Rev Andal Med Deporte. 2022; **15(2)**: *72-79*

Junta de Andalucía
Consejería de Educación y Deporte

Revista Andaluza de
Medicina del Deporte

https://ws072.juntadeandalucia.es/ojs

Revision

Suicidal behaviors and sedentary behavior in adolescents: systematic review and meta-analysis

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ARTICLE INFORMATION: Received 29 June 2020, accepted 19 October 2020, online 20 October 2020

ABSTRACT

Objective: To determine the association between suicidal behaviors (ideation, planning and attempt) and sedentary behavior in adolescents.
Method: Systematic searches were performed in eight databases (MEDLINE/PubMed; Web of Science; Scopus; SPORTDiscus; LILACS; SciELO; PsycINFO; CINAHL). The effect measures used for meta-analysis were odds ratios and 95% confidence intervals, directly collected from included studies.
Results: Eleven studies were included in the systematic review and six articles were included in the meta-analysis. The meta-analysis showed that adolescents who used video games/computers for ≥3 hours/day were more likely of having suicidal ideation. Adolescents who used television or video game/computer for ≥3 hours/day were more likely of having suicide attempt. Boys who spent ≥3 hours/day in combined sedentary behavior were less likely of having suicidal attempt.
Conclusions: There is an increased likelihood of suicidal behaviors, in special suicide ideation and attempt in adolescents who used video games/computers and watched television for ≥3 hours/day.
Keywords: Sedentary behavior; Adolescent; Suicidal ideation; Suicidal planning; Suicide attempted.

Comportamientos suicidas y sedentarismo en adolescentes: revisión sistemática y metaanálisis

RESUMEN

Objetivo: Determinar la asociación entre comportamientos suicidas (ideación, planificación e intento) y sedentarismo en adolescentes.
Método: Se realizaron búsquedas sistemáticas en ocho bases de datos (MEDLINE/PubMed; Web of Science; Scopus; SPORTDiscus; LILACS; SciELO; PsycINFO; CINAHL). Las medidas de efecto fueron los odds ratios y intervalos de confianza del 95%, recopilados directamente de los estudios.
Resultados: Se incluyeron once estudios en la revisión sistemática y seis estudios en el metanálisis. El metanálisis mostró que los adolescentes que usaban videojuegos/computadoras durante ≥3 horas/día tenían más probabilidades de tener ideación suicida. Los adolescentes que usaban televisión y videojuego/computadora durante ≥3 horas/día tenían más probabilidades de tener un intento de suicidio. Los niños que pasaron ≥3 horas/día in comportamientos sedentarios combinados tenían más probabilidades de tener intento de suicidio.
Conclusiones: Existe una mayor probabilidad de conductas suicidas, en ideación e intento de suicidio en adolescentes que usaron videojuegos/computadoras y vieron televisión durante ≥3 horas/día.
Palabras clave: Conducta sedentaria; Adolescente; Ideación suicida; Planificación suicida; Intento suicidio.

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https://doi.org/10.33155/j.ramd.2020.10.003

Comportamentos suicidas e sedentarismo em adolescentes: revisão sistemática e meta-análise

RESUMO

Objetivo: Determinar a associação entre comportamentos suicidas (ideação, planejamento e tentativa) e comportamento sedentário em adolescentes.
Método: Pesquisas sistemáticas foram realizadas em oito bancos de dados (MEDLINE/PubMed; Web of Science; Scopus; SPORTDiscus; LILACS; SciELO; PsycINFO; CINAHL). As medidas de efeito utilizadas para a metanálise foram odds ratio e intervalos de confiança de 95%, coletados diretamente dos estudos.
Resultados: Onze estudos foram incluídos na revisão sistemática e cinco artigos foram incluídos na meta-análise. A meta-análise mostrou que os adolescentes que usavam videogame/computador por ≥3 horas/dia tinham maiores chances de ter ideação suicida. Os adolescentes que usavam televisão ou videogame/computador por ≥3 horas/dia apresentaram maiores chances de tentativa de suicídio. Os meninos com ≥3 horas/dia em comportamentos sedentários combinados apresentaram menores chances de reportar tentativas de suicídio.
Conclusões: Existe maiores chances de comportamentos suicidas, em especial ideação e tentativa de suicídio em adolescentes que usavam videogame/computador e assistiam televisão por ≥3 horas/dia.
Palavras-chave: Comportamento sedentário; Adolescente; Ideação suicida; Planejamento suicida; Tentativa suicídio.

Introduction

Considered a complex public health problem, suicide is responsible for the deaths of about 800000 people a year worldwide.[1] Among adolescents (aged 10-19 years) suicide is considered the third leading cause of death, already among youth (aged 15-24 years) is the second, and although it affects all socioeconomic groups, higher prevalence is found in socially vulnerable and male adolescents.[2-6] In contrast, nonfatal suicidal behaviors (ideation, planning, and attempt) are more prevalent in females, younger and single people, or those with psychiatric disorders.[1]

Suicidal behaviors are risk factors for suicide, non-fatal actions that precede suicide, and are considered potential risk factors for suicide.[2] During adolescence, hormonal, bodily and social environment changes occur,[1,7] which lead to greater attention to adolescent health. Adolescents are more prone and vulnerable to mental health problems such as depression, anxiety, eating disorders, substances and psychotics use disorders.[1,7] In this context, inadequate lifestyle habits such as inadequate sleep quality, sedentary behavior, difficulties in relating to friends, alcohol consumption and cigarette and drug use are associated with higher prevalence of suicidal behaviors.[8] In addition to these habits, due to technological development, evidence suggests that sedentary behavior can also interact with mental health, and deserves attention for maintaining health.[9]

Studies have shown a strong relationship between long screen time with symptoms of depression, anxiety, hyperactivity, inattention, low levels of psychological well-being and perceived quality of life.[10,11] In addition, for adolescents who stay in front of the screen for more than two hours a day, the likelihood of presenting suicidal behavior may be aggravated regardless of other factors such as weight status, eating habits or levels of physical activity.[10-14]

A systematic review has shown that adolescents with high sedentary time are more likely of reporting suicidal ideation, but because only three of the five studies evidenced this relationship, the findings were considered insufficient.[9] No systematic review with meta-analysis has associated suicidal planning with sedentary behavior; however, original studies have reported that the longer the screen-based sedentary behavior, such as video game and computer games, the greater the likelihood of adolescents having suicidal planning.[15] In meta-analysis with data of original studies from 43 countries, leisure-time sedentary was associated with increased likelihood of suicide attempts in adolescence.[16] No systematic reviews with meta-analysis that analyzed the three suicidal behaviors related to sedentary behavior were found. In this sense, the aim of the present study was to determine the association between suicidal behaviors (ideation, planning and attempt) and sedentary behavior in adolescents by systematic literature review with meta-analysis.

Method

This systematic review and meta-analysis was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines[17] and followed recommendations of the Cochrane Collaboration Handbook[18] to respond to the following question: What is the association between suicidal behaviors (ideation, planning and attempt) and sedentary behavior in adolescents? The study protocol was registered in the PROSPERO database (registration number: CRD42019131556).

Systematic Search Strategy

Systematic searching was performed on MEDLINE (by PubMed), Web of Science, Scopus (by Elsevier), SPORTDiscus (by EBSCOhost), LILACS (by Virtual Health Library), SciELO, PsycINFO (by American Psychological Association - APA) and CINAHL (by EBSCOhost) databases.

Search terms, keywords, health science descriptors (DECS) or medical subject headings (MESH) related to the PECO acronym (patient / population, exposure, comparison and outcome) were used. In this sense, Population (P) was composed of children and adolescents (adolesc* OR teen OR teenager OR child* OR youth OR scholar OR students OR “school children” OR “school teenager” OR teenage OR adolescence OR student OR “young people”); Exposure (E) was composed of sedentary behaviors (“sedentary behavior” OR “sedentary lifestyles” OR “screen time” OR “sitting time” OR “sedentary time” OR “screen-based” OR “television viewing” OR driving OR “video game” OR computer OR “adolescent behavior” OR “sedentary lifestyle” OR “TV viewing” OR videogame OR “time in the sitting position” OR “watching TV” OR “sedentary behavior” OR “computer use”); Comparison (C) was not applied in the search strategy; and Outcome (O) was composed of suicidal behaviors (suicid* OR “self-harm” OR “self-poisoning” OR “Self-injurious behavior” OR “self-mutilation”).

The search terms were combined using Boolean operators (OR was used to combine search terms from the same PECO group and AND to combine search terms from different groups). Truncation symbols (*) were also used to search for all words derived from the same prefix; quotation marks (“”) to search for exact terms. Filters were used to refine the search as document type (article and inpress article), keyword related to the search area.

The search was performed in November 2018 and updated in June 2019 and September 2020, considering all articles published up to these dates. Additionally, references from eligible studies

and those related to the subject of this review were manually searched to find other relevant studies.

Eligibility Criterion

Articles were included in the systematic review according to the following criteria: 1) children and adolescents aged 2-19 years (when the study only reported average age values, this average should be up to 19 years); 2) all types of study design (cross-sectional, longitudinal, clinical, cohort studies, interventions, case-controls); 3) studies that analyzed the association between suicidal behaviors and any type of sedentary behavior in children and adolescents.

Review articles, course conclusion works/dissertations/theses, abstracts, book chapters and expert opinions were excluded, because, in general, these documents are transformed into articles, which would increase the duplicity of files.

Study selection and data extraction

Records retrieved by the database search strategy were exported to reference management software and duplicates were accounted for and excluded. Records were initially screened by title and abstract. Potentially eligible records were evaluated for the full text to confirm the inclusion criteria. Both steps were independently performed by two reviewers (AFS and CAAJ), who screened records by title and abstract and in case of disagreement, a third reviewer (DASS) was consulted.

The following data were extracted: authors' names and year of publication, location and year of data collection, study design, age group, type of suicidal and sedentary behavior measure. In case of divergence among data independently extracted by two reviewers (AFS and CAAJ), the article was consulted again and in the absence of consensus, a third (DASS) reviewer resolved the conflict.

When data required for meta-analysis were not available in the full record, authors were contacted by email to obtain data.[15] In the absence of feedback, results were included in the graphical presentation of the meta-analysis, but without considering them as the final result.

Risk of bias assessment

As with the other steps, the risk of bias was independently assessed by two reviewers (AFS and CAAJ) and, in the absence of consensus, a third author (DASS) was consulted. Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies of the National Institutes of Health[19] was used to assess the risk of bias. For each criterion evaluated, the following scores were assigned: "no" (N), "not reported" (NR), "yes" (Y) and "not applicable" (NA). At the end of the study classification, a total score was assigned to each study based on the number of positive responses. Each study was rated as good (i.e., most criteria had low risk of bias) - score from 13 to 14; average (i.e., some criteria had moderate bias risk) - score from 9 to 12; or poor (i.e., few criteria met and with high risk of bias) - score below 9[19,20] (Supplementary Table 1).

Statistical analysis

Independent meta-analysis were performed for each type of exposure (sedentary behavior measure: television time, video game or computer time and combined sedentary behavior measures) and outcome (suicidal behaviors: ideation and suicide attempt). The effect measures used for meta-analysis were odds ratios (OR) and their respective 95% confidence intervals (95% CI), directly collected from included studies, with adjusted values. For all analyses, OR and 95% CI were transformed into natural logarithms.

To assess the heterogeneity between the studies the participants characteristics and the study methods were considered. In addition, the heterogeneity were considered significant when $p < 0.1$ in the chi-square test or $I^2 > 50\%$. Meta-analyses were performed by subgroups when the presentation of the study effect measure represented a source of heterogeneity (measure for female, male or both sexes). For some variables, data from primary studies were not comparable (effect measure presented by sex). Therefore, were presented in meta-analysis graphs only for viewing these data. In these cases, the authors of these studies were contacted to obtain the necessary information for data comparability, but there was no return or availability of information.

For this reason, the overalls measures obtained in meta-analysis were not considered as results of the present study. Data were comparable and, therefore, compatible with the statistical summarization for: 1) Subgroup "measure for both sexes" in the television time and video game / computer time for both suicidal behaviors (ideation and attempt); 2) Subgroups "measure for females" and "measure for males" in the combine sedentary behaviors for both ideation and suicide attempt meta-analyses. For these analyses, we use the fixed or random effect model based on data characteristics (age group, exposure and outcome assessment methods and measurement presentation) and heterogeneity results.

Sensitivity analysis to verify the influence of each effect measure on the overall OR obtained in the analysis was performed by subgroups already specified as comparable (items 1 and 2) when the meta-analysis combined three or more studies results. Publication bias analysis was not performed because the minimum number of studies for the implementation of this test (≥ 10 studies) was not reached. Statistical analyses were performed using STATA® software version 13.0 (StataCorp LP, Texas, USA).

Results

Study Selection

The literature search identified a total of 3466 publications in databases. After removal of duplicate studies (n = 603) and reading of titles and abstracts, 127 articles were read in full. At the end of the search, 10 articles were included in the systematic review. In addition, after reading the reference list, another article was included, totaling 11 studies included in the systematic review[15,16,21-29] (Figure 1).

Of the total systematic review studies (n = 11), five were included in the meta-analysis graphs because presented the same metrics for outcomes and exposures.[15,25-28] Of the six studies that were excluded from the meta-analysis, two were excluded because they analyzed suicidal behaviors in a clustered manner;[21,22] two analyzed data from different countries;[16,29] one stratified by ethnicity;[24] and one presented different analysis models, being incomparable to the other studies[23] (Figure 1).

Study characteristics

Six studies were carried out in the United States,[15,21,22,24-26] one in Canada,[28] one in the Netherlands,[23] one comprised samples from Cambodia, Indonesia, Malaysia, Myanmar, the Philippines, Thailand and Vietnam,[27] one used data from 43 countries subdivided into regions[16] and one used data from 52 countries subdivided into regions.[29] All articles included in the final analysis had cross-sectional design (n = 11) (Table 1).

Of the 11 studies included in this review, eight analyzed suicidal ideation,[15,23-29] two analyzed suicide planning,[15,29] six analyzed suicide attempt[15,16,25,26,28,29] and two articles identified grouping of the three suicidal behaviors.[21,22] The most prevalent measures of sedentary behavior in studies were hours of use or playing on the

computer, hours playing video games and hours watching television[15,16,21-29] (Table 1)

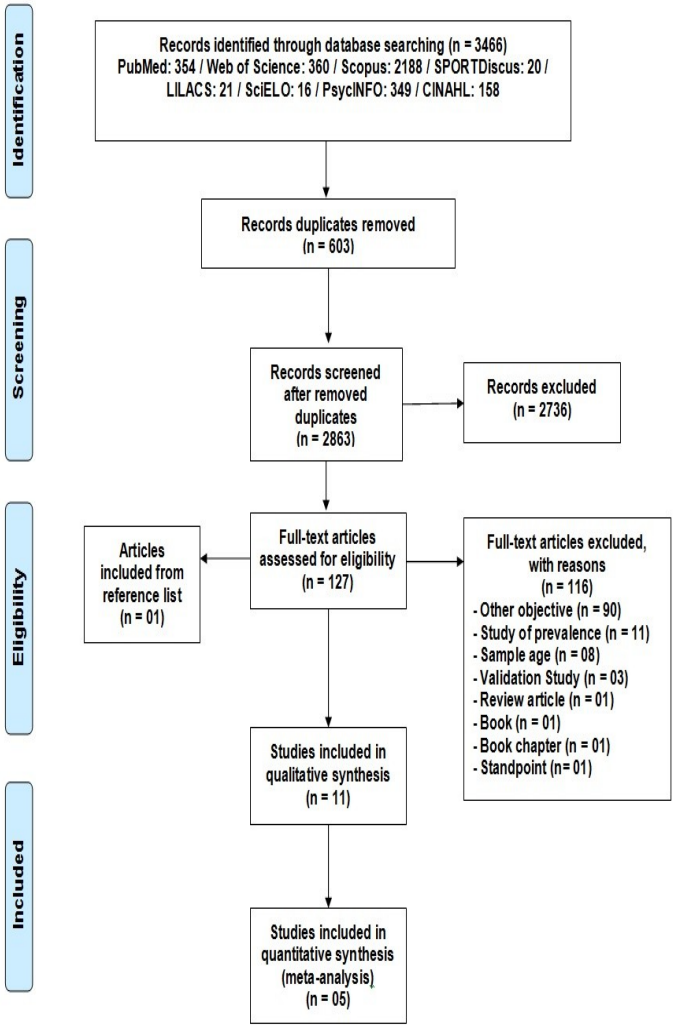

Figure 1. Flowchart of the selection of studies on the association between suicidal behaviors and sedentary behavior included in the systematic review and meta-analysis.

Risk of bias

Regarding the risk of bias of investigated studies, all studies (n = 11) presented regular risk of bias[15,16,21-29] (Table 2).

Meta-analysis and sensitivity analyses

Among the 11 studies included in the systematic review, only four[15,25,26,28] had characteristics compatible with the meta-analysis, and a study was inserted only as a graphic representation.[27] The meta-analysis showed that there is no significant increase in the odds of adolescents having suicidal ideation when presenting long television time (OR: 1.12; 95% CI: 1.00 - 1.26; p = 0.056) (Figure 2A). On the other hand, there is significant increase in the likelihood of adolescents having suicidal ideation when presenting long video games/computers use time (OR: 1.49; 95% CI: 1.29 - 1.72) (Figure 2B). The combined sedentary behaviors were pooled in the meta-analysis according to sex. There was no significant association with suicidal ideation (female OR: 0.93; 95% CI: 0.57 - 1.53; male OR: 0.89; 95% CI: 0.70 - 1.14) (Figure 2C).

In the meta-analysis for suicide attempt, both the television time (OR: 1.24; 95% CI: 1.08 - 1.43) and the video game/computer time (OR: 1.69; 95% CI: 1.43 - 2.00) were directly associated with suicide attempt in analysis for both sexes (Figure 3A-B). For combined sedentary behaviors and suicide attempt, the studies were pooled in female and male subgroups. For female there was no significant association (OR: 1.20; 95% CI: 0.90 - 1.59), but in male sedentary behaviors was associated with lower probability of suicide attempt (OR: 0.78; 95% CI: 0.61 - 0.98) (Figure 3C).

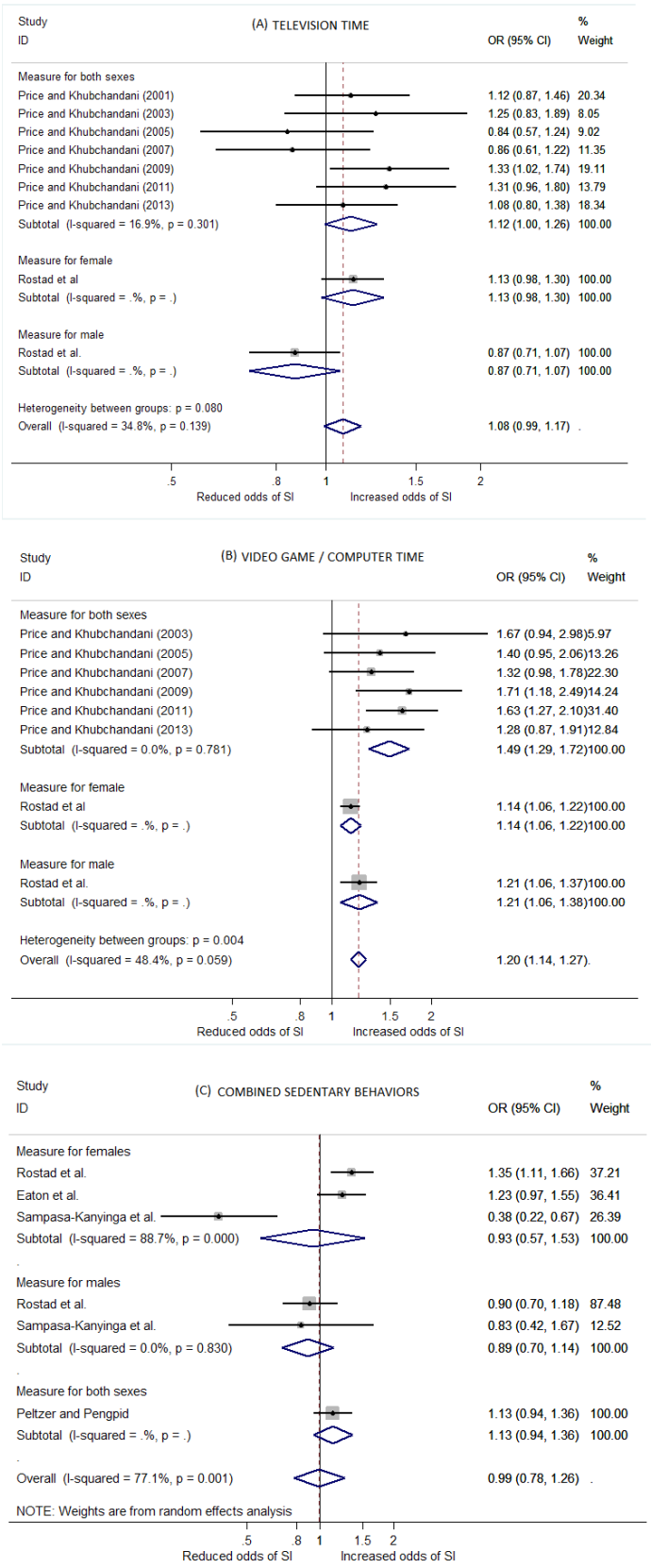

Figure 2. Forest plot showing odds ratio (OR) and 95% Confidence Intervals (CI) for the association between television time (Figure 2A), video game/computer time (Figure 2B), combined sedentary behavior (Figure 2C) and suicidal ideation (SI). Subtotal and overall estimates were obtained by meta-analysis with fixed effects.

Table 1. Description of studies on suicidal behavior and sedentary behavior in adolescent included (n=11).

Reference	Country/Research year	Design	Quality Score	Age (years)	Populaton/Sample	Suicidal behaviors	Measure of Sedentary behavior
Arat[24]	United States/2013	Cross-sectional	11/14	12-18	NR/10563	Ideation	Use of television (hours/day)
Eaton et al.[25]	United States/2007	Cross-sectional	12/14	14-18	6942/ ♀: 6322	Ideation and attempt	Use of video games, and computer (hours/day)
Lowry et al.[21]	United States/1991 - 2011	Cross-sectional	10/14	14-18	NR/ about 14000	Grouping of suicidal behaviors (ideation, planning and attempt).	Use of television, video game, and computer (hours/day)
Mérelle et al.[23]	Nederland/2013 - 2014	Cross-sectional	12/14	Average : 14.4	21053 ♂: 10400 ♀:10653	Ideation	Use of computer (hors/day)
Peltzer and Pengpid[27]	Cambodia, Indonesia, Malaysia, Myanmar, Philippines, Thailand and Vietnam/2007 - 2013	Cross-sectional	10/14	13-15	NR / 30284 ♂: 14750 ♀:15534	Ideation	Total screen time, use of television, video game, talking to friends, and playing cards (hours/day)
Price and Khubchandani[26]	United States/2001 - 2013	Cross-sectional	09/14	14-18	NR/ 13721	Ideation and attempt	Use of television, and video game (hours/day).
Rostad et al.[15]	United States/2015	Cross-sectional	12/14	14-18	NR / 15506 ♂: 7749 ♀: 7757	Ideation, planning and attempt	Total screen time, use of television, video game and computer (hours/day).
Sampasa-Kanyinga et al.[28]	Canadá/2015 and 2017	Cross-sectional	12/14	11-20	NR / 10183 ♂: 4520 ♀: 5663	Ideation and attempt	Total screen time use of watching TV/movies, playing video/computer games, chatting on a computer, emailing, or surfing the Internet (hours/ day)
Twenge et al.[22]	United States/2009 - 2015	Cross-sectional	11/14	13-18	NR/ 506820	Grouping of suicidal behaviors (ideation, planning and attempt).	Use of television, computer, and video game (hours/day).
Uddin et al.[29]	52 countries 2003 - 2015	Cross-sectional	11/14	13-17	NR/206357 ♂: 101115 ♀: 105242	Ideation, planning and attempt.	Time sitting and watching television, playing computer games, talking with friends, or doing other sitting activities (hours/day).
Vancampfort et al.[16]	43 countries/2009 - 2015	Cross-sectional	12/14	12-15	NR/126.392 ♂: 64586 ♀:61806	Attempt	Use of television, computer, talking with friends, or doing other sedentary activities (hours/day).

NR: Not reported; ♂: male; ♀: female

Table 2. Bias risk assessment of studies included in the systematic review.

Reference	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Total score
Arat[25]	Y	Y	Y	Y	Y	N	N	Y	Y	NA	Y	NA	NA	N	11
Eaton et al.[26]	Y	Y	Y	Y	Y	N	N	NA	Y	NA	Y	NA	NA	Y	12
Lowry et al.[21]	Y	N	Y	N	Y	N	N	Y	Y	NA	Y	NA	NA	Y	10
Mérelle et al.[24]	Y	Y	Y	Y	Y	N	N	NA	Y	NA	Y	NA	NA	Y	12
Peltzer and Pengpid[28]	Y	Y	Y	N	Y	N	N	NA	Y	NA	Y	NA	NA	N	10
Price and Khubchandani[27]	Y	Y	N	N	N	N	N	Y	Y	NA	Y	NA	NA	Y	09
Rostad et al.[15]	Y	Y	Y	Y	Y	N	N	Y	Y	NA	Y	NA	NA	Y	12
Sampasa-Kanyinga et al.[29]	Y	Y	Y	Y	Y	N	N	Y	Y	NA	Y	NA	NA	Y	12
Twenge et al.[22]	Y	Y	Y	N	Y	N	N	Y	Y	NA	Y	NA	NA	Y	11
Uddin et al.[30]	Y	Y	Y	N	Y	N	N	NA	Y	NA	Y	NA	NA	Y	11
Vancampfort et al.[16]	Y	Y	Y	Y	Y	N	N	Y	Y	NA	Y	NA	NA	Y	12

Y: Yes; N: No; NA: Not applicable; NR: Not reported. Q1: Was the research question or objective in this study clearly stated?; Q2: Was the study population clearly specified and defined?; Q3: Was the participation rate of eligible persons at least 50%?; Q4: Were all the subjects selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study prespecified and applied uniformly to all participants?; Q5: Was a sample size justification, power description, or variance and effect estimates provided?; Q6: For the analyses in this study, were the exposures of interest measured prior to the outcome(s) being measured?; Q7: Was the time frame sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?; Q8: For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (e.g., categories of exposure, or exposure measured as a continuous variable)?; Q9: Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?; Q10: Were the exposures assessed more than once over time?; Q11: Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?; Q12: Were the outcome assessors blinded to the exposure status of participants?; Q13: Was loss to follow-up after baseline 20% or less?; Q14: Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposures and outcomes?

Heterogeneity (I^2> 50%; p<0.1) was observed only in the suicidal ideation meta-analysis for the subgroup of "measure for female". For this reason and the characteristics of individual studies, the random effect model was applied. For the other meta-analysis, the fixed effect model was applied (data not shown in tables / figures).

Discussion

The present meta-analysis showed greater likelihood of suicide attempt among adolescents who spent more time sedentary behavior in front of the television. Watching television has often been associated with depressive symptoms, physical and sexual victimization among adolescents and being bullied in the school environment, i.e., bullying experiences that could be associated with contents broadcasted on television shows, whose violent nature promotes suicidal behavior.[15,22] In a study of trends of suicide attempts in Latin adolescents from 2001 to 2013, no significant results for association between watching television for three hours or more and suicide attempts were reported.[26] However, literature shows that higher duration and frequency of television watching are associated with unfavorable body composition, increased risk of cardiometabolic diseases, unfavorable behavioral conduct, premature death from all causes, and physiological and psychological problems.[14,30] Thus, discouraging excessive screen time may be beneficial in reducing the risk of suicide attempt.[15]

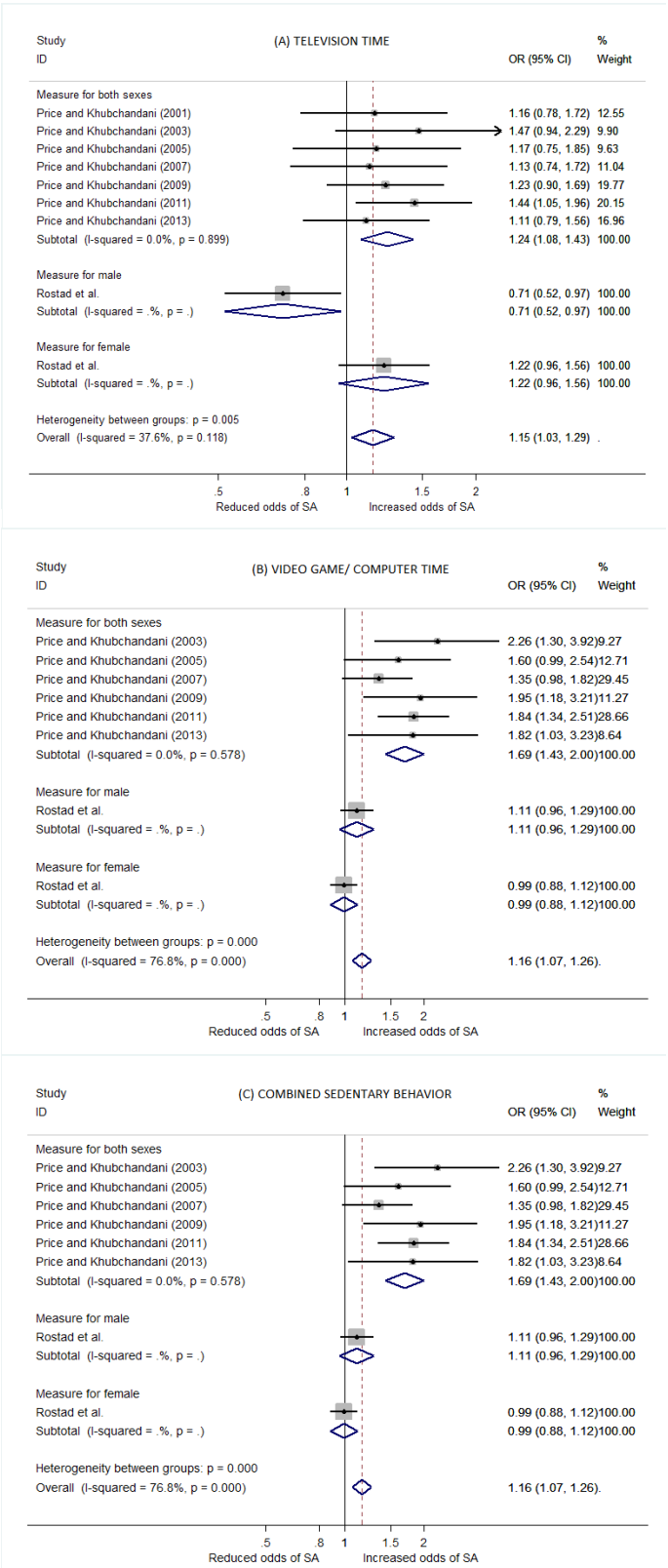

Figure 3. Forest plot showing odds ratio (OR) and 95% Confidence Intervals (CI) for the association between television time (Figure 3A), video game/computer time (Figure 3B), combined sedentary behavior (Figure 3C) and suicidal attempt (SA). Subtotal and overall estimates were obtained by meta-analysis with fixed effects.

Regarding video game/computer time sedentary behavior, the present meta-analysis found increased likelihood of suicidal ideation and suicide attempt in adolescents who spend more time using these devices. Results similar to those of the present study had already been reported by original articles.[15,26] Possible justification for this finding is that exposure to media through computer can lead to victimization, in the form of cyberbullying, which occurs through defamatory messages or threats via email, social networks, blogs and mobile phones.[15,31] Moreover, both computer games and video games can lead to increased aggression, social isolation, depressive and attention-deficit symptoms, which ultimately favor suicidal ideation.[15,32]

Only for the male three hours or more of combined sedentary behavior (television hours, video games, computer games, computer use and total screen time) was associated with decrease in the likelihood of suicidal attempt. On the one hand, the technological advances have increased the availability of information and presented new ways to connect and learn but, increased use of media by youth may have some adverse consequences, for example experiences of bullying, teen dating violence, and suicide risk.[15] Patterns differ for male and female adolescents because males may be more frequently playing video games than using social media, potentially compromising their development of interpersonal skills and making them vulnerable to all forms of bullying, but, not suicide risk and may also play video games to cope with real-life problems.[15]

In addition, this meta-analysis reported no significant increase in the likelihood of suicidal ideation, for adolescents both sexes, and suicidal attempt to female adolescents who reported three hours or more combined measures of sedentary behavior (television hours, video games, computer games, computer use and total screen time), as reported in other studies.[26,28,33] However, it should be noted that a study developed with both sexes show that more time spent in combined sedentary behavior is associated with increased odds of suicide attempts.[16] In the sensitivity analysis the combined sedentary behaviors and suicidal ideation for females showed the most important differences. When the impact of individual results was assessed, by removing analyses one at a time, withdrawing the Sampasa-Kanyinga et al. study from the meta-analysis, the result becomes significant (OR: 1.29; 95% CI: 1.06 – 1.52). The observed discrepancies may be explained, at least in part, by the difference in the cutoff point of time in sedentary behavior adopted in each study or by some random difference in the sample cut.

Finally, this meta-analysis reported no significant increase in the odds of suicidal ideation for adolescents who watched television for three hours or more, as reported in a study with Latin adolescents[26] and a trend study (2001-2013) with students from the United States.[15] Thus, the lack of association between suicidal ideation and time watching television may be justified because in the last decade, the preference of adolescents was for other electronic media that allow choice of content,[15] which in general, is not allowed by television. However, the significance values found in the analysis were borderline and the sensitivity analysis performed leaves room for a possibility of association. In addition, it was possible to perform a meta-analysis between television time and suicidal ideation with only one study of different cross-sections,[26] which may have been insufficient to analyze such association with greater sensitivity. When the impact of individual results was assessed, by removing analyses one at a time, was observed that in sensitivity test for television time and suicidal ideation the withdrawal of any study from the meta-analysis alters the result to a significant association in the same direction.

Half of the studies in this systematic review took place in the United States. From 1999 to 2016, suicide rates have been increased significantly in 44 states, and 25 states experienced increases increased 30%. In 2016 nearly 45,000 suicides (15.6/100,000 population) occurred in the United States among persons aged ≥10 years.[34] However, the differential rate of decrease in suicidal ideation versus attempts, seen over the past 20 years, suggests the pool of adolescents who have seriously considered or planned for suicide without actually attempting suicide has been decreasing, but this that impulsive or unplanned suicide attempts may have become more common.[21] In addition to mental health conditions and prior suicide attempts, other

contributing circumstances include social and economic problems, access to lethal means (e.g., substances, firearms) among persons at risk, and poor coping and problem-solving skills.[34] According to studies, compared with students with no suicidal ideation or attempts, carry a weapon on school property was one of the health-risk behaviors most strongly associated with suicide attempts among female students.[21,26] Therefore, we realized through the period of the research that both the oldest studies, as well as the newest and longest-lasting studies occurred in the United States, which shows greater concern in researching this subject and treating it more openly in society.

The fact that all included studies had cross-sectional design is among the limitations of this meta-analysis, which does not allow for temporal or causal relationships. Due to the small number of studies, it was not possible to perform meta-regression analyses to explore sources of heterogeneity, and because there is only one study on the association between suicidal planning and sedentary behavior, it was not possible to perform meta-analysis with this behavior.

Conclusion

The present meta-analysis reported that there is an increased likelihood of suicide attempt in adolescents who watch television for more than three hours, but showed no association between television time and suicidal ideation. In addition, adolescents of both sexes who reported spending more than or equal to three hours playing video and computer games or using the computer were more likely to have suicide ideation and attempt. For the combination of three or more hours in different types of sedentary behaviors (television, video games, computer games, computer use and total screen time), male adolescents were less likely of having suicidal attempt, but female adolescents showed no association between combination sedentary behaviors time and suicidal attempt. Also, adolescents that combination of three or more hours in different types of sedentary behaviors showed no association with suicidal ideation.

Thus, time spent in sedentary behaviors, such as hours of watching television, playing video games, playing computer games, or using computers, can cause social and emotional problems that lead to isolation, searching for inappropriate content and bullying, and can lead to suicidal behaviors such as ideation and attempt. This information serves as a warning to parents, teachers and government organizations for possible interventions aimed at reducing sedentary behavior in the domestic, school and other social areas. For, the primary prevention of sedentary lifestyle can come from simple actions such as breaking the sedentary time, the modest reduction in screen time and the replacement of electronic games by recreational and socially interactive games.

Authothsip. All the authors have intellectually contributed to the development of the study, assume responsibility for its content and also agree with the definitive version of the article. **Conflicts of interest.** The authors have no conflicts of interest to declare. **Funding.** No funding. **Provenance and peer review.** Not commissioned; externally peer reviewed. **Ethical Responsabilities.** *Protection of individuals and animals:* The authors declare that the conducted procedures met the ethical standards of the responsible committee on human experimentation of the World Medical Association and the Declaration of Helsinki. *Confidentiality:* The authors are responsible for following the protocols established by their respective healthcare centers for accessing data from medical records for performing this type of publication in order to conduct research/dissemination for the community. *Privacy:* The authors declare no patient data appear in this article.

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