 2023). En un estudio realizado con adolescentes españoles, se encontró que la práctica de AF vigorosa se correlacionaba con menores tasas de cibervictimización (Benítez-Sillero et al., 2021a). Esto se puede explicar por varios mecanismos. A nivel físico, la AF intensa puede mejorar la autoeficacia y la autoestima, reduciendo la vulnerabilidad a ser acosado (Greco, 2021). Cognitivamente, el ejercicio regular puede mejorar la regulación emocional y el manejo

del estrés, habilidades cruciales para enfrentar y prevenir situaciones de bullying y cyberbullying (Passarello et al., 2022). Socialmente, la participación en deportes puede aumentar las oportunidades de formar redes de apoyo y fortalecer relaciones con compañeros (Delfin et al., 2024).

A su vez, el tiempo y la regularidad de la práctica de AF son factores esenciales para maximizar sus beneficios en la reducción del bullying y cyberbullying (García-Hermoso et al., 2020). Estudios han demostrado que realizar al menos 60 minutos de AF diaria, como recomiendan las guías de movimiento, puede tener efectos protectores contra el bullying y cyberbullying (Sampasa-Kanyinga et al., 2020). Además, el momento del día en que se realiza la actividad también puede influir (Maeneja et al., 2022). Ejercicios matutinos pueden preparar mejor a los estudiantes para enfrentar los desafíos del día escolar, al mejorar su estado de ánimo y niveles de energía (Hormazábal-Aguayo et al., 2019). Por otro lado, la AF después de la jornada escolar puede servir como un medio para liberar tensiones acumuladas y reducir el estrés (McGovern & Kulinna, 2023).

La evidencia sugiere que el momento más influyente para la práctica de AF en relación con la reducción de bullying es durante la jornada escolar (Méndez et al., 2019b). El fenómeno del bullying y cyberbullying en el ámbito educativo ha cobrado relevancia debido a sus graves consecuencias sobre la salud mental y el bienestar de los estudiantes (Esquivel et al., 2023). El contexto escolar se presenta como un escenario óptimo para la realización de bullying o cyberbullying ya que es un entorno donde los estudiantes pasan una gran cantidad de tiempo interactuando con sus pares, lo que facilita la aparición de conflictos (Lizut, 2019). Sin embargo, la prevalencia de bullying y cyberbullying no es uniforme en todas las áreas del currículum de primaria y secundaria (Myers & Cowie, 2019; Zych et al., 2019). Diversos estudios, exponen que áreas que promueven el trabajo colaborativo, la creatividad o la inclusión como artes, música y las humanidades suelen ser menos propensos a comportamientos de bullying (Zych et al., 2019). Por lo contrario, áreas que promueven la competitividad y la exposición física de los estudiantes como las Matemáticas, las Ciencias o la Educación Física (EF) pueden ser más propensas a incidentes de bullying escolar (Myers & Cowie, 2019).

Se ha demostrado que los estudiantes de EF pueden ser más propensos a experimentar bullying o cyberbullying (Benítez-Sillero et al., 2021a). En una revisión sistemática, se encontró que la inactividad física y el comportamiento sedentario se asocian con una mayor victimización por bullying, lo que sugiere que los estudiantes menos activos podrían ser más vulnerables a este tipo de acoso (García-Hermoso et al., 2020). Esto puede deberse a la percepción de debilidad física o a la falta de habilidades sociales que facilitan la integración en grupos, aumentando la probabilidad de ser blanco de bullying (Armitage, 2021).

Estrategias para la elaboración de programas de AF dirigidos a reducir el bullying y cyberbullying en niños y adolescentes

La AF juega un papel esencial no solo en el bienestar físico, sino también en la promoción de un ambiente escolar inclusivo y libre de bullying y cyberbullying. Incorporar programas de AF en el entorno educativo puede ser una estrategia efectiva para reducir tanto el bullying como el cyberbullying. Diversos estudios respaldan la implementación de estos programas como un medio para mejorar el comportamiento y la salud mental de los estudiantes.

Desde las instituciones educativas se deben diseñar estrategias que promuevan la práctica regular y adecuada de la AF. Estas pautas pueden incluir la incorporación de programas de EF que fomenten la cooperación y la inclusión, así como actividades extracurriculares deportivas accesibles y atractivas para todos los estudiantes (Benítez-Sillero, et al., 2021b; Greco, 2021). A su vez, es fundamental que los docentes reciban formación sobre cómo integrar estrategias de prevención del bullying en las clases de EF y otras actividades escolares, creando así un ambiente escolar que apoye la AF y desaliente los comportamientos agresivos (Benítez-Sillero et al., 2021b). Adicionalmente, deben ser establecidas y comunicadas a todos los miembros de la comunidad educativa políticas claras y estrictas contra el cyberbullying (Chicote-Beato et al., 2024). A nivel familiar, es esencial fomentar una comunicación abierta entre padres e hijos sobre el uso de la tecnología y los riesgos asociados, supervisando y guiando el uso de internet (Páez-Esteban et al., 2020; Khairi et al., 2022).

Finalmente, es esencial educar a los estudiantes en la importancia de la práctica de AF para la salud mental y el bienestar social. La educación sobre estos beneficios puede ayudar a los estudiantes a entender cómo la AF puede reducir el estrés, mejorar el estado de ánimo y fomentar relaciones sociales saludables (Fahy et al., 2016). Un ambiente escolar que promueva estos valores puede contribuir significativamente a la reducción del bullying y cyberbullying entre niños y adolescentes (Sampasa-Kanyinga et al., 2020).

La promoción de la resiliencia y las habilidades sociales en los niños y adolescentes es otra estrategia clave para manejar efectivamente las situaciones de bullying. Los programas educativos que fomenten el respeto, la empatía y el desarrollo de habilidades sociales, junto con una mayor supervisión adulta en momentos y lugares críticos, como recreos y pasillos, pueden reducir significativamente el bullying (Gaffney et al., 2021).

Para que un programa de AF sea efectivo en la reducción del bullying y el cyberbullying, debe estar bien estructurado y adecuadamente implementado. Es decir, debe tener en cuenta el tiempo de práctica de AF, la intensidad (OMS, 2019), el momento de práctica (antes, durante o después de la jornada) (Hormazábal-Aguayo et al., 2019) o el tipo de AF (Trajković et al., 2020).

Como conclusión, estos programas tienen el potencial de mejorar las variables de aprendizaje al reducir el estrés y la ansiedad, promoviendo una mejor salud mental y física (Benítez-Sillero et al., 2020b). Además, contribuyen a disminuir la incidencia de bullying y cyberbullying al fomentar un ambiente escolar más positivo y cohesivo (Ng et al., 2022), mejoran la capacidad de los estudiantes para manejar el estrés, lo que a su vez mejora su rendimiento académico y su capacidad para participar en el aprendizaje profundo (Estrada-Vidal et al., 2022) y apoyan a los estudiantes en el desarrollo de habilidades de afrontamiento saludables y en el establecimiento de relaciones positivas con sus iguales (Ng et al., 2022).

INTRODUCTION

Physical Activity: A Brief Overview of Physical and Psychological Health Benefits

Physical activity (PA) comprises all those movements that increase energy expenditure and are produced by skeletal muscles (Piggin, 2020). According to the World Health Organization (WHO, 2022), this activity is not limited exclusively to exercise, but also includes play, physical work, housework, and other forms of recreational or leisure movements. PA recommendations provided by the WHO vary according to age. For adults, 150-300 minutes of moderate-intensity PA per week is suggested, or 75-150 minutes if the activity is of vigorous intensity. For children and adolescents, the recommendations specify at least 60 minutes of moderate- to vigorous-intensity PA per day, prioritizing aerobic activities (WHO, 2022).

At present, there are multiple benefits of PA practice on health. In general, there is consensus that the systematic practice of PA facilitates weight control by significantly reducing overweight and/or obesity (Oppert et al., 2023; Soares et al., 2023), reduces the risk of cardiovascular disease (Cillekens et al., 2022; Patnode et al., 2022), minimizes the risk of chronic diseases such as type 2 diabetes (Kanaley et al., 2022), reduces the risk of breast and colon cancer (Chang & Chiu, 2023; Goldschimidt et al., 2023) as well as coronary heart disease (Cleven et al., 2020; Roberts et al., 2021). Particularly, in the pediatric population, in addition to benefiting normal physical development, regular PA practice improves bone density (Faienza et al., 2020; Proia et al., 2021), optimizes cardiopulmonary and muscular function (Kao et al., 2020; Zhao et al., 2024) and, in general, contributes to better metabolic and cardiovascular health (Kao et al., 2020; Thyfault & Bergouignan, 2020). Additionally, the beneficial effects of PA also extend significantly to mental health (Andermo et al., 2020). It has been demonstrated that PA practice has been shown to reduce levels of stress, anxiety and depression (Gonzalez-Valero et al., 2023; Singh et al., 2023), and improve mood and emotional stability (Huang et al., 2023). The endorphins released during PA produce a sense of well-being and euphoria, which can reduce stress and increase happiness (Crombie et al., 2018). In addition, PA contributes to better cognitive performance (You et al., 2023), and offers significant benefits in psychological resilience (Kim et al., 2023).

Based on the above, it is important to analyze how, in contrast to the widely recognized benefits of PA, behaviors such as bullying and cyberbullying negatively affect the psychological health of young people. These problems emerge as significant challenges in the school setting, with profound implications for students' emotional well-being, psychological stability, and personal development.

Bullying and cyberbullying. Causes, types and consequences for the psychological health of young people

School harassment, commonly known as bullying, is a form of physical, verbal and/or psychological violence that manifests itself among peers within the educational environment. This type of harassment or intimidation usually extends over time, significantly deteriorating the quality of life and academic performance of young people (Nain, 2023). According to the United Nations Educational, Scientific and Cultural Organization (UNESCO, 2019), bullying involves intentional and repeated aggressive behavior that occurs in an unequal power relationship, where the aggressor seeks to inflict pain or discomfort on the victim. Within the educational context, bullying promotes a hostile environment, causing negative effects on students such as anxiety or isolation (Cerezo, 2002). Within bullying, there are several types that can be classified according to the ways in which they manifest themselves (Kennedy, 2020) (Figure 1). According to the latter author, physical bullying includes hitting, pushing or any other contact that can cause bodily harm; verbal bullying, on the other hand, includes insults, teasing or threats. Finally, psychological or emotional bullying involves social exclusion, rumor spreading and other forms of intimidation that affect the self-esteem and emotional well-being of the individual (Kennedy, 2020). Along the same lines, bullying roles are divided into three main categories: victims, aggressors and observers (Páez-Esteban et al., 2020) (Figure 1). Victims generally exhibit passive behavior; in contrast, bullies are divided into two types: active and passive (Laninga-Wijnen et al., 2023; Revuelta-Domínguez et al., 2023; Santoyo & Frías, 2014). Unlike victims, bullies show remarkable self-confidence (Laninga-Wijnen et al., 2023; Revuelta-Domínguez et al., 2023; Santoyo & Frías, 2014), frequently occupy leadership positions in their groups (Santoyo & Frías, 2014), and report feeling emotions of joy or anger while carrying out the bullying (Pedditzi et al., 2022).

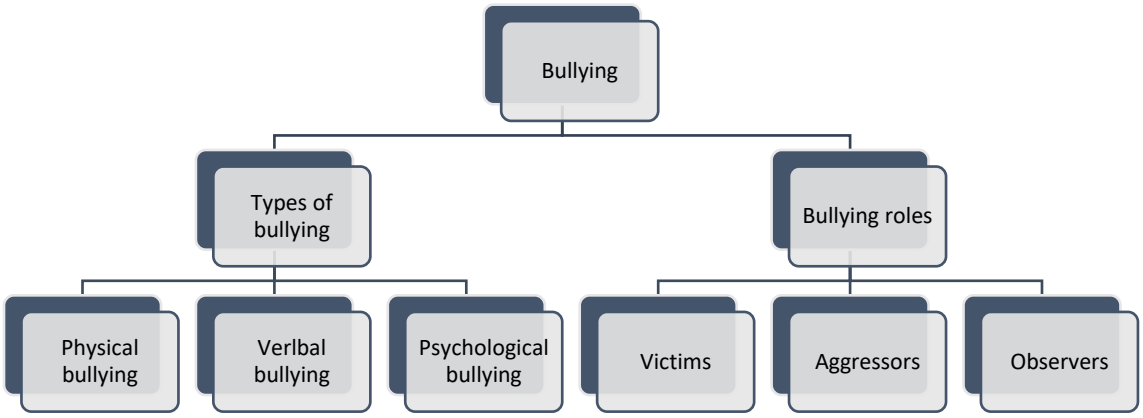

Figure 1. Representation of bullying, types and roles.

The causality of bullying can be diverse. On the one hand, individual factors such as low self-esteem, need for domination, family difficulties or lack of empathy may play a role (Silva et al., 2020). On the other hand, sociocultural aspects such as the normalization of violence, school structures that promote excessive competitiveness, as well as the lack of adult supervision also contribute to the prevalence of this aggressive behavior among peers (Shannon, 2013).

Bullying is most prevalent in secondary education, especially among 12–15-year-olds, a stage marked by intense physical, emotional and social changes (Fischer et al., 2020). During this phase, students experience insecurities and seek to establish their social status, sometimes through bullying behaviors (Dietrich & Ferguson, 2020).

After understanding bullying in its many forms, recognizing the roles within these dynamics, and identifying the causes from which these behaviors may result, it is of great relevance to examine how specific contexts, such as PA practice, can both perpetuate and mitigate these behavioral patterns. PA, which has been valued as beneficial for its ability to strengthen health and well-being (Mahindru et al., 2023), also reflects and enhances the power structures and social dynamics that can give rise to bullying (Green et al., 2024; Orunbayey, 2023). Additionally, with an appropriate pedagogical approach, PA can become a valuable tool to counteract bullying (Chen et al., 2023b), fostering inclusion,

mutual respect and collaboration (Chen et al., 2023b). This dual role played by PA in schools leads to reconsider how sport and PE are approached, and how these practices and strategies can be integrated into bullying prevention (Chen et al., 2023b), thus promoting a safer and more welcoming school environment for all students.

On the other hand, cyberbullying, also known as cyberbullying, is defined as aggressive and deliberate behavior, carried out repeatedly through electronic media against a victim (Martínez-Soto & Ibabe, 2023). This phenomenon includes several characteristics, such as the anonymity of the aggressor, the ability to reach the victim at any place and time, and the potential virality of the bullying acts (Ramadan, 2023). Types of cyberbullying include harassment (offensive or threatening messages), defamation (spreading false rumors), identity theft (impersonating another person to cause harm), deliberate exclusion from online activities, and visual cyberbullying (sending compromising images or videos) (Palade & Pascal, 2023). The roles in cyberbullying are mainly divided into aggressors, victims, and bystanders, the latter being crucial in the bullying dynamics by having the power to intervene or amplify the harm by supporting the aggressor (Revuelta-Domínguez et al., 2023). Santoyo & Frías (2014) classify the aggressor as active or passive and describe it as that individual who acquire a perception of greater power when they lead groups and inflict harm and mistreatment on one or several peers. Pedditzi et al. (2022) identified opposite feelings between aggressors and victims, since the aggressors felt happiness or anger during the act of mistreatment towards their peers and the victims or bystanders reported feeling sad or were unable to identify their emotions in such events.

Cyberbullying differs from traditional bullying in several key ways. While traditional bullying usually occurs in physical and limited settings, such as school, cyberbullying can happen anytime, anywhere, through various digital platforms (Ramadan, 2023). The anonymity afforded by cyberbullying can increase aggressor aggressiveness by decreasing the perception of immediate consequences (Boichuk et al., 2023). In addition, the impact of cyberbullying may be more prolonged and widespread due to the viral dissemination capacity of digital content (Palade & Pascal, 2023). This difference is also reflected in the emotional response of victims, who may feel greater helplessness and hopelessness (Peebles, 2014).

On the one hand, as in bullying, the causes that may precede this phenomenon of cyberbullying are multifaceted, including individual, family and social factors (Arató et al., 2022; Guo et al., 2021). Among the individual factors, low self-esteem, the need for power and control, and lack of social skills stand out (Arató et al., 2022). In the family context, lack of parental technological supervision and poor communication may contribute significantly to cyberbullying (Arató et al., 2022). Socially, peer pressure and normalization of aggressive online behavior play a crucial role (Guo et al., 2021). On the other hand, the consequences of cyberbullying are also manifold (Gohal et al., 2023; Saltz et al., 2020). At the physical and psychological level, victims may experience anxiety, depression, and in extreme cases, suicidal ideation (Saltz et al., 2020). On the academic level, academic performance may be severely affected, including decreased academic performance, increased truancy, and school dropout (Gohal et al., 2023).

In Spain, the prevalence of cyberbullying among children and adolescents is alarming. Recent studies indicate that approximately 24% of students have been victims of cyberbullying at least once (Benítez-Sillero et al., 2021a). The likelihood of cyberbullying is higher in key transitional stages, such as the transition from primary to secondary school, due to changes in social dynamics and pressure to adapt to new environments (López-Meneses et al., 2020). In addition, the increased use of electronic devices and social networks contributes significantly to exposure to cyberbullying (Benítez-Sillero et al., 2021a).

Therefore, cyberbullying is considered to be a complex problem that significantly affects the well-being of children and adolescents. (Parmar & Dutt, 2024). And, therefore, it is crucial to address this issue holistically, including education, to mitigate its effects and prevent its occurrence.

Consequences of bullying and cyberbullying on school learning

Bullying and cyberbullying affect several learning variables within the educational environment and generate high levels of anxiety in stressful situations such as exams (Zaglodina & Pankratova, 2021). Both bullying and cyberbullying have a significant impact on students' academic performance (Torres et al., 2020).

Recent studies have shown that victims of bullying and cyberbullying present lower learning levels compared to their non-victimized peers (Touloupis & Athanasiades, 2022). Bullies also tend to show poor academic performance, although in some cases they may have superior academic performance due to factors such as manipulation and control over their victims (Escortell et al., 2020). In relation to cyberbullying, it has been observed that students who engage in digital bullying behaviors, either as victims or aggressors, tend to have lower academic performance due to the stress and anxiety associated with these experiences (Cañas et al., 2020). This stress negatively affects their ability to concentrate and participate in academic activities (Lin et al., 2020).

Bullying and cyberbullying not only affect overall academic performance, but also influence specific learning variables (Torres et al., 2020). Research has shown that bullying and cyberbullying can diminish students' ability to obtain deep learning, which involves a more meaningful understanding and application of knowledge (Aparisi et al., 2021) due to the constant exposure to stress and anxiety that these phenomena generate (Cañas et al., 2020). This negative emotional state impacts the higher cognitive functions necessary for meaningful understanding and application of knowledge, which is essential for deep learning (Aparisi et al., 2021). Additionally, victimized students tend to focus on surface learning, which focuses on memorization without deep understanding, as a coping strategy in the face of stress (Heiman et al., 2019). The emotional burden and the feeling of insecurity and helplessness create an unfavorable learning environment, where concentration and motivation are severely affected (Simion, 2023).

Instead of engaging in critical thinking processes and deep analysis, victimized students resort to surface learning as a coping strategy (Cava et al., 2021). This type of learning allows students to meet minimal academic requirements while coping with constant stress (Whiting et al., 2021). This approach to academic survival is less cognitively demanding and provides a false sense of control amid the emotional turbulence caused by bullying and cyberbullying (Delgado et al., 2019).

On the other hand, bullying and cyberbullying negatively affect decision making and task planning (Aparisi et al., 2021; Esquível et al., 2023) due to several interrelated reasons. Significant emotional and psychological impact, including anxiety, depression, and low

self-esteem, reduces their ability to concentrate and make informed decisions, affecting executive functions necessary for organization and planning (Esquivel et al., 2023). Chronic stress affects the executive functions of the brain, essential for decision making and planning (Palomares-Ruiz et al., 2021), while disruptions in learning due to constant worry about bullying and cyberbullying impair organizational skills (Delgado et al., 2019). Finally, mental health problems such as depression and anxiety result in a lack of interest in academic activities and difficulty managing time and school responsibilities, perpetuating a cycle of poor academic performance and ongoing stress (Savani et al., 2023). Victims often experience significant difficulties in organization and time management, which often results in procrastination of academic tasks (Palomares-Ruiz et al., 2021) due to compromised academic self-efficacy and negative perception of their abilities decrease their motivation and increase procrastination (Aparisi et al., 2021). This cycle of procrastination and underachievement is perpetuated due to low self-esteem and increased anxiety, which reinforces a negative pattern of academic behavior (Amran & Zulkifli, 2020).

The consequences of bullying and cyberbullying on learning variables are profound and long-lasting (Livazović & Ham, 2019). Students who experience bullying and/or cyberbullying tend to have lower satisfaction with their school life and poorer perceptions of their academic self-efficacy (Aparisi et al., 2021).

This dissatisfaction and lack of confidence can lead to a higher dropout rate and continued poor academic performance (Amran & Zulkifli, 2020). In addition, the experience of being a victim of bullying and cyberbullying correlated with a higher level of anxiety and stress can lead to mental health problems such as depression and generalized anxiety (Esquivel et al., 2023). These mental health problems not only affect academic performance, but also interfere with the student's social and emotional development (Awadalla et al., 2020).

Bullying, cyberbullying and internet addiction

Bullying and cyberbullying experienced by young people also has an influence on daily habits and behaviors, including internet use (Fermani et al., 2023). Internet addiction is defined by the compulsive and excessive use of digital technologies, interrupting daily

activities and personal responsibilities (Trigo, 2021). Among the main causes of this addiction in elementary and high school students are the search for social validation, the need to belong, and the avoidance of emotional or social problems they face in their immediate environment (Cao, 2023).

The link between bullying and cyberbullying and internet addiction is complex and multifaceted. The literature suggests that students who experience bullying, whether physical or cyber, have an increased risk of developing internet addictions (Siavashnasab et al., 2023; Tsimtsiou et al., 2018). This is partly because young people who experience bullying look to the digital world for a refuge where they can find emotional support and a sense of belonging that they lack in their physical environment (Hellfeldt et al., 2020). In addition, the use of the internet can become a tool to evade the painful reality of daily bullying (Jaskulska et al., 2022). Cyberbullying, like traditional bullying, can lead to feelings of hopelessness, anxiety, and depression (Eyuboglu et al., 2021). These feelings may drive youth to spend more time online, seeking solace and validation in virtual communities (Sikorska et al., 2021). This behavior may, in turn, exacerbate symptoms of Internet addiction, creating a vicious cycle that is difficult to break (Marciano et al., 2020).

The consequences of Internet addiction in students who suffer from bullying or cyberbullying are varied and can aggravate existing emotional and social problems (Albikawi, 2023). These students may experience decreased academic performance, social isolation, as well as increased anxiety and depression due to lack of concentration and excessive time spent on online activities (Albikawi, 2023; Chen et al., 2023a). Excessive reliance on the Internet may further hinder these youths' ability to develop healthy interpersonal relationships and resolve conflicts constructively (Marciano et al., 2020). Additionally, excessive time online may exacerbate pre-existing mental health problems (Nguyen et al., 2022). Youth who spend many hours online often report higher levels of stress and feelings of loneliness, which can lead to further deterioration of their emotional well-being (Méndez et al., 2019a).

As in previous sections, in addition to considering PA as a potentially effective strategy to mitigate the negative effects of bullying it can also decrease internet addiction (Cheng et al., 2023a). Participating in sport activities can provide students with a positive outlet

for stress and negative emotions, thus reducing their dependence on the internet as a coping mechanism (Méndez et al., 2019a).

Role of physical activity in bullying and cyberbullying behaviors among children and adolescents

It has been found that regular PA practice has a significant impact on reducing bullying and cyberbullying behaviors among children and adolescents (García-Hermoso et al., 2020). Several studies have shown that participation in PA not only improves physical and mental health, but can also decrease the incidence of aggressive behaviors (Giandonato et al., 2021; Teferi, 2020). A specific study in Canada revealed that meeting PA and screen time recommendations is associated with lower odds of being a victim or perpetrator of school bullying and cyberbullying (Sampasa-Kanyinga et al., 2020). On a physical level, this may be because endogenous endocannabinoids and opioids such as enkephalins, endorphins and dynorphins are released during PA practice, which improve the functioning of the Central Nervous System and promote a balance between neurotoxic quinurenine and neuroprotective quinurenic acid, reducing disruptive behaviors (Cortés-Cortés et al., 2019; Crombie et al., 2018; Pedersen, 2019). These physiological changes may improve mood and foster greater emotional resilience, resulting in better conflict management and a reduction in the incidence of bullying.

Sport typology also plays a crucial role in bullying (Nery et al., 2019; Vveinhardt & Fominiene, 2022). Team sports, such as soccer or basketball, which foster cooperation and group cohesion, are considered beneficial for the amelioration of bullying and cyberbullying behaviors (Trajković et al., 2020). However, this typology due to team pressure and competitiveness may report higher prevalence than individual sports (Vveinhardt & Fominiene, 2022). Conversely, sports with an individual focus may, in some cases, exacerbate aggressive behaviors, especially if competition dynamics are not properly managed (Pourabdol et al., 2020).

In addition to the type of sport, the intensity with which PA is practiced also influences the incidence of bullying and cyberbullying behaviors (Kirklewski et al., 2023). Research indicates that higher exercise intensity is associated with a reduction in the prevalence of

bullying and cyberbullying (Kirklewski et al., 2023). In a study conducted with Spanish adolescents, vigorous PA practice was found to correlate with lower rates of cyberbullying (Benítez-Sillero et al., 2021a). This can be explained by several mechanisms. At the physical level, intense PA can improve self-efficacy and self-esteem, reducing vulnerability to being bullied (Greco, 2021). Cognitively, regular exercise can improve emotional regulation and stress management, crucial skills for coping with and preventing bullying and cyberbullying situations (Passarello et al., 2022). Socially, participation in sports can increase opportunities to form support networks and strengthen peer relationships (Delfin et al., 2024).

In turn, the time and regularity of PA practice are essential factors to maximize its benefits in reducing bullying and cyberbullying (García-Hermoso et al., 2020). Studies have shown that performing at least 60 minutes of PA daily, as recommended by movement guidelines, can have protective effects against bullying and cyberbullying (Sampasa-Kanyinga et al., 2020). In addition, the time of day when the activity is performed may also have an influence (Maeneja et al., 2022). Morning exercises may better prepare students to face the challenges of the school day by improving their mood and energy levels (Hormazábal-Aguayo et al., 2019). On the other hand, PA after the school day can serve as a means to release accumulated tensions and reduce stress (McGovern & Kulinna, 2023).

Evidence suggests that the most influential time for PA practice in relation to bullying reduction is during the school day (Méndez et al., 2019b). The phenomenon of bullying and cyberbullying in the educational setting has gained relevance due to its serious consequences on the mental health and well-being of students (Esquivel et al., 2023). The school context is presented as an optimal setting for bullying or cyberbullying. realization of bullying or cyberbullying since it is an environment where students spend a large amount of time interacting with their peers, which facilitates the emergence of conflicts (Lizut, 2019). However, the prevalence of bullying and cyberbullying is not uniform across primary and secondary curriculum areas (Myers & Cowie, 2019; Zych et al., 2019). Several studies, expose those areas that promote collaborative work, creativity, or inclusion such as arts, music, and the humanities tend to be less prone to bullying

behaviors (Zych et al., 2019). Conversely, areas that promote competitiveness and physical exposure of students such as mathematics, science, or physical education (PE) may be more prone to bullying incidents (Myers & Cowie, 2019). It has been shown that PE students may be more likely to experience bullying or cyberbullying (Benítez-Sillero et al., 2021a). In a systematic review, physical inactivity and sedentary behavior were found to be associated with increased bullying victimization, suggesting that less active students may be more vulnerable to bullying (García-Hermoso et al., 2020). This may be due to the perception of physical weakness or lack of social skills that facilitate integration into groups, increasing the likelihood of being a target of bullying (Armitage, 2021).

Strategies for the development of physical activity programs aimed at reducing bullying and cyberbullying in children and adolescents

PA plays an essential role not only in physical well-being, but also in promoting an inclusive and bullying and cyberbullying-free school environment. Incorporating PA programs in the educational environment can be an effective strategy to reduce both bullying and cyberbullying. Several studies support the implementation of these programs as a means to improve the behavior and mental health of students.

Educational institutions should design strategies that promote the regular and appropriate practice of PA. These guidelines may include the incorporation of PA programs that encourage cooperation and inclusion, as well as extracurricular sports activities that are accessible and attractive to all students (Benítez-Sillero, et al., 2021b; Greco, 2021). In turn, it is essential that teachers receive training on how to integrate bullying prevention strategies into PE classes and other school activities, thus creating a school environment that supports PA and discourages aggressive behaviors (Benítez-Sillero et al., 2021b). Additionally, clear and strict anti-cyberbullying policies should be established and communicated to all members of the educational community (Chicote-Beato et al., 2024). At the family level, it is essential to foster open communication between parents and children about the use of technology and the associated risks, supervising and guiding the use of the Internet (Páez-Esteban et al., 2020; Khairi et al., 2022).

Finally, it is essential to educate students on the importance of PA practice for mental health and social well-being. Education about these benefits can help students understand how PA can reduce stress, improve mood, and foster healthy social relationships (Fahy et al., 2016). A school environment that promotes these values can contribute significantly to the reduction of bullying and cyberbullying among children and adolescents (Sampasa-Kanyinga et al., 2020).

Promoting resilience and social skills in children and adolescents is another key strategy to effectively manage bullying situations. Educational programs that foster respect, empathy, and social skills development, along with increased adult supervision at critical times and places, such as recess and hallways, can significantly reduce bullying (Gaffney et al., 2021).

For a PA program to be effective in reducing bullying and cyberbullying, it must be well structured and properly implemented. That is, it must take into account the time of PA practice, the intensity (WHO, 2019), the time of practice (before, during or after the day) (Hormazábal-Aguayo et al., 2019) or the type of PA (Trajković et al., 2020).

As a conclusion, these programs have the potential to improve learning variables by reducing stress and anxiety, promoting better mental and physical health (Benítez-Sillero et al., 2020b). In addition, they contribute to decreasing the incidence of bullying and cyberbullying by fostering a more positive and cohesive school environment (Ng et al., 2022), improve students' ability to manage stress, which in turn improves their academic performance and their ability to engage in deep learning (Estrada-Vidal et al., 2022), and support students in developing healthy coping skills and establishing positive relationships with their peers (Ng et al., 2022).

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OBJETIVOS

General

Analizar las posibles asociaciones y niveles de riesgo de los comportamientos de bullying y cyberbullying respecto a variables de aprendizaje en niños y adolescentes. Según el objetivo específico de cada estudio se ha incluido la práctica de AF como variable independiente o covariable.

Específicos

- Revisar y analizar críticamente la literatura científica mediante una revisión sistemática para conocer las relaciones y efectos de los estímulos de práctica de AF antes, durante y después del horario escolar en comportamientos de bullying y cyberbullying de niños y adolescentes (**Paper I**).
- Conocer los niveles de asociación de la práctica de AF con el bullying y cyberbullying en función del sexo y tras ajustar por edad, IMC, estudios de la madre y repetición de curso académico (**Paper II**).
- Analizar la asociación y evaluar el nivel de riesgo de padecer bullying y cyberbullying con el aprendizaje profundo, aprendizaje superficial, planificación y procrastinación escolar en función del sexo, tras ajustar por edad, IMC, estudios de la madre y promedio de AF semanal (**Paper III**).
- Conocer la posible asociación y cuantificar el riesgo de las víctimas y agresores, de bullying y cyberbullying de padecer ansiedad ante los exámenes en función del sexo y tras ajustar por edad, IMC, nivel educativo materno, AF semanal y rendimiento académico (**Paper IV**).
- Analizar la asociación del bullying y cyberbullying con el uso de internet, teléfono móvil y videojuegos en niños y adolescentes en función del sexo y tras ajustar por edad, IMC, estudios de la madre y promedio de AF semanal (**Paper V**).
- Conocer la asociación de la práctica de AF semanal con el tiempo de uso de aplicaciones de redes sociales mediante teléfono móvil tras ajustar por edad e IMC (**Paper VI).**

AIMS

General

To analyze the possible associations and risk levels of bullying and cyberbullying behaviors with respect to learning variables in children and adolescents. Depending on the specific objective of each study, PA practice was included as an independent variable or covariate.

Specific

- To review and critically analyze the scientific literature through a systematic review to determine the relationships and effects of PA practice stimuli before, during and after school hours on bullying and cyberbullying behaviors in children and adolescents **(Paper I).**
- To determine the levels of association of PA practice with bullying and cyberbullying as a function of sex and after adjusting for age, BMI, mother's education and repetition of academic year **(Paper II).**
- To analyze the association and assess the level of risk of bullying and cyberbullying with deep learning, surface learning, planning and decision making and school procrastination as a function of sex, after adjusting for age, BMI, mother's education and average weekly PA **(Paper III).**
- To determine the possible association and quantify the risk of victims and aggressors of bullying and cyberbullying of suffering from test anxiety as a function of sex and after adjusting for age, BMI, maternal education level, weekly PA and academic performance **(Paper IV).**
- To analyze the association of bullying and cyberbullying with the use of internet, cell phone and video games in children and adolescents as a function of sex and after adjusting for age, BMI, mother's educational level and average weekly PA **(Paper V).**
- To determine the association of weekly PA practice with the time spent using social networking applications via cell phone after adjusting for age and BMI **(Paper VI).**

MATERIAL Y MÉTODOS

La sección de material y métodos de la presente memoria de Tesis se resume en la siguiente tabla que incluye la información metodológica más relevante de los artículos que componen la memoria de Tesis (Tabla 1):

Tabla 1.

Tabla resumen de las metodologías utilizadas en los diferentes artículos que componen esta Tesis Doctoral.

Artículo	Diseño	Participantes	Procedimiento	Variables	Análisis estadístico
I. Influence and effect of physical activity before, during and after the school day on bullying and cyberbullying in young people: A systematic review.	Revisión sistemática. Estructura en base a otras revisiones previas y la guía PRISMA.	29 estudios fueron incluidos en la revisión. Doce estudios fueron longitudinales y 17 fueron transversales.	Cuatro bases de datos fueron revisadas desde enero de 2013 a marzo de 2024 (PubMed, SCOPUS, Web of Science, Eric).	Se realizó la búsqueda en las anteriores bases de datos usando los siguientes términos: (1) Actividad física (physical activity academic lessons, physical active programme, physically active classes, physical education, active lesson break, active break, active pauses, recess, recreation, cooperative games, active movement, active displacement, active pre-school programs, extracurricular activities, after school activities, extracurricular sport). (2) Acoso escolar (bullying, cyberbullying, bullying school). (3) Niños (children, childhood, adolescents, students, school, high school).	Porcentajes y frecuencias.
II. Asociación de la práctica de actividad física semanal con bullying y cyberbullying	Transversal.	Un total de 1152 estudiantes de primaria y secundaria (10-16 años, 586 chicas).	El nombre de cada participante fue codificado. La cumplimentación de los cuestionarios y las medidas de	AF semanal (PACE+ Adolescent Physical Activity Measure Physical (Prochaska et al., 2001). Bullying (European bullying intervention project questionnaire	Para estudiar la asociación entre los niveles de práctica de AF con peores niveles de bullying y cyberbullying (víctimas y agresores) se llevó a cabo un análisis ANCOVA separado por

en chicos y chicas de 10 a 16 años.			peso y talla se llevaron a cabo durante las clases de EF.	versión española de Ortega-Ruiz et al. (2016)): Factor 1: victimización. Factor 2: agresión. Cyberbullying (European cyberbullying intervention project questionnaire (ECIPQ)): Factor 1: cibervictimización. Factor 2: ciberagresión. Covariables: edad, IMC, estudios de la madre y repetición de cursos académicos.	sexo y ajustado por edad, IMC, estudios de la madre y repetición de cursos académicos.
III. Bullying and Cyberbullying. A high Risk for Superficial Learning, Poor Planning and School Procrastination in English.	Transversal.	Un total de 1263 estudiantes de primaria y secundaria (10-16 años, 649 chicas).	El nombre de cada participante fue codificado. La cumplimentación de los cuestionarios y las medidas de peso y talla se llevaron a cabo durante las clases de EF.	Bullying (European bullying intervention project questionnaire versión española de Ortega-Ruiz et al. (2016)): Factor 1: victimización. Factor 2: agresión. Cyberbullying (European cyberbullying intervention project questionnaire (ECIPQ)): Factor 1: cibervictimización. Factor 2: ciberagresión. Actitudes hacia el studio (Revised study process questionnaire (R-SPQ-2F) versión revisada (Biggs et al., 2001)). Factor 1: aprendizaje superficial. Factor 2: aprendizaje profundo.	Para estudiar la asociación entre el bullying y cyberbullying (víctimas y agresores) con las variables de aprendizaje profundo y superficial, planificación y toma de decisiones y procrastinación se llevó a cabo un análisis ANCOVA separado por sexo. Para conocer el nivel de riesgo que supone la victimización/agresión de bullying y el cyberbullying hacia tener valores más bajos en aprendizaje profundo, superficial, planificación y toma de decisiones y procrastinación, se llevó a cabo una regresión

				Planificación y toma de decisiones (Escala para la evaluación de la planificación y toma de decisiones (Darden et al., 1996)): Factor 1: Planificación y toma de decisiones. Procrastinación (Academic procrastination scala-short form" (APS-SF) validada psicométricamente por Yockey (2016)): Factor 1: procrastinación. Covariables: edad, estudios de la madre, IMC y AF semanal.	logística binaria. Estos análisis fueron ajustados por edad, estudios de la madre, IMC y AF semanal.
IV. Association of high levels of bullying and cyberbullying with test anxiety in boys and girls aged 10 to 16 years.	Transversal.	Un total de 912 estudiantes de primaria y secundaria (10-16 años, 481 chicas).	El nombre de cada participante fue codificado. La cumplimentación de los cuestionarios y las medidas de peso y talla se llevaron a cabo durante las clases de EF.	Bullying (European bullying intervention project questionnaire versión española de Ortega-Ruiz et al. (2016)): Factor 1: victimización. Factor 2: agresión. Cyberbullying (European cyberbullying intervention project questionnaire (ECIPQ)): Factor 1: cibervictimización. Factor 2: ciberagresión. Ansiedad ante los exámenes (Cuestionario de ansiedad ante los exámenes (CAEX-A)):	Para estudiar la asociación entre el bullying y cyberbullying (víctimas y agresores) con la ansiedad ante los exámenes se llevó a cabo un análisis ANCOVA separado por sexo. Para conocer el nivel de riesgo que supone la victimización/agresión de bullying y el cyberbullying hacia tener valores más altos en ansiedad ante los exámenes se llevó a cabo una regresión logística binaria. Estos análisis fueron ajustados por edad, estudios de la madre, IMC, AF

				Factor 1: Respuesta fisiológica. Factor 2: Conductas de evitación. Factor 3: Respuesta cognitiva. Covariables: edad, estudios de la madre, IMC, AF semanal y rendimiento académico.	semanal y rendimiento académico.
V. Association of bullying and cyberbullying with internet use, cell phone use and video game use in children and adolescents.	Transversal.	Un total de 677 estudiantes de primaria y secundaria (10-16 años, 359 chicas).	El nombre de cada participante fue codificado. La cumplimentación de los cuestionarios y las medidas de peso y talla se llevaron a cabo durante las clases de EF.	Bullying (European bullying intervention project questionnaire versión española de Ortega-Ruiz et al. (2016)): Factor 1: victimización. Factor 2: agresión. Cyberbullying (European cyberbullying intervention project questionnaire (ECIPQ)): Factor 1: cibervictimización. Factor 2: ciberagresión. Internet (Spanish PIUQ-9 (Otiura-Tirsano). Teléfono móvil ("SAS-SV" (Kwon et al., 2013)). Videojuegos (Internet Gaming Disorder Scale–Short–Form (IGDS9–SF) (Pontes & Griffiths, 2015)). Covariables: edad, IMC, estudios de la madre y AF semanal.	Para estudiar la asociación entre el bullying y cyberbullying (víctimas y agresores) con el uso de internet, teléfono móvil y videojuegos se llevó a cabo un análisis ANCOVA separado por sexo. Para conocer el nivel de riesgo que supone la victimización/agresión de bullying y el cyberbullying hacia tener valores más altos de uso de internet, teléfono móvil, y videojuegos se llevó a cabo una regresión logística binaria. Estos análisis fueron ajustados por edad, estudios de la madre, IMC y AF semanal.
VI. Asociación de la Actividad Física con	Transversal.	Un total de 465 estudiantes de primaria y	El nombre de cada participante fue codificado. La	AF semanal (PACE+ Adolescent Physical Activity Measure Physical (Prochaska et al., 2001)).	Para estudiar si los adolescentes con baja práctica de AF tenían peores niveles de tiempo de

aplicaciones móviles y redes en jóvenes de 10 a 16 años.		secundaria (10-16 años, 220 chicas).	cumplimentación de los cuestionarios y las medidas de peso y talla se llevaron a cabo durante las clases de EF.	Uso de aplicaciones móviles: registro directo desde dispositivos.	empleo de aplicaciones móviles y redes que aquellos participantes con altos niveles de AF se realizó un análisis de covarianza (ANCOVA). Estos análisis fueron ajustados por edad e IMC.

AF: Actividad física. IMC: Índice de masa corporal. ANCOVA: Análisis de covarianza.

MATERIAL AND METHODS

The material and methods section of this Thesis report is summarized in the following table, which includes the most relevant methodological information of the articles included in the Thesis report (Table 1):

Table 1.

Summary table of the methodologies used in the different articles that make up this Doctoral Thesis.

Paper	Desing	Participants	Procedure	Variables	Statistical analysis
Influence and effect of physical activity before, during and aftr the school day on bullying and cyberbullying in young people: A systematic review.	Systematic review. Structure based on other previous reviews and the PRISMA guide.	29 studies were included in the review. Twelve studies were longitudinal and 17 were cross-sectional.	4 databases were reviewed from January 2013 to March 2024 (PubMed, SCOPUS, Web of Science, Eric).	The above databases were searched using the following terms: (1) Physical activity (physical activity academic lessons, physical active programme, physically active classes, physical education, active lesson break, active break, active pauses, recess, recreation, cooperative games, active movement, active displacement, active pre-school programs, extracurricular activities, after school activities, extracurricular sport). (2)Bullying (bullying, cyberbullying, bullying school). (3) Children (children, childhood, adolescents, students, school, high school).	Percentages and frequencies.
II. Association of weekly physical activity practice with bullying and cyberbullying	Cross-sectional.	A total of 1152 primary and secondary school students (10- 16 years old, 586 girls).	The name of each participant was coded. The completion of the questionnaires and weight and height measurements were	Weekly PA (PACE+ Adolescent Physical Activity Measure Physical (Prochaska et al., 2001)). Bullying (European bullying intervention project questionnaire Spanish version of Ortega-Ruiz et al. (2016)):	To study the association between levels of PA practice with worse levels of bullying and cyberbullying (victims and aggressors), an ANCOVA analysis was carried out separated by sex and adjusted

in boys and girls aged 10 to 16 years.			carried out during the PE classes.	Factor 1: victimization. Factor 2: aggression. Cyberbullying (European cyberbullying intervention project questionnaire (ECIPQ)): Factor 1: cybervictimization. Factor 2: cyberaggression. Covariates: age, BMI, mother's education and repetition of academic years.	for age, BMI, mother's studies and repetition of academic years.
III. Bullying and Cyberbullying. A high Risk for Superficial Learning, Poor Planning and School Procrastination in English.	Cross-sectional.	A total of 1,263 primary and secondary school students (10-16 years old, 649 girls).	The name of each participant was coded. The completion of the questionnaires and weight and height measurements were carried out during the PE classes.	Bullying (European bullying intervention project questionnaire Spanish version of Ortega-Ruiz et al. (2016)): Factor 1: victimization. Factor 2: aggression. Cyberbullying (European cyberbullying intervention project questionnaire (ECIPQ)): Factor 1: cybervictimization. Factor 2: cyberaggression. Attitudes towards study (Revised study process questionnaire (R-SPQ-2F) revised version (Biggs et al., 2001)). Factor 1: superficial learning. Factor 2: deep learning. Planning and decision making (Scale for the evaluation of	To study the association between bullying and cyberbullying (victims and aggressors) with the variables of deep and surface learning, planning and decision making, and procrastination, an ANCOVA analysis was carried out, separated by sex. To find out the level of risk of bullying victimization/aggression and cyberbullying towards having lower values in deep learning, surface learning, planning and decision making, and procrastination, a binary logistic regression was performed. These analyses were adjusted for age, mother's education, BMI and weekly PA.

				planning and decision making. (Darden et al., 1996)): Factor 1: Planning and decision making. Procrastination (Academic procrastination scala-short form (APS-SF) psychometrically validated by Yockey (2016)): Factor 1: procrastination. Covariates: age, mother's education, BMI and weekly PA.	
IV. Association of high levels of bullying and cyberbullying with test anxiety in boys and girls aged 10 to 16 years.	Cross-sectional.	A total of 912 primary and secondary school students (10-16 years old, 481 girls).	The name of each participant was coded. The completion of the questionnaires and weight and height measurements were carried out during the PE classes.	Bullying (European bullying intervention project questionnaire Spanish version of Ortega-Ruiz et al. (2016)):Factor 1: victimization. Factor 2: aggression. Cyberbullying (European cyberbullying intervention project questionnaire" (ECIPQ)):Factor 1: cybervictimization. Factor 2: cyberaggression. Test anxiety (Test Anxiety Questionnaire (CAEX-A)): Factor 1: Physiological response. Factor 2: Avoidance behaviors. Factor 3: Cognitive response. Covariates: age, mother's education, BMI, weekly PA and academic performance.	To study the association between bullying and cyberbullying (victims and aggressors) and test anxiety, an ANCOVA analysis was carried out separately by sex. Binary logistic regression was performed to determine the level of risk of bullying victimization/aggression and cyberbullying for higher test anxiety. These analyses were adjusted for age, mother's education, BMI, weekly PA and academic performance.

V. Association of bullying and cyberbullying with internet use, cell phone use and video game use in children and adolescents.	Cross-sectional.	A total of 677 primary and secondary school students (10-16 years, 359 girls).	The name of each participant was coded. The completion of the questionnaires and weight and height measurements were carried out during the PE classes.	Bullying (European bullying intervention project questionnaire Spanish version of Ortega-Ruiz et al. (2016)): Factor 1: victimization. Factor 2: aggression. Cyberbullying (European cyberbullying intervention project questionnaire (ECIPQ)): Factor 1: cybervictimization. Factor 2: cyberaggression. Internet (Spanish PIUQ-9 (Otiura-Tirsano)). Mobile phone ("SAS-SV" (Kwon et al., 2013)). Videogames (Internet Gaming Disorder Scale–Short–Form (IGDS9–SF) (Pontes & Griffiths, 2015)) Covariates: age, BMI, mother's education and weekly PA.	To study the association between bullying and cyberbullying (victims and aggressors) with the use of internet, cell phone and video games, an ANCOVA analysis was carried out separated by sex. Binary logistic regression was performed to determine the level of risk of bullying victimization/aggression and cyberbullying to have higher values of internet, cell phone and video game. These analyses were adjusted for age, mother's education, BMI and weekly PA.
VI. Association of Physical Activity with mobile applications and networks in young people aged 10-16 years.	Cross-sectional.	A total of 465 primary and secondary students (10-16 years, 220 girls).	Each participant's name was coded. Completion of questionnaires and weight and height measurements were carried out during PE classes.	Weekly PA (PACE+ Adolescent Physical Activity Measure Physical (Prochaska et al., 2001)). Use of mobile applications: direct recording from devices.	To study whether adolescents with low PA practice had worse levels of time spent using mobile apps and networks than those participants with high levels of PA, an analysis of covariance (ANCOVA) was performed. These analyses were adjusted for age and BMI.

PA: Physical activity. BMI: Body mass index. ANCOVA: Analysis of covariance.

RESULTADOS Y DISCUSIÓN

Los resultados y discusión se presentan en la forma en que han sido previamente publicados/sometidos en revistas científicas. Adicionalmente, en la siguiente tabla se ofrece un resumen de los principales resultados obtenidos en cada uno de los estudios realizados (Tabla 2):

Tabla 2

Resumen de los resultados obtenidos en los diferentes artículos que componen la presente Tesis.

Artículo	Resultados
I. Influence and effect of physical activity before, during and after the school day on bullying and cyberbullying in young people: A systematic review.	La presente revisión sistemática tuvo como objetivo analizar los estímulos de AF antes, durante y después del horario escolar sobre el bullying y cyberbullying en estudiantes entre 6 y 18 años. Un total de 29 estudios con diseños longitudinales y transversales realizados entre enero de 2013 y febrero de 2024 cumplieron los criterios de inclusión. En general, los programas de AF aplicados en distintos momentos de la jornada diaria han demostrado efectividad en la reducción de la victimización por bullying y la mejora de comportamientos relacionados, así como en el alivio de factores psicológicos adversos derivados del bullying.
II. Asociación de la práctica de Actividad Física semanal con bullying y cyberbullying en chicos y chicas de 10 a 16 años.	El presente estudio revela que no existen diferencias de victimización de bullying en los adolescentes respecto a su nivel de práctica semanal de AF. Sin embargo, los chicos físicamente activos muestran un nivel mayor de agresión por bullying en comparación con los inactivos. En cuanto al cyberbullying, los resultados de victimización y agresión en función del nivel de AF semanal parece que no afecta en las chicas, sin embargo, los estudiantes físicamente activos presentaron tanto menores niveles de victimización como de agresión.
III. Bullying and Cyberbullying. A high Risk for Superficial Learning, Poor Planning and School Procrastination.	Los resultados han mostrado que tanto las victimas como agresores de bullying y cyberbullying presentan un aprendizaje más superficial, tienen valores más bajos en planificación y tienden a retrasar las tareas de clase. Las chicas víctimas de bullying se ven afectadas en mayor medida que los chicos y presentan el doble de riesgo que las no víctimas hacia la procrastinación. Los datos muestran, además,

	que la victimización del cyberbullying tiene un mayor impacto negativo en el aprendizaje que el tradicional bullying. Este riesgo se multiplica x 3 y x 4 hacia tener altos valores de aprendizaje superficial y procrastinación, respectivamente. En el caso del cyberbullying, los efectos negativos que sufren los agresores sobre las variables de aprendizaje son más acusados aún. En ambos sexos, el riesgo de exposición hacia tener altos valores de aprendizaje superficial, baja planificación y alta procrastinación se multiplica x 8, x 2 y x 10, respectivamente.
IV. Association of high levels of bullying and cyberbullying with test anxiety in boys and girls aged 10 to 16 years.	Los principales resultados muestran que las víctimas de bullying y cyberbullying tienen respuestas fisiológicas y cognitivas significativamente más elevadas, y en el caso del cyberbullying también se incrementan los comportamientos de evitación. Los agresores, tanto de bullying como de cyberbullying, presentan mayores valores en todas las dimensiones de la ansiedad ante los exámenes. De manera general, tanto víctimas como agresores sufren un alto riesgo de ansiedad ante los exámenes, siendo más acusado en víctimas de cyberbullying, particularmente en términos de respuestas fisiológicas y cognitivas.
V. Association of bullying and cyberbullying with internet use, cell phone use and video game use in children and adolescents.	El presente estudio expone que tanto víctimas como agresores de bullying y cyberbullying presentan una mayor propensión al uso prolongado de Internet, teléfono móvil y videojuegos con porcentajes significativamente elevados en chicas en comparación con los chicos. A su vez, las víctimas o agresores de cyberbullying tienen el doble de posibilidad de tener elevados niveles en estas variables que los víctimas o agresores de bullying tradicional.

VI. Asociación de la actividad física con aplicaciones móviles y redes en jóvenes de 10 a 16 años.	Los resultados muestran que los jóvenes con bajos niveles de práctica de AF muestran mayor tiempo de empleo de aplicaciones móviles como WhatsApp, YouTube y buscadores que aquellos estudiantes con altos niveles de práctica de AF. Sin embargo, los jóvenes con alto nivel de práctica de AF emplean mayor tiempo en aplicaciones de compra online. No se han hallado diferencias significativas en función del nivel de práctica de AF en redes de contactos sociales como TikTok, Instagram, Be real, Twitter y Spotify.

RESULTS AND DISCUSSION

The results and discussion are presented in the form in which they have been previously published/submitted in scientific journals. Additionally, the following table provides a summary of the main results obtained in each of the studies performed (Table 2):

Table 2

Summary of the results obtained in the different articles included in this Thesis.

Paper	Results
I. Influence and effect of physical activity before, during and aftr the school day on bullying and cyberbullying in young people: A systematic review	The present systematic review aimed to analyze PA stimuli before, during and after school hours on bullying and cyberbullying in students aged 6 to 18 years. A total of 29 studies with longitudinal and cross-sectional designs conducted between January 2013 and February 2024 met the inclusion criteria. In general, PA programs applied at different times of the daily day have shown effectiveness in reducing bullying victimization and improving related behaviors, as well as alleviating adverse psychological factors resulting from bullying.
II. Association of weekly Physical Activity practice with bullying and cyberbullying in boys and girls aged 10 to 16 years.	The present study reveals that there are no differences in bullying victimization in adolescents with respect to their level of weekly PA practice. However, physically active boys show a higher level of bullying aggression compared to inactive boys. Regarding cyberbullying, the results of victimization and aggression as a function of weekly PA level seem not to affect in girls, however, physically active students presented both lower levels of victimization and aggression.
III. Bullying and Cyberbullying. A high Risk for Superficial Learning, Poor Planning and School Procrastination.	The results have shown that both victims and aggressors of bullying and cyberbullying present more superficial learning, have lower values in planning and tend to procrastinate on class tasks. Girls who are victims of bullying are affected to a greater extent than boys and are twice as likely as non-victims to procrastinate. The data also show that cyberbullying victimization has a greater negative impact on learning than traditional bullying. This risk is multiplied x 3 and x 4 towards having high values of superficial learning and procrastination, respectively. In the case of cyberbullying, the negative effects

	suffered by aggressors on learning variables are even more pronounced. In both sexes, the risk of exposure to having high values of superficial learning, low planning and high procrastination is multiplied x 8, x 2 and x 10, respectively.
IV. Association of high levels of bullying and cyberbullying with test anxiety in boys and girls aged 10 to 16 years.	The main results show that victims of bullying and cyberbullying have significantly higher physiological and cognitive responses, and in the case of cyberbullying also increased avoidance behaviors. Both bullying and cyberbullying perpetrators have higher values on all dimensions of test anxiety. In general, both victims and aggressors suffer a high risk of test anxiety, being more pronounced in cyberbullying victims, particularly in terms of physiological and cognitive responses.
V. Association of bullying and cyberbullying with internet use, cell phone use and video game use in children and adolescents.	The present study shows that both victims and aggressors of bullying and cyberbullying have a higher propensity to prolonged use of the Internet, cell phones and video games, with significantly higher percentages in girls compared to boys. In turn, victims or aggressors of cyberbullying are twice as likely to have high levels of these variables than victims or aggressors of traditional bullying.
VI. Association of physical activity with mobile applications and networks in young people aged 10 to 16 years.	The results show that young people with low levels of PA practice show greater time spent on mobile applications such as WhatsApp, YouTube and search engines than those students with high levels of PA practice. However, young people with high levels of PA practice spend more time on online shopping apps. No significant differences were found depending on the level of PA practice in social networking sites such as TikTok, Instagram, Be real, Twitter and Spotify.

I

Influence and Relationship of Physical Activity before, during and after the School Day on Bullying and Cyberbullying in Young People: A Systematic Review.

Rusillo-Magdaleno, A., Moral-García, J.E., Brandão-Loureiro, V., & Martínez-López, E.J. (2024).

Education Sciences, 14, 1094.
*(***JCR: 2,5,** ***Q1*** *Education & Educational Research;* **SJR: 0,67,** ***Q2*** *Education).*

education sciences

MDPI

Systematic Review

Influence and Relationship of Physical Activity before, during and after the School Day on Bullying and Cyberbullying in Young People: A Systematic Review

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Abstract: The aim of this systematic review was to analyze the influence of the practice of Physical Activity (PA) before, during and after school hours on bullying and cyberbullying in children and adolescents. Studies were identified in four databases (PubMed, SCOPUS, Web of Science, ERIC) from January 2013 to March 2024. A total of 29 studies met the inclusion criteria. Seventeen studies used a cross-sectional design to explore the association between these variables, and 12 articles had a longitudinal design with PA interventions. The review found that PA is associated with significant improvements in bullying and cyberbullying, reduced depressive symptoms, and strengthened social relationships, responsibility, and self-esteem. PA before the school day may be effective in reducing bullying victimization. During the school day, it promotes affective behaviors related to bullying, such as empathy and respect for others, and optimizes psychological factors such as self-concept and self-esteem. After-school PA reduces bullying and disruptive behaviors in non-educational contexts. It is recommended to implement PA programs that address social, emotional and behavioral aspects throughout the day, with Educational Centers and Physical Education as the central axis. Didactic recommendations for implementing PA programs against bullying/cyberbullying in school and extracurricular contexts are included.

Keywords: physical education; bullying; cyberbullying; children; adolescents

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1. Introduction

Bullying is defined as aggressive behavior intended to physically, psychologically and socially harm another person [1,2]. It is linked to serious consequences, such as violent and disruptive behavior, as well as psychological problems such as low self-esteem, anxiety and depression [1,3,4]. Bullying can manifest itself through physical, verbal or psychological aggression, all of which significantly affect the psychoemotional well-being of victims [5–7]. Globally, around 30% of students report having experienced bullying, although this prevalence varies by region and culture [8]. The rise of technology and social media has shifted traditional bullying to cyberbullying, where new technologies are used to harm a victim who cannot easily defend himself or herself [9,10]. Like traditional bullying, cyberbullying can involve verbal harassment or threats of physical harm [11,12]. The Internet and mobile devices facilitate anonymity and depersonalization, amplifying the reach and impact of cyberbullying [9,13]. Internationally, cyberbullying shows high prevalence rates, with victimization ranging from 13.99% to 57.5%, and aggression ranging from 6% to 46.3% [14].

Given that bullying or cyberbullying can be negatively related to the motor competence and/or morphotype of schoolchildren in the educational environment [15,16], at times such as arrival and departure from school, during recess periods or in physical education classes [17,18], participation in PA has been identified as a potential protective factor against

bullying, fostering social and emotional skills such as empathy and self-regulation that contribute to the reduction of aggressive behaviors [7,19]. In structured settings, such as physical education classes, PA may reduce the likelihood of bullying by promoting cooperative behaviors and social connectedness [2,20], suggesting that regular PA appears to be inversely related to bullying and cyberbullying victimization [21,22]. Recent studies suggest that those who actively participate in organized sports or physical activities have lower rates of victimization, partly due to improved physical self-concept, which reduces the perceived vulnerability to bullies [21]. However, lack of participation in physical activities or a high level of sedentary lifestyle is associated with higher victimization in both traditional bullying and cyberbullying, due to factors such as social isolation and low self-esteem [22].

The relationship between PA and bullying may vary according to developmental period and school stage, following different patterns. In the early years, with schoolchildren aged 6–12 years, engaging in regular PA appears to be related to a lower prevalence of bullying. Participation in organized sports promotes social skills and values such as respect and empathy, which reduces the likelihood of being a victim or perpetrator of bullying [23], and children who comply with PA recommendations have a lower risk of being victimized, due to factors such as greater social integration and better self-perception [24]. In secondary education (13–16 years), the dynamics between PA and bullying, including its manifestations in the digital domain, become more complex. Adolescents who engage in competitive sports tend to have stronger coping mechanisms against cyberbullying, as these activities foster resilience and group cooperation [21]. However, some studies suggest that a higher frequency of competitive PA may be related to aggressive behaviors in some adolescents, which could increase their involvement in the bullying role [23]. These differences could be due to changes in social and emotional structure that occur during adolescence, where power conflicts and self-assertion play a more predominant role in bullying behavior in both physical and digital environments [25], with cyberbullying being more prevalent among adolescents, partly due to the increased use of electronic devices and social networks [26]. In summary, PA interventions in childhood do not usually focus on reducing cyberbullying, as this is not a prevalent problem among younger children. However, in adolescence, interventions that promote PA could be effective not only in reducing relational bullying, but also in preventing cyberbullying by improving self-esteem and fostering a sense of belonging within organized sports groups [21].

In this line, previous studies show that PA performed before, during or after school hours can produce benefits in the physical, mental and socio-emotional health of children and adolescents [21,27–32]. However, we are not aware of any study that has aggregated and analyzed the relationship between the type of PA and the timing of the PA stimulus on bullying/cyberbullying at these early ages.

Firstly, there are PA stimuli before the start of the school day, for example, with active commuting to the educational center or through active starts [22,33]. This PA improves physical-mental activation, emotional well-being and social interaction among students, in addition to reducing aggressive behaviors and fostering positive relationships [21,29]. This PA can also foster a favorable mood throughout the school day and reduce the incidence of bullying [31]. On the other hand, one of the key moments and where young people spend the most time throughout the day is during the school day [34]. Recess, active breaks or physically active classes can have an impact on improving classroom behavior [35], lead to a reduction in disciplinary infractions and create a more positive environment [36]. In addition, the PE class is a key moment for the detection, control, reduction and prevention of bullying situations [37,38]. Bullying can be detected and affected in various situations such as team selection, cooperative and competitive activities, physical skill exercises or during the use of private spaces where students may feel vulnerable [37]. However, the practice of non-competitive team sports seems to foster healthy social relationships and reduce the risk of aggressive behaviors among adolescents [23].

Therefore, the well-targeted physical education class can be used as a preventive measure against bullying [21,32], creating an inclusive and safe environment in schools [27,29,39]. It can provide students with an ideal learning environment for the development of social skills and friendship [40,41], prioritizing cooperation over excessive competition [42], fostering empathy and inclusiveness [40,43] and providing opportunities for students with a priori 'perpetrator' characteristics to develop more pro-social behaviors, and for 'victims' to improve their self-confidence and group participation [39].

Another of the moments where PA practice is the cause or acts as prevention of confrontations or bullying situations is during after-school activities [2,44]. After-school activities, on multi-sport fields or gymnasiums, are a key venue for bullying and cyberbullying among youth [45]. Nearly one-third of bullying experiences occur outside the school environment [45]. The prevalence of bullying and cyberbullying behaviors in relation to after-school PA participation is classified according to the practice of various types of sports and modality [46]. Sometimes, in these post-school day moments, the prevalence of bullying and/or cyberbullying increases due to less structured environments or abusive internet use [47,48]. However, after-school PA may also be related to a decrease in bullying [49], because voluntary PA practice fosters the development of positive social and emotional skills [50]. Therefore, PA can play an important role in the formation of resilient and socioemotionally aware students in bullying situations, promoting a safe and healthy environment [2].

Finally, there may be some important covariates that affect the relationship between PA and bullying/cyberbullying. First, the Primary and Secondary Education stages coincide with the intensive use of technologies and social networks [51], leading to a higher exposure to bullying and cyberbullying risks [52]. In this sense, it seems that both age and sex could decisively impact the perception and experience of bullying, as well as the types and frequency of PA [53]. Also, socioeconomic status could play an important role because opportunities for PA and bullying experiences may vary significantly between different socioeconomic contexts [54,55]. The complexity of assessing the effects of PA, due to contextual and personal factors, highlights the need to analyze the specific timing of its practice around the school day.

Previous research has analyzed the impact of PA practice on bullying behaviors during the school day [56,57]. However, there are no known systematic reviews focused on analyzing the possible impact of the type and timing of PA (before, during, and after the school day) on youth bullying/cyberbullying. Therefore, the research question is the following: Can the type and timing of PA influence the incidence of bullying and cyberbullying in young people in primary and secondary education?

Based on the above, the aim of this systematic review was to analyze the influence and relationship of PA practice before, during and after school on bullying and cyberbullying in primary and secondary school students. Educational proposals are included with concrete practical recommendations for their implementation in the school and family context.

2. Materials and Methods

This systematic review shares the same structure as previous reviews [32,58] and follows PRISMA'S guidelines [59]. A comprehensive search was performed in four databases (PubMed, SCOPUS, Web of Science, ERIC) for relevant articles published between January 2013 to July 2024. Table 1 shows the main terms and search strings that were used: (1) Physical activity (physical activity academic lessons, physical active program, physically active classes, physical education, active lesson break, active break, active pauses, recess, recreation, cooperative games, active movement, active displacement, active pre-school programs, extracurricular activities, after school activities, extracurricular sport); (2) Bullying (bullying, cyberbullying, bullying school); (3) Children (children, childhood, adolescents, students, school, high school).

Table 1. Database search strategy.

Database	Search Strategy	Limits	Filtered Items
PubMed	("physical activity academic lessons" OR "physical active programme" OR "physically active classes" OR "physical education" OR "active lesson break" OR "active break" OR "active pauses" OR recess OR recreation OR "cooperative games" OR "active movement" OR "active displacement" OR "active pre-school programs" OR "extracurricular activities" OR "after school activities" OR "extracurricular sport") AND (bullying OR cyberbullying OR "bullying school") AND (child, OR children OR childhood OR adolescent OR students OR school OR "secondary school")	Articles published from 1 January 2013 to 31 July 2024 Age: 6–18 years Language: English and Spanish Journal article	241
Scopus			177
Web of Science			260
ERIC			219

Selection criteria

Articles retrieved during the searches were selected using the following criteria: (1) full-text report published in a peer-reviewed journal; (2) conducted in pre-school, in-school, and after-school activities in children and adolescents aged 6 to 18 years; (3) written in English or Spanish; (4) used a cross-sectional or two-group intervention design; (5) ethnicity was not an exclusion criterion.

Data extraction and reliability

The search was conducted by three independent reviewers (XXX). They read the titles and abstracts of all retrieved articles. A meeting was held to resolve disagreements about eligibility. Information on author, title, objective, sample size, age, country, design, measurement, confounders, main results, and conclusions were extracted from all studies. The results of studies potentially relevant to the selected topics were reviewed.

Assessments of quality and level of evidence

According to a review study, only one third of systematic reviews in education present tools for quality assessment of the studies analyzed [60]. Based on this information, the present systematic review presented a quality assessment performed on the basis of other standardized assessment lists [61] and our selection criteria (Table 2). Items were scored as follows: 2 = fully reported; 1 = partially reported; 0 = not reported or unclear. The list consisted of six items related to population, setting, measurements, design, confounders, and outcome reporting. The total quality scores of the studies were calculated by summing the scores of the individual items (range: 0–12) and were used to categorize the level of evidence provided: studies with a total quality score > 9 were classified as high quality, those scoring 5–8 were classified as medium quality, and those scoring <5 were classified as low quality, and thus were not included in the detailed analysis for this paper.

Table 2. List of included studies with quality scores.

	Authors	A	B	C	D	E	F	Total Score	Quality Level
1	Aguilar-Herrero et al. [20]	2	2	1	2	0	0	7	MQ
2	Benítez-Sillero et al. [62]	2	2	2	2	2	2	12	HQ
3	Benítez-Sillero et al. [21]	2	2	2	2	2	0	10	HQ
4	Benítez-Sillero et al. [63]	2	2	2	2	2	1	11	HQ
5	Carraro et al. [64]	2	2	1	2	2	0	9	HQ
6	Case et al. [65]	2	2	1	2	2	0	9	HQ
7	Corral-Pernía et al. [66]	2	2	2	2	2	1	11	HQ
8	Driessens [67]	2	2	1	2	2	0	9	HQ
9	Evans et al. [68]	2	2	2	2	2	2	12	HQ
10	Fung & Lee [69]	2	2	1	2	2	0	9	HQ
11	Garnett et al. [70]	2	2	1	2	2	0	9	HQ
12	Greco [71]	2	2	2	2	2	0	10	HQ
13	Holbrook et al. [72]	2	2	1	2	2	0	9	HQ
14	Hormazábal-Aguayo et al. [73]	2	2	2	2	2	2	12	HQ
15	Khitaryan et al. [74]	2	2	2	2	1	0	9	HQ

Table 2. *Cont.*

	Authors	A	B	C	D	E	F	Total Score	Quality Level
16	Mannocci et al. [75]	2	2	2	2	2	1	11	HQ
17	Mayfield et al. [76]	2	2	2	2	2	0	10	HQ
18	Menéndez-Santurio & Fernández-Río [77]	2	2	1	2	2	0	9	HQ
19	Montero-Carretero et al. [38]	2	2	2	2	2	0	10	HQ
20	Montero-Carretero et al. [78]	2	2	2	2	2	0	10	HQ
21	Nery et al. [79]	2	2	2	2	2	2	12	HQ
22	Oliveira et al. [19]	2	2	2	2	2	0	10	HQ
23	Park et al. [80]	2	2	1	2	2	0	9	HQ
24	Philippot et al. [81]	2	2	2	2	0	0	8	MQ
25	Rojo-Ramos et al. [82]	2	2	2	2	2	0	10	HQ
26	Roman & Taylor [83]	2	2	2	2	2	1	11	HQ
27	Savucu et al. [84]	2	2	2	2	2	0	10	HQ
28	Vveinhardt & Fominiene [85]	2	2	2	2	2	0	10	HQ
29	Vveinhardt & Fominiene [86]	2	2	2	2	2	0	10	HQ
30	Widyastari et al. [87]	2	2	1	2	2	0	9	HQ

Note: High quality (HQ) = 9–12. Medium quality (MQ) = 5–8. A. The study was a full report published in a peer-reviewed journal. B. The study is conducted in school, pre-school, or after-school activities. C. The PA and the selected bullying was clearly described. D. The sample was of primary school youth between 6 and 18 years old. E. The study had a cross-sectional or interventional design with a control group or condition. F. The data were adjusted for confounding factors.

3. Results

Figure 1 shows the flow of the search results through the systematic review process. The initial search retrieved 897 articles that were reduced to 877 by the elimination of duplicates. Subsequently, with examination of titles and abstracts, 89 studies were excluded. In the last step, 757 papers were excluded because the population, age, design, or language did not meet the selection criteria. Therefore, 30 studies were included in the systematic review. Seventeen (56.67%) had a cross-sectional design and thirteen (43.33%) had a longitudinal design. Two (7.4%) of the papers were classified as medium quality and the rest as high quality.

The review covers data from 60,782 primary and secondary students; 7767 students belong to primary education, 44,932 to secondary education, and three studies do not differ in primary or secondary (8144). The sample of the studies ranged from 11 participants [81] to 13,695 [67]. The studies covered 15 different countries of origin. Nine studies were conducted in Spain, four in Italy, four in the United States, two in Lithuania and one study was analyzed in Chile, Belgium, Brazil, China, England, South Korea, Thailand, Turkey, Canada, Portugal and Armenia. Table 3 shows the main characteristics of the studies analyzed before school hours, Table 4 shows the mains characteristics of the studies analyzed during school hours and Table 5 shows the mains characteristics of the studies analyzed after school hours.

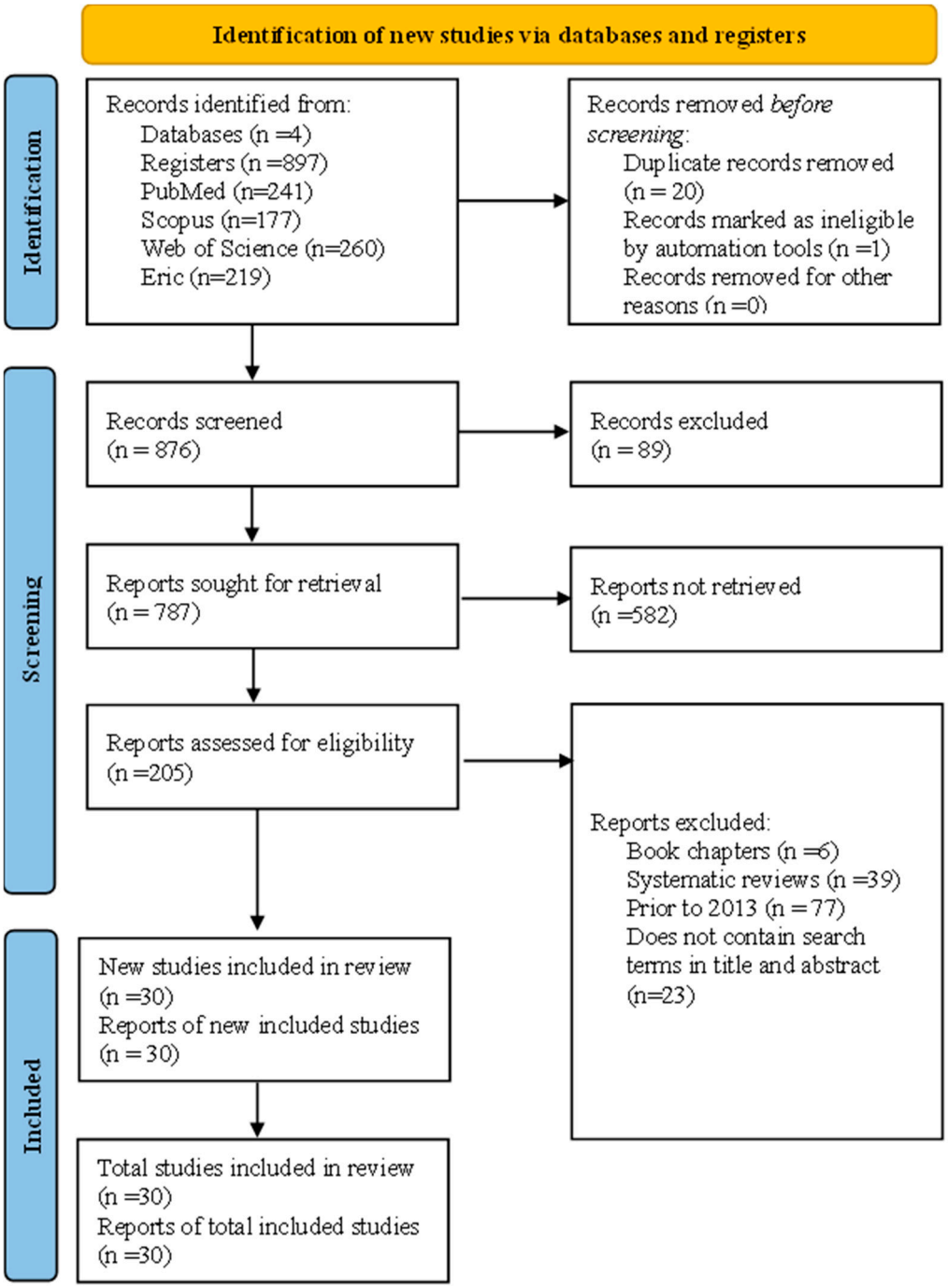

Figure 1. Search results through systematic review process.

Table 3. Main characteristics of the analyzed studies before school hours.

Physical Activity before School Hours						
	Authors/Year/Title	**Study Design/Intervention (Duration)/ Confounders**	**Sample/Age (Years)/ Country**	**Groups/Physical Activity Measures/Intensity**	**Bullying Measures**	**Results**
Cross-Sectional studies	Garnett et al., 2017 [70]/A mixed-methods evaluation of the Move it Move it! before-school incentive-based physical activity programme	Cross-sectional/Move it Move it! (25 min/day, 3 days/week)/No confounders	129 students/8–11 years/United States	Move it Move it! Program: run or walk in playground in school during 25 min/MVPA	Cornell's school climate bullying survey (Cornell, 2015)	Results assessing the relationship between kilometers walked and bullying victimization suggest that students who reported less bullying victimization had, on average, run/walked more kilometers compared to their peers who reported more bullying victimization
Longitudinal studies	Hormazábal-Aguayo et al., 2019 [73]/Can a before-school physical activity program decrease bullying victimization in disadvantaged children? The Active-Start Study	Intervention randomized controlled trial design/Active-Start intervention (30 min/day, 5 days/week, 8 week)/Confounders: age, sex, weight status, PHV and school	146 students/8–10 years/Chile	Two groups: EG (n = 88): Active-Start intervention CG (n = 58): no Active-Start intervention/Daily PA: sports games adapted to the age of the participants, playground games, dancing and other recreational and cooperative activities/MVPA	Scale extracted from the Single School Well-being Questionnaire-CUBE (Ministerio de Educación del Perú—MINEDU, 2013)	The influence of the PA program on the categories of bullying victimization shows a statistically significant reduction in the likelihood of physical bullying (OR = 0.18; 95% CI, 0.04–0.82; $p = 0.027$) and verbal bullying (OR = 0.13; 95% CI, 0.02–0.97; $p = 0.046$) after the 8 weeks

Table 4. Main characteristics of the studies analyzed during school hours.

	Physical Activity during School Hours					
	Authors/Year/Title	**Study Design/Intervention (Duration)/ Confounders**	**Sample/Age (Years)/ Country**	**Groups/Physical Activity Measures/Intensity**	**Bullying Measures**	**Results**
Cross-Sectional studies	Montero-Carretero et al., 2020 [38]/Predicting Bullying through Motivation and Teaching Styles in Physical Education	Cross-sectional design/No confounders	608 students/11–15 years/Spain	Cross-sectional. IV: Support style of the PE teacher. DV: Perpetration and victimization of bullying	The Spanish version of the European Bullying Intervention Project	Autonomy-supportive style negatively predicted bullying perpetration and bullying victimization. These results underscore the potential responsibility of physical education teachers in the fight against bullying, and by supporting autonomy and avoiding a controlling style, they can help reduce bullying perpetration and victimization
	Mannocci et al., 2023 [75]/"Fare male farsi male" project—Are cyberbullying and cyber victimisation associated with physical activity levels? A cross-sectional study in a sample of Italian adolescents	Cross-sectional design/Confounder: sex, age, educational level, time of use of technology, tobacco addiction	2112 students/12–18 years/Italy	Cross-sectional, IV: Cyberbullying. DV: Levels of PA	Italian version of the European Cyberbullying Intervention Project Questionnaire (ECIPQ)	The study indicated that sex was a risk factor for being a victim of cyberbullying, while spending one hour or less on the Internet, not smoking and being female were protective factors against cyberbullying. As for PA at the vigorous level, it seems to be related to less involvement in cyberaggressions
	Benítez-Sillero et al., 2022 [66]/Victimization in bullying and cyberbullying and organized physical activity: The mediating effect of physical self-concept in adolescents	Cross-sectional design/Confounders: gender and age	870 students/12–19 years/Spain	Cross-sectional. IV: Victimization and cybervictimization. DV: PA and physical self-concept	Spanish version of the "European Bullying Intervention Project Questionnaire (EBIPQ)" and the cyberbullying scale of the "European Cyberbullying Intervention Project Questionnaire (ECIPQ)"	A negative relationship was found between PA and both victimization and cybervictimization. Physical self-concept had a stronger relationship with PA in boys

Table 4. *Cont.*

Physical Activity during School Hours					
Authors/Year/Title	**Study Design/Intervention (Duration)/ Confounders**	**Sample/Age (Years)/ Country**	**Groups/Physical Activity Measures/Intensity**	**Bullying Measures**	**Results**
Menéndez-Santurio & Fernández-Río, 2018 [77]/Attitudes towards violence and the important role of students in the physical education classroom	Prospective ex post facto cross-sectional and correlational design/No Confounders	918 students/12–18 years/Spain	Cross-sectional. IV: Students' perceptions of PE classes. DV: Attitudes toward violence in class	"Violence Attitude Level Scale"	Negative correlations were found between the important role of the student body and attitudes towards violence. The results of the linear regression analysis showed that the important role of the student body significantly and negatively predicted attitudes towards gratuitous violence, violence linked to self-protection, and general violence
Roman & Taylor, 2013 [83]/A Multilevel Assessment of School Climate, Bullying Victimization, and Physical Activity	Cross-sectional design, multilevel modeling/Confounders: sociodemographic variables	7786 students/12–16 years/United States	Cross-sectional. IV: bullying victimization. DV: PE class days	To measure bullying victimization Bully/Victim Questionnaire	Students who reported being bullied were less likely to report participating in PA more than 1 day per week. Bullying victimization had a significant negative association with days in PE classes
Corral-Pernía et al., 2018 [66]/Bullying and cyberbullying according to moderate vigorous physical activity (MVPA) in secondary school students	Cross-sectional design/Confounders: age	54 students/12–18 years/Spain	Cross-sectional. IV: Bullying and cyberbullying victim and perpetrator. DV: Moderate to vigorous PA	For measuring bullying "European Bullying Intervention Project Questionnaire (EBIP-Q)", for measuring cyberbullying "European Cyberbullying Intervention Project Questionnaire (ECIP-Q)"	Involvement in bullying was 22.2%. Involvement in cyberbullying was 5.6%. No significant differences were found according to gender in relation to involvement in bullying or cyberbullying. The average time spent performing moderate to vigorous PA (MVPA) was 810.76 min per week. No significant correlations were found between MVPA and bullying or cyberbullying

Table 4. *Cont.*

	Physical Activity during School Hours					
	Authors/Year/Title	**Study Design/Intervention (Duration)/ Confounders**	**Sample/Age (Years)/ Country**	**Groups/Physical Activity Measures/Intensity**	**Bullying Measures**	**Results**
	Rojo-Ramos et al., 2024 [82]/Impact of motor self-efficacy on cyberbullying in adolescents and pre-adolescents in physical education	Cross-sectional design with convenience sampling/No confounder	1232 students/8–18 years/Spain	Cross-sectional. IV: Motor Self-Efficacy. DV: Cyberbullying	The European Cyberbullying Intervention Project Questionnaire (ECIP-Q)	The higher the level of self-efficacy, the lower the level of abuse and victimization. Therefore, physical activity could be considered to act as a regulator of cyberbullying
Longitudinal studies	Philippot et al., 2021 [81]/Effect of Physical Exercise Training on Bullying and Depression in a Classroom: A Case Report	Intervention, randomly selected design/(50 min/day, 4 days/week, 5 week)/No confounders	11 students/9–11 years/Belgium	Program of physical activity low or moderate-high intensity: games that feeling of movement, postural control, awareness of body, and slow relay races with balancing, mime games, and walk/run plays while perpetuating equilibration, and cooperative, interactive games focused on fun and social contact without a focus on performance	Self-perception profile for children was used in its French version to document the way each child assessed his skills (social, athletic, school, physical, behavioral, and self-esteem) before and after the intervention (Harter, 1985)	A five-week program of low- to moderate-intensity physical exercise was able to reduce symptoms of depression and anxiety in a nonclinical sample of preadolescents attending elementary school. The intervention appeared to be especially beneficial for a bullied individual
	Aguilar-Herrero et al., 2021 [20]/Effectiveness of educational program in physical education to promote socioaffective skills and prevent violence in primary school	Intervention, quasi-experimental design/(60 min/day, 2 days/week, 6 week)/No confounders	58 students/10–12 years/Spain	Physical activity program based on Corporal Expression	Socio-affective skills questionnaire for secondary school students (Armada-Crespo, 2017)	Comparison of means after the intervention (posttest) showed differences for the dimensions of social relationship ($p = 0.000$), respect-responsibility ($p = 0.001$), self-esteem ($p = 0.000$) and aggression victimization ($p = 0.000$)

Table 4. *Cont.*

Physical Activity during School Hours					
Authors/Year/Title	**Study Design/Intervention (Duration)/ Confounders**	**Sample/Age (Years)/ Country**	**Groups/Physical Activity Measures/Intensity**	**Bullying Measures**	**Results**
Oliveira et al., 2017 [19]/Cooperative games as a pedagogical strategy for decreasing bullying in physical education: notable changes in behavior	Intervention quasi-experimental design/(60 min/day, 2 days/week, 12 weeks)/No confounders	120 students/9–11 years/Brazil	Physical activity program based on cooperative games	Two behavior log sheet, verbal aggression, physical aggression	The cooperative games managed to reduce the cases of physical and verbal bullying in an expressive way. For verbal bullying before the intervention, means were calculated as 21 $\pm$ 5.7 events and after 3.2 $\pm$ 1.92 (p = 0.0002)
Benítez-Sillero et al., 2020 [62]/Intervention programme to prevent bullying in adolescents in physical education classes (PREBULLPE): a quasi-experimental study	Longitudinal, ex post facto, quasi-experimental, pre–post design/(60 min/day, 5 days/weeks, 3 weeks)/Confounders: sex and school grade	764 students/12–19 years/Spain	Two groups: EG (n = 439): program to prevent bullying in adolescents in physical education classes (PREBULLPE) CG (n = 325): no program PREBULLPE	Spanish version of the European Bullying Intervention Project Questionnaire (EBIPQ)	Victimization and aggression in bullying and cybervictimization decreased significantly more in the quasi-experimental group than in the control group
Mayfield et al., 2017 [76]/Effectiveness of a Playground Intervention for Antisocial, Prosocial, and Physical Activity Behaviors	Longitudinal cluster-randomized design/(15 min/day, 5 days/week, 8 weeks)/No confounders	3588 students/8–11 years/United States	Four groups: two experimental groups: EG: Peaceful Playground Two control groups: no intervention of Peaceful Playground	Activity levels of students were assessed by direct observation using SOPLAY	The main influence of the intervention indicated no differences in sedentary behaviors or MVPA between the intervention and control schools. A significant increase in prosocial verbal interactions was observed in control schools, contrary to expectations
Carraro et al., 2014 [64]/Brief report: Play fighting to curb self-reported aggression in young adolescents	Longitudinal, ex post facto, quasi-experimental/pre–post design/(45 min/day, 2 days/week, 4 weeks)/No confounders	210 students/13–15 years/Italy	Two groups: EG (n = 103): wrestling games program. CG (n = 107): volleyball lessons	AQ-12 (Aggression Questionnaire) to measure aggression	A significant effect over time was found on the AQ-12 subscales pre- and post-intervention. In the fighting game group, but not in the volleyball group, there was a significant decrease in all subscales of the AQ-12: Physical Aggression, Verbal Aggression, Anger, and Hostility. All were large effects with Cohen's d > 0.50

Table 4. *Cont.*

Physical Activity during School Hours					
Authors/Year/Title	**Study Design/Intervention (Duration)/ Confounders**	**Sample/Age (Years)/ Country**	**Groups/Physical Activity Measures/Intensity**	**Bullying Measures**	**Results**
Fung & Lee, 2018 [69]/Effectiveness of Chinese Martial Arts and Philosophy to Reduce Reactive and Proactive Aggression in Schoolchildren	Longitudinal, quasi-experimental design/pre-post design, (90 min/day, 1 day/week, 24 weeks)/No confounders	3511 students/8–10 years/China	Four groups: G1: skills only G2: philosophy only G3: skills and philosophy G4/CG: Physical fitness Chinese martial arts training, specifically Choy Li Fut, combined with philosophical training	Reactive-Proactive Aggression Questionnaire (RPQ) to assess aggression. In addition, the Child Behavioral Checklist-Youth Self-Report (CBCL-YSR) was used to assess behavioral problems, including aggressive behavior	Skills and philosophy training was the most effective intervention. Specifically, when the three types of martial arts intervention groups were compared with the placebo fitness group, only the skills and philosophy condition showed a significant reduction in self-assessments of reactive and proactive aggression, delinquent behavior, anxious/depressed symptoms, and attention problems at post-test and/or 6-month follow-up compared with baseline scores
Montero-Carretero et al., 2021 [78]/A-Judo: An Innovative Intervention Programme to Prevent Bullying Based on Self-Determination Theory—A Pilot Study	Longitudinal quasi-experimental design/(50 min/day, 2 days/week, 5 weeks)/No confounders	79 students/11–12 years/Spain	Two groups EG (n = 42): intervention program was called "A-Judo Programme". CG (n = 37): no information received	Spanish version of the "European Bullying Intervention Project Questionnaire (EBIP-Q)"	Significant changes with moderate to high effect sizes were observed in basic psychological needs, motivation, tolerance-respect, moral identity and bullying

Table 5. Main characteristics of the studies analysed after school hours.

	Physical Activity after School Hours					
	Authors/Year/Title	**Study Design/Intervention (Duration)/ Confounders**	**Sample/Age (Years)/ Country**	**Groups/Physical Activity Measures/Intensity**	**Bullying Measures**	**Results**
Cross-Sectional studies	Vveinhardt & Fominiene, 2022 [86]/Prevalence of bullying and harassment in youth sport: The case of different types of sport and participant role	Cross-sectional design/No confounders	1440 students/16–29 years/Lithuania	Cross-sectional. IV: Types of sports. DV: Bullying behavior in sports	"Bullying and harassment in sport questionnaire (BHISQ)". This questionnaire is based on several adapted scales, including the Illinois Bully Scale	In individual sports, three-fourths of respondents ascribe to one of three bullying-related roles, while one-fourth ascribe to none of the roles In combat sports, nearly four-fifths of respondents identify themselves as victims, observers or bullies. In team sports, two out of three respondents ascribe to one or more roles related to bullying. Almost one third of team sports participants identified themselves as victims. The highest manifestation of bullying occurs in team sports, where almost one-fifth of the respondents attributed themselves as bullies against members of their own team
	Holbrook et al., 2020 [72]/Sport participation moderates association between bullying and depressive symptoms in Italian adolescents	Cross-sectional based on data collected between February and April 2005/No confounders	4829 students/13–21 years/Italy	Cross-sectional. IV: Frequency of participation in sports. DV: Bullying victimization and depressive symptoms	EDIT (Epidemiology of Road Traffic Accidents) Questionnaire.	It was found that 18.7% of the students reported having been victims of bullying in the last year. Participation in sports had a buffering effect on the relationship between bullying and depressive symptoms
	Widyastari et al., 2022 [87]/Results from the Thailand 2022 report card on physical activity for children and youth	Cross-sectional, multistage random sampling/No confounders	6078 students/5–17 years/Thailand	Cross-sectional. IV: daily PA indicators and practices. DV: stress, anxiety, bullying	Subjective questionnaire of students on whether they had experienced any form of violence, scolding or insult, either intentional or unintentional, that made them feel unhappy, embarrassed, stressed and worried to the point of not wanting to go to school	During the pandemic, only 27% of Thai youths performed 60 min of PA daily. Fifteen percent accomplished less than 2 h of recreational screen time. 68% experienced bullying, affecting their desire to attend school. Two-thirds reported mild anxiety, and one-third, severe anxiety
	Savucu et al., 2017 [84]/Analysis on the Bullying Tendencies and Value Preferences of High School Students According To Level of Receiving Physical Education and Sports Course	Cross-sectional. Sample survey/No confounders	613 students/12–16 years/Turquía	Cross-sectional. IV: Physical education and sports course DV: Harassment trends and value preferences	"Harassment Tendencies Scale" developed by Dölek	Bullying tendencies differed by gender, number of physical education and sports courses, and family income. There is a moderate negative relationship between value scores and bullying tendencies. Students who take 6 or more hours of physical education and sports show greater bullying tendencies. Despite more hours of physical education, bullying tendencies are high in certain groups of students

Table 5. *Cont.*

Physical Activity after School Hours					
Authors/Year/Title	**Study Design/Intervention (Duration)/ Confounders**	**Sample/Age (Years)/ Country**	**Groups/Physical Activity Measures/Intensity**	**Bullying Measures**	**Results**
Case et al., 2016 [65]/Bullied Status and Physical Activity in Texas Adolescents	Cross-sectional based on data from the 2009–2011 SPAN (School Physical Activity and Nutrition) study/No confounder	6158 students/14–16 years/United States	Cross-sectional. VI: Harassment status. DV: PA recommendations	World Health Organization's School-Age Children's Health Behavior Survey	The results indicate that not meeting PA recommendations differed by gender and the interaction between bullying status and weight status. These findings illustrate possible differences in the associations between bullying status and not meeting PA recommendations among normal-weight, overweight, and obese adolescents, as well as between girls and boys
Benítez-Sillero et al., 2021 [21]/Relationship between Amount, Type, Enjoyment of Physical Activity and Physical Education Performance with Cyberbullying in Adolescents	Descriptive and cross-sectional design with non-probability based sampling/No confounder	867 students/12–19 years/Spain	Cross-sectional. VI: quantity, type and enjoyment of PA and Performance in Physical Education. DV: Cyberbullying in adolescents	Spanish version of European Cyberbullying Intervention Project Questionnaire (ECIPQ)	Lower participation in cyberaggressions of girls who do participate in physical activities in an organized way. There was significance in PA in their free time on this occasion with cybervictimization values
Evans et al., 2016 [68]/Bullying Victimization and Perpetration Among Adolescent Sport Teammates	Cross-sectional design/Confounders: gender of coach, gender of athlete, and type of sport	359 students/13–17 years/Canada and the United States	Cross-sectional. VI: Bullying behaviors. DV: Connections and relationships within the sports context	"Bullying in Sport Questionnaire (BSQ)", "Health Behaviors in School-aged Children (HBSC)" and the "Adolescent Peer Relations Instrument (APRI)"	Athletes who identified themselves as victims reported being bullied by their teammates, while athletes who identified themselves as perpetrators of bullying identified with their coach. Bullying and victimization occurred less frequently in sport with school, and in some cases were more frequent among males, on teams with a male coach, and in team sports compared to individual sports
Vveinhardt & Fominiene, 2020 [85]/Gender and age variables of bullying in organized sport: Is bullying "grown out of"?	Cross-sectional design/No confounders	382 students/16–29 years/Lithuania	Cross-sectional. IV: Participation in organized sports. DV: experience of bullying and harassment in sports	"Bullying and Harassment in Sport Questionnaire" (BHISQ)	Males showed a greater tendency toward antisocial and aggressive behaviors in sport compared to females. In addition, men experience and participate in bullying situations more frequently than women. Previous experiences of bullying are similar between genders, but men highlight more experiences in previous teams

Table 5. *Cont.*

	Physical Activity after School Hours					
	Authors/Year/Title	**Study Design/Intervention (Duration)/ Confounders**	**Sample/Age (Years)/ Country**	**Groups/Physical Activity Measures/Intensity**	**Bullying Measures**	**Results**
	Nery et al., 2018 [79]/Bullying in youth sport training: A nationwide exploratory and descriptive research in Portugal	Cross-sectional design. Exploratory and descriptive research at the national level/Confounders: Type of sport, geographic area of the sports club, age of athletes, number of years in sports, number of friends in the peer group	1458 students/6–18 years/Portugal	Cross-sectional: IV: Participation in sports and sports training. DV: Incidence and nature of bullying behaviors in adolescent athletes	"Sport Violence Study and Prevention Questionnaire: Bullying in Sport"	About 10% of the athletes reported being victims, 11% participated in bullying episodes as bullies and 35% as bystanders. Harassment episodes were generally characterized by low frequency and duration and were most often verbal harassment within the sports club. However, when episodes were repeated and of long duration, this tended to generalize to multiple types of bullying (especially verbal and social) and multiple locations where episodes occurred, in sports clubs and also in competitions
Longitudinal studies	Greco 2021 [71]/Multilateral teaching in physical education improves resilience and self-efficacy in adolescents and could help reduce bullying behaviors	Longitudinal, quasi-experimental design/(90 min/day, 2 days/week, 12 weeks)/No confounders	60 students/14–16 years/Italy	Two groups: EG (n = 30): Psychoeducational activities program combined with physical exercise training and team games. CG (n = 30): No intervention program	The study used the Child and Youth Resilience Measure (CYRM-28) to assess various aspects of resilience and the Self-Efficacy Questionnaire for Children (SEQ-C) to measure different facets of self-efficacy	Significant improvements were found for resilience and self-efficacy scales in the experimental group. These results may help in the improvement of bullying behaviors
	Park et al., 2017 [80]/Effects of physical education, extracurricular sports activities, and leisure satisfaction on adolescent aggressive behavior: A latent growth modeling approach	Longitudinal design/Latent Growth Model (LGM) approach and secondary data from KYPS (Korea Youth Panel Survey), annual survey/No confounders	2647 students/12–18 years/South Korea	Latent growth model	The scales were adopted from the KYPS, as their validity and reliability had been previously confirmed	Adolescents' aggressive behavior decreased over time. The rate of change was significantly greater in females than in males. Extracurricular sports activities and leisure time satisfaction had a positive influence on this change in aggression

Table 5. *Cont.*

Physical Activity after School Hours					
Authors/Year/Title	**Study Design/Intervention (Duration)/ Confounders**	**Sample/Age (Years)/ Country**	**Groups/Physical Activity Measures/Intensity**	**Bullying Measures**	**Results**
Driessens, 2015 [67]/Extracurricular activity participation moderates impact of family and school factors on adolescents' disruptive behavioral problems	Longitudinal based on secondary data from the Longitudinal Study of Young People in England/No confounders	13,695 students/13–17 years/England	Intervention and experimental groups were not specified	The questionnaire used to measure bullying in the study was based on four yes/no questions identified by Mynard & Joseph as the major types of bullying	Associations were found between school factors, family factors, participation in extracurricular activities and the presence of disruptive behavior problems. Extracurricular activities attenuated the impact of school and family factors on the presence of disruptive behavior problems
Khitaryan et al., 2024 [74]/Judo as an alternative intervention model to prevent bullying at schools: a pilot study	Longitudinal design/(60 min/day, 1 day/week, 16 weeks)/No confounders	61 students/10–13 years/Armenia	Two experimental groups are presented. No control group	The Spielberger-Khanin State-Trait Anxiety Inventory, the D. Olweus Bullying Questionnaire, and a self-developed questionnaire aimed at self-assessment of qualities such as anxiety, physical and verbal aggression, etc.	This pilot study provides preliminary evidence that judo can serve as an effective alternative intervention for bullying prevention in schools. Judo has been found to be effective in helping individuals avoid bullying, largely due to its emphasis on self-defense, discipline, and confidence-building

3.1. Influence and Effect of PA before School Hours on Bullying and Cyberbullying

In relation to PA before school hours, the scientific literature is scarce. Only two studies have been found. The first study has a cross-sectional design. In this study, active travel to school was associated with bullying levels. It showed that students who traveled more distance by active travel suffered less bullying than those who traveled less [70]. The second study has a longitudinal design, specifically, a randomized controlled trial. The intervention was conducted with 30 min daily for 8 weeks, with a control and an experimental group. The results of this work exposed that those students who completed the 8-week program significantly reduced the probability of suffering bullying [73].

3.2. Influence and Effect of PA during the School Day on Bullying and Cyberbullying

Regarding PA within the school day and its influence and effect on bullying and cyberbullying, 15 studies were analyzed, seven of which had cross-sectional designs and eight longitudinal designs. First, the cross-sectional studies explore the correlations between PA, bullying and cyberbullying, and various risk and protective factors in the PE classroom. Montero-Carretero et al. [38] identify a negative relationship between an autonomy-promoting teaching style and the incidence of bullying. Mannocci et al. [75] identified that vigorous PA practice proved to be a protective factor, reducing the risk of cyberbullying. However, they argue that gender may be an important risk factor for cyberbullying, noting that women tend to be more vulnerable in these contexts. Benítez-Sillero et al. [63] and Menéndez-Santurio & Fernández-Río [77] support the findings on the benefits of PA, observing negative relationships between regular exercise and more positive perceptions towards physical education classes, which were associated with a decrease in both levels of victimization and attitudes towards violence. Roman & Taylor [83] suggest that a higher frequency of PE classes could be associated with a reduction in bullying victimization. This phenomenon could be related to the results of Rojo-Ramos et al. [82], who found negative relationships between the level of self-efficacy and victimization. However, Corral-Pernía et al. [66] found no significant correlations between moderate to vigorous intensity PA and bullying or cyberbullying, indicating that the relationship between PA and these behaviors may be complex.

On the other hand, PA-based interventions show a general trend towards reducing bullying and improving symptoms related to depression and anxiety. These interventions vary in terms of duration, frequency and type of activity, ranging from body expression programs to cooperative games, active recess or combat sports. The studies by Philippot et al. [81], Aguilar-Herrero et al. [20], Oliveira et al. [19] and Benítez-Sillero et al. [62], study PA stimuli in the PE classroom. In these studies, they highlight significant improvements in participants' behavior and highlight a significant reduction in bullying behavior through a quasi-experimental approach, emphasizing the potential efficacy of PA. However, Mayfield et al. [76] studied active recess encouragement and found no significant differences, suggesting the need for further research.

Lastly, research on combat sports applied fighting games, achieving a significant decrease in aggression after eight intervention sessions [64]. In a similar vein, Fung & Lee [69] highlighted the use of martial arts to mitigate reactive and proactive aggression, as well as emotional and attention problems, and Montero-Carretero et al. [78] focused on judo as a means to foster basic psychological needs and reduce bullying, with sessions designed to improve motivation, tolerance and respect.

3.3. Influence and Effect of after-School PA on Bullying and Cyberbullying

Finally, to analyze the influence and correlation of after-school PA on bullying and cyberbullying, 13 studies were analyzed, nine of which had cross-sectional designs and four longitudinal designs. The cross-sectional studies analyzed provide a broad view on the relationship between participation in extracurricular sports activities, and their impact on youth bullying.

Benítez-Sillero et al. [21] examined the relationship between PA and cyberbullying, finding differences in victimization according to the amount and type of PA practiced. In accordance with these results, Vveinhardt & Fominiene [86] exposed that bullying behaviors vary according to the type of sport practiced. In this line, Holbrook et al. [72] identified that team sports practiced after school hours can buffer the negative impact of bullying on the depressive symptoms of young people. For their part, Nery et al. [79] offered an exploratory view on the incidence of bullying in athletes, suggesting that about 50% of athletes are participants in bullying problems in their different roles.

From another perspective, Widyastari et al. [87] linked the daily practice of moderate to vigorous intensity PA with a reduction in the levels of stress, anxiety and bullying. Similarly, Savucu et al. [84] identified a negative correlation between school PA practice and bullying tendencies.

Additional studies such as Case et al. [65] observed that adherence to PA recommendations varied by sex and bullying status. Evans et al. [68] and Vveinhardt & Fominiene [85] investigated bullying dynamics in sport contexts, highlighting sex differences in favor of girls in antisocial and aggressive behaviors. Thus, these studies collectively underline the complex interaction between PA and bullying, highlighting the need for differentiated approaches depending on the type and amount of PA and sex-sensitive approaches in sport and educational program design.

In turn, the longitudinal studies reviewed provide an overview of the impact of various PA and educational programs on aggressive behavior and bullying among young people. Park et al. [80] used the latent growth model to show that regular participation in PA after the school day can decrease aggressive behavior over time. On the one hand, team sports have also shown significant benefits: Greco [71] observed how a twelve-week team game program produced improvements in participants' resilience and self-efficacy, suggesting that these activities are effective anti-bullying strategies. On the other hand, another study shows that individual sports that foster self-defense, discipline and confidence, such as judo, can both prevent and help to avoid bullying (Khitaryan et al.) [74]. Finally, Driessen [67] examined how school and family factors can influence disruptive behavior problems in after-school activities.

3.4. Influence of Covariates on the Effect of PA Stimuli at Different Times of the Day on Bullying and Cyberbullying

This systematic review has observed that 27.58% of the studies analyzed used confounding variables. The most commonly used covariates were socioeconomic status through maternal education [62,68,73,75,79] and participation in school-based bullying prevention programs [63,73]. Studies such as Benítez-Sillero et al. [62] and Hormazábal-Aguayo et al. [73] have shown that there is an influence of the mother's educational level and participation in school programs on victimization and bullying. On the other hand, sex appears as another important covariate [62,68,75,79]; however, two studies show no differences by sex [73,79]. Most of these studies found a greater effect of physical exercise on bullying prevention in girls than in boys [63,68,75].

The effect of sex suggests that the association between more time spent in PA and less victimization is more frequent in adolescent girls than in boys [66]. However, only one study associates more vigorous PA with better bullying prevention in boys [79]. This trend in favor of girls could be explained by the dose-response effect, i.e., boys are more active than girls and, therefore, the stimulus achieved, due to lower levels of PA, may not be sufficient to produce the same effect on bullying prevention in both sexes. Other possible covariates that could affect the association of PA with bullying prevention are the economic status of the student's household [75], heart rate [62], age [68,73], or body mass index (BMI) [66,68,79]. Research highlights the critical importance of including covariates to understand complex relationships between PA and bullying [66,79].

4. Discussion

The present systematic review aimed to analyze the influence and effect of PA stimuli before, during and after school hours on bullying and cyberbullying in students aged 6 to 18 years. A total of 30 studies with cross-sectional and longitudinal designs conducted between January 2013 and July 2024 met the inclusion criteria. In general, cooperative PA programs, team, body expression, body-to-body or group dynamics applied at different times of the day, have shown effectiveness in reducing bullying victimization and improving related aggression behaviors, as well as alleviating adverse psychological factors derived from bullying.

4.1. Physical Activity before School and Its Influence and Effect on Bullying and Cyberbullying

The results of the present systematic review show that students who perform PA programs before school significantly reduce school victimization [70,73]. Additionally, it has been shown that the practice of morning PA induces more significant changes in the brain, both at the molecular level and in brain function [88]. This phenomenon enhances cerebral blood flow by practicing PA [89] and is produced by a contraction of muscles, which leads to the release of messenger substances such as hormones or biochemical compounds into the blood [90,91]. These substances travel to the brain and induce various processes, including the release of neurotransmitters such as dopamine, serotonin, and norepinephrine [92,93]. These neurotransmitters are crucial for stress regulation and/or reward processes [94,95]. In addition to a higher integral activation of the subject early in the morning that could result in better socio-behavioral improvements [91].

From a psychosocial approach, group PA can also foster a sense of social cohesion and belonging, factors that are fundamental to improving interpersonal relationships among students [96]. The creation of these bonds can conditionally reduce bullying behaviors by strengthening supportive networks and mutual respect among participants [73]. In addition, PA contributes to improving self-esteem and self-efficacy, which may empower students to deal more assertively with conflict or bullying situations, and deter bullies from continuing their behaviors due to the change in power dynamics and trust within the group [97].

4.2. Physical Activity during the School Day and Its Influence and Effect on Bullying and Cyberbullying

PA during the school day is related to significant improvements in bullying behaviors, reduction in depressive symptoms, and strengthening of social relationships, responsibility, and self-esteem in boys and girls [19,20,62,63,72,75,77,81,83,87]. These results contrast with studies that indicate a relationship between lack of PA and an increased risk of school bullying, aggression, depression and anxiety [3,98–100], while others find no significant differences [23,66,76].

Bullying behaviors can be exacerbated or mitigated by factors such as teaching style, which when supportive of autonomy, promotes constructive conflict resolution as opposed to a more controlling style that can increase frustration and aggression among students [38]. Social and cultural expectations about sex roles, as well as the amount of PA, weight status, and family income, also influence school behavior [65,82,84]. Studies by De Luca et al. [101], Wang et al. [102] and Wei & Graber [32] corroborate that socioeconomic status and teaching style significantly affect bullying levels, highlighting that regular participation in PA can develop better social skills and self-esteem, contributing to a safer and more respectful school environment.

Teachers specialized in PE positively value the incorporation of exercise in the school routine for its psychosocial benefits. During exercise, endogenous endocannabinoids and opioids such as enkephalins, endorphins and dynorphins are released, which improve the functioning of the central nervous system and promote a balance between neurotoxic quinurenine and neuroprotective quinurenic acid, reducing disruptive behaviors [92,103,104].

These physiological changes may improve mood and foster greater emotional resilience, resulting in better conflict management and a reduction in the incidence of bullying.

In conclusion, the practice of PA not only improves the physical condition of students, but also enhances positive motivations and attitudes, reducing the incidence of school bullying [105]. In addition, it fosters respect, empathy and assertiveness [106,107]. The inclusion of sports and games that promote cooperation over competition is crucial, as it facilitates the internalization of core values and enhances socioemotional skills, creating an environment of mutual respect that can effectively prevent bullying and cyberbullying [57].

4.3. Physical Activity after School Hours and Its Influence and Effect on Bullying and Cyberbullying

After-school PA practice has been found to contribute to reduced levels of bullying, with significant variations by sex [32]. This variability in associations may be attributed to differences in the nature of bullying, whether traditional or cyberbullying, the predominant means used by each sex, and the psychological impact that bullying may have on the student body [108]. In turn, some authors have considered the practice of PA after school, specifically combat or team sports, as beneficial for the reduction of bullying and disruptive behaviors [49,109].

Additionally, this review has observed differences in bullying typologies depending on the role given to students in the sport context (participants in team sports, leaders, captains or substitutes and participants in individual sports) [37,46,77]. For example, according to Pill & Slee [110] and Salimi et al. [111] team games improve resilience, self-efficacy and reduce bullying levels [71] by promoting inclusion, mutual respect and empathy [112]. However, there is evidence that team sports can also perpetuate bullying behaviors [113,114] while individual sports such as wrestling, martial arts or judo tend to significantly reduce aggression [64,69,74,78] due to improved self-esteem and self-confidence [115]. Marracho et al. [46], for their part, expose that, depending on the work or level of demand of the athlete, individual sports can show bullying behaviors due to high levels of stress and anxiety.

Previous studies suggest that participation in structured and well-supervised after-school PA may be instrumental in promoting prosocial behavior and mitigating bullying [21,71,84]. Such correlations could be attributed to neuroplasticity mechanisms, involving increased gray matter volume in frontal areas and the hippocampus [116,117]. In addition, PA is reported to promote the release of neurotrophic factors and contribute to improved cerebrovascular health [117], with these changes being reflected in improved cognitive and behavioral functions [104] that may lead to increased empathy and prosocial behaviors among students, thus reducing bullying situations.

4.4. Inclusion of Covariates between Physical Activity and Bullying/Cyberbullying

Finally, the inclusion of covariates can provide a more detailed and nuanced analysis of the relationships between the main variables [118]. In this systematic review, studies such as those by Hormazábal-Aguayo et al. [73], Benítez-Sillero et al. [62,63], Mannoci et al. [75], Corral-Pernía et al. [66], Roman & Taylor [83], Evans et al. [68] and Nery et al. [79], evidence how the inclusion of covariates enriches the understanding of the dynamics between PA practice and the incidence of behaviors such as bullying, victimization and aggression, both in physical and digital environments. However, those studies included in this work that do not include covariates present significant associations that we do not know if they are mediated by other important variables. The non-inclusion of covariates may be due to methodological limitations, such as complexity in study design, difficulty in collecting additional data, and the challenge of advanced statistical analysis. Therefore, it is relevant to incorporate covariates to understand more precisely the dynamics that affect bullying behaviors, thus improving the effectiveness of educational interventions.

4.4.1. Practical Recommendations

General recommendations for addressing bullying and cyberbullying through PA may share common elements; however, some interventions may be more effective in specific groups due to developmental differences [22]. In primary education, interventions that emphasize collaboration and empathy in inclusive physical activities may be more appropriate for fostering early social skills [24], while in secondary education, where adolescents experience more complex social dynamics and greater use of technology, more personalized strategies that include approaches to emotional resilience and digital competence may be necessary [21]. The observed developmental differences suggest that future research should focus on exploring how cognitive, emotional and social changes at various stages of childhood and adolescence influence the effectiveness of interventions [119]. Considering these aspects could enrich the understanding of how to adapt bullying and cyberbullying prevention and mitigation strategies according to the developmental stage of students [120].

Based on the entire systematic review, a table summarizing the main recommendations for practical application to mitigate or reduce bullying behaviors through PA stimuli before, during or after the school day is presented (Table 6). This table is intended to serve as a valuable tool for educators, parents and education, PA and health professionals in the formulation of effective programs and policies that promote more inclusive, safe and healthy school environments for young people.

Table 6. Recommendations for physical activity before, during and after school time, to produce short and long-term results on bullying or cyberbullying in children or adolescents.

Time and Type of Physical Activity	Program	Type/Time/Program Intensity	Consequences on Bullying or Cyberbullying
Physical activity before school hours			
Active commuting to school	Move it Move it! (https://doi.org/10.1177/0017896916652432)	Active commuting to school: 25 min/day, 3 days/week/moderate intensity • Pedibus (school transportation on foot, where students are picked up to go to school by means of established routes and stops). • PiEfcitos Path (through active displacement, students achieve symbolic distances to be able to go to other centers and get rewards).	Reduction of problem behaviors, such as bullying, which contributes to a positive school climate.
Sports, cooperative and recreational games	Active-Start intervention (https://doi.org/10.1016/j.ijchp.2019.05.001)	Sports and cooperative games: 30 min/day, 5 days/week/moderate to vigorous intensity • Capture the flag game (the objective is to capture the opposing team's flag, and then move it back to your base next to yours to win the game). • Relay race (one child runs a certain distance, then passes the Witness to the next and so on until the race distance is completed). • Parachute game (participants move the parachute until the wave moves the ball in a circular path, preventing it from falling).	Lower levels of bullying victimization and improved school climate and pro-social environment.
Physical activity during school hours			
Active recess	Physical activity based on popular games and playful games. (https://doi.org/10.1111/josh.12506) (These same stimuli can be adapted and applied in a reduced version to active breaks and physically active classes)	Popular games, 15 min/day, 5 days/week/moderate to vigorous intensity • Hopscotch game (jumping on one or two legs, depending on the number of boxes at that level, you must avoid stepping on the box where the stone is. Once passed, you stop at a rest, remove the stone and continue jumping until the end). • Four corners game (one person is placed in each corner and another in the center, those in the corners must move from one side to the other or change corners, the player who is in the center must try to place himself in one of the corners that is free, and so the one who is left without a corner will be the one who is placed in the center). • Team handkerchief game (the person with the handkerchief will call out a number, the member of each team with that number must run to get the handkerchief and bring it back to where it was).	Reduced bullying, improved conflict resolution and increased self-regulatory behaviors.

Table 6. *Cont.*

Time and Type of Physical Activity	Program	Type/Time/Program Intensity	Consequences on Bullying or Cyberbullying
Physical Education Classes	Low to moderate intensity physical exercise program of cooperative and interactive games focused on fun and social contact. (http://doi.org/10.21926/obm.icm.2101002)	Cooperative games: 45 min/day, 4 days/week/low to moderate exercise intensity • Human figures (using their bodies and interacting with the bodies of their peers, they must create figures that represent an object). • Ball circle (pass the ball around the circle without dropping it on the ground, following certain rules, such as using only the feet or passing it in a specific direction). • Human Maze (the team must guide a blindfolded team member through a maze made of sports equipment with verbal instructions).	Effective in decreasing bullying tendencies in children and reduction in symptoms of depression and anxiety.
	Physical activity program based on Corporal Expression (https://doi.org/10.47197/retos.v0i41.82683)	Musical games, choreographies and theatrical games: 60 min/day, 2 days/week/moderate intensity • Who am I? (Mime games and theatrical performance). • Group choreography, chain dance. • Simon says (the organizer is Simon. The other children should gather around Simon, who gives instructions by saying, "Simon says..." telling the children to perform a physical action. Each child must perform the action. If the phrase is not preceded by "Simon says" the action must not be performed).	Bullying prevention measure and reinforcement of emotional behavior by strengthening interpersonal relationships among students, favoring their social skills and competencies.
	Cooperative games program (https://doi.org/10.7752/jpes.2017.03162)	Cooperatives games: 60 min/day, 2 days/week/moderate intensity • Weighted relay race (each team receives a mat. They must use the mat to carry a teammate without the person on the mat touching the ground). • Treasure hunt (this game focuses on finding an object cooperatively. Players solve clues to advance to the next step and ultimately find the treasure). • Cooperative Gymkhana (set of tests of skill or ingenuity performed in groups or teams along a course with a recreational objective).	Reducing physical and verbal harassment cases and aggressive attitudes.

Table 6. *Cont.*

Time and Type of Physical Activity	Program	Type/Time/Program Intensity	Consequences on Bullying or Cyberbullying
	Physical activity program based on methodological strategies of the physical education area (PREBULLPE). (https://doi.org/10.1080/17408989.2020.1799968)	Cooperative games, body expression games, motor story, symbolic games, relay games and competitive games: 45 min/day, 2 day/week/moderate to vigorous intensity • Animal race (each team must move like a specific animal (e.g., jump like a kangaroo, run like a cheetah, crawl like a crab) through an obstacle course). • Symbolic games (teams simulate a space mission. They must "navigate" through different stations representing planets, performing specific tasks at each station, such as collecting "rock samples" (balls) or overcoming a "meteor storm" (avoiding moving obstacles)). • Balloon battle (students are divided into two teams and each team has a number of balloons in their "territory". The goal is to launch the balloons into the opposing territory and prevent them from falling into their own. If a balloon lands in the territory, it must be thrown again).	Reducing bullying, victimization and aggression and cyberbullying victimization.
	Intervention program based on fighting games (https://doi.org/10.1016/j.adolescence.2014.09.009)	Body-to-body games and situations involving touching, physical contact and opposition: 45 min/day, 2 days/week/moderate to vigorous intensity • The sumo of balls (a large circle is drawn on the floor and a large ball is placed in the center. Two students compete to push the ball out of the circle using only their bodies without using their hands). • Contact race (students pair up and sit on the floor, back to back, with their arms interlocked. They must stand up together and move in coordination toward the goal, moving forward without letting go of each other). • The circle of strength (students form a circle and hold hands. In the center, one student tries to break the circle while the others try to keep it closed).	Prevent and reduce bullying behaviors and reduce aggressive behaviors.
	Program of Chinese Martial Arts and Philosophy (https://doi.org/10.1097/DBP.0000000000000565)	Martial skills, defense techniques and attack techniques: 90 min/day, 10 sessions/week/moderate to vigorous intensity • Karate circuit (students rotate through different stations, each focusing on a specific karate skill). • Self-defense (students practice self-defense techniques against multiple attackers. They learn to move strategically, use blocking and deflecting techniques, and remain calm under pressure). • Martial arts training (Taekwondo, Muay Thai, Jiu-jitsu, Kickboxing, Aikido, Capoeira, Sambo, Savate, Kendo).	Significant reduction in self-assessments of reactive and proactive aggression, delinquent behavior, anxiety/depressive symptoms, and attention problems.

Table 6. *Cont.*

Time and Type of Physical Activity	Program	Type/Time/Program Intensity	Consequences on Bullying or Cyberbullying
	A-Judo Program (https://doi.org/10.3390/su13052727)	Group dynamics, brainstorming, debates, guided discussions, viewing of videos, role-playing, critical reflections or case studies: 50 min/day, 2 days/week/moderate to vigorous intensity • Judo training (students practice judo techniques, focusing on throws, takedowns and ground control). • Card Castle Challenge (students are divided into teams and must build a card castle in a set amount of time. Each team must move around the area looking for and collecting hidden cards while performing physical tasks before returning to their home base and adding cards to the castle).	Improvement in autonomy, competence and affinity, motivation, tolerance-respect, moral identity and harassment.
Physical activity after school hours			
After-school physical activity programs	Multilateral education program (https://doi.org/10.2478/pcssr-2021-0008)	Team activities or games, cardiovascular endurance and flexibility activities: 90 min/day, 2 days/week/moderate to vigorous intensity • Group Yoga (postures designed to improve flexibility, strength and balance). • Chain Pilla-pilla (two children hold hands and create the first chain. They will have to touch others to join the group. The others will try to run away, when they are caught, they must join the chain). • Group bicycle route (a group of students make a bicycle route following the indications of a map, for this they must be guided cooperatively in space).	Significant improvements for levels of resilience, self-efficacy, promotion of prosocial attitudes, transmission of values and reduction of bullying victimization rates.

4.4.2. Limitations and Strengths

This systematic review shows some weaknesses; for example, as this is a topic of rigorous topicality, the literature is still scarce and this makes it difficult to standardize the proposals based on the time at which PA is performed and the type. Additionally, some programs show inaccuracy in their implementation. Another limitation could be the absence of covariates in some included studies. Another potential limitation may be the link between bullying and active travel to school, as there is a lack of studies focusing exclusively on this activity, which limits the understanding of its specific benefits. Furthermore, the practice of active travel may be hindered in areas where safety conditions are poor, either due to dangerous surroundings or lack of adequate infrastructure, which may deter both pupils and parents from allowing active travel. Another aspect to be taken into account is the possible confusion among participants when interpreting the concept of active travel. Therefore, for future research, it is crucial to be clear about the terms and contexts in which active travel occurs. Despite the above limitations, this is the first time that a systematic review classifies PA stimuli according to the time of practice and type of PA performed in children and adolescents, and compares them with bullying and cyberbullying. This review has analyzed cross-sectional and longitudinal designs, and provides a guide of practical recommendations suggesting the timing of implementation, duration and time of PA practice to decrease or prevent bullying and cyberbullying behaviors.

5. Conclusions

This review identified 30 studies that associated the relationships and consequences of PA practice stimuli before, during and after the school day with bullying and cyberbullying in children and adolescents. After an exhaustive analysis, it is shown that PA stimuli, mostly cooperative, at different times of the day, reduce victimization, improve aggression and disruptive behaviors of students, and alleviate the psychological factors resulting from bullying. However, the study of PA practice has clarified that the type of sport, the context in which it is performed, the role given to the students within the practice of PA, the pedagogical style or the school climate can significantly influence aggressive behaviors. Therefore, these findings underscore the need for holistic approaches throughout the day, including cooperative, socioemotional and behavioral aspects, since PA before and after school has been shown to significantly reduce behaviors related to bullying and cyberbullying.

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II

Asociación de la práctica de actividad física semanal con bullying y ciberbullying en chicos y chicas de 10 a 16 años.

Rusillo-Magdaleno, A., Suárez-Manzano, S., Moral-García, J.E., & Ruiz-Ariza, A. (2024).

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Asociación de la práctica de actividad física semanal con bullying y ciberbullying en chicos y chicas de 10 a 16 años

Association of weekly physical activity practice with bullying and cyberbullying in boys and girls aged 10 to 16 years

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Resumen. El objetivo del presente estudio fue analizar la asociación de la práctica de actividad física (AF) con el bullying y ciberbullying. Participaron 1152 estudiantes españoles (50.9% chicas) entre 10 y 16 años (13.24 ± 1.78). La asociación entre variables se realizó mediante análisis de covarianza (ANCOVA). Este análisis se desarrolló por separado para chicos y chicas y se ajustaron por edad, índice de masa corporal, estudios de la madre y repetición de curso académico. Los resultados mostraron que no existen diferencias estadísticamente significativas en la victimización de bullying en los adolescentes respecto a su nivel de práctica semanal de AF (p>.05). Sin embargo, los chicos físicamente activos (al menos una hora de MVPA ≥ cinco días/semana) tenían un nivel mayor de agresión por bullying en comparación con los inactivos (p=.012; d = 0.218). En cuanto al ciberbullying, los resultados de victimización y agresión en función del nivel de AF semanal parece que no afecta en las chicas (todos p > .05), sin embargo, los estudiantes físicamente activos presentaron tanto menores niveles de victimización (p=.017; d=0.217) como de agresión (p=.060; d=0.468). Los resultados sugieren la necesidad de diseñar intervenciones educativas multifacéticas que promuevan tanto la práctica de AF, como protección de la victimización en ciberbullying e intervención psicológica dirigida a la reeducación de los efectos de agresión asociados a su práctica.
Palabras Clave: Actividad física, ejercicio físico, bullying, ciberbullying, victimización, agresión.

Abstract. The aim of the present study was to analyze the association between physical activity (PA) and bullying and cyberbullying. A total of 1152 Spanish students (50.9% girls) between 10 and 16 years of age (13.24 ± 1.78) participated. The association between variables was performed by analysis of covariance (ANCOVA). This analysis was performed separately for boys and girls and adjusted for age, body mass index, mother's education and repetition of academic year. The results showed that there were no statistically significant differences in bullying victimization in adolescents with respect to their level of weekly PA practice (p>.05). However, physically active boys (at least one hour of MVPA ≥ five days/week) had a higher level of bullying aggression compared to inactive ones (p=.012; d=0.218). Regarding cyberbullying, victimization and aggression scores as a function of weekly PA level appeared to be unaffected in girls (all p > .05), however, physically active students had both lower levels of victimization (p=.017; d=0.217) and aggression (p=.060; d=0.468). The results suggest the need to design multifaceted educational interventions that promote both PA practice, as protection from cyberbullying victimization, and psychological intervention aimed at the re-education of the aggression effects associated with its practice.
Keywords: Physical activity, physical exercise, bullying, cyberbullying, victimization, aggression.

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Introducción

La actividad física (AF), definida como cualquier movimiento corporal producido por los músculos esqueléticos que requiere un gasto de energía (Piggin, 2020), es un tema de gran relevancia en la sociedad contemporánea. La práctica de AF se ha asociado con la mejora de la salud cardiorrespiratoria y muscular (Pojednic et al., 2022), la salud ósea (Brooke-Wavell et al., 2022) y los indicadores metabólicos (Chaput et al., 2020). Asimismo, se ha demostrado que esta práctica contribuye a mejoras en las funciones cognitivas y el rendimiento académico (Berrios-Aguayo et al., 2022). Estos beneficios se producen, en parte, debido al aumento en la liberación de endorfinas, neurotransmisores asociados con el bienestar y la reducción del dolor (Matei et al., 2023). En contraste, una vida sedentaria conlleva graves consecuencias para la salud. Entre los problemas más comunes se encuentran el sobrepeso y la obesidad (Pojednic et al., 2022), las enfermedades cardiovasculares (Chaput et al., 2020), la diabetes tipo 2 (Kanaley et al., 2022) y problemas de salud mental como la ansiedad y la depresión (Fernández-García et al., 2024). La Organización Mundial de la Salud (OMS) recomienda que los niños y adolescentes de cinco a 17 años realicen diariamente al menos 60 minutos de AF moderada a vigorosa (OMS, 2022). Sin embargo, más del 80% de los adolescentes y el 27% de los adultos a nivel mundial no cumplen con las recomendaciones de AF establecidas. Esta disminución en la práctica de AF entre los jóvenes puede deberse a una combinación de factores. Los cambios en los patrones de transporte, con una mayor dependencia del transporte motorizado en lugar de modos activos como caminar o andar en bicicleta (Aubert et al., 2022), y la falta de motivación asociada a problemas sociales (Sampasa-Kanyinga et al., 2020) contribuyen a esta tendencia. Parece que la carga académica y el estrés escolar provocan también que los jóvenes prioricen sus estudios sobre la AF (Wunsch et al., 2017). Este incremento de la inactividad física está estrechamente relacionado con la aparición de problemas sociales que pueden influir negativamente en el comportamiento social de los jóvenes (Sampasa-Kanyinga et al., 2020), promoviendo un ambiente hostil y susceptible a conductas de bullying (Jiménez-Barbero et al., 2020).

El acoso escolar, comúnmente conocido como bullying, se define como una manifestación de maltrato entre estudiantes, caracterizada por la perpetración de actos de violencia física o mental mantenidos en el tiempo (Menin et

al., 2021). Esta conducta puede ser ejecutada por uno o varios individuos y está dirigida hacia otro sujeto o grupo en situación de indefensión (Nain, 2023). Este maltrato genera episodios de agresión y victimización, creando un ambiente hostil en el aula y acarreando consecuencias como crisis de ansiedad, aislamiento social y una disminución en el interés por el aprendizaje (Sampasa-Kanyina et al., 2020). Estudios recientes, han evidenciado que el 42% de los niños y el 37% de las niñas estaban expuestos a actos de acoso escolar (OMS, 2023). No obstante, estos valores podrían ser superiores debido a la aparición de nuevas modalidades de acoso como el ciberacoso (Menin et al., 2021).

El ciberacoso, también conocido como ciberbullying, se define como el uso de medios digitales, tales como redes sociales, aplicaciones de mensajería y sitios web para acosar, amenazar, humillar o dañar a una persona de manera intencionada y recurrente (Menin et al., 2021). Esta forma contemporánea de acoso se distingue por su capacidad de superar las limitaciones físicas, permitiendo a los agresores hostigar a sus víctimas en cualquier momento y lugar (Ramadan, 2023). Entre las características del ciberacoso se incluyen la propagación de rumores, la divulgación de información personal sin consentimiento y la creación de perfiles falsos para perjudicar la reputación de alguien (Espelage et al., 2024). Esta modalidad de acoso ha experimentado un considerable aumento a nivel global y ha captado una atención significativa por parte de los investigadores en los últimos cinco años (Kumari et al., 2020). Una característica distintiva de esta forma de acoso respecto al bullying tradicional es el anonimato proporcionado por las plataformas digitales, lo cual permite a los agresores actuar sin temor a represalias (Malik y Dadure, 2024). En relación con los roles en el acoso, se ha observado que las víctimas suelen exhibir una conducta pasiva, mientras que los agresores pueden clasificarse en dos categorías: activos y pasivos (Cheng et al., 2024). Los agresores, a diferencia de las víctimas, muestran una notable confianza en sí mismos (Laninga-Wijnen et al., 2023), tienden a liderar grupos (Santoyo y Frías, 2014) y reportan experimentar sentimientos de satisfacción o ira durante el acto de acoso (Pedditzi et al., 2022).

Diversas variables pueden influir en la experiencia del bullying, manteniendo una relación compleja con la AF. Por ejemplo, la edad y el sexo influyen en la percepción y experiencia del acoso, así como en los tipos y frecuencia de AF (Finet et al., 2023). Un índice de masa corporal (IMC) elevado se observa en una proporción significativa de los casos de acoso escolar (Cheng et al., 2022). Los adolescentes con sobrepeso presentan un 26% más de probabilidades de ser víctimas de bullying en comparación con aquellos que tienen un peso normal (Pérez-de Corcho et al., 2023). En el ámbito del ciberacoso, la obesidad juvenil está presente en el 17.2% de los casos (Sergentanis et al., 2021). No obstante, algunos estudios no han hallado asociaciones estadísticamente significativas entre la obesidad y el ciberacoso (Lee et al., 2018). Se ha constatado también que el rendimiento académico, la salud mental y el coeficiente de inteligencia, asociados con el nivel de estudios de las madres (Fakhrunnisak y Patria, 2022) se relaciona con el acoso escolar debido a la percepción social que el alumnado crea de sus iguales, la autoestima y las habilidades de los estudiantes para mejorar sus interacciones sociales. Por otro lado, los estudiantes que repiten un año pueden enfrentar un mayor riesgo de victimización por parte de sus pares, debido a la posible percepción de vulnerabilidad asociada con el retraso académico (Cava et al., 2021). Por tanto, la inclusión de estas covariables es esencial para comprender de manera precisa y completa este fenómeno social complejo. Estas variables demográficas y de salud pueden modular la manifestación y la relación del acoso con la AF, proporcionando una perspectiva holística que permite identificar posibles interacciones y diferencias en la experiencia del acoso entre diferentes grupos de población.

En base a lo expuesto anteriormente, el objetivo del presente trabajo de investigación fue analizar la asociación entre la práctica de AF y la experimentación se situaciones de bullying y ciberbullying en escolares y adolescentes de ambos sexos en la población española, ajustando por edad, IMC, nivel de estudios de la madre y repetición de curso académico. Se hipotetiza que los individuos activos físicamente podrían tener mayor protección ante estos episodios de acoso con una menor participación tanto en actitudes de agresión como de victimización.

Método

Participantes

Un total de 1152 estudiantes de educación primaria y secundaria de entre 10 y 16 años (13.24 ± 1.78 años, 50.9% chicas) participaron en el presente estudio cuantitativo transversal. El registro de datos se llevó a cabo entre los meses de febrero y mayo de 2023. Se encuestaron estudiantes de siete centros educativos de la comunidad autónoma de Andalucía (España). Los centros fueron seleccionados por conveniencia y los participantes fueron asignados de forma aleatoria en proporción al número total de estudiantes de cada grupo de clase. Las características antropométricas y sociodemográficas aparecen detalladas en la Tabla 1.

Medidas

Variables dependientes

Para analizar el nivel de bullying se utilizó el "European Bullying Intervention Project Questionnaire" versión española de Ortega-Ruiz et al. (2016). Los resultados de fiabilidad son aceptables (α de Crombach victimización = 0.76, α de Crombach agresión = 0.79). Por otro lado, para evaluar el ciberbullying se utilizó la versión española del "European Cyberbullying Intervention Project Questionnaire" (ECIPQ; Del Rey et al., 2015). Este instrumento incluye 22 ítems. Los resultados de fiabilidad son aceptables (α cibervictimización = 0.82, α ciberagresión = 0.76), validado por Álvarez-Marín et al. (2022). Ambos cuestionarios se administran de manera individual, para completarlos se requiere aproximadamente 15 minutos y emplean una escala

tipo Likert con una puntuación que oscila entre 0 = Nunca y 4 = Más de una vez a la semana. Los ítems exploran la frecuencia con la que se han producido las conductas descritas durante los dos últimos meses.

Tabla 1.
Características biométricas, datos sociodemográficos, promedio de AFMV y variables de bullying y ciberbullying segmentados por sexo

	Todos (n = 1152)		Chicos (n = 566)		Chicas (n = 586)		
Variables	Media	DT/ %	Media	DT/%	Media	DT/%	p
Edad (años)	13.24	1.78	13.26	1.8	13.22	1.76	.695
Peso (kg)	52.39	13.61	54.79	14.99	50.07	11.69	<.001
Talla (m)	1.59	0.11	1.61	0.13	1.57	0.85	<.001
IMC (kg/m^2)	20.51	4.04	20.78	3.94	20.26	4.13	.030
Nivel escolar de la madre (%)							<.001
Sin estudios	53 (4.6%)		26 (4.7%)		27 (4.6%)		
Primarios	118 (10.4%)		61 (11%)		57 (9.7%)		
Secundarios	167 (14.6%)		63 (11.4%)		104 (17.7%)		
F. Profesional	158 (13.9%)		78 (14.1%)		80 (13.7%)		
Universitarios	402 (35.3%)		180 (32.5%)		222 (37.9%)		
N/C	242 (21.2%)		146 (26.4%)		96 (16.4%)		
Repetidor curso	138 (12.1%)		83 (14.8%)		55 (9.4%)		.005
Promedio AFMV	4.00	1.76	4.26	1.8	3.76	1.69	<.001
Victimización Bullying							.021
Nunca	175 (15.2%)		104 (18.4%)		71 (12.1%)		
Alguna vez	599 (52%)		283 (50%)		316 (53.9%)		
Una o dos veces/mes	283 (24.6%)		127 (22.4%)		156 (26.6%)		
Una vez/semana	76 (6.6%)		42 (7.4%)		34 (5.8%)		
Más de una vez /semana	19 (1.6%)		10 (1.8%)		9 (1.5%)		
Agresión Bullying							.034
Nunca	333 (28.6%)		150 (26.5%)		180 (30.7%)		
Alguna vez	647 (56.2%)		316 (55.8%)		331 (56.5%)		
Una o dos veces/mes	137 (11.9%)		80 (14.1%)		57 (9.7%)		
Una vez/semana	32 (2.8%)		19 (3.4%)		13 (2.2%)		
Más de una vez /semana	6 (0.5%)		1 (0.2%)		5 (0.9%)		
Victimización Ciberbullying							.017
Nunca	507 (44%)		275 (48.6%)		232 (39.6%)		
Alguna vez	569 (49.4%)		257 (45.4%)		312 (53.2%)		
Una o dos veces/mes	57 (4.9%)		25 (4.4%)		32 (5.5%)		
Una vez/semana	17 (1.5%)		7 (1.2%)		10 (1.7%)		
Más de una vez /semana	2 (0.2%)		2 (0.4%)		0 (0%)		
Agresión Ciberbullying							.316
Nunca	660 (57.3%)		321 (56.7%)		339 (57.8%)		
Alguna vez	435 (37.8%)		213 (37.6%)		222 (37.9%)		
Una o dos veces/mes	36 (3.1%)		23 (4.1%)		13 (2.2%)		
Una vez/semana	21 (1.8%)		9 (1.6%)		12(2%)		
Más de una vez /semana	0 (0%)		0 (0%)		0(0%)		

Nota: Los datos se presentan como media y desviación típica (DT) en variables continuas y frecuencia (%) en variables categóricas. IMC = Índice de Masa Corporal; DT = desviación típica; AFMV = Actividad física moderada vigorosa.

Variable Independiente

Para medir el nivel de AF semanal se evaluó mediante el cuestionario PACE+ Adolescent Physical Activity Measure Physical (Prochaska et al., 2001). Este consta de dos ítems en el que se pregunta el número de días en que los participantes habían acumulado 60 minutos de AF a intensidad moderada o vigorosa durante los últimos siete días y durante una semana típica. La puntuación final se obtuvo haciendo una media de ambas respuestas: (P1 + P2) / 2.

Variables de confusión

La edad, los estudios de la madre y repetición de cursos académicos de cada participante se registraron a partir de un cuestionario de datos sociodemográficos. El IMC se calculó mediante la fórmula de Quetelet: peso (kg)/ altura^2 (m). Para obtener las medidas de peso y altura se empleó una báscula digital ASIMED® tipo B, clase III y un tallímetro portátil SECA® 214 (SECA Ltd., Hamburgo, Alemania). Ambas medidas se realizaron con ropa ligera y sin calzado.

Procedimiento

La recopilación de datos se realizó durante el año académico 2022/23. Se entregó a los estudiantes, padres y tutores legales una explicación oral y escrita sobre la naturaleza y el propósito del estudio. Se obtuvo también la autorización de la dirección de los centros educativos y de los profesores de Educación Física. Para asegurar el anonimato y la confidencialidad, los nombres de los alumnos participantes fueron codificados. Cada estudiante completó cuestionarios sobre acoso escolar y práctica de AF durante los últimos siete días y una semana típica. Durante la administración de los cuestionarios y la medición de peso y altura, un investigador especializado proporcionó instrucciones y controló el tiempo, mientras que dos asistentes de investigación atendieron las posibles dudas y perturbaciones (por ejemplo, separación para garantizar la confidencialidad de las respuestas, ruido externo al aula, alumnos confundidos, funcionamiento de dispositivos electrónicos o conexión a internet). El estudio fue aprobado por la Comisión de Bioética de la Universidad de Jaén (España), con referencia NOV.22/2.PRY. El diseño del estudio cumple con la normativa legal española vigente que regula la investigación clínica en humanos (Real Decreto 561/1993 sobre ensayos clínicos), así como con los principios fundamentales de la Declaración de Helsinki (2013, Brasil)

Análisis estadístico

La comparación de las variables continuas y categóricas de todos los estudiantes y entre chicos y chicas se llevó a cabo mediante las pruebas t de Student y χ^2, respectivamente. La normalidad y la homocedasticidad de los datos se verificaron mediante las pruebas de Kolmogorov-Smirnov y Levene, respectivamente. Para estudiar si los adolescentes físicamente inactivos (al menos una hora de MVPA < cinco días/semana) tenían peores niveles de bullying victimización y agresión y ciberbullying victimización y agresión que aquellos participantes activos (al menos una hora de MVPA ≥ cinco días/semana) se realizó un análisis de covarianza (ANCOVA). El bullying victimización, bullying agresión, ciberbullying victimización y ciberbullying agresión se empleó como variable dependiente y se introdujo la práctica de AF como factor fijo. Para evaluar la magnitud de la dife-

rencia entre dos medias de grupos en una escala estandarizada se llevó a cabo la d de Cohen, donde 0.2 = efecto pequeño, 0.5 = efecto medio y 0.8 = efecto grande (Ventura-León, 2018). El porcentaje de diferencia entre grupos se calculó como: [(Medida grande - medida pequeña) / medida pequeña] x 100. En todos los análisis se empleó la edad, el IMC, el nivel de estudios de la madre y la repetición de curso como covariables. Todos los análisis se realizaron por separado para chicos y chicas. Para todos los resultados se empleó un nivel de confianza del 95% ($p < .05$). Todos los cálculos se realizaron con el programa estadístico SPSS, v. 25.0 para WINDOWS (SPSS Inc., Chicago).

Resultados

Análisis de covarianza de la práctica de AF respecto al bullying victimización y agresión

Los adolescentes físicamente activos mostraron un nivel más alto de bullying agresión (7.26%) que los físicamente inactivos (1.57 ± 0.60 vs. 1.46 ± 0.57 u.a) F(1,1125) = 9.565, p=.002, d=0.188, 1-β=0.871 (figura 1B). El análisis segmentado por sexo, mostró que los chicos físicamente activos tenían valores superiores en agresión de bullying (8.31%) con diferencias estadísticamente significativas respecto a los no activos (1.63 ± 0.62 vs. 1.5 ± 0.57 u.a) F(1,542) = 6.339, p=.012, d=0.218, 1-β=0.71. Las anteriores diferencias no fueron significativas en chicas (p>.05). No se hallaron diferencias estadísticamente significativas de bullying victimización en función de la práctica de AF (todos p>.05), figura 1B).

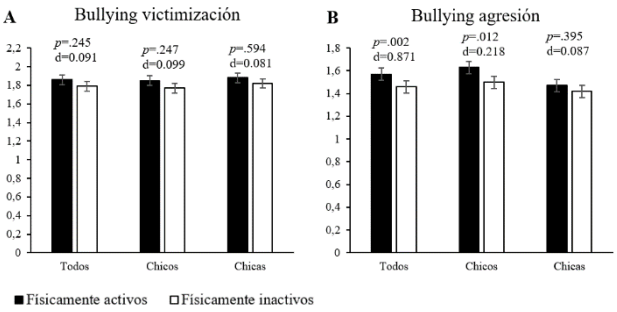

Figura 1. Asociación de la práctica de actividad física semanal respecto al bullying victimización y agresión. Físicamente inactivos = al menos una hora de MVPA < cinco días/semana y físicamente activos = al menos una hora de MVPA ≥ cinco días/semana. AFMV = Actividad física moderada vigorosa

Análisis de covarianza de la práctica de AF respecto al ciberbullying victimización y agresión

Los jóvenes físicamente activos mostraron menores niveles de ciberbullying victimización (9.59%) que sus compañeros físicamente inactivos (1.29 ± 0.49 vs. 1.42 ± 0.69 u.a.) F(1,1125)=7.241, p=.007, d=0.217, 1-β=0.767. El análisis segmentado por sexo mostró que los chicos físicamente activos tenían niveles más bajos de ciberbullying victimización (10.29%) que aquellos físicamente inactivos (1.29 ± 0.53 vs. 1.43 ± 0.74 u.a.) F(1,542) = 5.731, p=.017, d=0.217, 1-β=0.666. Sin embargo, en chicas no se hallaron diferencias estadísticamente significativas en función de la práctica de AF (p>.05, figura 2A). Finalmente, no se hallaron diferencias estadísticamente significativas de ciberbullying agresión en función de la práctica de AF (todos p>.05, figura 2B).

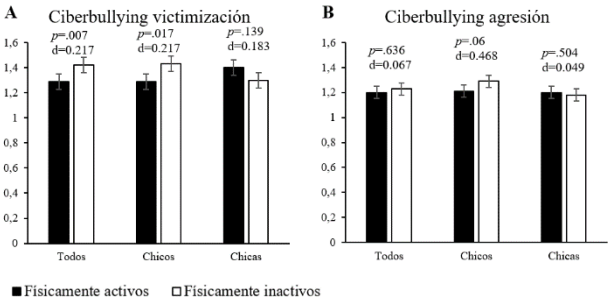

Figura 2. Asociación de la práctica de actividad física respecto al ciberbullying victimización y agresión (ver más detalles de leyenda en figura 1)

Discusión

El presente estudio revela que no existen diferencias de victimización de bullying en los adolescentes respecto a su nivel de práctica semanal de AF. Sin embargo, los chicos físicamente activos muestran un nivel mayor de agresión por bullying en comparación con los inactivos. En cuanto al ciberbullying, los resultados de victimización y agresión en función del nivel de AF semanal parece que no afecta en las chicas, sin embargo, los estudiantes físicamente activos presentaron tanto menores niveles de victimización como de agresión. Por tanto, la hipótesis principal del estudio se cumple parcialmente ya que según los resultados solamente los chicos presentan diferencias estadísticamente significativas en función del nivel de práctica de AF.

Se hipotetiza que los individuos activos físicamente podrían tener mayor protección ante estos episodios de acoso con una menor participación tanto en actitudes de agresión como de victimización.

Uno de los principales hallazgos de este estudio revela que los estudiantes físicamente activos manifiestan niveles significativamente más elevados de agresión por bullying en comparación con los inactivos. Estos resultados son consistentes con los hallazgos de Newman et al. (2021) quienes encontraron que la participación en deportes está asociada con comportamientos agresivos en adolescentes. Por otro lado, Cristello et al. (2020) también observaron una relación entre la competitividad en deportes y la agresión entre pares. Este fenómeno puede deberse a que la competencia en deportes puede promover rivalidades y dominancia (Tyler et al., 2021), llevando a jóvenes atléticos a usar la agresión para afirmar su superioridad. Además, las dinámicas grupales dentro de estos entornos pueden generar comportamientos excluyentes o intimidatorios hacia aquellos percibidos como menos capaces o diferentes (Thedinga et al., 2021).

Sin embargo, otros estudios que analizan la tipología de deporte en el acoso escolar exponen que juegos individuales organizados y supervisados pueden lograr una disminución

en las agresiones entre pares (Carraro et al., 2014; Fung y Lee, 2018; Simões et al., 2021). En la misma línea, los deportes de equipo mostraron efectos amortiguadores en el acoso y síntomas depresivos en jóvenes (Holbrook et al., 2020) y mejores en los comportamientos de los participantes (Greco, 2021; Olmedo et al., 2023).

Por otra parte, nuestros hallazgos indican que los estudiantes físicamente activos, especialmente los chicos, presentan niveles más bajos de victimización por ciberbullying en comparación con los inactivos. Este resultado está en línea con los estudios de Flick et al. (2022) y Lehman (2023) quienes encontraron que la AF regular está asociada con una menor probabilidad de victimización en línea, posiblemente debido a una mayor autoconfianza y habilidades sociales desarrolladas a través del deporte. Sin embargo, otras investigaciones no encontraron esta relación, sugiriendo que otros factores, como el uso de tecnología y las habilidades digitales, pueden jugar un papel más significativo (Griffith et al., 2023; Lusianawati et al., 2023).

Finalmente, nuestro estudio no encontró diferencias estadísticamente significativas en la agresión por ciberbullying según la práctica de AF. Este hecho concuerda con investigaciones previas, que no hallaron una relación directa entre la AF y la agresión en línea (Benítez-Sillero et al., 2023; Benítez-Sillero et al., 2021). Por el contrario, otros estudios sugieren que la AF puede tener un efecto protector contra la agresión cibernética (Rojo-Ramos et al., 2024), posiblemente debido a la estructura y el apoyo social que proporciona la participación en deportes organizados. Por tanto, parece que la relación entre la AF y las diferentes formas de bullying y ciberbullying es compleja y multifacética. Mientras que la AF está asociada con un aumento en la agresión por bullying, también parece ofrecer una protección contra la victimización por ciberbullying. Estos hallazgos subrayan la necesidad de considerar el contexto y la naturaleza de la AF, así como otros factores sociales y personales, al diseñar intervenciones para prevenir el bullying y el ciberbullying en la población infantil y juvenil.

Limitaciones y fortalezas

El presente estudio presenta ciertas limitaciones metodológicas y procedimentales que es necesario señalar. Entre ellas, destacan las limitaciones inherentes a la naturaleza transversal del diseño, la cual no permite establecer relaciones de causalidad y depende de la veracidad con la que los participantes respondan a las diversas medidas implementadas. Existe la posibilidad de que algunos estudiantes hayan proporcionado respuestas con el fin de mantener una imagen positiva de sí mismos. Además, la muestra fue seleccionada por conveniencia, lo que impide que sea representativa de la población española. Otra limitación que se podría destacar sería la medida de práctica de AF, la cual se tiene en cuenta solamente el tiempo de práctica, no el tipo de deporte. Por otra parte, entre las medidas que refuerzan la fortaleza de nuestros datos se encuentra la utilización de técnicas de codificación que garantizan el anonimato y la confidencialidad de los participantes, la implementación de instrumentos con alta fiabilidad y validez interna comprobada. Finalmente, el empleo de una amplia cantidad de covariables (edad, índice de masa corporal, nivel educativo de la madre y promedio de AF semanal) proporciona resultados inéditos en el campo de la educación.

Conclusiones

El presente estudio concluye que, de forma general, la práctica de AF semanal no está asociada significativamente con la victimización de bullying en adolescentes. Sin embargo, los jóvenes físicamente activos, especialmente los chicos, presentan un nivel significativamente mayor de agresión por bullying en comparación con los inactivos (al menos una hora de MVPA < cinco días/semana). En cuanto al ciberbullying, los resultados de victimización y agresión en función del nivel de AF semanal parece que no afecta en las chicas, sin embargo, los estudiantes físicamente activos manifiestan menores niveles tanto de victimización como de agresión. Estos hallazgos sugieren la necesidad de diseñar intervenciones educativas multifacéticas que promuevan tanto la práctica de AF como protección de la victimización en ciberbullying como de intervención psicológica dirigida a la reeducación de los efectos de agresión asociados a su práctica. Futuros estudios deberían explorar estas relaciones y las posibles variables moderadoras y mediadoras para proporcionar una comprensión más completa de estos fenómenos.

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Declaración de interés

Los autores declaran no tener ningún conflicto de intereses

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III

Bullying and cyberbullying. A high risk for the superficial learning, poor planning and school procrastination.

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Bullying and cyberbullying. A high risk for the superficial learning, poor planning and school procrastination

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Keywords: aggression, victimisation, bullying, cyberbullying, teaching, learning, schoolchildren, decision-making.

Abstract

The aim of the present study was to analyse the association of bullying and cyberbullying with deep learning, superficial learning, planning and decision making, as well as school procrastination. A total of 1263 Spanish schoolchildren (51.39% girls) aged 10-16 years (13.23 ± 1.77) participated. The association between variables and the analysis of exposure risk was performed by analysis of covariance (ANCOVA) and binary logistic regression respectively. All analyses were conducted separately for boys and girls and adjusted for age, body mass index, mother's education and average weekly physical activity. Results showed that girls who were victims of bullying and cyberbullying had significantly higher procrastination towards class tasks (7% and 16%, respectively). In addition, cyberbullying victims acquire more superficial learning (5.28%). In general, victims of bullying have almost twice the risk of having higher values of superficial learning and procrastination than non-victims. This risk is multiplied by 3 and 4, respectively, in the case of cyberbullying victims. On the other hand, bullying aggressors were also found to have high superficial learning (7.34%) and higher procrastination (17.45%). In the case of cyberbullying, aggressors also had more superficial learning (boys = 13.38% and girls = 9.56%), worse values in planning and decision making (boys = 3.82% and girls = 3.3%) and more procrastination (boys = 16.81% and girls = 20.48%). In both sexes, the risk of exposure to aggression towards the above variables is multiplied by 8, 2 and 10, respectively. All these findings reveal that bullying and cyberbullying can affect young people in key learning variables, beyond those of physical, psychological or socio-emotional aspects already known. Immediate and systematic actions are needed to monitor and prevent bullying and cyberbullying inside and outside the school context, creating safe spaces and providing counselling for both victims and aggressors.

1 Introduction

Bullying has been defined as a manifestation of mistreatment between students, characterised by acts of physical or mental violence and sustained over time (1). This behaviour can be perpetrated by one or several individuals and is directed towards another subject or group that is in a situation of inability to defend itself (1,2). This type of mistreatment generates episodes of aggression and victimisation that provoke a hostile environment in the classroom and lead to consequences such as anxiety crises, isolation and a decrease in interest in learning (3,4). It has been found that 32% of the adolescent population has experienced bullying by their peers at least once a month(5), however, these values could be much higher as bullying is adopting new forms such as cyberbullying (6).

Cyberbullying refers to the use of digital media such as social networks, messaging apps and websites with the intent to intentionally and repeatedly harass, threaten, humiliate or harm a person (7,8). This modern bullying procedure is distinguished by its ability to transcend physical barriers as it allows aggressors to attack their victims anytime, anywhere (9). Characteristics of cyberbullying include spreading rumours, publishing personal information without consent, and creating fake profiles to damage someone's reputation (10). This form of bullying has experienced a considerable rise internationally and has attracted significant attention from researchers in the last five years (11). A relevant feature that differentiates this form of bullying from traditional bullying is the anonymity offered by the platforms as they allow bullies to act without fear of retaliation (12). With regard to bullying roles, it has been observed that victims tend to manifest passive behaviour, while bullies can be classified into two categories: active and passive (13–15). Bullies, unlike victims, demonstrate ostensible self-confidence (13–15), tend to lead groups (15) and report experiencing feelings of happiness or anger during the act of bullying (16).

Despite the above differences, bullying and cyberbullying represent a common problem among students in educational institutions (17). This phenomenon has reported negative effects on physical (physical violence) (18), psychological (verbal violence or insults) (19) or socio-emotional (isolation) aspects (20,21), but there are still few studies that analyse the direct effect on key aspects for comprehensive youth development such as learning. Some variables that have already begun to be studied in this line are the negative effects on the attitude towards education (22), poor quality learning (23), or the inadequate study strategies it provokes in students involved in bullying (24).

In this context, learning-related variables have been assessed by monitoring the acquisition of learning through methods that differentiate between deep learning and surface learning (25). Deep learning is defined as an educational process by which students achieve comprehensive understanding by implementing cognitive strategies of analysis and inference (Çetín & Demèrtaş, 2022) and is characterised by providing intrinsic motivation (27). In contrast, superficial learning is identified by the student's inability to relate new knowledge to previously acquired information, favouring a passive approach focused on memorisation and the application of basic cognitive strategies (28). This extrinsically motivated category of knowledge acquisition is distinguished by a constant preoccupation with potential school failure (29).

On the other hand, other variables that determine effectiveness towards the acquisition of competences in students are planning and decision making towards classroom tasks. Planning is defined as the set of steps to be taken to achieve a specific goal, which involve the organisation and recognition of the task (30). Students with low perceived stress, high self-esteem and lower frustration have been found to have high levels of planning (31,32). Moreover, bullying experiences may result in poor learning planning (33). Another relevant aspect is related to decision-making, characterised by following a complex process involving phases of problem identification and analysis, evaluation of personal decisions, and exploration of alternative

solutions (34,35). Despite the above, planning, decision-making and task completion may be postponed for various reasons such as procrastination. Procrastination is described as the tendency of students to intentionally delay relevant tasks or decisions, opting instead for more pleasurable activities (36). The main characteristic resulting from procrastination behaviour is the heavy workload at the last minute (37). As a result, the perpetuation of the procrastination cycle can lead to elevated levels of stress and anxiety (38), low self-esteem, lack of self-regulation and intrinsic motivation (39) and consequently low learning efficacy (40,41).

All of the above allows us to identify a complex relationship between bullying and learning variables that may be, in turn, affected by many other covariates. Specifically, it has been observed that bullying tends to occur mainly between students of the same gender (42). In addition, bullied girls are at a higher risk of poor academic performance compared to boys (43) and tend to seek outside help, while boys tend to respond at the time or later (42) Another relevant variable, in the context of learning and bullying dynamics, is the inclusion of the mother's educational level due to its influence on attitudes, knowledge and practices related to parenting and child rearing (44,45). Recent studies have reported the importance of analysing the mother's educational level to control for effects and to obtain more accurate and reliable results in research related to adolescents' academic development and psychosocial well-being (46).

Finally, there are other variables that may affect many young people and also have a complex relationship with bullying (47–49). On the one hand, students who practised physical activity at least four times a week show higher values on indicators of aggression compared to students who practised less frequently (49). On the other hand, not meeting the recommended weekly physical activity guidelines seems to be associated with 14% more bullying victimisation (47). In the educational context, bullying was one of the main reasons why students dropped out of Physical Education classes, with 11.1% of students experiencing physical bullying, 13.6% verbal bullying and 12.8% social bullying (48). Moreover, a high body mass index (BMI) is present in a large proportion of bullying-related cases (50–52). Overweight young people were 26% more likely to experience bullying victimisation than those of normal weight (53–55). In the case of cyberbullying, youth obesity is also present in 17.2% of cases (56). However, other studies found no significant associations between obesity and cyberbullying (54,57). Age is also a possible confounding variable given its relevance in previous studies, where cognitive and emotional maturity have been found to significantly influence how individuals learn and interact with their environment (58,59). Academic performance, mental health and IQ have also been found to be significantly associated with mothers' educational attainment (46).

Based on the above, the aim of the present study was to analyse the association between victims and perpetrators of bullying and cyberbullying with deep learning, superficial learning, planning and decision-making and procrastination in schoolchildren and adolescents of both sexes in the Spanish population, after adjusting for age, BMI, mother's level of education and average AFMV. The present study hypothesised that both young victims and perpetrators of bullying and cyberbullying have a poorer quality of learning and present a higher risk of superficial learning, low planning, difficulties in decision making and school procrastination.

2 Method

2.1 Participants

A total of 1263 primary and secondary school students aged 10-16 years (13.23 ± 1.76 years, 51.38% girls) participated in the present cross-sectional quantitative study. Data collection took place between February and May 2023. Students from 7 schools in the autonomous community of Andalusia (Spain) were surveyed. Schools were selected by convenience and participants were

selected randomly and proportionally to the total number of each class group. Anthropometric and sociodemographic characteristics are detailed in Table 1.

Table 1. Biometric and sociodemographic characteristics, bullying/cyberbullying (behaviors described during the last two months), learning and confounding variables in adolescents, segmented by sex.

	All (n = 1263)		**Boy (n = 614)**		**Girls (n = 649)**		
Variables	**Mean/N**	**SD/%**	**Mean/N**	**SD/%**	**Mean/N**	**SD/%**	***p***
Age (years)	13.23	1.77	13.22	1.81	13.25	1.72	0.801
Weight (kg)	52.38	13.54	54.79	15.04	50.09	11.50	<0.001
Size (m)	1.59	0.11	1.61	0.13	1.57	0.08	<0.001
Body Mass Index (kg/m^2)	20.52	4.02	20.81	3.96	20.24	4.06	0.012
Mother's school level (%)							
No studies	4.8%		4.6%		4.9%		
Elementary studies	10.5%		10.7%		10.2%		
Secondary studies	14.4%		11.4%		17.3%		0.020
Professional training	13.6%		13.7%		13.6%		
University studies	35.4%		32.6%		38.1%		
N/C	20.4%		25.1%		16%		
Mean MVPA	4.01	1.76	4.30	1.81	3.73	1.67	<0.001
Bullying victimization							
Never	192	15.2	110	17.9	82	12.6	
Once or twice	668	52.9	309	50.3	359	55.3	
Once or twice/month	301	23.8	140	22.8	161	24.8	0.058
Once/week	82	6.5	45	7.3	37	5.7	
More tan once/week	20	1.6	10	1.6	10	1.5	
Bullying aggression							
Never	352	27.9	158	25.7	194	29.9	
Once or twice	716	56.7	344	56	372	57.3	
Once or twice/month	153	12.1	90	14.7	63	9.7	0.020
Once/week	34	2.7	20	3.3	14	2.2	
More tan once/week	8	0.6	2	0.3	6	0.9	
Cyberbullying victimization							
Never	556	44	296	48.2	260	40.1	
Once or twice	625	49.5	282	45.9	343	52.9	
Once or twice/month	61	4.8	26	4.2	35	5.4	0.025
Once/week	19	1.5	8	1.3	11	1.7	
More tan once/week	2	0.2	2	0.3	0	0	
Cyberbullying aggression							
Never	718	56.8	346	56.4	372	57.3	
Once or twice	485	38.4	235	38.3	250	38.5	

Once or twice/month	37	2.9	23	3.7	14	2.2	0.389
Once/week	23	1.8	10	1.6	13	2	
More tan once/week	0	0	0	0	0	0	
Deep learning	2.89	0.72	2.83	0.74	2.95	0.70	0.004
Superficial learning	2.73	0.76	2.84	0.76	2.62	0,.4	<0.001
Planning and decision making	5.46	0.97	5.35	1.04	5.56	0.88	<0.001
Procrastination	2.39	0.98	2.49	1.01	2.28	0.95	<0.001

2.2 Dependent variables

Attitudes towards study

The revised version of the “Revised study process questionnaire” (R-SPQ-2F) (60) was used to measure attitudes towards study. This version included 20 items and was structured in two dimensions. Factor 1: Superficial learning (10 items, e.g. <<I learn some things by heart and repeat them, over and over again, even though I do not understand them>>) and Factor 2: Deep learning (10 items, e.g. <<I ask myself questions about subject topics to see if I have understood them clearly>>). Responses are scored on a Likert-type scale with values ranging from 1 = Almost always/always happens to me to 5 = Never or rarely happens to me. The reliability indices obtained using Cronbach's α-statistic were: α superficial learning = 0.790, α deep learning = 0.773.

Planning and decision-making

To analyse planning and decision making, the "Scale for the assessment of planning and decision making" (61) was used. The factor structure consists of a single factor including 8 items (e.g., <<I think a lot in my head and analyse everything when I try to solve a problem>>). Responses are scored on a Likert-type scale ranging from 1 = Strongly Disagree to 7 = Strongly Agree. The reliability index obtained using Cronbach's α statistic was α = 0.818.

Procrastination

The "Academic procrastination scala-short form" (APS-SF) psychometrically validated by Yockey (2016) was used to assess participants' level of procrastination. The factor structure of this version is a single factor composed of five items (e.g., <<I leave homework or class assignments to the last minute>>). Responses are scored on a Likert-type scale with values ranging from 1 = Completely false to 5 = Completely true. The reliability index obtained in this dimension was carried out using Cronbach's α statistic and has a result of α=0.839.

2.3 Predictor/independent variables

Bullying and cyberbullying

The level of bullying was assessed using the instrument "European bullying intervention project questionnaire" Spanish version of (63), 14 items. On the other hand, the Spanish version of the "European cyberbullying intervention project questionnaire" (ECIPQ; (64) was used to assess cyberbullying, this instrument includes 22 items. Reliability results are high for both bullying (Crombach's α victimization = 0.840 and Crombach's α aggression = 0.814) and cyberbullying (α cybervictimization = 0.872 and α cyberaggression = 0.877). Both questionnaires were administered individually and employ a Likert-type scale with a score ranging from 1 = Never to

5 = More than once a week. The items explore the frequency with which the described behaviours have occurred during the last two months and both require approximately 15 minutes to complete.

2.4 Confounding variables

Age, body mass index, mother's education, and weekly physical activity

The age and educational level of each participant's mother were recorded using a socio-demographic data questionnaire (46,58). Moreover, BMI (65) was calculated using the Quetelet formula: weight (kg)/height2 (m). A digital scale ASIMED® type B, class III and a portable measuring rod SECA® 214 (SECA Ltd., Hamburg, Germany) were used to obtain weight and height measurements. Both measurements were taken in light clothing and without shoes. Weekly physical activity level was assessed using the "PACE+ Adolescent physical activity measure physical" questionnaire (66). This consists of two items asking the number of days on which the participants have performed at least 60 minutes of physical activity at moderate or vigorous intensity during the last 7 days and during a typical week. The final score was obtained by averaging both responses: (P1 + P2) / 2). Its reliability index was $\alpha = 0.739$.

2.5 Procedure

Data recording was carried out during the academic year 2022/23. A verbal and written description of the nature and purpose of the study was given to students, parents and legal guardians. Permission was also obtained from the school management and physical education teachers. The names of the participating students were coded to ensure anonymity and confidentiality. Each student completed questionnaires on bullying, attitudes towards studying, planning and decision-making, procrastination and a socio-demographic information table. During the completion of the questionnaires and the weight and height measurements, a specialized researcher gave instructions and monitored the time, while two research assistants observed possible doubts and any possible disturbances (e.g., space separation to ensure confidentiality of answers, noise outside the classroom, confused students, operation of electronic tools or internet connection). The study was approved by the Bioethics Commission of the University of Jaén (Spain), reference NOV.22/2.PRY. The design took into account the current Spanish legal regulations governing clinical research in humans (Royal Decree 561/1993 on clinical trials), as well as the fundamental principles established in the Declaration of Helsinki (2013, Brazil).

2.6 Statistical analysis

Comparison of continuous and categorical variables for all students and between boys and girls was carried out using Student's t-tests and $\chi 2$ tests, respectively. The normality and homoscedasticity of the data were verified using the Kolmogorov-Smirnov and Levene tests, respectively. To study whether adolescents with high levels of bullying and cyberbullying victimization/aggression had worse learning levels than those participants with low levels, an analysis of covariance (ANCOVA) was performed. Deep learning, superficial learning, planning and decision making, and procrastination were used as dependent variable and bullying victimization, bullying aggression, cyberbullying victimization, and cyberbullying aggression were entered as fixed factor. The bullying and cyberbullying values were dichotomized so that participants who stated that they had never been a victim/offender of bullying and/or cyberbullying (questionnaire score = 1) were labelled as "Never" and those who had ever been a victim/offender (questionnaire score = 2-5) were labelled as "Sometimes". Because many comparison groups had different sample sizes, effect sizes were calculated using Hedges' ğ, where 0.2 = small effect, 0.5 = medium effect, and 0.8 = large effect (67). The percentage of difference between groups was calculated as: [(Large-measurement - small-measurement) / small-measurement] x 100. To find out the level of risk of bullying victimization/aggression and

cyberbullying towards lower values in deep learning, superficial learning, planning and decision-making, and procrastination, a binary logistic regression was carried out. For this, the dependent variables were dichotomised by taking the median as a reference (68,69). Each strategy was classified as High ≥ median (reference group) vs. Low < median (risk group). In all analyses, age, BMI, mother's educational attainment and weekly physical activity were used as covariates. All analyses were conducted separately for boys and girls. A 95% confidence level ($p < 0.05$) was used for all results. All calculations were performed with the statistical software SPSS, v. 25.0 for WINDOWS (SPSS Inc., Chicago).

3 Results

3.1 Analysis of covarienza of bullying and cyberbullying victimization with respect to deep and surface learning, planning and school procrastination

Bullying victimized girls showed higher procrastination towards class tasks (6.97%) than non-victims (2.15 ± 1.03 vs. 2.3 ± 0.94 a.u.) $F(1,643) = 4.241$, $p = 0.04$, ğ = 0.158, 1-β = 0.538 (fig. 1d). No significant differences were found in any other learning variable as a function of bullying victimization (all $p > 0.05$; fig. 1a - 1d). On the other hand, boys and girls victims of cyberbullying showed higher values in superficial learning: 5.28% (2.65 ± 0.8 vs. 2.79 ± 0.72 a.u.) $F(1,1245) = 12.102$, $p = 0.001$, ğ = 0.185, 1-β = 0.935 (fig 2b) and procrastination: 15.98% (2.19 ± 0.97 vs. 2.54 ± 0.97 a.u.) $F(1,1245) = 45.275$, $p < 0.001$, ğ = 0.361, 1-β = 0.998 (fig 2d). The data also showed that planning and decision making was significantly lower in girls who were victims of cyberbullying: 2.36% ($p = 0.022$) but not in boys ($p > 0.05$), fig 2c. No significant differences in deep learning were found as a function of cyberbullying victimization (all $p > 0.05$, fig. 2a).You may insert up to 5 heading levels into your manuscript as can be seen in “Styles” tab of this template. These formatting styles are meant as a guide, as long as the heading levels are clear, Frontiers style will be applied during typesetting.

------ Figure 1 ------

------ Figure 2 ------

3.2 Analysis of covarienza of aggression in bullying and cyberbullying with respect to deep and superficial learning, planning and school procrastination

Young bullying aggressors showed significantly lower deep learning: -3.5% (2.96 ± 0.76 vs. 2.86 ± 0.71 a.u.) $F(1,1245) = 6.977$, $p = 0.008$, ğ = 0.138, 1-β = 0.752 (fig. 2a), higher superficial learning: 7.34% (2.59 ± 0.72 vs. 2.78 ± 0.76 a.u.) $F(1,1245) = 20.673$, $p < 0.001$, ğ = 0.254, 1-β = 0.995 (fig. 2b), lower values in planning and decision making: -2.40% (5.55 ± 0.94 vs. 5.42 ± 0.98 a.u.) $F(1,1245) = 5.614$, $p = 0.018$, ğ = 0.134, 1-β = 0. 658 (fig 2c) and high procrastination: 17.45% (2.12 ± 0.94 vs. 2.49 ± 0.98 a.u.) $F(1,1245)48.346$, $p < 0.001$, ğ =0.392, 1- β=1.000. More specifically, aggressor girls had worse values in all learning variables: Deep learning: -3.78% ($p = 0.031$, fig. 3a), superficial learning: 7.66% ($p = 0.001$, fig. 3b), planning: - 4.01% ($p = 0.005$, fig. 3c) and procrastination: 25.26% ($p < 0.001$, fig. 3d). In boys, significant differences were only found in superficial learning and procrastination, where offenders showed higher values: 6.25% ($p = 0.007$, fig. 3b) and 8.09% ($p = 0.008$, fig. 3c), respectively.

Similarly, cyberbullying aggressors had higher values of superficial learning: -11.54% (2.6 ± 0.74 vs. 2.9 ± 0.75 a.u.) $F(1,1245) = 44.154$, $p < 0.001$, ğ = 0.403, 1-β =1. 000 (fig. 4b) and procrastination towards class tasks: 18.55% (2.21 ± 0.97 vs. 2.62 ± 0.95) $F(1,1245) = 44.362$, $p < 0.001$, ğ = 0.197, 1-β = 1.000 (fig. 4d), as well as lower planning: -3.55% (5.54 ± 0.98 vs. 5.35 ± 0.94 a.u.) $F(1,1245) = 11.477$, $p = 0.001$, ğ = 0.403, 1-β = 0.923 (fig. 4c). Gender segmented analysis indicated that, in both boys and girls, cyberbullying offenders had higher values of superficial learning (boys =13.38% and girls = 9.56%; both $p < 0.001$, fig. 4b), lower planning

scores (boys = 3.82% and girls = 3.3%; both $p < 0.020$, fig. 4c) and higher procrastination towards class tasks (boys = 16.81% and girls = 20.48%; both $p < 0.001$, fig. 4d). No statistically significant differences were found overall, nor segmented by gender, in the deep learning variable as a function of cyberbullying aggression (all $p > 0.05$).The equations should be inserted in editable format from the equation editor.

------ Figure 3 ------

------ Figure 4 ------

3.3 Binary logistic regression on bullying and cyberbullying victimization and aggression with respect to deep and surface learning, planning and school procrastination

Data showing the risk of exposure to bullying and cyberbullying victimization/aggression with respect to the learning variables are shown in Table 2. Victims of bullying were 1.5 and 1.9 times more likely, and thus at greater risk, than non-victims to have high values for superficial learning (Odds ratio [OR] = 1.500; $p < 0.001$) and procrastination towards class tasks (OR = 1.910, $p < 0.001$), respectively. Similar risk values were obtained for the two previous variables when the analysis was carried out separately for boys and girls (both OR >1.47; $p < 0.001$). On the other hand, cyberbullying victims were 3.6, 1.4 and 4.3 times more likely than non-victims to have high values of superficial learning, low planning and high procrastination (OR = 3.579, OR = 1.444 and OR = 4.335, respectively, all $p < 0.008$). Gender-differentiated results showed that boys and girls had a similar risk of superficial learning (both OR > 3.6; $p < 0.001$) and procrastination (both OR > 4.2; $p < 0.001$). However, the risk of poor planning was only significant in girls (OR =1.730, $p = 0.006$). Finally, the risk probability of low deep learning outcomes was not significant in any case (all $p > 0.05$).

On the other hand, bullying aggressors were 2.9, 1.3 and 3.5 times more likely than non-aggressors to have high values of superficial learning, low planning and high procrastination (OR = 2.880, OR = 1.331 and OR = 3.468, respectively, all $p < 0.004$). Sex-differential analysis showed significant risk scores in aggressor girls but not in boys (superficial learning: OR = 3.167, $p < 0.001$; planning and decision making: OR= 1.386, $p = 0.024$ and procrastination: OR = 4.213, $p < 0.001$). In turn, cyberbullying aggressors were 7.6, 2.3 and 10.1 times more at risk than non-aggressors for high values of superficial learning, low planning and high procrastination (OR = 7.636, OR = 2.270 and OR = 10.068, respectively, all $p < 0.001$). Similar risk values were obtained for the above three variables when the analysis was conducted separately for boys and girls (all $p < 0.001$). Finally, the risk probability of low deep learning outcomes was not significant in any case (all $p > 0.05$).

Table 2. OR and 95% CI for levels of victimization/aggression in bullying and cyberbullying according to learning indicators in schoolchildren and adolescents. Deep learning, superficial learning, planning and procrastination were included in the logistic regression as a categorical variable (low vs high). OR was adjusted for age, body mass index, mother's educational level and average weekly physical activity. OR: odds ratio; CI: confidence interval.

		All (1251)				Boys (602)				Girls (649)			
		N	***p***	**OR**	**95%CI**	**N**	***p***	**OR**	**95%CI**	**N**	***p***	**OR**	**95%CI**
Bullying victimization													
Deep learning	**High**	606		1	Referent	260		1	Referent	346		1	Referent
	Low	645	0.364	1.073	0.922 – 1.248	342	0.140	1.177	0.948 – 1.463	303	0.902	0.986	0.793 – 1.227
Superficial learning	**Low**	628		1	Referent	262		1	Referent	366			Referent
	High	623	<0.001	1.50	1.28 – 1.747	340	<0.001	1.476	1.180 – 1.846	283	0.001	1.561	1.248 – 1.954
Planning and decision making	**High**	600		1	Referent	264		1	Referent	336		1	Referent
	Low	651	0.536	1.049	0.902 – 1.218	338	0.176	1.160	0.936 – 1.437	313	0.678	0.955	0.770 – 1.185
Procrastination	**Low**	588		1	Referent	254		1	Referent	334			Referent
	High	663	<0.001	1.91	1.611 – 2.265	348	<0.001	1.59	1.261 – 2.013	315	<0.001	2.396	1.858 – 3.091
Bullying aggressor													
Deep learning	**High**	606		1	Referent	260		1	Referent	346			Referent
	Low	645	0.079	1.101	0.969 – 1.582	342	0.147	1.236	0.928 – 1.647	303	0.097	1.263	0.958 – 1.664
Superficial learning	**Low**	628		1	Referent	262		1	Referent	366			Referent
	High	623	<0.001	2.88	2.256 – 3.668	340	<0.001	2.524	1.807 – 3.526	283	<0.001	3.167	2.214 – 4.531
Planning and decision making	**High**	600		1	Referent	264		1	Referent	336			Referent
	Low	651	0.004	1.331	1.094 – 1.620	338	0.175	1.211	0.918 – 1.596	313	0.024	1.386	1.044 – 1.840
Procrastination	**Low**	588		1	Referent	254		1	Referent	334			Referent
	High	663	<0.001	3.468	2.650 – 4.538	348	<0.001	2.793	1.951 – 4.00	315	<0.001	4.213	2.789 – 6.365
Cyberbullying victimization													
Deep learning	**High**	606		1	Referent	260		1	Referent	346			Referent
	Low	645	0.216	0.847	0.650 – 1.102	342	0.074	0.697	0.470 – 1.035	303	0.985	0.996	0.691 – 1.437
Superficial learning	**High**	628		1	Referent	262		1	Referent	366			Referent
	Low	623	<0.001	3.579	2.498 – 5.128	340	<0.001	3.943	2.179 – 6.778	283	<0.001	3.557	2.217 – 5.707
Planning and decision making	**High**	600		1	Referent	264		1	Referent	336			Referent
	Low	651	0.008	1.444	1.100 – 1.895	338	0.315	1.213	0.832 – 1.767	313	0.006	1.730	1.166 – 2.568
Procrastination	**Low**	588		1	Referent	254		1	Referent	334			Referent
	High	663	<0.001	4.335	2.927 – 6.422	348	<0.001	4.768	2.587 – 8.787	315	<0.001	4.192	2.489 – 7.060
Cyberbullying aggressor													
Deep learning	**High**	606		1	Referent	260		1	Referent	346			Referent
	Low	645	0.532	0.914	0.688 – 1.213	342	0.067	0.668	0.433 – 1.029	303	0.557	1.115	0.761 – 1.634
Superficial learning	**Low**	628		1	Referent	262		1	Referent	366			Referent
	High	623	<0.001	7.636	4.460 – 13.073	340	<0.001	9.636	4.181 – 22.203	283	<0.001	6.174	3.061 – 12.453
Planning and decision learning	**High**	600		1	Referent	264		1	Referent	336			Referent
	Low	651	<0.001	2.270	1.601 – 3.217	338	<0.010	1.886	1.164 – 3.056	313	<0.001	2.624	1.573 – 4.374
Procrastination	**Low**	588		1	Referent	254		1	Referent	334			Referent
	High	663	<0.001	10.068	5.502 – 18.421	348	<0.001	12.226	4.935 – 30.288	315	<0.001	8.346	3.689 – 18.885

4 Discussion

The aim of the present study was to analyse the association of bullying and cyberbullying victimization and aggression with different learning variables in schoolchildren and adolescents of both sexes. In general, the results have shown that both victims and aggressors of bullying and cyberbullying present a more superficial learning, have lower values in planning and decision making and tend to delay class tasks. Girls who are victims of bullying are affected to a greater extent than boys and are twice as likely as non-victims to procrastinate. The data also show that cyberbullying victimization has a greater negative impact on learning than traditional bullying. This risk is multiplied x 3 and x 4 towards having high values of superficial learning and procrastination, respectively. In the case of cyberbullying, the negative effects suffered by aggressors on learning variables are even more pronounced. In both sexes, the risk of exposure to having high values of superficial learning, low planning and high procrastination is multiplied x 8, x 2 and x 10, respectively.

According to the present study, young people affected by bullying and cyberbullying, regardless of being a victim or aggressor, are not associated with any positive effect on the studied variables of deep learning, superficial learning, planning and procrastination towards class tasks. These findings coincide with Bergmann (70), who found no significant associations between bullying and positive effects on student learning variables. Likewise, the results obtained in this work, coincide with previous research that attributed to students affected by bullying lower academic grades and a predominance of superficial learning (71–73), more time to plan and make decisions (74) and greater academic procrastination (75,76).

On the other hand, the negative effects of bullying and cyberbullying on learning are more harmful in girls than in boys. According to these findings, several research studies that associated bullying/cyberbullying with anxiety or depression variables converge in that girls are more susceptible to the negative consequences of bullying than boys (77–79). Within the educational field, recent studies have associated bullying behaviors with learning variables, with girls obtaining worse academic results compared to boys (43,80). However, for other researchers, victims of bullying or cyberbullying obtained lower academic performance, with no significant differences between boys and girls (81). The present study coincides with the current trend aimed at addressing bullying and cyberbullying as public health problems, with a special focus on protecting and supporting girls. The main value of the present research lies in providing quantitative results with risk calculation aimed at assessing the effect on learning variables, especially in girls, who seem to be at higher risk of suffering the adverse consequences of bullying and cyberbullying.

Another aspect that generates controversy is the possible differentiating role of victimization and aggression on learning variables. Our data have revealed that, similar to victims, young aggressors also present low values in most of the learning variables. For example, bullying aggressor girls showed lower values in deep learning, as well as in planning and decision making, in addition to acquiring more superficial learning and tending to procrastinate on class tasks. In line with these results, recent research has shown that the bullying climate, whether victim or aggressor is directly associated with student learning (82,83). Specifically, several studies have found that bullying students have lower levels of deep learning and higher levels of surface learning (84), low planning and responsible decision making (85) and high procrastination (86).

Our data have also revealed that both victimization and aggression, derived from cyberbullying, have a greater negative impact on learning than traditional bullying. Similarly, recent researchers have suggested that both victimization and aggression in cyberbullying turn out to be more harmful on learning variables compared to traditional bullying (20,23,87). It appears that cyberbullying, due to its pervasive and anonymous nature, has a more profound and lasting

impact on learning (23), negative consequences on students' academic performance (20) and significant impact on emotional and mental well-being (87). However, other works argue that cyberbullying and traditional bullying negatively affect psychological symptoms and well-being, without clearly differentiating which of the two has a more severe impact on learning (77,88). Based on the information provided, a clear general trend is shown indicating that cyberbullying may have more severe consequences due to its invasive and persistent nature.

4.1 Limitations and strengths

The present study has some methodological and procedural limitations that should be noted. These include those inherent to the cross-sectional nature of the design, which does not allow causal relationships to be established and depends on the veracity with which the participants respond to the various measures implemented. There is a possibility that some students may have provided answers oriented to maintaining a positive self-image. In addition, the sample was selected for convenience, which prevents it from being representative of the Spanish population. On the other hand, among the measures that underpin the strength of our data is the use of coding techniques that guarantee the anonymity and confidentiality of the participants, the implementation of instruments with high reliability and proven internal validity, as well as rigorous data collection and exhaustive compliance with the procedure. Finally, the use of a large number of covariates (age, BMI, mother's educational level and average weekly physical activity) shows unprecedented results in the field of education.

5 Conclusions

The present study allows us to conclude that boys and girls who are victims of bullying have almost twice the risk of having higher values of superficial learning and procrastination towards class tasks than non-victims. In the case of girls, procrastination towards class tasks increases by 7%. Victims of cyberbullying present 5.3% more superficial learning and 16% more procrastination towards class tasks than non-victims, multiplying the risk due to this exposure by 3 and 4, respectively. In general, bullying and cyberbullying aggressors have more negative learning values than non-aggressors. Young cyberbullying aggressors register lower values of deep learning (-11.5%) and acquire more superficial learning (boys = 13.4% and girls = 9.6%), plan worse (boys = 3.8% and girls = 3.3%) and tend to procrastinate on class tasks (boys = 16.8% and girls = 20.5%). In both sexes, the risk of exposure to having high values of superficial learning, low planning and high procrastination is multiplied x 8, x 2 and x 10, respectively.

6 Conflict of Interest

The authors declare no conflict of interest

7 Author Contributions

Conceptualization, A.R.-M. and A.R.-A.; methodology and formal analysis, T.M.-R. and A.R.-A.; data curation, T.M.-R. and M.T.-C.; writing—original draft preparation, A.R.-M. and M.T.-C.; writing—review and editing, A.R.-M. and M.T.-C.; supervision, A.R.-A.; funding acquisition, A.R.-A. and M.T.-C. All authors have read and agreed to the published version of the manuscript.

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10 Institutional Review Board Statement

The study was conducted in accordance with the Declaration of Helsinki, and approved by the Ethics Committee of the University of Jaén (Spain) (protocol code: NOV.22/2.PRY approved on 13 January April 2023) for studies involving humans. Informed consent was obtained from all subjects and their guardians involved in the study.

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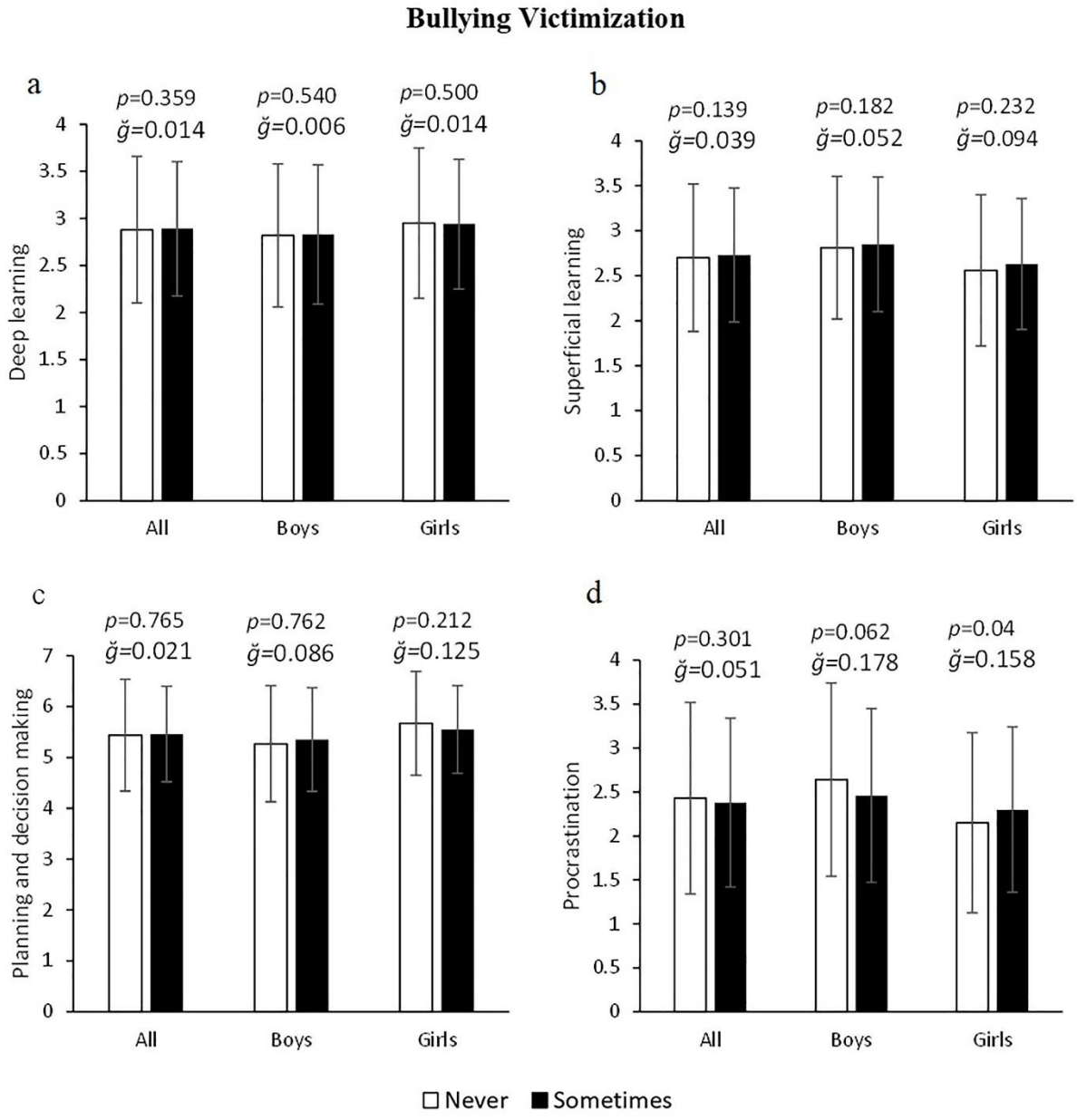
Figure 1.

Association of bullying victimization with deep and superficial learning, planning and school procrastination.



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710 **Figure 2.**

711 *Associations of cyberbullying victimization with deep and superficial learning, planning, and*
712 *school procrastination.*

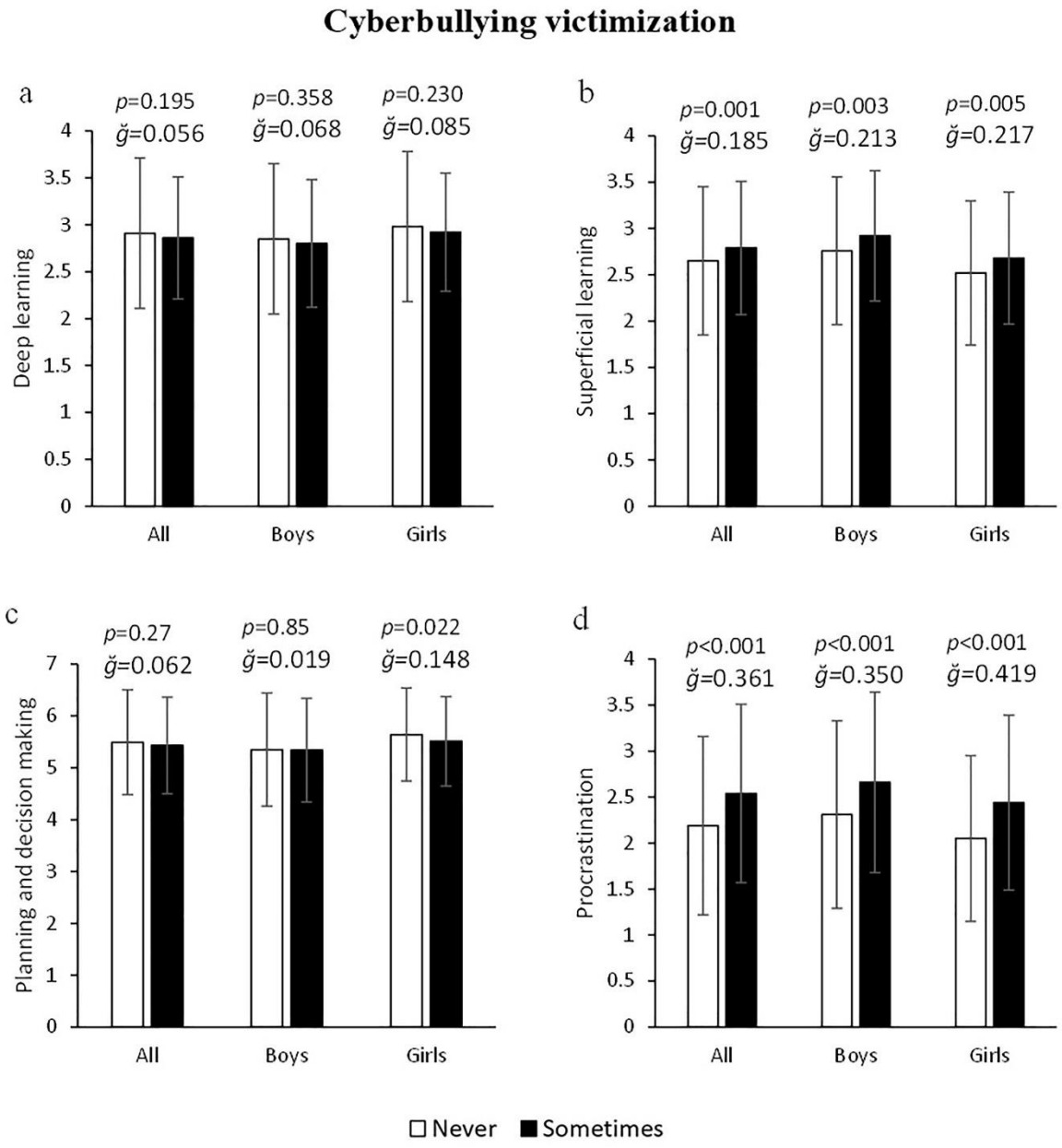

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Figure 3.

Associations of aggression in bullying with deep and superficial learning, planning, and school procrastination.

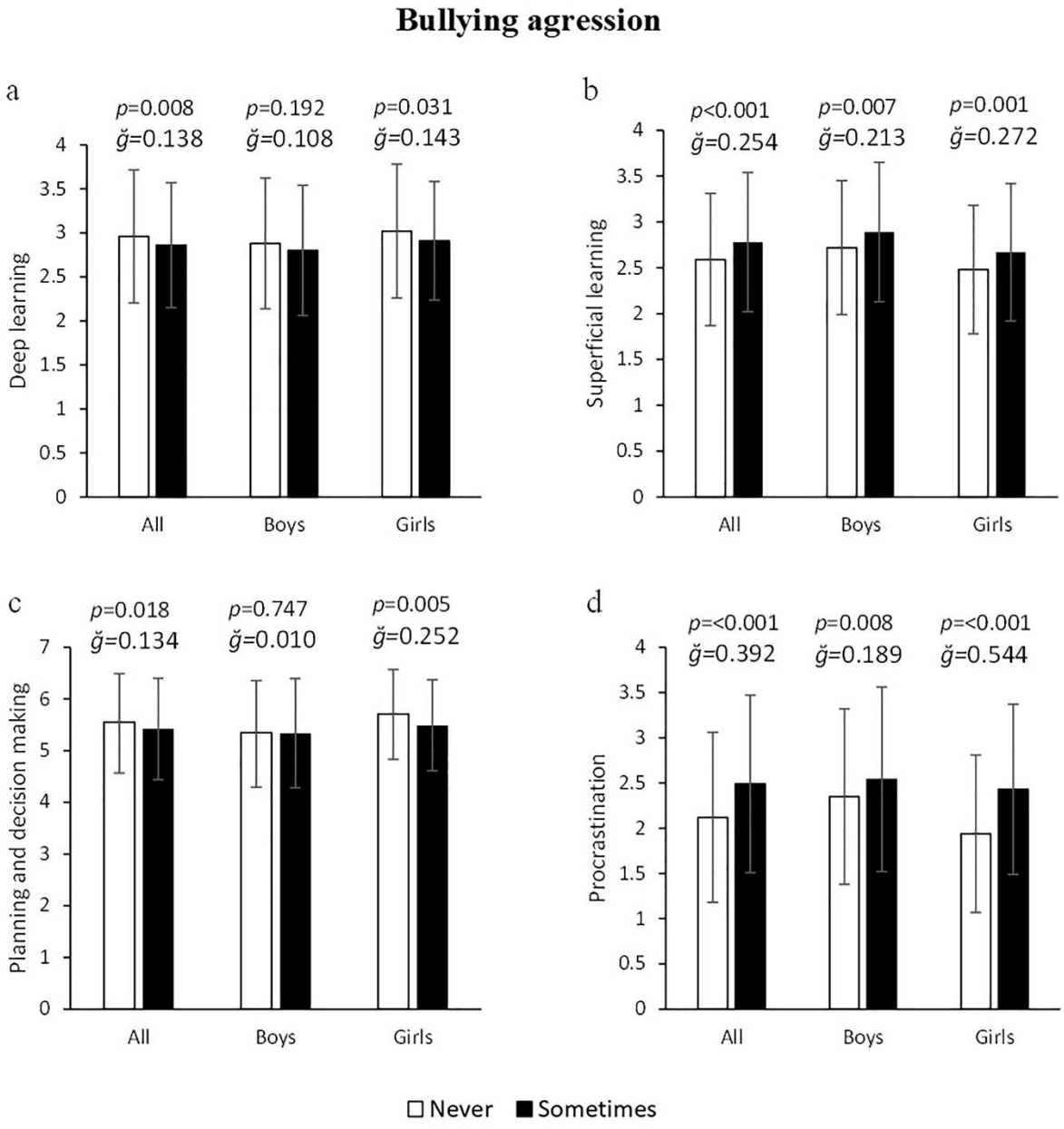
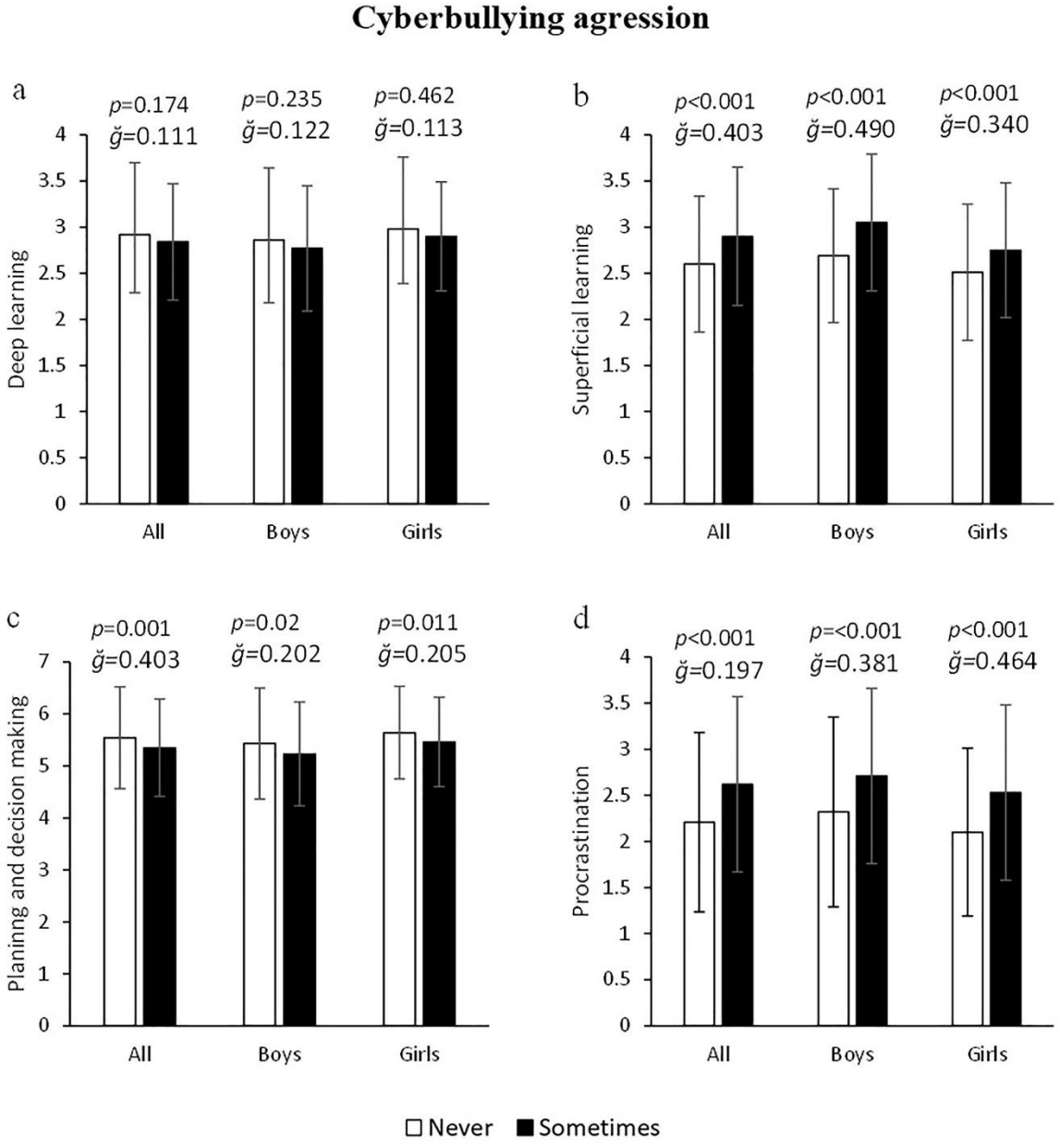


Figure 4.

Associations of aggression in cyberbullying with deep and superficial learning, planning, and school procrastination.



IV

Association of High Levels of Bullying and Cyberbullying with Test Anxiety in Boys and Girls Aged 10 to 16 Years.

Rusillo-Magdaleno, A., de la Torre-Cruz, M.J., Ruiz-Ariza, A., & Suárez-Manzano, S. (2024).

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Article

Association of High Levels of Bullying and Cyberbullying with Test Anxiety in Boys and Girls Aged 10 to 16 Years

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Abstract: The increase in cases of bullying and cyberbullying has raised concerns about its impact on the mental health of young people, particularly its relationship with test anxiety, underscoring the need to delve deeper into this issue. Therefore, the aim of this study was to examine whether suffering and perpetrating aggressive acts (bullying and cyberbullying) are related to different dimensions of test anxiety. A total of 912 Spanish students (girls 52.7%) aged between 10 and 16 years (13.43 ± 1.73) participated in this study. The European Bullying Intervention Project Questionnaire, the European Cyberbullying Intervention Project Questionnaire, and the Test Anxiety Questionnaire (CAEX-A) were used. The association between test anxiety and bullying/cyberbullying (as victims and aggressors) was calculated via analysis of covariance (ANCOVA) and binary logistic regression. All analyses were performed separately for boys and girls and adjusted for age, body mass index, maternal educational level, and academic performance. Students in bullying or cyberbullying contexts achieved significantly higher values in practically all anxiety factors analyzed ($p < 0.05$), especially in cognitive responses: 33.14% and 22.56% for bullying and cyberbullying victims, respectively, and 22.56% and 23.9% for aggressors. Victims of cyberbullying harassment had a high risk (OR: 8.311) of suffering diarrhoea, palpitations, chest tightness, nausea and fainting during exams, as well as avoidance behaviors (OR: 5.106) (both $p < 0.001$). The results, disaggregated by gender, showed that the relationship between feeling bullied in face-to-face interactions and experiencing test anxiety was only evident for girls, which seems to place them in a more vulnerable situation. Female victimization, although less frequent, could have lasting and harmful consequences. These findings highlight the need not only to implement intervention strategies in the school setting aimed at preventing and reducing bullying and cyberbullying but also to address anxiety and its physical and cognitive manifestations in both victims and aggressors.

Keywords: aggressor; students; avoidance behaviors; cognitive responses; physiological responses; victim

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1. Introduction

School harassment, commonly referred to as bullying, has been described as a form of mistreatment among peers that manifests through violent acts, whether physical or psychological, sustained over time [1]. These hostile behaviors can be exercised by an individual or a collective and be directed towards a person or a group that is in a vulnerable position, being unable to offer an effective defence [1]. According to data from the United Nations Educational, Scientific, and Cultural Organization [2], almost one-third of adolescents have been bullied by their peers at least once in the past month. The repercussions of this phenomenon include significant episodes of anxiety, a tendency towards isolation, and a decrease in motivation towards learning [3]. In addition, over the last decade, digital transformation has facilitated the emergence of new forms of bullying. These actions, employing multiple channels of aggression, are even more contagious and pernicious and can far exceed the consequences of traditional bullying [4].

Cyberbullying is defined as the deliberate and repeated use of digital platforms, including social networks, communication applications, and websites, for the purpose of intimidating, denigrating, threatening or harming an individual [5,6]. A remarkable increase in this new mode of bullying has been observed on a global scale, becoming a focus of academic and social interest in the last decade [6]. A distinctive feature of cyberbullying is its ability to overcome geographical limitations, allowing perpetrators to victimize their targets at any time and from any location [7]. Among the forms of cyberbullying are the propagation of false information, the unauthorized disclosure of personal data, and the generation of fictitious identities in order to damage a person's image [8,9]. These behaviors can be translated into different roles, where victims tend to exhibit behaviors of a passive nature, aggressors manifest a marked self-confidence, and bystanders witness acts of aggression without intervening in them [10]. At present, the distinction between traditional bullying and cyberbullying is relevant. A significant difference is the degree of anonymity that digital platforms provide, which translates into greater freedom to maintain the bullying behavior on the part of the aggressor, confident of the low probability of their facing consequences [11].

Involvement in bullying or cyberbullying, whether in the role of victim or perpetrator, has been associated with the mental health and psychological well-being of children and adolescents [12,13]. Findings from various studies suggest that victimization is associated with increased vulnerability to the presence of anxious-depressive symptomatology [12,14], isolation [15], and suicidal ideation [16] in school populations. Furthermore, the severity of such manifestations increases with time and the level of victimization [17]. In the last decade, Kowalski et al. [18], through their general model of aggression, ventured the possibility that the relationship between bullying and psychological difficulties is not direct. Instead, they suggested that the relationship might be mediated by the influence of cognitive-emotional variables or mechanisms. In this regard, the results of the studies by Irwin et al. [14] and Anderson et al. [12] showed that both the perception of guilt (positively) and attributed resilience (negatively) mediated the relationship between victimization and the presence of anxious symptomatology.

In this line of argument, several studies have examined the existence of gender differences in the perpetration or receipt of aggressive acts. While most findings suggest that boys are more likely than girls to be perpetrators and victims of aggressive acts, whether traditional or cyberbullying [19–21], authors such as Slonje and Smith [22] have suggested that boys and girls bully and are bullied equally. In a different vein, findings from research conducted by Markkanen et al. [23] showed that the highest number of cybervictimization episodes occurred among adolescent girls. Furthermore, while girls appear to be less likely to be involved in bullying, the effects of being victimized are more long-lasting and damaging than those experienced by their male peers [24].

On the other hand, school anxiety is a multifaceted construct that includes social anxiety, school discouragement, and test anxiety, among other factors [25]. Of these, test anxiety has been the most studied emotion in the last decade [20,26]. Test anxiety is characterized as a set of responses that accompany concerns about negative consequences or loss of competence when faced with an exam or demanding learning situation [27]. Traditionally, test anxiety consisted of both affective and physiological and cognitive components [28]. The physiological aspects of anxiety include automatic responses of the body such as accelerated heart rate, increased sweating, and reflex activation of the autonomic nervous system [29]. The physiological responses produced by test anxiety are characterized by an activation of the autonomic nervous system, manifested by symptoms such as diarrhoea, palpitations, chest tightness, nausea and fainting [30].

From a cognitive perspective, anxiety is characterized by persistent worries, negative expectations and biases in information processing, which contribute to maintaining alertness to potential dangers [31,32]. Students may experience difficulty concentrating [33] and intrusive thoughts that interfere with the ability to recall and process new information [34,35] and solve problems during exams [33]. Finally, the avoidance of certain

behaviors in an attempt to avoid anxiety-provoking situations, although it reduces anxiety in the short term, perpetuates the disorder by preventing the person from facing and evaluating their fears in a realistic manner [36]. Students adopt avoidance behaviors to avoid facing the exam, a tactic that involves dodging preparation for anticipated events, as termed by Rudaz et al. [37] and Torrano et al. [38].

Studies consistently report that girls report higher levels of general anxiety as well as test anxiety compared to their male peers [20,25,30,39,40]. Similarly, Nyroos et al. [41] report cross-cultural differences in the manifestation of different components of test anxiety. In their study, Nordic adolescents stand out for their use of the avoidance component, while Eastern adolescents scored highest on the physiological response. There was also an interaction between gender and culture. Thus, Nordic girls scored highest on autonomic anxiety, while their Asian counterparts scored lowest. In addition, Chinese male students scored highest on the cognitive component. Previous studies have also found that cognitive and emotional maturity significantly influence the way people understand and handle stress and interact with their environment; therefore, age is considered another determinant factor to be taken into account in the analysis of bullying and cyberbullying processes [42].

For many teachers, taking exams is the gold standard by which to check academic performance and, therefore, possible interferences that may affect the process and execution can have very negative as well as unfair and discriminating consequences for young students [43]. As indicated in previous sections, test anxiety is higher in girls than in their male peers, and this anxiety is positively associated with the presence of other emotional problems [44,45], school dropout, and even suicidal ideation [26,46].

Often, sustained bullying and cyberbullying behaviors lead to stress levels incompatible with the concentration aptitude required for test-taking [47,48]. Although the issues of bullying and school anxiety are of great interest to teachers and educational administrators, there is a paucity of research that examines the possible relationships between bullying/cyberbullying and test anxiety in school populations. An exception is the recent work of Schlesier et al. [20]. The results of their study showed that higher levels of victimization were associated with higher levels of test anxiety, which, in turn, appeared to lead to a higher number of days of school absence.

Given the lack of research, the aim of the present study was to analyze the association between bullying and cyberbullying and test anxiety and the risk of victims and aggressors of bullying and cyberbullying suffering from test anxiety in schoolchildren and adolescents. As boys are more involved in bullying (both as perpetrators and victims), while girls report higher rates of test anxiety, such relationships were examined for all participants and separately by gender. In each case, a positive association was hypothesized between bullying/cyberbullying (particularly in the role of victim) and the physiological, cognitive, and behavioral manifestations of test anxiety. As physical activity and body mass index have been associated with bullying/cyberbullying [49,50], and maternal education level has been associated with attitudes towards school and children's academic performance [51,52], these variables were used as confounders.

2. Materials and Methods

2.1. Design and Participants

A total of 912 primary and secondary school students aged 10–16 years (mean age ± standard deviation: 13.43 ± 1.73 years; 52.7% girls and 47.3% boys) participated in this cross-sectional quantitative study. Students from seven educational centers in Andalusia (Spain) were surveyed. The centers were chosen by convenience, and the participants were distributed randomly and in proportion to the size of each class. Anthropometric and sociodemographic characteristics are detailed in Table 1. Boys were more physically active than girls (4.35 ± 1.75 vs. 3.64 ± 1.70; $p < 0.001$) and had a higher BMI (21.03 ± 3.99 vs. 20.45 ± 4.28, $p = 0.034$). Scores on physiological response (1.86 ± 0.76 vs. 1.57 ± 0.56; $p < 0.001$) and cognitive response to test anxiety (2.48 ± 0.97 vs. 1.96 ± 0.77; $p < 0.001$) were higher for girls.

Table 1. Biometric characteristics, the sociodemographic data of participants, mean MVPA, bullying and cyberbullying variables, physiological response to anxiety, avoidance behaviors, and cognitive responses to anxiety segmented by gender.

	All (*n* = 912)		**Boys (*n* = 431)**		**Girls (*n* = 481)**		
Variables	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	***p***
Age (years)	13.43	1.73	13.43	1.75	13.43	1.71	0.964
BMI (kg/m^2)	20.72	4.15	21.03	3.99	20.45	4.28	**0.034**
Mother's school level (%)							**0.030**
No studies	5.4%		5.2%		5.6%		
Primary studies (EGB)	13.5%		13.9%		13.2%		
Secondary studies (BUP)	14.4%		11.6%		16.8%		
Professional training	13.2%		12.1%		14.1%		
University studies	32.5%		30.7%		34.1%		
N/C	21%		26.5%		16.2%		
Mean MVPA	3.97	1.76	4.35	1.75	3.64	1.70	**<0.001**
Academic performance	6.86	1.61	6.76	1.59	6.94	1.52	0.123
Bullying victimization	1.80	0.78	1.77	0.78	1.83	0.79	0.211
Bullying aggression	1.52	0.64	1.55	0.65	1.49	0.63	0.148
Cyberbullying victimization	1.26	0.47	1.26	0.47	1.27	0.48	0.628
Cyberbullying aggression	1.21	0.47	1.22	0.46	1.21	0.47	0.672
Physiological response to anxiety	1.71	0.69	1.57	0.56	1.86	0.76	**<0.001**
Avoidance behaviors	1.24	0.57	1.23	0.57	1.25	0.58	0.688
Cognitive response to anxiety	2.24	0.92	1.96	0.77	2.48	0.97	**<0.001**

Values are presented as means and standard deviations, or percentage. BMI = body mass index; SD = standard deviation; MVPA = moderate vigorous physical activity.

2.2. Measures

Predictor/independent variables.

Bullying and cyberbullying.

The level of bullying was assessed using 14 items from Ortega-Ruiz et al.'s [53] Spanish version of the European Bullying Intervention Project Questionnaire. As an example, the following item will be shown (Someone has hit, kicked, or pushed me). On the other hand, the Spanish version of the European Cyberbullying Intervention Project Questionnaire (ECIPQ) [54] was used to assess cyberbullying. The second instrument includes 22 items (Someone has said bad words or insulted me using email, SMS, or WhatsApp). Reliability results are high for both bullying (Cronbach's α victimization = 0.832; Cronbach's α aggression = 0.811) and cyberbullying (Cronbach's α cybervictimization = 0.869; Cronbach's α cyberaggression = 0.875). Both questionnaires were administered individually and employ a Likert-type scale with a score ranging from 1 (never) to 5 (more than once a week). The items explore the frequency with which the described behaviors have occurred during the past two months. The averages of the individual questionnaires were calculated for further analysis.

Dependent variables.

Test anxiety.

The Examination Anxiety Questionnaire (CAEX-A) for compulsory education students [55] was used to measure test anxiety. This instrument includes 37 items and a factorial composition of three dimensions. Factor 1, physiological response, includes 20 items related to symptoms such as diarrhoea, palpitations, chest tightness, nausea, and fainting (During exams my hands sweat); factor 2, avoidance behaviors, employs three items, where the anxious motor response of flight to a test situation is analyzed (I get sick and make excuses for not taking a test); and factor 3, cognitive response, includes 14 items related to aspects such as difficulty concentrating and intrusive thoughts that interfere with the ability to process information, remember new information, and solve problems during exams (While I am taking the exam, I think I am doing very poorly). Responses are scored

on a Likert-type scale with values ranging from 1 (not at all) to 5 (very much). An average was calculated for each of the factors included in the questionnaire. The reliability indices obtained using the Cronbach's α statistic were as follows: physiological response, α = 0.897; avoidance behaviors, α = 0.823; and cognitive response, α = 0.792.

Confounding variables.

Age, mother's education, BMI, weekly PA and academic performance.

The age and educational level of each participant's mother were recorded using a sociodemographic data questionnaire. Academic performance was considered as the results for each student in the immediately preceding academic evaluation. BMI was calculated using the Quetelet formula: weight (kg)/height^2 (m). To obtain weight and height measurements, an ASIMED® type B, class III digital scale and a SECA® 214 portable measuring rod (SECA Ltd., Hamburg, Germany) were used. Both measurements were taken in light clothing and without footwear. The level of weekly physical activity was assessed using the PACE+ Adolescent Physical Activity Measure [56]. This consists of two items that ask for the number of days on which the participants performed at least 60 min of MVPA during the last seven days and during a typical week (In the last 7 days, on how many of them did you do at least 60 min of physical activity?) The final score is obtained by averaging the two responses: (P1 + P2)/2). Its reliability index was Cronbach's α = 0.751.

2.3. Procedure

Data collection was carried out during the corresponding academic period in the 2022/23 and 2023/24 academic years. The purpose and nature of the study were communicated verbally and in writing to students, parents and relatives/legal guardians. Authorization was obtained from the school management and physical education teachers. In order to preserve confidentiality and anonymity, the names of the participants were coded. Each student completed questionnaires on bullying, attitude towards exams, and a sociodemographic information table. During the completion of the questionnaires and weight and height measurements, a specialized researcher gave the instructions and controlled the time, while two research assistants responded to possible doubts and any possible disturbances (e.g., separation to guarantee the confidentiality of the answers, noise outside the classroom, operation of electronic tools or internet connection). Completion of all self-report measures required approximately 30 min. This study was approved by the Bioethics Commission of the University of Jaen (Spain) (reference NOV.22/2.PRY). The design took into account current Spanish legal regulations governing clinical research in humans (Royal Decree 561/1993 on clinical trials) as well as the fundamental principles established in the Declaration of Helsinki (2013, Brazil).

2.4. Statistical Analysis

Comparison of continuous and categorical variables between boys and girls was carried out using Student's *t*-tests and χ^2 tests, respectively (Table 1). The normality and homoscedasticity of the data were verified using the Kolmogorov-Smirnov and Levene tests, respectively. To study whether adolescents who had never been victims/offenders of bullying and cyberbullying presented lower levels of test anxiety than those participants who had been victims/offenders, an analysis of covariance (ANCOVA) was performed. Each dimension of test anxiety (physiological response, avoidance behaviors and cognitive response) was used as a dependent variable and bullying victimization, bullying aggression, cyberbullying victimization and cyberbullying aggression were entered as fixed factors. The bullying and cyberbullying values were dichotomized so that participants who stated that they had never been victims/offenders of bullying and/or cyberbullying (questionnaire score = 1) were labeled "never" and those who had been victims/offenders (questionnaire score = 2–5) were labeled "sometimes". Because many comparison groups had different sample sizes, the effect size was calculated using Hedges' ğ, where 0.2 was a small effect, 0.5 a medium effect, and 0.8 a large effect [57]. The percentage difference between groups was calculated as [(Large-measurement − small-measurement)/small-measurement] × 100.

In order to examine the risk of being a victim or perpetrator of bullying and cyberbullying according to the scores obtained on the anxiety dimensions of the test, several binary logistic regression analyses were carried out. For the above, the dependent variables were dichotomized, taking the median as a reference, since there are several studies that use it for categorization, such as that by Kobel et al. [58]. Each dimension was classified as high $\geq$ median (risk group) vs. low < median (reference group). In all analyses, age, BMI, mother's educational level, weekly MVPA, and academic performance were used as covariates. Analyses were performed separately for boys and girls. A 95% confidence level ($p < 0.05$) was used for all results. All calculations were performed with the statistical program SPSS, v. 25.0, for Windows (SPSS Inc., Chicago, IL, USA).

3. Results

3.1. Analysis of Covariance of Bullying and Cyberbullying Victimization with Respect to Test Anxiety (Physiological Response, Avoidance Behaviors, and Cognitive Response)

Young bullying victims (Figure 1a–c) showed significantly higher values than those students who had not been victims of bullying in physiological responses (diarrhoea, palpitations, chest tightness, nausea and fainting): 25.69% (1.44 ± 0.44 vs. 1.81 ± 0.74 a.u.) $F(1, 714) = 36.563$, $p < 0.001$, ğ = 0.531, 1-β = 0.999; and in cognitive responses (difficulty concentrating and thoughts interfering with the ability to process and solve problems): 33.14% (1.78 ± 0.672 vs. 2.37 ± 0.94 a.u.) $F(1, 714) = 51.339$, $p < 0.001$, ğ = 0.656, 1-β = 0.999 (Figure 1a–c). Results by gender showed that girls who were victimized by bullying had significantly higher values for all anxiety behaviors than those who were not victimized (all $p < 0.004$). No significant differences were found in any anxiety behavior in boys as a function of bullying victimization (all $p > 0.05$). On the other hand, cybervictimized adolescents showed higher scores than non-victims for all anxiety factors: physiological responses: 26.97% (1.52 ± 0.55 vs. 1.93 ± 0.76 a.u.) $F(1, 714) = 66.815$, $p < 0.001$, ğ = 0.606, 1-β = 0. 999; avoidance behaviors: 20.18% (1.14 ± 0.38 vs. 1.37 ± 0.73 a.u.) $F(1, 714) = 25.211$, $p < 0.038$, ğ = 0.381, 1-β = 0.999; and cognitive responses: 22.56% (1.95 ± 0.86 vs. 2.52 ± 0.91 a.u.) $F(1, 714) = 76.576$, $p < 0.001$, ğ = 0.489, 1-β = 0.999. Similarly, the results segmented by gender (boys and girls) were significant in all cases (all $p < 0.001$), except avoidance behaviors in girls ($p = 0.067$) (see Figure 1d–f).

3.2. Analysis of Covariance of Aggression in Bullying and Cyberbullying with Respect to Test Anxiety (Physiological Response, Avoidance Behaviors and Cognitive Response)

Boys and girls who reported committing aggression had higher scores than those who did not commit aggression on all dimensions of test anxiety: physiological responses: 21.05% (1.52 ± 0.48 vs. 1.84 ± 0.76 a.u.) $F(1, 714) = 31.648$, $p < 0.001$, ğ = 0.461, 1-β = 1.000; avoidance behaviors: 17.69% (1.13 ± 0.31 vs. 1.33 ± 0.68 a.u.) $F(1, 714) = 13.849$, $p < 0.009$, ğ = 0.333, 1-β = 0. 960; and cognitive responses: 22.56% (1.95 ± 0.83 vs. 2.39 ±0.93 a.u.) $F(1, 714) = 38.950$, $p < 0.001$, ğ = 0.487, 1-β = 1.000 (Figure 2a–c). The results, segmented by gender, showed that both male and female aggressors achieved higher scores on all anxiety dimensions with respect to their non-aggressor peers (all $p < 0.032$), except avoidance behaviors in girls ($p = 0.126$). Similarly, cyberbullying male and female aggressors presented higher values than non-aggressors in all anxiety factors: physiological responses: 22.64% (1.59 ± 0.57 vs. 1.95 ± 0.80 a.u.) $F(1, 714) = 46.689$, $p < 0.001$, ğ = 0.526, 1-β = 1.000; avoidance behaviors: 24.56% (1.14 ± 0.37 vs. 1.42 ± 0.78 a.u.) $F(1, 714) = 33.932$, $p < 0.001$, ğ = 0.472, 1-β = 1.000; and cognitive responses: 23.9% (2.05 ± 0.88 vs. 2.54 ± 0.92 a.u.) $F(1, 714) = 52.709$, $p < 0.001$, ğ = 0.545, 1-β = 1.000 (Figure 2d–f).

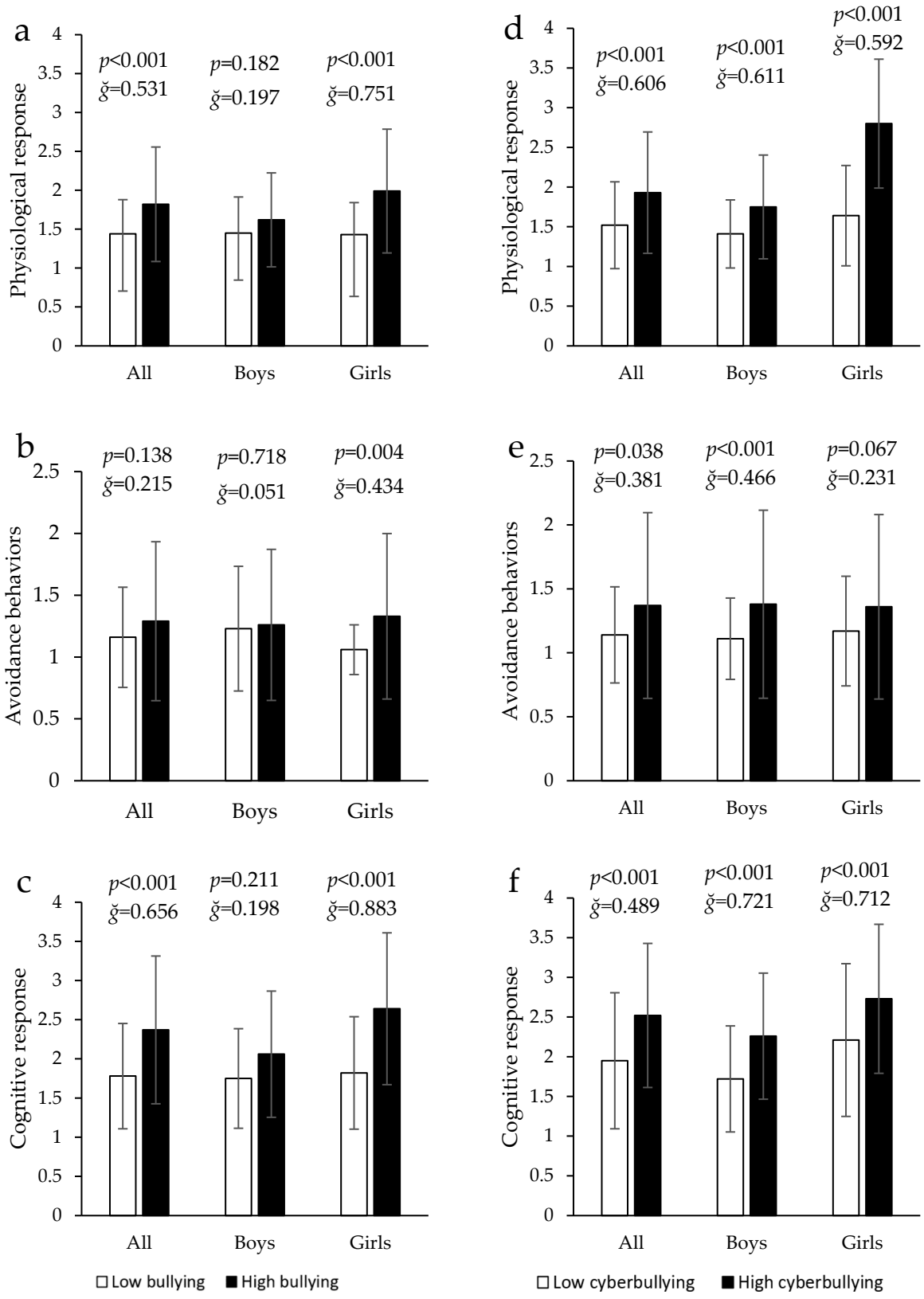

Figure 1. Means and error bars for all participants and differentiated by gender in the dimensions that compose test anxiety (physiological response, avoidance behavior and cognitive response). (**a**–**c**) distinguish between victims and non-victims of traditional bullying. (**d**–**f**) distinguish between victims and non-victims in cyberbullying.

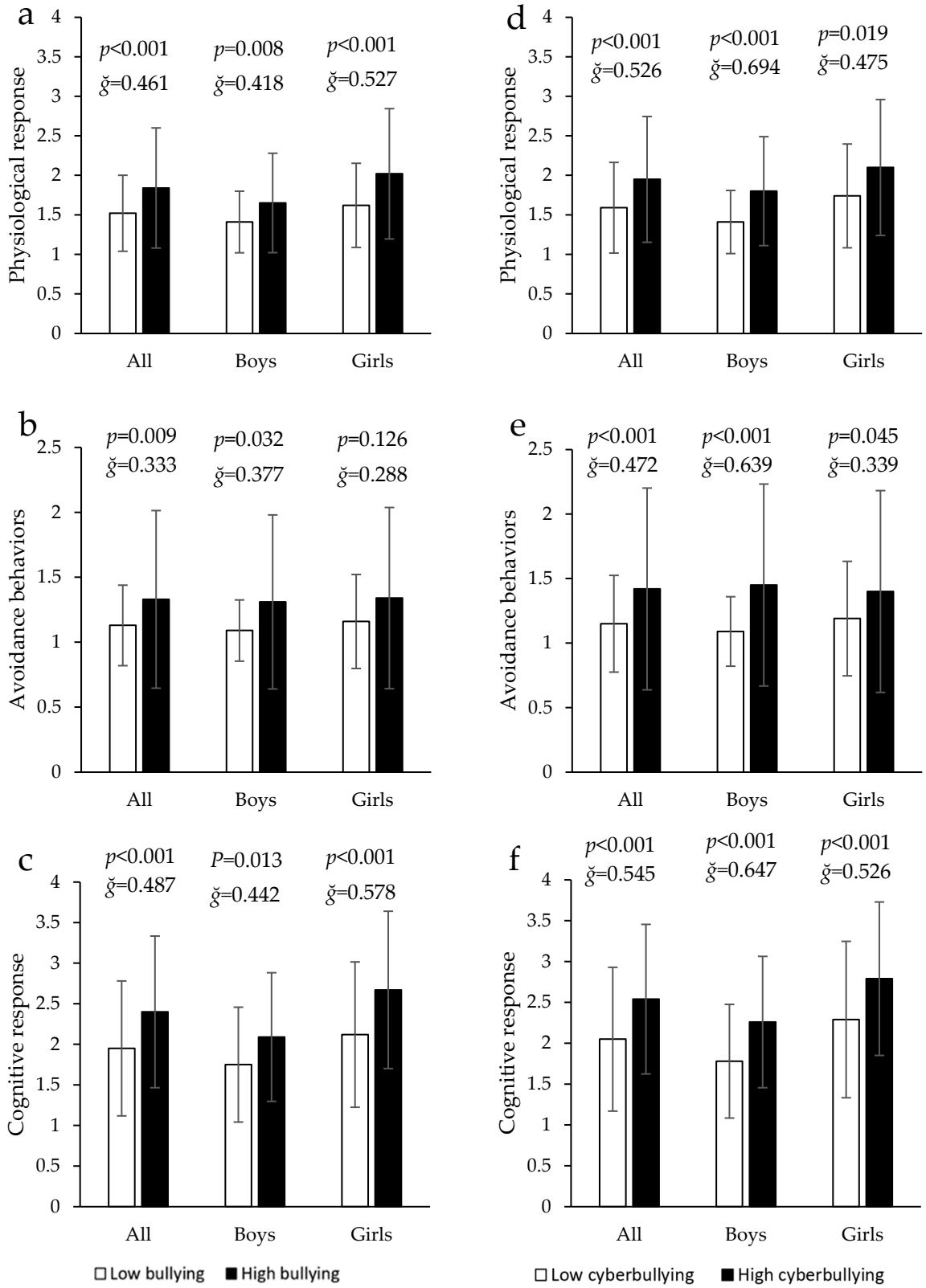

Figure 2. Means and error bars for all participants and differentiated by gender in the dimensions that compose test anxiety (physiological response, avoidance behavior and cognitive response). (**a**–**c**) distinguish between perpetrators and non-perpetrators of traditional bullying. (**d**–**f**) distinguish between perpetrators and non-perpetrators in cyberbullying.

3.3. Binary Logistic Regression

Data showing the risk of exposure to bullying and cyberbullying victimization and aggression for test anxiety are set out in Table 2. Youths with high bullying victimization were 2.05 and 2.88 times more likely to have high physiological (odds ratio [OR] = 2.058, $p < 0.001$) and higher cognitive (OR = 2.884; $p < 0.001$) anxiety responses to exams, respectively, and were thus at greater risk than non-victims. The results, segmented by gender, showed that girls and boys with high bullying victimization had a higher risk of test anxiety in almost all factors, especially girls (OR = 2.22, OR = 1.68 and OR = 4.03), for physiological response, avoidance behaviors, and cognitive response, respectively (all $p < 0.023$). In turn, cyberbullying victims showed 8.31, 5.11, and 21.55 times higher risk than non-victims for high levels of physiological responding, avoidance behaviors, and cognitive responses to tests, respectively (OR = 8.311, OR = 5.106 and OR = 21.545) (all $p < 0.001$). The data also showed that boys and girls with high levels of cyberbullying victimization were, respectively, 20.03 and 41.45 times more at risk for cognitive responses involving difficulty concentrating and thoughts that interfere with the ability to process and solve problems (all $p < 0.05$).

Table 2. OR and 95% CI for levels of victimization/aggression in bullying and cyberbullying according to dimensions of test anxiety. Physiological responses, avoidance behaviors, and cognitive responses were included in the regression as categorical variables (low vs. high). OR was adjusted for age, body mass index, mother's educational level, average weekly physical activity, and average academic performance. OR: odds ratio; CI: confidence interval.

		All (912)				Boys (431)				Girls (481)			
		N	***p***	**OR**	**95%CI**	**N**	***p***	**OR**	**95%CI**	**N**	***p***	**OR**	**95%CI**
Bullying victimization													
Physiological response	**Low**	438		1	Referent	244		1	Referent	194		1	Referent
	High	452	<0.001	2.058	1.636–2.588	174	0.013	2.055	1.485–2.844	278	<0.001	2.225	1.579–0.133
Avoidance behaviors	**Low**	696		1	Referent	333		1	Referent	363			Referent
	High	216	0.063	1.131	0.866–1.543	98	0.331	1.134	0.822–1.633	118	0.023	1.683	0.217–2.326
Cognitive response	**Low**	450		1	Referent	269		1	Referent	181			Referent
	High	447	<0.001	2.884	2.234–3.724	155	0.039	1.522	1.165–1.968	292	<0.001	4.039	2.633–0.197
Bullying aggression													
Physiological response	**Low**	438		1	Referent	244		1	Referent	194			Referent
	High	452	<0.001	1.724	1.325–2.243	174	<0.001	2.133	1.452–3.133	278	0.023	1.892	1.241–0.883
Avoidance behaviors	**Low**	696		1	Referent	333		1	Referent	363			Referent
	High	216	<0.001	2.341	1.780–3.079	98	<0.001	2.148	1.471–3.136	118	<0.001	2.733	1.791–4.169
Cognitive response	**Low**	450		1	Referent	269		1	Referent	181			Referent
	High	447	<0.001	2.580	1.908–3.489	155	<0.001	2.865	1.885–4.354	292	<0.001	4.776	2.644–8.624
Cyberbullying victimization													
Physiological response	**Low**	438		1	Referent	244		1	Referent	194			Referent
	High	452	<0.001	8.311	4.610–14.983	174	<0.001	15.429	6.111–38.957	278	<0.001	5.724	2.585–12.673
Avoidance behaviors	**Low**	696		1	Referent	333		1	Referent	363			Referent
	High	216	<0.001	5.106	3.358–7.766	98	<0.001	5.341	2.829–10.084	118	<0.001	4.022	3.815–7.959
Cognitive response	**Low**	450		1	Referent	269		1	Referent	181			Referent
	High	447	<0.001	21.545	9.842–47.164	155	<0.001	20.030	7.154–56.080	292	<0.001	41.452	9.628–78.463
Cyberbullying aggression													
Physiological response	**Low**	438		1	Referent	244		1	Referent	194			Referent
	High	452	<0.001	6.560	3.617–11.899	174	<0.001	14.296	5.757–35.684	278	<0.001	5.043	2.115–12.026
Avoidance behaviors	**Low**	696		1	Referent	333		1	Referent	363			Referent
	High	216	<0.001	6.479	3.922–10.702	98	<0.001	8.285	3.854–17.808	118	<0.001	3.707	1.380–9.309
Cognitive response	**Low**	450		1	Referent	269		1	Referent	181			Referent
	High	447	<0.001	14.431	6.455–32.263	155	<0.001	26.912	8.504–85.162	292	<0.001	18.034	4.567–71.212

For aggressors, the risk of exposure was also significantly higher in all dimensions of test anxiety for both bullying and cyberbullying: physiological response (OR = 1.724 and OR 6.560, respectively); avoidance behaviors (OR = 2.341 and OR = 6.479, respectively) and cognitive responses (OR = 2.580 and OR = 14.431, respectively) (in all cases, $p < 0.001$). The results, segmented by gender, showed that girls and boys with high levels of bullying aggression had a higher risk of test anxiety on all factors (OR = 1.892, $p = 0.023$ for the lowest). However, the highest risk for anxiety was achieved by male cyberbullying aggressors for

both physiological and cognitive responses to exams (OR = 14.29 and OR = 26.91) and by female aggressors for cognitive responses (OR = 18.03) (all $p < 0.001$).

4. Discussion

The present study aimed to determine the association that bullying and cyberbullying victimization and aggression, along with their respective risk, have with test anxiety. The main results show that victims of bullying and cyberbullying have significantly higher physiological and cognitive responses, and, in the case of cyberbullying, they also demonstrate increased avoidance behaviors. Both bullying and cyberbullying perpetrators have higher values in all dimensions of test anxiety. In general, both victims and aggressors suffer a high risk of test anxiety, which is more pronounced in cyberbullying victims, particularly in terms of physiological and cognitive responses. Recent studies have highlighted the correlation between bullying and additional emotional problems such as depression, which could be exacerbating anxiety in these scenarios [59,60]. Overall, test anxiety not only decreases educational progress but also affects students' mental health and wellbeing, impacting their ability to cope with assessments and their long-term academic performance [61,62].

4.1. Bullying and Cyberbullying Victimization and Test Anxiety

Our study evidences a significant increase in physiological symptoms (diarrhoea, palpitations or chest tightness) cognitive symptoms (such as problems concentrating and recalling information), and avoidance behavior in girls exposed to traditional forms of bullying. In the case of boys, no differences were observed in the different components of test anxiety according to their victimization status. A different pattern of results was obtained for the phenomenon of cybervictimization. In this domain, both boys and girls who reported being cybervictimized by their peers reported higher symptoms of test anxiety, with the exception of the avoidance component in the case of girls.

Specifically, cyberbullying victims experience a 26.97% increase in physiological responses. Girls face a 31-fold increased risk of suffering the described negative physiological effects in examination contexts compared to those who do not experience cyberbullying. Furthermore, cyberbullying victims, particularly boys, demonstrate an increase in these avoidance behaviors of 20.18%, with a risk percentage that is five times higher than that of non-victimized students. Finally, girls and boys affected by cyberbullying show a 22.56% increase in concentrating and recalling information compared to their unaffected peers.

Our findings are consistent with those of Anderson et al. [12] and Irwin et al. [14], who found that victimization during the school years is directly associated with vulnerability to a greater number of anxious–depressive symptoms [63,64]. This increased school anxiety has been linked to the presence of additional emotional problems [44,45], school disaffection and absenteeism [20], and suicidal ideation [26]. Thus, victimization via the aggressive acts of peers is directly associated with test anxiety, a fact that is of particular concern for girls who feel attacked in face-to-face interactions [20,26,39] as it could lead to the presence of more severe emotional and behavioral problems. This last finding contradicts the findings of Khong et al. [65] and Carvalho et al. [66], who found no significant differences between the two forms of bullying, suggesting that traditional bullying and cyberbullying have similar negative effects on victims. The observed differential relationship is of particular interest because, according to Stewart-Tufescu et al. [24], although girls are less involved in bullying, the effects of victimization are longer-lasting and more harmful than those experienced by their male peers.

4.2. Bullying and Cyberbullying Perpetration and Test Anxiety

Bullying and cyberbullying aggressors also show considerable increases in physiological responses (21.05% and 22.64%) and dysfunctional cognitive responses (22.56% and 23.9%), respectively, suggesting that anxiety and stress associated with aggressive behavior may also impair their academic performance. These results can be explained, in part, by the power dynamics and constant social tension that aggressors experience, the behavior

of whom, while it may provide a temporary sense of dominance, also leads to stress and possible long-term psychological repercussions [67,68]. Previous studies corroborate our findings, reporting that stress associated with bullying can significantly disrupt cognitive function, impeding students' ability to process and retain new information and solve problems effectively [69,70].

Anxiety generated by bullying can lead to intrusive thoughts, further interfering with cognitive abilities during exams [71,72]. In addition, other evidence suggests that bullies may experience internal conflict and anxiety due to dissonance between their aggressive behavior and social norms, potentially increasing their anxiety in evaluative contexts [73]. The manifestation of symptoms of a physiological and cognitive nature associated with bullying and cyberbullying perpetration must be analyzed with caution because additional factors, such as the type of exam, organization, study time management and the number of students present in the evaluative test must be taken into account [74].

On the other hand, only boys who were perpetrators of bullying were found to engage in significantly higher levels of avoidance than their uninvolved peers, while in the case of cyberbullying, both boys and girls showed an even higher percentage or risk increase in avoidance: about six times higher than that of non-aggressors. This differential relationship between traditional forms of aggression and avoidance behaviors as a function of gender may be due to girls being less involved in the perpetration of violent acts through direct interaction [19–21], or the fact that girls may feel more justified in their aggressive behavior towards peers, a justification that would act as a stress buffer or mitigator. In our study, the differential relationship was not observed when boys and girls bullied their peers using remote media.

4.3. Limitations and Strengths

The study presented here has a number of limitations. First, the use of a convenience sample (Andalusian primary and secondary school students aged 10–16) may limit the generalizability of the findings to older students or contexts. Second, the cross-sectional nature of the design limits our ability to infer causality between bullying and anxiety. Future research should consider longitudinal designs and expand the sample to different cultural contexts to deepen our understanding of these dynamics and test the universality of the findings. Third, the use of self-report measures may be considered an additional limitation as the information provided by the participant may not reflect their true behavior due to inaccurate recall or social desirability.

However, the strengths of this study include the large sample size (a total of 912 students in primary and secondary education) and the use of measures that have been shown to be reliable and valid in previous studies. The gendered examination of the relationships between traditional bully and cyberbullying and the dimensions that make up test anxiety can be considered a further strength given the limited amount of research that has addressed this issue. Finally, the inclusion of a number of confounding variables in the outcome analysis strategies (body mass index, maternal education level, physical activity, and academic performance) helps to make the observed relationships less ambiguous.

5. Conclusions

The present study highlights the impact of bullying and cyberbullying on test anxiety in Spanish primary and secondary school students. The results show that acts of cyberbullying, whether in the role of victim or perpetrator, are directly related to the different components of test anxiety, with the exception of avoidance reactions, regardless of the gender of the participant, as observed in previous studies [75,76]. Nevertheless, a different relationship was observed among victims of traditional bullying. In these circumstances, the relationship between feeling bullied and experiencing test anxiety was only evident among girls, which seems to place them in a situation of greater vulnerability. As indicated above, female victimization, although less frequent, has longer-lasting and harmful consequences.

Therefore, our findings highlight the need not only to implement intervention strategies in the school environment aimed at preventing and reducing bullying and cyberbullying but also to manage anxiety and its physical and cognitive manifestations in both victims and aggressors. To this end, it is suggested that educational institutions implement policies and protocols against bullying and cyberbullying, including specific surveillance and prevention measures to create safe environments and support both victims and aggressors [77].

Furthermore, efforts should focus on the acquisition and development of social and emotional skills in boys and girls. In this sense, Schlesier et al. [20] advocate the implementation of cognitive–behavioral interventions from a social information processing perspective, which include a set of guidelines (e.g., encoding behavior, interpreting signals, clarifying goals, deciding on the appropriate response, and implementing that response) to help students manage and cope with challenging situations such as bullying or anxiety. Table 3 shows some actions and recommendations that could contribute to the development and teaching of study and anxiety management strategies to support affected students and improve their academic performance.

Table 3. Study and anxiety management strategies to support affected students and improve their academic performance.

Number	Action or Treatment Focused on Test Anxiety	Scientific Citation
1	Implement school programs that integrate the teaching of relaxation and mindfulness techniques before exams for students affected by bullying and cyberbullying	Foody and Samara [78]
2	Develop digital education programs for parents and students that include strategies for managing anxiety related to cyberbullying	Coelho, Marchante, and Romao [79]
3	Offer workshops on stress management and self-help techniques to improve test stress resilience in affected students	Eyuboglu et al. [77]
4	Create school activities that promote resilience and help students develop coping skills in the face of stressful testing situations	Gohal et al. [80]
5	Establish reporting and support systems that allow students to communicate their concerns about bullying anonymously and receive counseling to manage anxiety before exams	Martínez-Monteagudo et al. [60]
6	Launch awareness campaigns that educate students about the effects of bullying and cyberbullying on test anxiety and how to address it	Paulmony et al. [81]
7	Provide workshops for families on how to support students in managing test anxiety, especially in the context of bullying	Schneider and King [82]
8	Encourage the use of emotion journals for students to document their experiences and emotions related to exams, allowing for better follow-up and support	Marshall et al. [83]
9	Implement rapid action protocols in schools to address bullying incidents and reduce victims' immediate anxiety before exams	Xia et al. [84]
10	Offer psychological recovery programs that include cognitive behavioral therapy to address both bullying and test anxiety in victims and perpetrators	Zhou et al. [85]

Given the limited research that has examined the relationship between bullying and test anxiety, it is suggested that more research should be conducted on the relationship between bullying and test anxiety, including that of older students (prior to the start of university education). In addition, the inclusion of mediating variables such as resilience, mental toughness, self-esteem or perceived social support (from family, teachers or peers) would allow us to explore whether any of these cognitive-emotional mechanisms help to mitigate the detrimental effects of bullying on anxiety in educational contexts.

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Bullying and cyberbullying are associated with inappropriate use of the Internet, cell phones and videogames in children and adolescents.

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Bullying and cyberbullying are associated with inappropriate use of the Internet, cell phones and video games in children and adolescents

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Abstract: The aim of the present study was to analyze the possible association of bullying and cyberbullying with the level of Internet, cell phone and video game use in children and adolescents. A total of 677 Spanish students (53.03% girls) aged 10 to 16 years (13.81 ± 1.56) participated. The association between variables and risk of exposure was carried out by analysis of covariance (ANCOVA) and binary logistic regression (Odds ratio = OR), respectively. All analyses were performed separately for boys and girls and adjusted for age, body mass index, mother's education and average weekly physical activity. The results showed that both victims and perpetrators of bullying and cyberbullying present a significant increase and risk of abusive and inappropriate use of internet, cell phone and video games. Girls involved in bullying/cyberbullying behaviors reached the highest percentages of inappropriate use of internet (≥ 10.36%), cell phone (≥ 29.25%) and video games (≥ 23.19%) with respect to peers not affected by bullying behaviors. In all cases, girls, both victims and aggressors of bullying and cyberbullying, multiplied the risk of harmful use of these devices by at least 3 times. The highest risk values are observed in cyberbullying behaviors, where the aggressor boys multiply the risk x8.4 times and the victim girls by 16.5 times. It is suggested to implement educational policies to prevent situations especially of cyberbullying in both victims and aggressors, prioritizing student safety. Teachers and families should collaborate, providing specialized support, technological supervision and digital education to ensure a safe environment for children and adolescents.

Keywords: school bullying; adolescents; aggression; cyberbullying; internet; cell phone; videogames; social networks; victimization

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1. Introduction

In today's society, Internet use among children and adolescents has increased considerably in recent years due to the easy access and expansion of technology [1,2]. Several studies have concluded that between 65% and 78% of children and young people, respectively, consume the Internet excessively on a daily basis [3,4] and addiction to cell phones now affects all social strata, with 15% of young people spending more than four hours a day online [5]. This abuse in the use of mobile devices has aroused scientific interest due to the negative impact it has on physical, emotional and social health [6]. At the physiological level, it has been shown that the overuse of electronic devices leads to structural changes in the brains of young people [7,8] as impairment in cognitive control during emotional processing [9,10] and reduction in functional connectivity in brain regions

related to cognitive control of emotional stimuli [11,12]. On the other hand, the excessive consumption of video games in young people is associated with significant risks of low psychological well-being [13], poor nutrition [14] as well as anxiety [8], social isolation and depression [15]. Despite the above, some video games, especially those with an interactive design, can promote physical activity and the development of social and cognitive skills [16]. In addition, factors such as intrinsic and extrinsic motivation of young people can mediate the frequency of video game use due to the usefulness of these technologies and their integration in learning activities [17].

According to recent studies, the excessive use of the Internet, mobile devices and video games also impairs the cognitive control of young people and reduces their ability to manage emotions, considered key factors for maintaining healthy social relationships [18]. Another common aspect of the overuse of these technological applications is their relationship with the appearance of bullying behaviors or attitudes in children and adolescents, such as bullying and cyberbullying [19,20]. It seems that young people would take refuge in new technologies to avoid situations of harassment or bullying because the virtual environment provides a temporary escape from reality [21,22].

Although many studies consider that the abuse of technology can contribute to the development of bullying behavior, it is essential to consider the opposite effect as well. The consequences of bullying, considered as a manifestation of mistreatment between students, characterized by acts of physical or mental violence and maintained over time [23], could generate a rebound effect by further increasing the time spent on internet, cell phone and video games [24]. Moreover, the repercussions of these bullying behaviors would affect the victims as well as the perpetrators and observers, manifesting themselves in behaviors of impulsivity, anger and school violence [25,26] that have a very negative influence on the educational environment of adolescents [27–29]. Cyberbullying, on the other hand, is characterized by its persistent nature and the ease with which the aggressor can hide his identity [27], would show more long term implications for the students involved such as low self-esteem [30], mental health problems [31], low social development [32] as well as poor academic performance [33,34]

Recent studies have also revealed that young people may respond differently to the above stimuli depending on their age [35], body mass index [BMI] [36], the practice of weekly physical activity [37] and the parents' level of studies [38]. In addition, it appears that adolescents of different sexes tend to experience and engage in bullying unequally [39]. While boys are more likely to engage in direct and physical forms of bullying, girls are more likely to engage in relational bullying such as social exclusion and rumor spreading [40]. Girls may also be more vulnerable to cyberbullying due to their greater concern for appearance and social acceptance, which makes them more susceptible to virtual psychological attacks [41]. On the other hand, boys may pressure their peers to demonstrate their dominance and power through aggressive online behavior [42]. These dynamics, together with differential access to and use of technologies, contribute to the fact that the experiences and consequences of bullying and cyberbullying vary significantly between sexes.

Numerous studies have addressed the association of school bullying and cyberbullying with the abuse of internet and cell phone use [13,17,43,44] and video games [8,14,15]. However, the explicit association of victimization and aggression with the excessive use of these technologies has been little explored [45]. The present research provides a pioneering approach in differentiating the roles of bullying, which may offer new insights into how both victims and perpetrators of bullying may overuse and addictively use new technologies [46]. Based on the above, the aim of the present study was to analyze the possible association of bullying and cyberbullying with the use of the Internet, cell phones

and video games in the Spanish school and adolescent population of both sexes, after adjusting for age, BMI, mother's level of education and average physical activity. We also sought to determine the level of risk involved in bullying victimization/aggression and cyberbullying in relation to abusive use of the Internet, cell phones and video games. We hypothesized that those young people with a higher level of participation in bullying and/or cyberbullying, regardless of role, would in turn have a more inappropriate use of internet, cell phone and video games.

2. Materials and Methods

2.1. Participants

A total of 677 primary and secondary school students aged 10-16 years (mean age ± standard deviation: 13.81 ± 1.56 years) (53.03% girls and 46.97% boys) participated in the present cross-sectional quantitative study. Data collection took place from February to May 2023. Students from 7 educational centers in the autonomous community of Andalusia (Spain) were surveyed. The sample was selected by convenience. The anthropometric and sociodemographic characteristics are detailed in Table 1.

Table 1. Biometric characteristics, sociodemographic data of participants, average AFMV, bullying and cyberbullying variables, internet, cell phone and video game use segmented by sex.

	All (n = 677)		**Boys (n = 318)**		**Girls (n = 359)**		
Variables	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	***p***
Age (years)	13.81	1.56	13.76	1.67	13.85	1.47	0.452
BMI (kg/m²)	20.93	4.12	21.39	4.23	20.53	3.98	0.006
Mother's level of education (%)							0.047
No studies	37(5.53)		19(6.12)		18(5.01)		
Primary education	95(14.21)		51(16.45)		44(12.25)		
Secondary education	111(16.59)		46(14.83)		65(18.11)		
Professional training	101(15.09)		47(15.16)		54(15.04)		
University studies	218(32.58)		87(28.06)		131(36.49)		
N/C	107(15.99)		60(19.35)		47(13.09)		
Mean MVPA	3.85	1.74	4.08	1.77	3.64	1.7	0.001
Bullying victimization	1.75	0.76	1.74	0.79	1.75	0.73	0.823
Bullying aggression	1.49	0.62	1.58	0.67	1.41	0.56	<0.001
Cyberbullying victimization	1.28	0.49	1.27	0.47	1.29	0.5	0.665
Cyberbullying aggression	1.24	0.50	1.25	0.49	1.23	0.51	0.548
Internet use	2.33	0.78	2.31	0.78	2.36	0.78	0.409
Cell phone use	2.59	1.13	2.53	1.09	2.66	1.17	0.137
Uso of video games	1.87	0.88	2.16	0.91	1.61	0.76	<0.001

[1] Data are presented as mean for continuous variables and percentage for categorical variables. BMI = Body Mass Index; SD = standard deviation; MVPA = Vigorous Moderate Physical Activity.

2.2. Predictor/independent variables

Bullying y cyberbullying

The level of bullying was assessed using the "European bullying intervention project questionnaire" instrument, Spanish version, from Ortega-Ruiz et al.[47], 14 items. To assess cyberbullying, we used the Spanish version of the "*European cyberbullying intervention project questionnaire*" (ECIPQ; [48] which includes 22 items. Reliability scores were high for both bullying (Crombach's α victimization = 0.830 and Crombach's α aggression = 0.811) and cyberbullying (α cybervictimization = 0.821 and α cyberaggression = 0.837). Both questionnaires were administered individually and employ a Likert-type scale with a score ranging from 1 = Never to 5 = More than once a week. The items explore the frequency with which the described behaviors have occurred during the past two months and both required approximately 15 minutes to complete.

2.3. Dependent variables

Internet, cell phone and video game use

The "Spanish PIUQ-9" instruments were used to quantify the level of internet, cell phone and video game use [49] designed to assess the psychological and behavioral impact of problematic Internet use along three main dimensions (obsession, neglect and control disorder), "SAS-SV" [50] used to measure the degree of dependence on cell phones and assess how it affects students' emotional attachment, compulsion, withdrawal symptoms and difficulty in reducing bullying, and to assess the degree of dependence on cell phones "*Internet Gaming Disorder Scale–Short–Form (IGDS9–SF)* [51], respectively. The latter measures dependence symptoms in online video game players by assessing problematic behaviors and experiences related to Internet gaming. Each instrument included 9 items and used a Likert-type scale with scores ranging from 1 = never/totally disagree to 5 = almost always/always/totally agree. All questionnaires were administered individually and presented high levels of reliability: Internet use (Crombach's α = 0.831) cell phone (Crombach's α = 0.849) and video games (Crombach's α = 0.813).

2.4. Confounding variables

Age, body mass index, mother's education and average weekly physical activity

The age and educational level of the mother of each participant were recorded by means of a sociodemographic data questionnaire. Age was considered as a confounding variable given its relevance in previous studies, where it has been found that maturational and emotional development together with psychological factors significantly influence the management of bullying stress [52,53]. It has also been found that academic performance, mental health and IQ are significantly associated with mothers' level of education [54,55]. BMI was calculated using the Quetelet formula: weight (kg)/height2 (m). To obtain weight and height measurements, an ASIMED® type B, class III digital scale and a SECA® 214 portable measuring rod (SECA Ltd., Hamburg, Germany) were used. Both measurements were taken in light clothing and without footwear. The level of weekly physical activity was assessed using the "*PACE+ Adolescent physical activity measure physical*" questionnaire [56]. This consists of two items asking the number of days in which the participants have performed at least 60 minutes of physical activity at moderate or vigorous intensity during the last 7 days and during a typical week. The final score was obtained by averaging both responses: (P1 + P2) / 2). Its reliability index was α = 0.744. Both BMI

and weekly physical activity were considered since they are related to physical and mental wellbeing, as well as to students' learning and self-esteem [57,58].

2.5. Procedure

Data collection was conducted during the 2022/2023 academic year. The purpose and nature of the study were communicated verbally and in writing to students, parents and legal guardians. Authorization was obtained from the school administration and physical education teachers. In order to preserve confidentiality and anonymity, the names of the participants were coded. During the completion of the questionnaires and weight and height measurements, a specialized researcher gave the instructions and controlled the time, while two research assistants observed possible doubts and any possible disturbances (e.g., separation space to guarantee the confidentiality of the answers, noise outside the classroom, confused students, operation of electronic tools or Internet connection). The study was approved by the Bioethics Commission of the University of Jaén (Spain), reference NOV.22/2.PRY. The design took into account the current Spanish legal regulations governing clinical research in humans (Royal Decree 561/1993 on clinical trials), as well as the fundamental principles established in the Declaration of Helsinki (2013, Brazil).

2.6. Statistical analysis

Comparison of the continuous and categorical variables between boys and girls was carried out using Student's t test and $\chi 2$ tests, respectively. The normality and homoscedasticity of the data were verified using the Kolmogorov-Smirnov and Levene tests, respectively. To study whether adolescents who had never experienced bullying and cyberbullying victimization/aggression were more likely to abuse the Internet, cell phones and video games than those who had been victims/aggressors, an analysis of covariance (ANCOVA) was performed. Measures of internet, cell phone and video game use were used as dependent variables and bullying victimization, bullying aggression, cyberbullying victimization and cyberbullying aggression were introduced as a fixed factor. The bullying and cyberbullying values were dichotomized such that: participants who stated that they had never been a victim/offender of bullying and/or cyberbullying (questionnaire score = 1) were labeled as "Never" and those who had ever been a victim/offender (questionnaire score = 2-5) were labeled as "Sometimes". Because many comparison groups had different sample sizes, effect sizes were calculated using Hedges' ğ, where 0.2 = small effect, 0.5 = medium effect, and 0.8 = large effect [59]. The percentage of difference between groups was calculated as: [(Large-measurement - small-measurement) / small-measurement] x 100. To determine the level of risk of bullying victimization/aggression and cyberbullying to have lower values in the level of internet, cell phone and video game use, a binary logistic regression was carried out. For this purpose, the dependent variables were dichotomized taking the median as a reference [60,61]. Each strategy was classified as High ≥ median (reference group) vs. Low < median (risk group). In all analyses, age, BMI, mother's educational level, weekly physical activity, and academic performance were used as covariates. Analyses were performed separately for boys and girls. A 95% confidence level ($p < 0.05$) was used for all results. All calculations were performed with the statistical program SPSS, v. 25.0 for WINDOWS (SPSS Inc., Chicago).

3. Results

Covariance analysis of victimization and aggression in bullying and cyberbullying with respect to internet use.

Analysis of covariance employing inappropriate internet use as the dependent variable and bullying measures as the fixed factor showed that, in all cases, victims and aggressors of bullying, as well as victims and aggressors of cyberbullying presented significantly higher scores (10. 23, 13.68, 11.42 and 19.72 %, respectively) of internet abuse

compared to all other participants (all F[1,661] > 11.213, $p < 0.030$, ğ > 0.383, Figure 1 a, b, c, d). When the results were differentiated by sex it was found that, in all cases, girls immersed in bullying situations had significantly higher scores of inappropriate internet use: A) for bullying victims = 18.72% (2.41 ± 0.78 vs. 2.03 ± 0.73 a.u., F[1,351] = 13.351, $p < 0.001$, ğ = 0.491, 1-β = 0.954, Figure 1a); B) for bullying aggressors = 16.59% (2.46 ± 0.78 vs. 2.11 ± 0.72. a.u., F[1,351] =16.242, $p < 0.001$, ğ = 0.458, 1-β = 0.980), Figure 1b); C) for cyberbullying victims = 10.36% (2.45 ± 0.78 vs. 2.22 ± 0.76. a.u., F[1,351] = 14.609, $p < 0.019$, ğ = 0.397, 1-β = 0.927), Figure 1c) and D) for cyberbullying aggressors = 18.43% (2.57 ± 0.76 vs. 2.17 ± 0.75 a.u., F[1,351] = 27.807, $p < 0.001$, ğ = 0.530, 1-β = 0.999), Figure 1d). For boys, the results showed 21.05% more inappropriate internet use in cyberbullying aggressors (2.53 ± 0.71 vs. 2.09 ± 0.78 a.u., F[1,304] = 21.894, $p = 0.033$, ğ = 0.5876, 1-β = 0.967). No significant differences were found in either victims or victims/offenders of bullying (all $p > 0.05$).

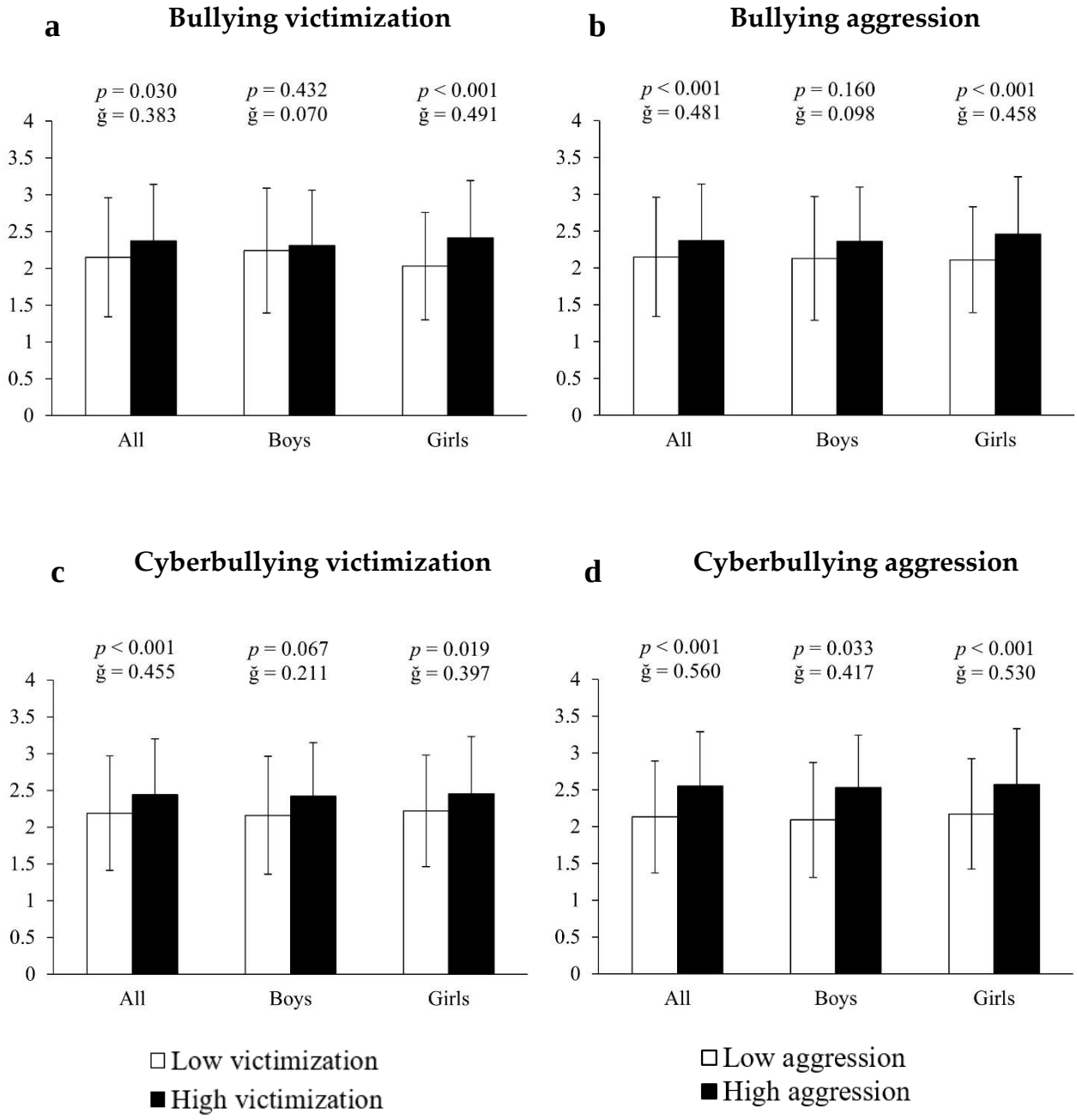
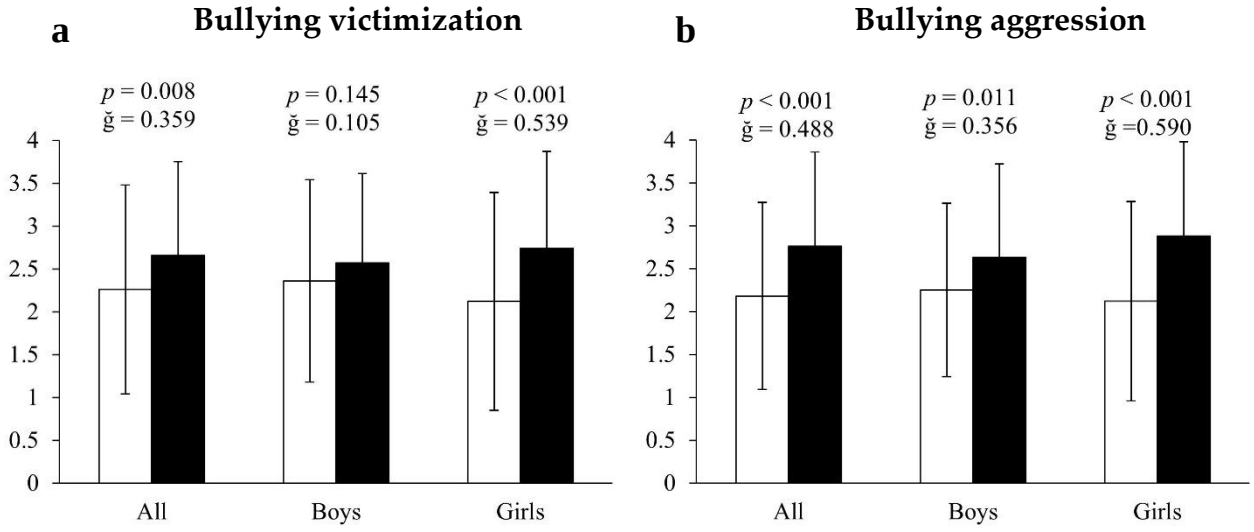


Figure 1. Association of victimization and aggression in bullying and cyberbullying with respect to internet use

Covariance analysis of victimization and aggression in bullying and cyberbullying with respect to cell phone use.

The analysis of covariance employing inappropriate or unhealthy cell phone use as the dependent variable and bullying measures as the fixed factor showed that, in all cases, victims and aggressors of bullying, as well as victims and aggressors of cyberbullying presented higher indicators of cell phone abuse (26. 55, 26.61, 26.55 and 31.42%, respectively) compared to all other participants (all F[1,661] > 14.363, p < 0.009, ğ > 0.358; Figure 2 a, b, c, d). Results segmented by sex showed that, in all cases, girls involved in bullying contexts had significantly higher scores of inappropriate cell phone use: A) bullying victims = 29.25% (2.74 ± 1.13 vs. 2.12 ± 1.17 a.u., F[1,351] = 14.171, $p < 0.001$, ğ = 0.539, 1-β = 956, Figure 2a); B) bullying aggressors = 35.85% (2.88 ± 1.11 vs. 2.12 ± 1.16 a.u.) F[1,351] = 35.474, $p < 0.001$, ğ = 0.590, 1-β = 0.999, figure 2b); C) cyberbullying victims = 35% (2.97 ± 1.15 vs. 2.2 ± 1.1, a.u., F[1,351] = 56.333, $p < 0.001$, ğ= 0.653, 1-β = 0.999, Figure 2c) and D) cyberbullying aggressors = 33.04% (3.06 ± 1.11 vs. 2.3 ± 1.1, a.u.) F[1,351] = 46.874, $p < 0.001$, ğ = 0.611, 1-β = 0.991, Figure 2d). For their part, boys immersed in bullying situations manifested significantly more inappropriate cell phone use in A) bullying aggressors = 16.89% (2.63 ± 1.09 vs. 2.25± 1.01, a.u., F[1,304] = 9.497, $p = 0.011$, ğ = 0.357, 1-β = 0.719, Figure 2b); B) cyberbullying victims = 14.01% (2.64 ± 1.04 vs. 2.27 ± 1.08 a.u., F[1,304] = 9.753, $p = 0.016$, ğ = 0.337, 1-β = 0.845, Figure 2c) and C) cyberbullying aggressors = 29.28% (2.87 ± 1.09 vs. 2.22 ± 1.01, a.u.) F[1,304] = 28.272, $p < 0.001$, ğ = 0.628, 1-β = 0.979, Figure 2d). However, no significant differences were found in boys who were victims of bullying ($p > 0.05$).



c Cyberbullying victimization

d Cyberbullying aggression

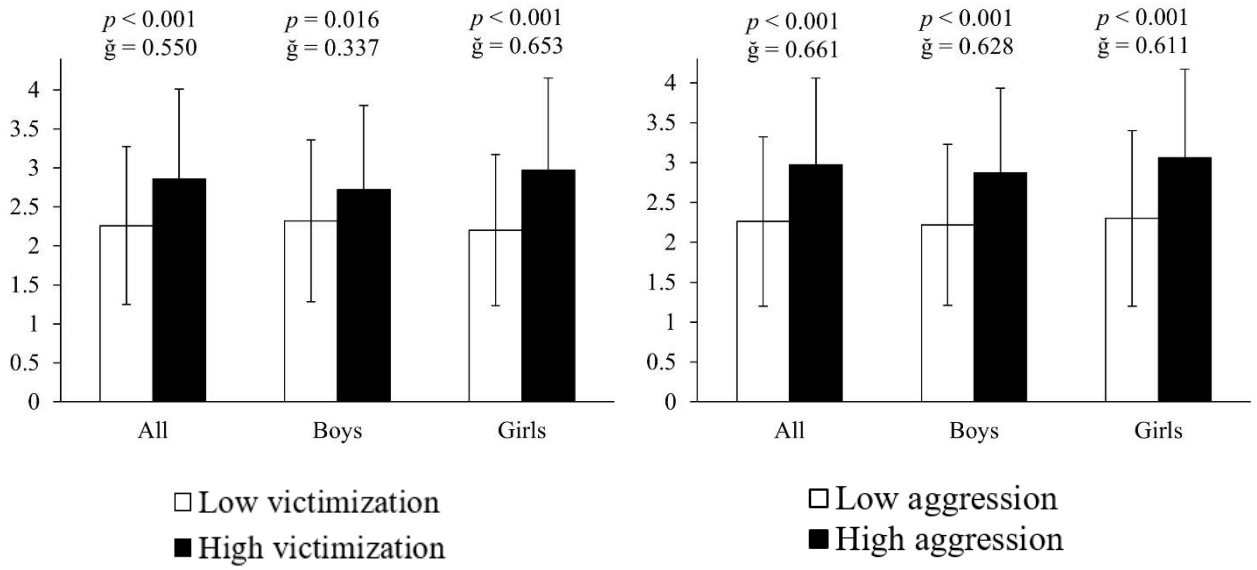
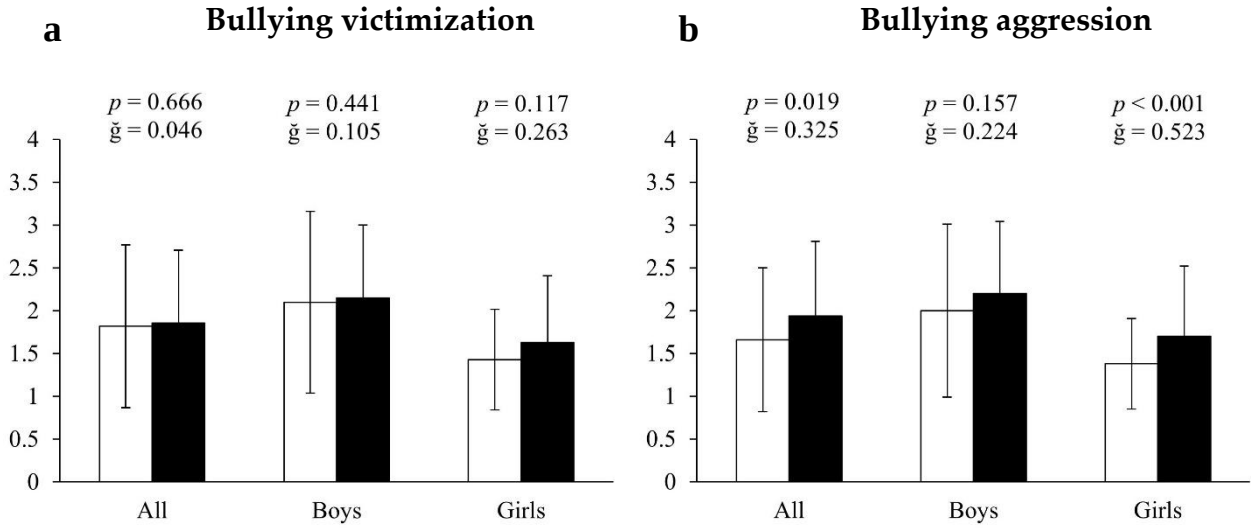


Figure 2. Association of victimization and aggression in bullying and cyberbullying with respect to cell phone use

Covariance analysis of bullying and cyberbullying victimization with respect to video game use.

Analysis of covariance using inappropriate or unhealthy video game use as the dependent variable and bullying measures as the fixed factor showed that both bullying aggressors and cyberbullying victims and aggressors had higher values of video game abuse (16.87, 15.20 and 20.71%, respectively) compared to the rest of the participants (all significant: F[1,661] > 13.158, $p < 0.020$, ğ > 0.301; Figure 2 b, c, d). Sex-segmented analysis revealed inappropriate video game use in: A) bullying aggressors = 23.19% (1.7 ± 0.82 vs. 1.38 ± 0.53, a.u., F[1,351] =24.315, $p < 0.001$, ğ = 0.523, 1-β = 0.945, Figure 3b); B) cyberbullying victims = 27.54% (1.7 ± 0.82 vs. 1.38 ± 0.53, a.u., F [1,351] = 26.416, $p < 0.001$, ğ = 0.517, 1-β = 0.979, figure 3c) and C) cyberbullying aggressors = 26.57% (1.81 ± 0.89 vs. 1.43 ± 0.58 a.u., F[1,351] = 27.916, $p < 0.001$, ğ = 0.512, 1-β = 0.966, figure 3d). In boys, inappropriate video game use was observed in cyberbullying aggressors = 16.08% (2.31 ± 0.85 vs. 1.99 ± 0.91, a.u., F[1,304] = 6.424, $p = 0.012$, ğ = 0.362, 1-β = 0.715, figure 3d), but not between victims and aggressors of bullying and victims of cyberbullying (all $p > 0.05$, figure a, b, c).



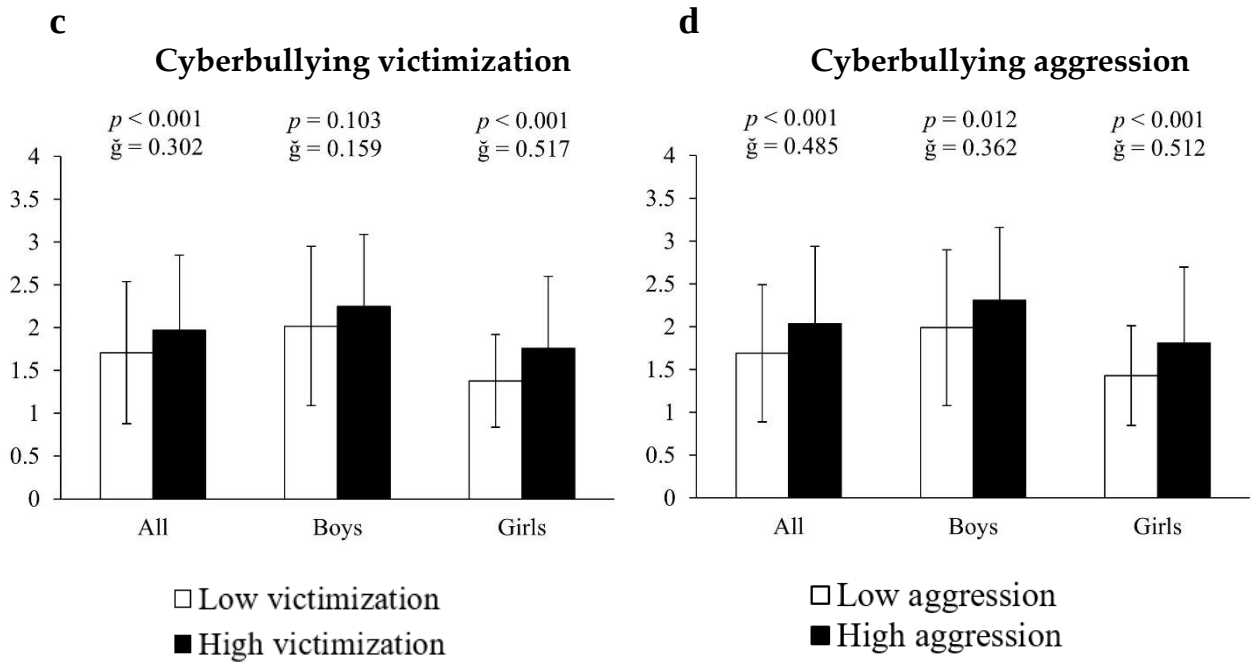


Figure 3. Association of victimization and aggression in bullying and cyberbullying with respect to the use of video games

Binary logistic regression on bullying and cyberbullying victimization and aggression with respect to internet, cell phone and video game use.

The data showing the risk of exposure to bullying and cyberbullying (victimization and aggression) with respect to internet, cell phone and video game abuse are presented in Table 2. Overall, bullied schoolchildren were shown to have 1.60 and 2.07 times the risk of inappropriate use of the internet (OR = 1.606; $p < 0.001$) and cell phone (OR = 2.017; $p < 0.001$) than those who were not bullied, respectively. Bullied girls had a higher risk of abusing the internet (OR = 2.080; $p < 0.001$), cell phone (OR = 2.898; $p < 0.001$) and video games (OR = 1.767; $p < 0.001$). On the other hand, bullying aggressors expressed 2.11; 2.52 and 3 times more risk of inappropriate use of internet, cell phone and video games, respectively (all $p < 0.001$). Both bullying boys and bullying girls were more likely to have unhealthy internet (OR = 1.503; $p = 0.027$ and OR = 3.826; $p < 0.001$, respectively) and cell phone use (OR = 1.659; $p = 0.006$ and OR = 8.068; $p < 0.001$, respectively). On the other hand, the risk of inappropriate use of video games was increased 3.40 times in bullying girls ($p < 0.001$) but not in boys ($p > 0.05$).

The cyberbullying data indicated that cyberbullying victims had a 4.53; 7.98 and 4.61 times higher risk of misusing the Internet compared to those who did not suffer cyberbullying. According to gender, in boys and girls victims of cyberbullying, a higher probability of abusive use of the internet (OR = 3.279; $p = 0.006$ and OR = 5.998; $p < 0.001$, respectively), cell phone (OR = 4.585; $p = <0.001$ and OR = 16.473; $p < 0.001$, respectively) and video games (OR = 3.999; $p = 0.049$ and OR = 5.484; $p < 0.001$, respectively) compared to those who were not bullied. Also, it was detected that schoolchildren aggressors of cyberbullying had a significant risk of making an unhealthy use of internet (OR=5.782; $p<0.001$), cell phone (OR=14.367; $p<0.001$) and video games (OR=3.839; $p<0.001$). This high probability of risk was confirmed in both aggressor boys and girls with respect to non-aggressors (all $p < 0.001$).

Table 2. Odds ratio (OR) and confidence intervals (95% CI) for levels of victimization/aggression in bullying and cyberbullying according to. Internet, cell phone and video game use were included in the logistic regression as a categorical variable (low vs. high). The OR was adjusted for age, body mass index, mother's educational level and average weekly physical activity.

		All (677)				Boys (318)				Girls (359)			
		N	***P***	**OR**	**95%IC**	**N**	***P***	**OR**	**95%IC**	**N**	***P***	**OR**	**95%IC**
Bullying victimization													
Internet	**Low**	326		1	Referent	151		1	Referent	175		1	Referent
	High	341	<0.001	1.606	1.286 – 2.005	159	0.080	1.313	0.968 – 1.780	182	<0.001	2.080	1.489 – 2.906
Mobile phone	**Low**	334		1	Referent	169		1	Referent	165			Referent
	High	333	<0.001	2.017	1.597 – 2.548	141	0.098	1.513	1.114 – 2.054	192	<0.001	2.898	2.000 – 4.199
Videogames	**Low**	344		1	Referent	110		1	Referent	234			Referent
	High	323	0.313	1.114	0.901 – 1.621	200	0.629	1.001	0.911 – 1.898	123	<0.001	1.767	1.291 – 2.419
Bullying agression													
Internet	**Low**	326		1	Referent	151		1	Referent	175		1	Referent
	High	341	<0.001	2.116	1.576 – 2.841	159	0.027	1.503	1.047 – 2.157	182	<0.001	3.826	2.268 – 6.453
Mobile phone	**Low**	334		1	Referent	169		1	Referent	165		1	Referent
	High	333	<0.001	2.521	1.850 – 3.436	141	0.006	1.659	1.158 – 2.375	192	<0.001	8.068	4.051 – 16.067
Videogames	**Low**	344		1	Referent	110		1	Referent	234		1	Referent
	High	323	<0.001	3.002	2.162 – 4.168	200	0.208	1.181	0.901 – 2.407	123	<0.001	3.403	2.096 – 5.526
Ciberbullying victimization													
Internet	**Low**	326		1	Referent	151		1	Referent	175			Referent
	High	341	<0.001	4.531	2.804 – 7.322	159	0.006	3.279	1.650 – 6.514	182	<0.001	5.998	3.061 – 11.752
Mobile phone	**Low**	334		1	Referent	169		1	Referent	165			Referent
	High	333	<0.001	7.980	4.477 – 14.222	141	<0.001	4.585	2.223 – 9.455	192	<0.001	16.473	5.940 – 45.686
Videogames	**Low**	344		1	Referent	110		1	Referent	234			Referent
	High	323	<0.001	4.616	2.809 – 7.583	200	0.049	3.999	1.009 – 12.732	123	<0.001	5.484	2.967 – 10.137
Ciberbullying agression													
Internet	**Low**	326		1	Referent	151		1	Referent	175		1	Referent
	High	341	<0.001	5.782	3.198 – 10.455	159	0.019	4.137	1.944 – 8.803	182	<0.001	8.628	3.282 – 22.683

Mobile phone	**Low**	334		1	Referent	169		1	Referent	165		1	Referent
	High	333	<0.001	14.367	6.358 – 32.465	141	<0.001	8.394	3.377 – 20.862	192	<0.001	14.333	4.554 – 38.113
Videogames	**Low**	344		1	Referent	110		1	Referent	234		1	Referent
	High	323	<0.001	3.839	3.562 – 13.132	200	<0.001	5.091	1.926 – 13.459	123	<0.001	9.699	3.676 – 25.589

4. Discussion

The aim of the present study was to analyze the association of bullying and cyberbullying with the use of internet, cell phone and video games in children and adolescents between 10 and 16 years of age. In general, the results have shown that both victims and aggressors of bullying and cyberbullying have higher percentages and higher risk of abusive use of internet, cell phone and video games than unaffected peers. In all cases, girls, both victims and aggressors of bullying and cyberbullying, multiply at least x3 the risk of harmful use of internet, cell phone and/or video games. In both sexes, cyberbullying has a greater negative impact on the abusive use of the Internet, cell phones and/or video games than traditional bullying. More specifically, the highest risk values are observed in the aggressor boys who multiply the risk by up to 8.4 and the victim girls by 16.5 times.

According to the results of this study, young people affected by bullying, both victims and aggressors, abuse the Internet more (10.2% in both cases) than those who are not. In addition, inappropriate use of the Internet is more prevalent in girls who are victims and aggressors of bullying (18.7% and 16.6%, respectively) than in boys. Similar results were found by Feijóo et al. [21] which analyzed the relationship between bullying and cyberbullying and Internet and cell phone use in a sample of 3188 young people aged 12-17 years, as well as those found by Sittichai & Smith [62] which studied the effect of high levels of internet use on mental well-being in 1140 students aged 12-18 years. Both studies concluded that both bullying and cyberbullying appear to be associated with abusive and problematic internet use, as well as directly affecting the mental well-being of adolescents. Regarding gender, some studies have associated bullying and cyberbullying with problematic internet use more in girls than in boys [63,64]. The present study also found that, although the results are significant in both boys and girls, the risks are higher in girls. For example, in bullying and cyberbullying aggression the risks amount to 8.07 and 14.33, respectively.

Furthermore, our results have also revealed that both victimization and aggression, related to cyberbullying, have a higher negative impact (11.42% and 19.72%, respectively) and twice the risk of abusive internet use than those affected only by traditional bullying. According to these findings, recent research suggests that cyberbullying has negative associations with respect to Internet use, not as clearly evident in traditional bullying [64,65]. However, some previous research also considers the use of the Internet as a cause of cyberbullying and not as a consequence [66–68]. It appears that cyberbullying, due to its pervasive and anonymous nature, may have a more profound impact than traditional bullying, due to the ease of access to the internet that technologies provide and the association of internet use with seeking emotional comfort or support on digital platforms [65,69,70].

On the other hand, our results reveal that students who are victims of cyberbullying are up to four times more likely to abuse the use of cell phones. Several previous studies have also concluded that students who suffer bullying and cyberbullying have a higher inappropriate use of cell phones than those not involved in bullying situations [71,72]. According to our results, gender emerges as a differentiating factor since female victims have a higher risk (x2.9 for bullying and x16.5 for cyberbullying) of inappropriate use of cell phones. These findings coincide with those obtained by Feijóo et al. [21], which found

that girls affected by bullying or cyberbullying abuse cell phones to a greater extent than boys in young people aged 12-17 years. It seems that girls, both victims and aggressors, would have a greater addiction to social networks than boys and therefore a greater dependence on the use of digital devices such as cell phones [73].

Regarding the type of bullying, data have shown that the main associations with inappropriate use of video games are found in victims (15.2%) and aggressors (20.7%) of cyberbullying. Previous studies have revealed that young people involved in cyberbullying are those who present a greater abuse of video games [69] or online games [70]. In terms of gender, we found a greater addiction to video games among girls who were victims of cyberbullying (27.54%) and aggressors of bullying (23.19%) and cyberbullying (26.57%). However, other recent research has attributed greater use of video games among boys [65,69,70] and even observed no differences by sex [21].

Finally, another aspect that can generate controversy is the differentiating role between victims and aggressors in the use of video games. In general, there seems to be a consensus that being a victim or aggressor of bullying or cyberbullying affects screen time [62,70,72]. The data presented in this study reveal that the most negative associations of bullying and cyberbullying, towards the abusive use of video games, occur in the aggressors. These findings coincide with those of Teng et al. [74], whose study, carried out on 3707 adolescents aged 12-19 years, showed that exposure to video games had a significant positive association with aggression behaviors in bullying and cyberbullying. Therefore, exposure to video games would in turn be associated with a greater likelihood of perpetrating cyberbullying. Although the significant differences between victims and aggressors are not always evident [69,71], cyberbullying perpetrators appear to show the highest association with psychological problems linked to excessive video game use compared to victims [75].

4.1. Limitations and strengths

The study has limitations, such as the impossibility of establishing causality due to its cross-sectional design and the dependence on the sincerity of the participants' responses, which could have been biased. In addition, convenience sampling limits its representativeness. However, the use of anonymity techniques, reliable and valid instruments, a rigorous collection process and the inclusion of key covariates (age, BMI, maternal education level and physical activity) are noteworthy, providing novel results in educational research.

5. Conclusion

The present study concludes that in general, both victims and aggressors of bullying and cyberbullying show significantly higher values of inappropriate use of internet, cell phone and video games than their classmates not affected by bullying behaviors. Girls involved in bullying/cyberbullying behaviors reach the highest percentages of inappropriate use of internet (≥ 10.36%), cell phone (≥ 29.25%) and video games (≥ 23.19%). In all cases, girls, both victims and aggressors of bullying and cyberbullying, multiply at least x3 the risk of harmful use of these devices. It is also found that the highest risk values are observed in cyberbullying behaviors, where the aggressor boys multiply the risk by 8.4 times and the victim girls by 16.5 times. Finally, in young people involved in bullying behaviors, excessive and inappropriate use of cell phones reached the highest values of association and risk among the devices analyzed.

Given that victims and aggressors of bullying and cyberbullying show a harmful use of internet, cell phones and video games, affecting girls more than boys, and that aggressors are particularly prone to high levels of technological abuse, with cyberbullying being an intensifying factor. It is recommended that strategies and policies be developed to prevent and address bullying and cyberbullying in the educational context by prioritizing student safety. Teachers should provide specialized counseling to the students involved,

with emphasis on girls. Likewise, families should take an active role in digital education, supervise the use of technologies and work together with schools to ensure a protected educational environment.

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Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and was approved by the Ethics Committee of the University of Jaén (Spain) (protocol code: NOV.22/2.PRY approved on January 13, April 2023) for studies involving human subjects. Informed consent was obtained from all subjects and their guardians involved in the study.

Conflicts of interest: The authors declare no conflicts of interest.

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VI

Asociación de la Actividad Física con aplicaciones móviles y redes en jóvenes de 10 a 16 años.

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ASOCIACIÓN DE LA ACTIVIDAD FÍSICA CON APLICACIONES MÓVILES Y REDES EN JÓVENES DE 10 A 16 AÑOS

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RESUMEN

El objetivo del presente estudio fue analizar la asociación de la práctica de Actividad Física (AF) semanal con el tiempo de uso de aplicaciones de redes sociales mediante teléfono móvil. Participaron 756 estudiantes españoles (47.3% chicas) entre 10 y 16 años (13.23 ± 1.77) de siete centros de la Comunidad autónoma de Andalucía (España). Se llevaron a cabo diferencias entre baja y alta AF semanal (< 2h vs. ≥4h/semana) en cada una de las redes sociales analizadas. La comparación de las variables continuas y categóricas se llevó a cabo mediante las pruebas t de Student y χ2, respectivamente. La asociación entre variables se realizó mediante un análisis de covarianza (ANCOVA). Este análisis fue ajustado por edad e índice de masa corporal. Los resultados mostraron que los adolescentes con bajos niveles de AF dedicaban más tiempo a aplicaciones como WhatsApp (p=0.04), YouTube (p=0.002) y buscadores (Google, safari) (p=0.013), mientras que aquellos con altos niveles de AF usaban más las aplicaciones de compras en línea (p=0.009). No se encontraron diferencias significativas en el uso de TikTok, Instagram, Be Real, Twitter y Spotify (todos p>0.05). Se sugiere promover un uso equilibrado de las tecnologías digitales y fomentar AF regular para mejorar la salud y el bienestar de los jóvenes. Se considera crucial implementar estrategias educativas y de concienciación para ayudar a los adolescentes a gestionar mejor el tiempo dedicado a las redes sociales, asegurando un empleo equilibrado y saludable.

PALABRAS CLAVE:

Actividad física; adolescentes; aplicaciones móviles; sedentarismo; salud

ASSOCIATION OF PHYSICAL ACTIVITY WITH MOBILE APPLICATIONS AND NETWORKS IN YOUNG PEOPLE AGED 10 TO 16 YEARS

ABSTRACT

The aim of the present study was to analyze the association between weekly physical activity (PA) practice and the time spent using social networking applications via cell phone. A total of 756 Spanish students (47.35% girls) aged 10-16 years (13.23 ± 1.77) from seven schools in the autonomous community of Andalusia (Spain) participated. Differences were carried out between low and high weekly PA (< 2h vs. ≥4h/week) in each of the analyzed social networks. Comparison of continuous and categorical variables was carried out using Student's t-tests and χ2 tests, respectively. The association between variables was performed by analysis of covariance (ANCOVA). This analysis was adjusted for age and body mass index. The results showed that adolescents with low levels of PA spent more time on apps such as WhatsApp (p=0.04), YouTube (p=0.002) and search engines (Google, safari) (p=0.013), while those with high levels of PA used online shopping apps more(p=0.009). No significant differences were found in the use of TikTok, Instagram, Be Real, Twitter and Spotify (all p>0.05). It is suggested to promote a balanced use of digital technologies and encourage regular PA to improve the health and well-being of young people. It is considered crucial to implement educational and awareness strategies to help adolescents better manage the time spent on social networks, ensuring a balanced and healthy use.

KEYWORD

Physical activity; adolescents; mobile applications; sedentary lifestyle; health.

INTRODUCCIÓN

La actividad física (AF) hace referencia a la realización de cualquier movimiento del cuerpo realizado por los músculos esqueléticos que requiere un gasto energético (Piggin, 2020). La práctica regular de AF se ha relacionado con numerosas mejoras en la salud, incluyendo beneficios para la salud cardiorrespiratoria y muscular (Pojednic et al., 2022), fortalecimiento óseo (Brooke-Wavell et al., 2022) y mejores indicadores metabólicos (Chaput et al., 2020). Además, la AF ha mostrado influir positivamente en las capacidades cognitivas y el rendimiento académico (Berrios-Aguayo et al., 2022). Estos efectos positivos se deben en parte a un aumento en la liberación de endorfinas, neurotransmisores que están asociados con el bienestar y la reducción del dolor (Matei et al., 2023). Por el contrario, un estilo de vida sedentario junto con una baja práctica de AF semanal, puede tener consecuencias graves para la salud, tales como sobrepeso y obesidad (Pojednic et al., 2022), enfermedades cardiovasculares (Chaput et al., 2020), diabetes tipo 2 (Kanaley et al., 2022), así como problemas de salud mental como ansiedad y depresión (Fernández-García et al., 2024).

La OMS (2020) recomienda que los jóvenes de entre cinco y 17 años realicen al menos 60 minutos de AF moderada a vigorosa diariamente. No obstante, se ha identificado que más del 80% de los adolescentes y el 27% de los adultos en todo el mundo no cumplen con estas recomendaciones. La reducción de la AF entre los jóvenes puede explicarse por diversos factores. Un cambio en los patrones de transporte, con una mayor dependencia del transporte motorizado en lugar de medios activos como caminar o andar en bicicleta (Aubert et al., 2022) y la falta de motivación relacionada con problemas sociales (Sampasa-Kanyina et al., 2020) son factores contribuyentes. Además, la presión académica y el estrés escolar a menudo llevan a los jóvenes a priorizar sus estudios sobre la AF (Wunsch et al., 2017).

En la actualidad, los jóvenes entre 10 y 16 años han mostrado una tendencia creciente a abandonar las actividades físicas para sumergirse en el mundo de las redes sociales y el uso de teléfonos móviles e internet (Pizzo et al., 2020; Singh & Patil, 2020). Según estudios recientes, el 93% de los adolescentes poseen un teléfono móvil y el 84% tiene un perfil en al menos una red social (Pizzo et al., 2020). Otro estudio reveló que el 35% de los usuarios de internet son adolescentes, con un uso promedio de 1 a 2 horas diarias (Singh & Patil, 2020). Algunas de las razones principales para el uso de internet en esta población juvenil incluyen la búsqueda de información académica, los juegos en línea y las redes sociales, siendo estos últimos los más prevalentes entre los adolescentes (Kumar et al., 2022).

Son muchas las aplicaciones móviles que la sociedad utiliza en su vida diaria, no obstante aquellas más utilizadas por los jóvenes incluyen TikTok, Instagram, WhatsApp, YouTube, juegos, BeReal, Twitter, buscadores como Google o Safari, Spotify y aplicaciones de compra online, entre otras. Cada una de estas aplicaciones tiene características particulares que atraen a los adolescentes. Por ejemplo, TikTok e Instagram son populares por su capacidad de compartir y consumir contenido visual de manera rápida y atractiva, fomentando la creatividad y la autoexpresión (Oliveira et al., 2021). WhatsApp es ampliamente utilizado para la comunicación instantánea y la coordinación de actividades sociales debido a su facilidad de uso y accesibilidad (Baytiyeh, 2020). YouTube y los juegos móviles proporcionan entretenimiento y a menudo se convierten en una parte importante del tiempo de ocio de los jóvenes (Adelhardt & Eberle, 2022; Kim & lee, 2021). Los

buscadores como Google son esenciales para la realización de tareas académicas y la búsqueda de información (Miklyaeva & Bezgodova, 2020). Spotify es preferido para escuchar música y podcasts, mientras que las aplicaciones de tiendas permiten a los adolescentes realizar compras y explorar nuevos productos fácilmente (Camilleri & Camilleri, 2019).

El uso abusivo del teléfono móvil y de internet tiene varias consecuencias negativas a nivel físico, cognitivo y social. Físicamente, el uso excesivo del móvil está asociado con problemas como dolor de cabeza, cuello, espalda y ojos, así como trastornos del sueño (Singh & Patil, 2020). Cognitivamente, el empleo intensivo de dispositivos móviles puede afectar la concentración y el rendimiento académico, además de provocar estrés y ansiedad debido a la sobrecarga de información y la necesidad constante de estar conectado (David & Hart, 2021). Finalmente, a nivel social, el exceso de tiempo conectado a las redes sociales puede conducir al aislamiento social, problemas de autoestima y conflictos interpersonales. Los adolescentes que pasan demasiado tiempo en las redes sociales pueden desarrollar una dependencia emocional de la validación externa y sufrir de ciberacoso (Khalil et al., 2020). Estos problemas surgen debido a la alteración de los ritmos circadianos, la falta de interacción cara a cara y la exposición constante a contenidos que pueden influir negativamente en la percepción de uno mismo y de los demás (Hjetlan et al., 2021).

A pesar de las conocidas ventajas de la AF en la salud cardiorrespiratoria, muscular, ósea y metabólica, así como en las capacidades cognitivas y el rendimiento académico, los jóvenes están optando cada vez más por actividades sedentarias como el uso de dispositivos móviles (Piggin, 2020). Esta tendencia está contribuyendo a una disminución en la práctica de AF (Fernández-García et al., 2024). La identificación de los patrones de uso de aplicaciones móviles, es crucial para desarrollar estrategias de intervención efectivas. En este contexto, resulta necesario investigar la asociación entre la práctica de AF y el tiempo de empleo del teléfono móvil, particularmente el uso de aplicaciones populares entre niños y adolescentes. Este conocimiento permitirá diseñar programas de promoción de la salud que integren recomendaciones de uso saludable de la tecnología, favoreciendo así un equilibrio entre las actividades físicas y digitales.

En base a todo lo anterior, el objetivo del presente trabajo fue analizar la asociación entre la práctica de AF y tiempo de empleo del teléfono móvil, concretamente el uso de las diferentes aplicaciones móviles más populares entre niños y adolescentes entre 10 y 16 años.

1. MÉTODO

1.1. PARTICIPANTES

Un total de 756 estudiantes de educación primaria y secundaria de entre 10 y 16 años (13.23 ± 1.77 años, 47.3% chicas) participaron en el presente estudio cuantitativo transversal. Sin embargo, en el análisis de datos solo fueron incluidos un total de 465 (Ver análisis estadístico). El registro de datos se llevó a cabo entre los meses de febrero y mayo de 2023. Se encuestaron estudiantes de siete centros educativos de la comunidad autónoma de Andalucía (España). Los centros fueron

seleccionados por conveniencia y los participantes asignados de forma aleatoria y proporcional al número total de cada grupo de clase. Las características antropométricas y sociodemográficas aparecen detalladas en la Tabla 1.

Tabla 1

Características biométricas, datos sociodemográficos, promedio de actividad física moderada a vigorosa (AFMV) y variables de bullying y ciberbullying segmentados por sexo.

	Todos (n = 465)		Chicos (n = 245)		Chicas (n = 220)		
Variables	**Media**	**SD**	**Media**	**SD**	**Media**	**SD**	***p***
Edad (años)	13.23	1.77	13.22	1.81	13.25	1.72	0.801
Peso (kg)	52.38	13.54	54.79	15.04	50.09	11.5	<0.001
Talla (m)	1.59	0.11	1.61	0.13	1.57	0.08	<0.001
IMC (kg/m^2)	20.51	4.02	20.81	3.96	20.24	4.06	0.012
Promedio AFMV	4.01	1.76	4.3	1.81	3.73	1.66	<0.001
Tiktok	94.14	64.85	99.26	64.98	89.89	64.61	0.036
Instagram	68.36	64.87	60.0	57.84	75.82	69.88	0.031
WhatsApp	39.79	46.17	30.99	35.19	47.68	53.03	<0.001
Youtube	61.40	60.58	71.45	72.33	52.43	46.29	0.036
Juegos	41.05	54.16	43.69	48.92	35.76	63.67	0.441
Be real	8.06	6.74	5.46	5.51	9.75	7.19	0.011
Twitter	13.48	14.39	14.69	15.57	12.61	13.64	0.579
Buscadores	16.23	15.66	16.82	13.27	15.76	17.38	0.683
Spotify	19.86	37.28	14.27	11.82	25.45	51.39	0.326
Tiendas	14.18	13.91	15.43	16.88	12.92	10.28	0.506

Nota: Los datos se presentan como media y desviación estándar (SD) en variables continuas y frecuencia (%) en variables categóricas. IMC = Índice de Masa Corporal.

1.2. MEDIDAS

- **Variable independiente:**

  Para medir el nivel de AF semanal se evaluó mediante el cuestionario PACE+ Adolescent Physical Activity Measure Physical (Prochaska et al., 2001). Este consta de dos ítems en el que se pregunta el número de días en que los participantes habían acumulado 60 minutos de AF a intensidad moderada o vigorosa durante los últimos siete días y durante una semana típica. La puntuación final se obtuvo haciendo una media de ambas respuestas: (P1 + P2) / 2.

- **Variable dependiente:**

  Para cuantificar el tiempo que los estudiantes dedicaron a aplicaciones en sus teléfonos móviles o tabletas, el investigador principal registró directamente los minutos desde los dispositivos de los participantes durante los últimos siete días de una semana típica.

- **Variables de confusión:**

  La edad de cada participante se registró a partir de un cuestionario de datos sociodemográficos. El IMC se calculó mediante la fórmula de Quetelet: peso (kg)/ altura2 (m). Para obtener las medidas de peso y altura se empleó una báscula digital ASIMED® tipo B, clase III y un tallímetro portátil SECA® 214 (SECA Ltd., Hamburgo, Alemania). Ambas medidas se realizaron con ropa ligera y sin calzado.

1.3. ANÁLSIS ESTADÍSTICO

La comparación de las variables continuas y categóricas se llevó a cabo mediante las pruebas t de Student y χ^2, respectivamente. La normalidad y la homocedasticidad de los datos se verificaron mediante las pruebas de Kolmogorov-Smirnov y Levene, respectivamente. Para estudiar si los adolescentes con baja práctica de AF (menos de dos horas de MVPA/semana) tenían peores niveles de tiempo de empleo de aplicaciones móviles y redes que aquellos participantes con altos niveles de AF (más de 4 horas de MVPA/semana) se realizó un análisis de covarianza (ANCOVA). Para la comparativa entre baja AF (N=134) y alta AF (N=330) todos los participantes que llevaron a cabo entre dos y cuatro horas/semana de AF (N=292) fueron excluidos del análisis estadístico. El tiempo de uso en redes y aplicaciones móviles se emplearon como variables dependientes y la AF (Baja Vs. Alta) como factor fijo. En todos los análisis se empleó la edad y el IMC como covariables. Para todos los resultados se empleó un nivel de confianza del 95% ($p < .05$). Todos los cálculos se realizaron con el programa estadístico SPSS, v. 25.0 para WINDOWS (SPSS Inc., Chicago).

2. RESULTADOS

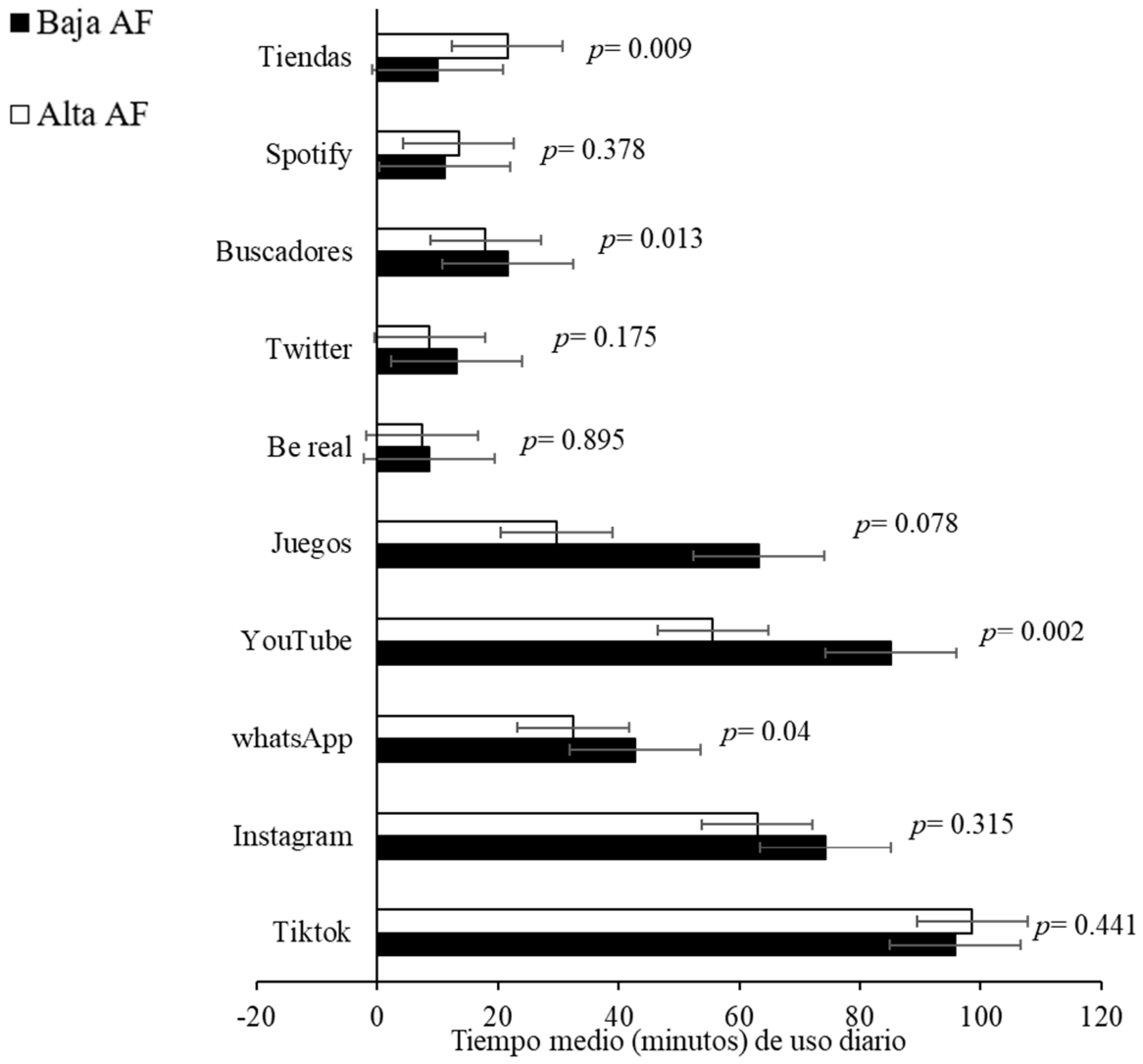
Análisis de covarianza de la práctica de AF respecto al tiempo de uso de aplicaciones móviles

Los jóvenes con bajos niveles de práctica de AF mostraron mayor tiempo de empleo diario de aplicaciones móviles, concretamente de WhatsApp (42.7 ± 51.82 vs. 32.53 ± 32.53 min) p=0.04, Youtube (85.06 ± 64.29 vs. 55.62 ± 63.97 min) p=0.002 y buscadores (21.63 ± 23.91 vs. 17.96 ± 12.82 min) p=0.013 que aquellos estudiantes que presentaron altos niveles de práctica de AF. En el tiempo de uso de juegos, aquellos que tenían un bajo nivel de AF mostraron mayores niveles, no obstante, estas diferencias solamente mostraron tendencia a la significatividad (p=0.078). Por el contrario, aquellos con alto nivel de práctica de AF informaron de mayor tiempo en aplicaciones de compra online (p=0.009). No se hallaron diferencias significativas en función del nivel de práctica de AF en TikTok, Instagram, Be real, Twitter y Spotify (todos p>0.05) (Figura 1).

En el alumnado con baja AF, se observa un uso predominante de TikTok con un total de 95.82 minutos, seguido de Instagram con 74.35 minutos, WhatsApp, con 42.7 minutos y YouTube, con 85.06 minutos. El tiempo dedicado a los juegos alcanza 63.25 minutos, mientras que BeReal y Twitter registran 8.67 y 13.11 minutos, respectivamente. Las búsquedas en internet acumulan 21.63 minutos, y Spotify se utiliza durante 11.25 minutos. Finalmente, las tiendas en línea tienen un tiempo de uso de 10 minutos. Por otro lado, los estudiantes con alta AF, TikTok mantiene un uso elevado con 98.62 minutos, Instagram muestra una disminución a 62.97 minutos y WhatsApp y YouTube también presentan una reducción en su uso con 32.53 y 55.62 minutos, respectivamente. Los juegos y BeReal tienen un uso notablemente menor con 29.69 y 7.43 minutos, respectivamente. Twitter se mantiene constante con 8.67 minutos, mientras que las búsquedas en internet y Spotify registran 17.96 y 13.44 minutos, respectivamente. Las tiendas en línea muestran un aumento considerable con 21.55 minutos.

Figura 1

Asociación del nivel de práctica de AF respecto al tiempo de uso de aplicaciones móviles, redes e internet. Baja AF = menos de dos horas de AFMV /semana y alta AF: más de cuatro horas de AFMV/semana. AFMV=Actividad física moderada vigorosa.



3. DISCUSIÓN

El presente estudio tenía como objetivo analizar la asociación entre la práctica de AF y tiempo de empleo del teléfono móvil, concretamente el uso de las diferentes aplicaciones móviles más populares entre niños y adolescentes entre 10 y 16 años. Los principales han revelado una relación negativa significativa entre los niveles de AF y el uso de diversas aplicaciones móviles entre los jóvenes de 10 a 16 años. Específicamente, se observó que los jóvenes con bajos niveles de práctica de AF dedicaban más tiempo al uso de aplicaciones como WhatsApp, YouTube y buscadores. Similarmente, el uso de YouTube y buscadores fue mayor en el grupo con bajos niveles de AF. Sin embargo, aunque los jóvenes con bajos niveles de AF mostraron un mayor uso de juegos móviles, estas diferencias no alcanzaron la significación estadística. En contraste, los jóvenes con bajos niveles de AF dedicaron menos tiempo a aplicaciones de compra online. No se encontraron diferencias significativas en el uso de TikTok, Instagram, Be Real, Twitter y Spotify en función del nivel de práctica de AF.

Los resultados del presente trabajo de investigación coinciden con hallazgos previos que sugieren una asociación entre bajos niveles de AF y mayor uso de aplicaciones móviles. Un estudio que asociaba la práctica de AF con las redes sociales halló que los adolescentes con menores niveles de AF tendían a pasar más tiempo en redes sociales y aplicaciones de entretenimiento, destacando específicamente un mayor uso de YouTube y aplicaciones de mensajería como WhatsApp (George et al., 2020). Similarmente, otro reciente estudio científico expuso que el uso excesivo de redes sociales y buscadores estaba significativamente relacionado con menores niveles de AF entre los adolescentes (Hjetland et al., 2020).

Las causas relacionadas con este fenómeno podrían explicarse debido a que el uso excesivo de aplicaciones móviles, especialmente aquellas que facilitan la comunicación y el entretenimiento pasivo, puede desplazar el tiempo que podría ser dedicado a la práctica de AF (Grimaldi-Puyana et al., 2020). Las aplicaciones como WhatsApp y YouTube son diseñadas para maximizar el tiempo de pantalla mediante notificaciones constantes y contenido atractivo debido a la activación del sistema de recompensa del cerebro, el cual libera dopamina, un neurotransmisor asociado con el placer y la satisfacción (Hamilton & Lee, 2020). Parece que estos efectos podrían llevar a los jóvenes a priorizar estas actividades sobre la práctica de ejercicio físico. Además, el uso frecuente de buscadores puede estar relacionado con actividades académicas o de ocio que no implican movimiento físico, contribuyendo a un estilo de vida más sedentario.

En contraposición, algunos estudios exponen que no siempre existe una relación negativa entre el uso de aplicaciones móviles y los niveles de AF. El estudio de Hamilton y Lee (2020) no encontró una asociación significativa entre el uso de redes sociales y los niveles de AF en adolescentes, sugiriendo que el impacto de las redes sociales puede variar dependiendo del contexto y del uso individual. Similarmente, otro estudio argumentó que el impacto de las redes sociales en el bienestar y la AF puede ser moderado por factores como el tipo de uso (pasivo vs. activo) y las características individuales de los usuarios, como la autopercepción y la autoestima (Beyens et al., 2020).

La ausencia de una asociación significativa entre diferentes niveles de práctica de AF semanal respecto al uso/abuso de redes sociales parece que podría también explicarse por la naturaleza multifacética del uso de aplicaciones móviles. Mientras que el uso pasivo de redes sociales puede estar asociado con un estilo de vida más sedentario, el uso activo (por ejemplo, la creación de contenido o la participación en comunidades en línea) puede no tener el mismo impacto negativo e incluso puede estar relacionado con niveles más altos de bienestar y AF (Beyens et al., 2020). Por tanto, podría considerarse el uso frecuente de redes sociales con una mayor probabilidad de ejercicio físico entre los estudiantes físicamente activos, pero con una menor probabilidad entre los estudiantes sedentarios (Shimoga et al., 2019). Lo anterior, deja una puerta abierta a la necesidad de continuar con investigaciones que profundicen más en la relación entre práctica de AF y empleo de redes sociales. Además, aún queda mucho por conocer respecto a las posibles diferencias por sexo y otras variables como las clases sociales, formación académica de los jóvenes entre otras.

Se concluye que los jóvenes con bajos niveles de práctica de AF muestran mayor tiempo de empleo de aplicaciones móviles como WhatsApp, Youtube y buscadores que aquellos estudiantes con altos niveles de práctica de AF. Sin embargo, los jóvenes con alto nivel de práctica de AF emplean mayor tiempo en aplicaciones de compra online. No se han hallado diferencias significativas en función del nivel de práctica de AF en redes de contactos sociales como TikTok, Instagram, Be real, Twitter y Spotify. Estos hallazgos subrayan la importancia de promover un uso equilibrado de las tecnologías digitales y fomentar AF regular para mejorar la salud y el bienestar de los jóvenes. Para ello, es crucial implementar estrategias educativas y de concienciación para ayudar a los adolescentes a gestionar mejor su tiempo, asegurando así un desarrollo equilibrado y saludable.

4. LIMITACIONES Y FORTALEZAS

El presente estudio presenta varias limitaciones metodológicas y procedimentales que deben mencionarse. Entre ellas, se encuentran las limitaciones propias de un diseño transversal, el cual no permite establecer relaciones de causalidad y depende de la sinceridad con la que los participantes respondan a las medidas implementadas. Es posible que algunos estudiantes hayan respondido de manera que favorezca una imagen positiva de sí mismos. Además, la muestra fue seleccionada por conveniencia, lo que limita su representatividad de la población española. No obstante, el estudio cuenta con fortalezas importantes. Se utilizaron técnicas de codificación que garantizan el anonimato y la confidencialidad de los participantes, así como instrumentos con alta fiabilidad y validez interna comprobada, y medidas objetivas del tiempo de uso de aplicaciones extraídas directamente de los dispositivos móviles. Finalmente, el empleo de múltiples covariables (edad, índice de masa corporal y nivel educativo de la madre) proporciona resultados novedosos en el campo de la educación.

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LIMITACIONES Y FORTALEZAS

Para asegurar una evaluación completa y crítica de los presentes estudios de investigación, se exponen limitaciones y fortalezas de los mismos. Este apartado permite reflexionar sobre la solidez metodológica de los estudios, así como sobre las posibles restricciones que podrían haber influido en los resultados, por ello es particularmente relevante considerar diversos factores. Dado que la investigación se desarrolla en el ámbito educativo, es necesario abordar la complejidad de estudiar variables psicológicas, las cuales son difíciles de medir con precisión debido a su naturaleza subjetiva y multifacética. Además, la variabilidad en la edad de la población estudiada introduce desafíos en la generalización de los resultados. Reconocer estas limitaciones y, al mismo tiempo, destacar las fortalezas del estudio, es crucial para contextualizar los resultados y orientar futuras investigaciones en el campo.

Limitaciones

El presente estudio presenta diversas limitaciones que deben ser consideradas al interpretar los resultados. En primer lugar, el diseño transversal empleado impide establecer relaciones de causalidad entre las variables estudiadas, limitándose a identificar asociaciones estadísticas que no permiten inferir una dirección clara en los efectos observados. Además, la utilización de muestras por conveniencia, aunque común en investigaciones de esta naturaleza, restringe la capacidad de generalización de los hallazgos a la población en general, lo que puede afectar la representatividad de los resultados. Es importante destacar que, debido a la naturaleza autoinformada de las encuestas, existe la posibilidad de sesgo en las respuestas de los participantes, quienes podrían haber respondido de manera que proyecte una imagen más favorable de sí mismos, ya sea de forma deliberada o inconsciente. Esto puede afectar la fiabilidad de los datos recopilados, especialmente en variables sensibles como la evaluación de la práctica de AF y las experiencias de bullying y cyberbullying. En este contexto, el uso de acelerómetros en lugar de cuestionarios autoinformados podría haber proporcionado una medición más precisa y objetiva de la AF, reduciendo la dependencia de la autopercepción de los participantes. En cuanto a la revisión sistemática realizada, aunque se llevó a cabo

un riguroso proceso de selección y evaluación de la calidad de los estudios incluidos, la ausencia de un metaanálisis limita la cuantificación precisa de los efectos observados.

Además, se debe considerar la posible influencia del sesgo de idioma, al haberse restringido la búsqueda a estudios publicados en inglés y español, lo que podría excluir investigaciones relevantes en otros idiomas. Finalmente, la falta de estudios con un diseño longitudinal en el ámbito de la influencia de la AF sobre el bullying y cyberbullying en adolescentes impide una comprensión más profunda de las dinámicas temporales entre estas variables, lo que representa una oportunidad para futuras investigaciones en este campo.

Fortalezas

El presente estudio presenta varias fortalezas que refuerzan la validez y relevancia de sus hallazgos. En primer lugar, la muestra utilizada en los estudios es notablemente amplia, abarcando un número significativo de niños, niñas y adolescentes de diversos contextos socioeconómicos y educativos. Esta amplitud en la muestra permite que los resultados obtenidos sean representativos de una población más diversa y, por tanto, aumenta la capacidad de generalización de las conclusiones a otros entornos escolares. Esta estrategia metodológica responde a la necesidad de asegurar que los hallazgos reflejen con precisión las dinámicas del bullying y cyberbullying en diferentes subgrupos poblacionales, lo cual es crucial en investigaciones que buscan influir en políticas educativas y estrategias de intervención. Además, la inclusión de covariables en los análisis realizados, como la edad, el IMC, el nivel educativo de la madre y el promedio de AF semanal, añade una capa de robustez al estudio, ya que permite controlar por factores que podrían confundir los resultados. Por ejemplo, en el análisis de la asociación entre la AF y los comportamientos de bullying, el control del IMC asegura que las diferencias observadas no sean simplemente atribuibles a variaciones en la composición corporal de los participantes, sino a la variable de interés, que es la práctica de AF.

Un aspecto adicional que fortalece este estudio es la implementación de códigos personales para garantizar el anonimato y la confidencialidad de los participantes al responder los cuestionarios. Este método ha sido crucial para reducir el sesgo de respuesta, ya que los estudiantes se sienten más libres de proporcionar respuestas honestas

sin temor a ser identificados. Esto es especialmente relevante en temas sensibles como el bullying, donde la veracidad de las respuestas puede verse comprometida por el miedo al estigma o a represalias. En cuanto a la evaluación de las variables de aprendizaje, se han utilizado las calificaciones escolares recientes como medida del rendimiento académico. Este enfoque es particularmente robusto porque se basa en datos objetivos y verificables, en lugar de depender únicamente de la autopercepción de los estudiantes o de cuestionarios autoinformados, lo que podría introducir sesgos. Por ejemplo, el análisis de cómo el bullying afecta al rendimiento en materias como matemáticas y lengua se realizó utilizando las notas reales de los estudiantes, lo que ofrece una imagen más precisa del impacto académico del acoso.

En el marco de la revisión sistemática, se destaca no solo la inclusión de estudios de catorce países diferentes a lo largo de once años, sino también el examen detallado de cómo los estímulos de práctica de AF se relacionan con distintos momentos de la jornada escolar. Este enfoque longitudinal y multigeográfico permite identificar patrones consistentes en diferentes contextos culturales y educativos. Para asegurar la rigurosidad de la revisión sistemática, se utilizó una lista estandarizada para evaluar la calidad de los estudios incluidos, garantizando que solo se consideraran investigaciones con altos estándares metodológicos. Esto es fundamental para proporcionar una base sólida sobre la cual se puedan formular recomendaciones prácticas.

El diseño experimental aleatorizado, utilizado en el contexto escolar con una amplia muestra experimental y de control, es otra fortaleza significativa de este trabajo. Este tipo de diseño permite establecer relaciones más fiables entre las variables estudiadas y es particularmente útil en el contexto de la educación, donde las intervenciones pueden ser aplicadas de manera controlada y sus efectos medidos con precisión.

Finalmente, la tesis ofrece una valiosa tabla de recomendaciones prácticas dirigida a docentes y progenitores, lo que facilita la implementación de estrategias para prevenir y mitigar el acoso escolar. La innovación de este trabajo también reside en la exploración de la asociación entre la práctica de AF en diferentes momentos del día y los comportamientos de acoso y ciberacoso, una contribución novedosa que podría tener implicaciones significativas para el diseño de programas de intervención en el ámbito escolar, ayudando a prevenir estas conductas desde una perspectiva integral que combina la actividad física con la educación en valores y la gestión del comportamiento.

LIMITATIONS AND STRENGTHS

To ensure a complete and critical evaluation of the present research studies, their limitations and strengths are presented. This section allows us to reflect on the methodological soundness of the studies, as well as on the possible restrictions that could have influenced the results, which is why it is particularly relevant to consider several factors. Given that the research takes place in the educational setting, it is necessary to address the complexity of studying psychological variables, which are difficult to measure accurately due to their subjective and multifaceted nature. In addition, the variability in the age of the population studied introduces challenges in generalizing the results. Acknowledging these limitations and, at the same time, highlighting the strengths of the study is crucial to contextualize the results and guide future research in the field.

Limitations

The present study has several limitations that should be taken into account when interpreting the results. First, the cross-sectional design used prevents us from establishing causal relationships between the variables studied, limiting us to identifying statistical associations that do not allow us to infer a clear direction of the observed effects. In addition, the use of convenience samples, although common in this type of research, limits the generalizability of the findings to the population at large, which may affect the representativeness of the results. Importantly, due to the self-reported nature of surveys, there is the potential for bias in the responses of participants who may have responded in a way that presents a more favorable image of themselves, either consciously or unconsciously. This may affect the reliability of the data collected, especially on sensitive variables such as ratings of PA practice and experiences of bullying and cyberbullying. In this context, the use of accelerometers instead of self-report questionnaires could have provided a more accurate and objective measure of PA, reducing the reliance on participants' self-perception. Regarding the systematic review performed, although a rigorous process of selection and quality assessment of the included studies was performed, the lack of meta-analysis limits the precise quantification of the observed effects. In addition, the possible influence of language bias should be

considered, as the search was limited to studies published in English and Spanish, which may exclude relevant research in other languages. Finally, the lack of studies with a longitudinal design in the area of the influence of PA on bullying and cyberbullying in adolescents prevents a deeper understanding of the temporal dynamics between these variables, which represents an opportunity for future research in this area.

Strengths

The present study presents several strengths that reinforce the validity and relevance of its findings. First, the sample used in the studies is remarkably broad, covering a significant number of children and adolescents from diverse socioeconomic and educational contexts. This breadth of the sample allows the results obtained to be representative of a more diverse population and, therefore, increases the generalizability of the findings to other school settings. This methodological approach responds to the need to ensure that the results accurately reflect the dynamics of bullying and cyberbullying in different population subgroups, which is crucial in research that seeks to influence educational policies and intervention strategies. Furthermore, the inclusion of covariates in the analyses performed, such as age, BMI, mother's educational level, and average weekly PA, adds a layer of robustness to the study, as it allows controlling for factors that could confound the results. For example, in the analysis of the association between PA and bullying behaviors, controlling for BMI ensures that the differences observed are not simply attributable to variations in the body composition of the participants, but to the variable of interest, which is the practice of PA.

An additional aspect that strengthens this study is the implementation of personal codes to guarantee the anonymity and confidentiality of the participants when answering the questionnaires. This method has been crucial in reducing response bias, as students feel freer to provide honest answers without fear of being identified. This is especially relevant in sensitive topics such as bullying, where the veracity of responses may be compromised by fear of stigma or retaliation. As for the assessment of learning variables, recent school grades have been used as a measure of academic performance. This approach is particularly robust because it is based on objective and verifiable data, rather than relying solely on student self-perception or self-reported questionnaires, which could introduce biases. For example, the analysis of how bullying affects performance in subjects such as

mathematics and language was conducted using students' actual grades, which gives a more accurate picture of the academic impact of bullying.

Within the framework of the systematic review, not only the inclusion of studies from fourteen different countries over eleven years is noteworthy, but also the detailed examination of how PA practice stimuli relate to different times of the school day. This longitudinal, multi-geographic approach allows us to identify consistent patterns across different cultural and educational contexts. To ensure the rigor of the systematic review, a standardized list was used to assess the quality of the included studies, ensuring that only research with high methodological standards was considered. This is essential to provide a solid basis on which to formulate practical recommendations.

The randomized experimental design, used in the school context with a large experimental and control sample, is another significant strength of this work. This type of design allows more reliable relationships to be established between the variables studied and is particularly useful in the context of education, where interventions can be applied in a controlled manner and their effects accurately measured.

Finally, the thesis offers a valuable table of practical recommendations addressed to teachers and parents, which facilitates the implementation of strategies to prevent and mitigate bullying. The innovation of this work also lies in the exploration of the association between PA practice at different times of the day and bullying and cyberbullying behaviors, a novel contribution that could have significant implications for the design of intervention programs in the school setting, helping to prevent these behaviors from a comprehensive perspective that combines physical activity with values education and behavioral management.

CONCLUSIONES

A modo de conclusión, la presente tesis doctoral ofrece una visión clara de cómo la AF puede tanto mitigar como, en algunos casos, exacerbar ciertos comportamientos relacionados con el acoso, dependiendo de diversos factores contextuales y pedagógicos. Asimismo, se proponen intervenciones educativas específicas basadas en los hallazgos, subrayando la necesidad de enfoques integrales que aborden no solo la dimensión física, sino también las áreas social, emocional y cognitiva del desarrollo de los estudiantes. Finalmente, se destaca la importancia de seguir investigando las relaciones observadas, lo que puede orientar futuras investigaciones y políticas educativas. A continuación, se presentan las principales conclusiones derivadas de este estudio.

- Los estímulos de AF en distintos momentos de la jornada, reducen la victimización en comportamientos de acoso, mejoran los comportamientos disruptivos del alumnado y alivian los factores psicológicos provenientes del acoso. No obstante, el momento de práctica de AF ha esclarecido que el tipo de deporte, el contexto en el que se realice, el rol otorgado al alumnado dentro de la práctica de AF, el estilo pedagógico o el clima escolar puede influenciar en los comportamientos agresivos. Por tanto, estos hallazgos subrayan la necesidad de enfoques holísticos a lo largo de la jornada habitual de un estudiante, que vayan más allá del ejercicio físico, abordando los aspectos sociales, emocionales y conductuales del desarrollo de los estudiantes.
- La práctica de AF semanal no está asociada significativamente con la victimización de bullying en adolescentes. Sin embargo, los jóvenes físicamente activos, especialmente los chicos, presentan un nivel significativamente mayor de agresión por bullying en comparación con los inactivos (al menos una hora de MVPA < cinco días/semana). En cuanto al ciberbullying, los resultados de victimización y agresión en función del nivel de AF semanal parece que no afecta en las chicas, sin embargo, los estudiantes físicamente activos manifiestan menores niveles tanto de victimización como de agresión. Estos hallazgos sugieren la necesidad de diseñar intervenciones educativas multifacéticas que promuevan tanto la práctica de AF como protección de la victimización en ciberbullying como de intervención psicológica dirigida a la reeducación de los

efectos de agresión asociados a su práctica. Futuros estudios deberían explorar estas relaciones y las posibles variables moderadoras y mediadoras para proporcionar una comprensión más completa de estos fenómenos.

- Chicos y chicas víctimas de bullying tiene casi el doble de riesgo de tener valores más altos de aprendizaje superficial y procrastinar las tareas de clase que las no víctimas. En el caso de las chicas la procrastinación hacia las tareas de clase se incrementa un 7%. Las víctimas de cyberbullying presentan un 5.3% más aprendizaje superficial y un 16% de procrastinación hacia las tareas de clase que las no víctimas, multiplicándose el riesgo debido a esta exposición por 3 y por 4, respectivamente. En general, los agresores de bullying y cyberbullying tienen valores más negativos de aprendizaje que los no agresores. Los jóvenes agresores de cyberbullying registran valores más bajos de aprendizaje profundo (-11.5%) y adquieren aprendizajes más superficiales (chicos =13.4% y chicas = 9.6%), planifican peor (chicos = 3.8% y chicas = 3.3%) y tienden a la procrastinación de las tareas de clase (chicos = 16,8% y chicas = 20.5%). En ambos sexos, el riesgo de exposición hacia tener altos valores de aprendizaje superficial, baja planificación y alta procrastinación se multiplica x 8, x 2 y x 10, respectivamente.
- Los comportamientos de bullying y el cyberbullying están relacionados con una más alta ansiedad ante los exámenes, afectando tanto a víctimas como a agresores. Las víctimas de bullying muestran aumentos del 25.69% en respuestas fisiológicas inadecuadas y un 33.14% en las respuestas cognitivas. Las víctimas de cyberbullying sufren incrementos similares en respuestas fisiológicas, cognitivas y de evitación (26.97%, 22.56% y 20.18%, respectivamente). Los agresores de ambos tipos de acoso también exhiben aumentos significativos en las mismas áreas, destacando la ansiedad relacionada con los exámenes en los agresores de cyberbullying con incrementos de 22.64% en respuestas fisiológicas y 23.9% en cognitivas. Los datos indican que las víctimas de cyberbullying enfrentan un nivel de riesgo extremadamente elevado de problemas de ansiedad en respuestas cognitivas, alcanzando un nivel de riesgo hasta 21.54 veces mayor en comparación con los no afectados. Los agresores de cyberbullying también presentan un nivel de riesgo considerablemente alto, con un aumento de hasta 14.43 veces en las respuestas cognitivas. Específicamente, las chicas víctimas de

cyberbullying experimentan un riesgo de hasta 31.45 veces mayor de exhibir respuestas cognitivas inadecuadas.

- Tanto chicos como chicas víctimas de bullying o cyberbullying presentan un uso de internet significativamente mayor en comparación con las no víctimas (10.23%). Similar al uso de internet, los estudiantes tienden a utilizar el teléfono de manera más intensiva cuando se ven afectados como víctimas y agresores de bullying (26.55%, 26.61% respectivamente) y cyberbullying (26.55% y 31.42% respectivamente) que aquellos que no están implicados en situaciones de acoso. En cuanto a los videojuegos, se sigue la misma línea, indicando un incremento en el tiempo dedicado a videojuegos por aquellos escolares afectados por bullying (16.87%) y cyberbullying (15.20% y 20.71%).

Conclusión general:

La práctica de la AF en distintos momentos del día puede reducir la victimización por acoso escolar, mejorar los comportamientos disruptivos y aliviar los factores psicológicos asociados al acoso. Sin embargo, el contexto y el tipo de deporte, así como el rol del alumnado, pueden influir en estos comportamientos, destacando la necesidad de enfoques holísticos que aborden aspectos sociales, emocionales y conductuales. La relación entre la AF y la victimización por bullying no es significativa, aunque los jóvenes físicamente activos, especialmente los chicos, muestran mayores niveles de agresión. En cuanto al ciberacoso, la AF parece reducir tanto la victimización como la agresión, especialmente en estudiantes activos. Las víctimas de bullying y ciberbullying tienen un mayor riesgo de aprendizaje superficial y procrastinación, y los agresores muestran en general peores resultados de aprendizaje. Ambos tipos de acoso están vinculados a una mayor ansiedad ante los exámenes, afectando tanto a víctimas como a agresores, con las víctimas de ciberbullying enfrentando un riesgo significativamente mayor. El uso intensivo de internet, teléfonos y videojuegos es mayor entre las víctimas y agresores de acoso, y se asocia con un menor bienestar físico y psicológico. Estos hallazgos sugieren la necesidad de intervenciones multifacéticas que combinen la promoción de la AF con medidas de protección contra el acoso y apoyo psicológico, para mitigar los efectos negativos del bullying y el ciberbullying en la vida académica y personal de los estudiantes.

CONCLUSIONS

In conclusion, this dissertation provides a clear picture of how PA can both mitigate and, in some cases, exacerbate certain bullying-related behaviors, depending on various contextual and pedagogical factors. Specific educational interventions are also proposed based on the findings, highlighting the need for comprehensive approaches that address not only the physical dimension, but also the social, emotional and cognitive areas of students' development. Finally, the importance of further investigating the observed relationships is highlighted, which may guide future research and educational policies. The main conclusions derived from this study are presented below.

- PA stimuli at different times of the day reduce victimization in bullying behaviors, improve students' disruptive behaviors and alleviate the psychological factors stemming from bullying. However, the timing of PA practice has clarified that the type of sport, the context in which it is performed, the role given to students within the practice of PA, the pedagogical style or the school climate can influence aggressive behaviors. Therefore, these findings underscore the need for holistic approaches throughout a student's regular day that go beyond physical exercise, addressing the social, emotional and behavioral aspects of student development.
- Weekly PA practice is not significantly associated with bullying victimization in adolescents. However, physically active youth, especially boys, present a significantly higher level of bullying aggression compared to inactive youth (at least one hour of MVPA < five days/week). Regarding cyberbullying, the results of victimization and aggression as a function of weekly PA level seem not to affect in girls, however physically active students manifest lower levels of both victimization and aggression. These findings suggest the need to design multifaceted educational interventions that promote both PA practice as protection from cyberbullying victimization and psychological intervention aimed at reeducating the aggression effects associated with its practice. Future studies should explore these relationships and possible moderating and mediating variables to provide a more complete understanding of these phenomena.

- Boys and girls who are victims of bullying have almost twice the risk of having higher values of superficial learning and procrastination towards class tasks than non-victims. In the case of girls, procrastination towards homework increases by 7%. Victims of cyberbullying present 5.3% more superficial learning and 16% more procrastination towards class tasks than non-victims, multiplying the risk due to this exposure by 3 and 4, respectively. In general, bullying and cyberbullying aggressors have more negative learning values than non-aggressors. Young cyberbullying aggressors register lower values of deep learning (-11.5%) and acquire more superficial learning (boys = 13.4% and girls = 9.6%), plan worse (boys = 3.8% and girls = 3.3%) and tend to procrastinate on class tasks (boys = 16.8% and girls = 20.5%). In both sexes, the risk of exposure to having high values of superficial learning, low planning and high procrastination is multiplied x 8, x 2 and x 10, respectively.
- Bullying and cyberbullying behaviors are related to higher test anxiety, affecting both victims and perpetrators. Victims of bullying show 25.69% increases in inappropriate physiological responses and 33.14% increases in cognitive responses. Victims of cyberbullying suffer similar increases in physiological, cognitive and avoidance responses (26.97%, 22.56% and 20.18%, respectively). Offenders of both types of bullying also exhibit significant increases in the same areas, with test-related anxiety standing out in cyberbullying offenders with increases of 22.64% in physiological and 23.9% in cognitive responses. The data indicate that cyberbullying victims face an extremely high risk level of anxiety problems in cognitive responses, reaching a risk level up to 21.54 times higher compared to those not affected. Cyberbullying aggressors also present a considerably high level of risk, with up to a 14.43-fold increase in cognitive responses. Specifically, girls who are victims of cyberbullying experience up to a 31.45-fold increased risk of exhibiting inappropriate cognitive responses.
- Both boys and girls who are victims of bullying or cyberbullying have significantly higher internet use compared to non-victims (10.23%). Similar to internet use, students tend to use the phone more intensively when they are affected as victims and aggressors of bullying (26.55%, 26.61% respectively) and cyberbullying (26.55% and 31.42% respectively) than those who are not involved in bullying situations. As for video games, the same line is followed, indicating

an increase in the time spent playing video games by those schoolchildren affected by bullying (16.87%) and cyberbullying (15.20% and 20.71%).

General conclusion:

The practice of physical activity (PA) at different times of the day can reduce bullying victimization, improve disruptive behaviors and alleviate psychological factors associated with bullying. However, the context and type of sport, as well as the role of the student, may influence these behaviors, highlighting the need for holistic approaches that address social, emotional and behavioral aspects. The relationship between PA and bullying victimization is not significant, although physically active youth, especially boys, show higher levels of aggression. As for cyberbullying, PA seems to reduce both victimization and aggression, especially in active students. Victims of bullying and cyberbullying have a higher risk of superficial learning and procrastination, and aggressors show worse learning outcomes. Both types of bullying are linked to increased test anxiety, affecting both victims and aggressors, with cyberbullying victims facing significantly higher risk. Intensive use of the internet, phones, and video games is higher among bullying victims and bullies, and is associated with lower physical and psychological well-being. These findings suggest the need for multifaceted interventions that combine PA promotion with anti-bullying protection measures and psychological support to mitigate the negative effects of bullying and cyberbullying on students' academic and personal lives.

APLICACIONES PRÁCTICAS Y PROSPECTIVAS FUTURAS DE ESTUDIO

Las aplicaciones prácticas derivadas de una investigación educativa representan la traducción directa de los hallazgos teóricos y empíricos a estrategias concretas que pueden ser implementadas en contextos reales. Estas aplicaciones prácticas son esenciales para orientar tanto a educadores como a padres en la adopción de medidas preventivas y de intervención. Además, establecer prospectivas de futuro es crucial para delinear caminos de investigación y desarrollo continuo, asegurando que las estrategias propuestas evolucionen y se adapten a las nuevas realidades educativas.

Aplicaciones prácticas

- Fomentar por parte de las familias e Instituciones educativas la práctica de AF con intensidad de Moderada a vigorosa en diferentes momentos de la jornada educativa, para servir como un mecanismo para liberar el estrés y desarrollar habilidades sociales positivas e influir de manera positiva en el padecimiento de bullying y cyberbullying.
- Es fundamental que los padres eduquen a sus hijos sobre el uso responsable de la tecnología. Esto incluye establecer límites claros sobre el tiempo de pantalla, supervisar el uso de dispositivos y enseñar sobre la privacidad en línea y la seguridad digital. Las familias deben estar informadas sobre las plataformas y aplicaciones que utilizan sus hijos y las posibles amenazas que pueden encontrar en línea.
- Las instituciones educativas deben implementar programas antibullying que aborden tanto el bullying tradicional como el cyberbullying. Estos programas deben incluir la formación de docentes y personal escolar para identificar y manejar situaciones de bullying de manera efectiva. Además, es importante involucrar a los estudiantes en actividades que promuevan la empatía, la resolución de conflictos y la convivencia pacífica.
- Creación de espacios seguros dentro de la escuela para proteger a los estudiantes de los efectos negativos del bullying. Incluir la designación de áreas específicas donde los estudiantes pueden ir si se sienten amenazados o necesitan hablar con

un adulto de confianza y establecer comités o grupos de apoyo entre pares que puedan ofrecer asistencia y mediar en conflictos.

- El enfoque de género es crucial al abordar el bullying y el cyberbullying, ya que los estudios indican que las chicas son más susceptibles a las consecuencias negativas del acoso que los chicos. Las políticas escolares deben incluir estrategias específicas para apoyar a las chicas y proporcionar recursos adicionales para aquellos que están en mayor riesgo de sufrir acoso. Los programas de sensibilización sobre el género y la igualdad deben ser parte integral del currículo escolar.
- El contexto escolar debe promover métodos de enseñanza que incentiven el pensamiento crítico, la resolución de problemas y la conexión de nuevos conocimientos con experiencias previas y pueden ofrecer talleres y recursos que ayuden a los estudiantes a organizar sus tareas, gestionar su tiempo de manera efectiva y tomar decisiones informadas sobre su educación.
- La colaboración entre familia y escuela es esencial para abordar el bullying y el cyberbullying de manera integral. Las escuelas deben organizar talleres y charlas educativas dirigidas a padres y tutores para informarles sobre los efectos del bullying, cómo detectarlo y qué medidas tomar para prevenirlo y gestionarlo. La participación activa de los padres en estas actividades puede fortalecer el apoyo que los estudiantes reciben tanto en el hogar como en la escuela.

Prospectivas futuras

- El uso de tecnologías de Inteligencia Artificial para la Detección temprana puede analizar el comportamiento de los estudiantes y detectar patrones de acoso mediante el análisis de datos de cámaras de seguridad, interacciones en plataformas educativas en línea y redes sociales. Estas herramientas permitirán una intervención temprana, proporcionando a los educadores y administradores escolares información valiosa para abordar los casos de bullying antes de que se agraven.
- Programas de formación integrales para docentes, incorporando módulos sobre la comprensión del bullying y el cyberbullying, estrategias de intervención, y el uso de herramientas tecnológicas para la detección. Estos programas deben ser obligatorios y actualizados regularmente para reflejar los últimos avances en la investigación sobre bullying.

- Sería relevante que se desarrollen programas comunitarios de apoyo que involucren a organizaciones locales, servicios sociales y de salud, y fuerzas del orden. Estos programas deben ofrecer recursos y asistencia tanto a las víctimas como a los agresores de bullying, y promover una cultura de respeto y tolerancia. La creación de espacios seguros y actividades comunitarias puede ayudar a reducir el aislamiento y la marginación de los estudiantes afectados por el bullying.
- Inclusión de programas de salud mental en el currículo escolar para abordar el impacto del bullying en el bienestar de los estudiantes. Las escuelas deberían integrar de manera sistemática la educación sobre salud mental en sus planes de estudio. Estos programas deben incluir talleres sobre habilidades de afrontamiento, gestión del estrés, y resiliencia, así como acceso a consejeros escolares y servicios de apoyo psicológico. La promoción de una cultura escolar que valore la salud mental puede reducir la incidencia de bullying y mejorar el bienestar general de los estudiantes.
- Propuesta por parte de las escuelas a una variedad de actividades deportivas y recreativas para fomentar la participación activa en estas actividades. Además, se deben desarrollar programas específicos que utilicen la AF como una herramienta para mejorar la cohesión grupal y reducir los conflictos.
- Llevar a cabo estudios longitudinales que sigan a los estudiantes a lo largo de varios años pueden proporcionar una comprensión más profunda del impacto a largo plazo del bullying en el desarrollo académico y emocional. Estas investigaciones son cruciales para desarrollar estrategias de intervención más efectivas y adaptadas a las necesidades de los estudiantes en diferentes etapas de su desarrollo. En el futuro, se espera que los fondos para la investigación sobre bullying aumenten, permitiendo la realización de estudios a gran escala que puedan influir en las políticas educativas a nivel nacional e internacional.

PRACTICAL APPLICATIONS AND PROSPECTS FOR FUTURE RESEARCH

Practical applications derived from educational research represent the direct translation of theoretical and empirical findings into concrete strategies that can be implemented in real contexts. These practical applications are essential to guide both educators and parents in the adoption of preventive and intervention measures. In addition, establishing future prospects is crucial to delineate paths of research and continuous development, ensuring that the proposed strategies evolve and adapt to new educational realities.

Practical applications

- Encourage families and educational institutions to practice PA with moderate to vigorous intensity at different times of the school day, to serve as a mechanism to release stress and develop positive social skills and positively influence bullying and cyberbullying.
- It is critical that parents educate their children about responsible use of technology. This includes setting clear limits on screen time, supervising device use, and teaching about online privacy and digital safety. Families should be informed about the platforms and apps their children use and the potential threats they may encounter online.
- Educational institutions should implement anti-bullying programs that address both traditional bullying and cyberbullying. These programs should include training teachers and school staff to identify and handle bullying situations effectively. In addition, it is important to involve students in activities that promote empathy, conflict resolution and peaceful coexistence.
- Creating safe spaces within the school to protect students from the negative effects of bullying. Include designating specific areas where students can go if they feel threatened or need to talk to a trusted adult and establishing committees or peer support groups that can offer assistance and mediate conflicts.
- A gender focus is crucial when addressing bullying and cyberbullying, as studies indicate that girls are more susceptible to the negative consequences of bullying than boys. School policies should include specific strategies to support girls and

provide additional resources for those most at risk of bullying. Gender and equality awareness programs should be an integral part of the school curriculum.

- The school context should promote teaching methods that encourage critical thinking, problem solving and connecting new knowledge with previous experiences and can offer workshops and resources that help students organize their homework, manage their time effectively and make informed decisions about their education.
- Family-school collaboration is essential to address bullying and cyberbullying in a comprehensive manner. Schools should organize workshops and educational talks aimed at parents and guardians to inform them about the effects of bullying, how to detect it and what measures to take to prevent and manage it. The active participation of parents in these activities can strengthen the support that students receive both at home and at school.

Future Prospects

- The use of Artificial Intelligence technologies for Early Detection can analyze student behavior and detect bullying patterns by analyzing data from security cameras, interactions on online educational platforms and social networks. These tools will enable early intervention, providing educators and school administrators with valuable information to address bullying cases before they escalate.
- Comprehensive training programs for teachers, incorporating modules on understanding bullying and cyberbullying, intervention strategies, and the use of technological tools for detection. These programs should be mandatory and regularly updated to reflect the latest advances in bullying research.
- It would be relevant that community support programs involving local organizations, health and social services, and law enforcement be developed. These programs should provide resources and assistance to both victims and perpetrators of bullying, and promote a culture of respect and tolerance. The creation of safe spaces and community activities can help reduce isolation and marginalization of students affected by bullying.

- Inclusion of mental health programs in the school curriculum to address the impact of bullying on student well-being. Schools should systematically integrate mental health education into their curricula. These programs should include workshops on coping skills, stress management, and resilience, as well as access to school counselors and psychological support services. Promoting a school culture that values mental health can reduce the incidence of bullying and improve the overall well-being of students.
- Proposition by schools to a variety of sports and recreational activities to encourage active participation in these activities. In addition, specific programs should be developed that use PA as a tool to improve group cohesion and reduce conflict.
- Conducting longitudinal studies that follow students over several years can provide a deeper understanding of the long-term impact of bullying on academic and emotional development. Such research is crucial for developing more effective intervention strategies tailored to the needs of students at different stages of their development. In the future, funding for bullying research is expected to increase, enabling large-scale studies that can influence education policy at national and international levels.

CURRICULUM VITAE RESUMIDO [SHORT CV]

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- Máster Universitario en Investigación y Docencia en Ciencias de la Actividad Física y Salud (2020-2021) Universidad de Jaén (Jaén, España)

Participación en proyectos de investigación

- Proyecto de Investigación I+D+I del Ministerio de Ciencia, Innovación y Universidades "Physical activity and sedentary behaviour in children and adolescents. Dose-response analysis in relationship with learning variables" (PID2022-137432OB-I00), incluido en la convocatoria de "Proyectos de Generación de Conocimiento 2022" del "Plan Estatal de Investigación Científica y Técnica y de Innovación 2021-2023". DURACIÓN: 2022 - 2025. RESPONSABLE: Emilio J. Martínez López. DOTACIÓN ECONÓMICA: 66.250€

- Proyecto de Innovación Docente "Aprendizaje basado en juegos (ABJ) como metodología activa de enseñanza aprendizaje para aspirantes a docentes de Educación Infantil y Primaria: Diseño, creación e implementación de recursos (PIMED13_202123)", incluido en la convocatoria 2021 del Plan de Innovación y Mejora Docente de la Universidad de Jaén (PIMED-UJA 2019-2023). DURACIÓN: 1/06/2022 - 31/05/2024. RESPONSABLES: Alberto Ruiz Ariza y Sara Suárez Manzano. DOTACIÓN ECONÓMICA: 1750 €

- Proyecto de Innovación Docente "Creación de Situaciones de Aprendizaje para la Vida mediante el modelo de Autoconstrucción sostenible de Materiales y el Aprendizaje de Servicio: propuestas creativas e innovadoras para docentes de Educación Infantil y Primaria (PID2024_015)", incluido en la convocatoria del 18 de enero de 2024 del Plan de Innovación y Mejora Docente de la Universidad de Jaén 2019-2024 (PIMED-UJA 2024). DURACIÓN: 2024 – 2026. RESPONSABLES: Alberto Ruiz Ariza y Sara Suárez Manzano. DOTACIÓN ECONÓMICA: 1872, 94 €

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