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RESEARCH ARTICLE

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SCREEN TIME AND MUSCULOSKELETAL PAIN IN ADOLESCENTS: A SYSTEMATIC REVIEW

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ABSTRACT

Aim: To analyze the association between screen time and musculoskeletal pain in adolescents. **Materials and methods:** A systematic review was carried out by analyzing publications of articles indexed in the National Library of Medicine (Medline / Pubmed), Latin American and Caribbean Literature in Health Sciences (LILACS), Scientific Electronic Library Online (SciELO), Cochrane Library and Scopus, in Portuguese, English and Spanish, with no restrictions regarding the date of publication. The following descriptors were used: 'Screen Time', 'Musculoskeletal Pain' and 'Adolescent' and their synonyms, recognized by the MeSH and DeCS vocabulary. These descriptors were crossed using the Boolean operators AND and OR. 766 articles were found, 707 of which were selected to have their titles and abstracts read. Among these articles, 13 were selected for full reading and after this stage, 7 articles were selected to be included in this present review. **Results:** The results showed an association between screen time and musculoskeletal pain, with the thoracolumbar, back and cervical regions being the most frequent anatomical locations. Screen times greater than 4 hours leads to musculoskeletal pain. The intensity of the pain depends on the frequency of use of the screens, as well as on the simultaneous use of these devices. **Conclusion:** An association was observed between the use of digital screens and musculoskeletal pain, indicating that the excessive and simultaneous use of digital screens causes damage to the lives of adolescents. In addition, there is a notable gap in the literature on the subject, reinforcing the need for more studies to be carried out, so that specific health strategies can be created for this population.

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INTRODUCTION

Technological development has increased in recent years and facilitated personal access to digital screens. The use of these screens (computers, tablets, cell phones and electronic games) has transformed the daily lives of adolescents, becoming a central part of their lives, whether for socialization, entertainment, learning or work purposes, or for expanding the interest of this age group (Hakala, 2002; Silva, 2006 and Hakala, 2012). The excessive use of digital screens can generate mental overload, overweight conditions, physical inactivity, musculoskeletal pain and decreased amount of sleep in these adolescents, leading to symptoms of aggressiveness, irritability and tiredness (Hakalam, 2012; Milde-Busch, 2010).

The maintenance of inadequate postures for a prolonged period of time, commonly adopted during the use of the devices, may justify the presence of some of these symptoms (Hakala, 2012; Milde-Busch, 2010; Hakala, 2006 and Punamäki, 2007; Van den Bulck, 2004; Anderson, 2001; Saueressiget, 2015). Musculoskeletal pain and its association with the use of digital screens, specifically for internet use (cell phones and video games), has been an area of interest in research, since studies show that these problems are common in people who have pain (Hakala, 2002; Silva, 2006 and Saueressiget, 2015). A study carried out in Brazil, in 2015 (Silva, 2015), demonstrated the high prevalence of musculoskeletal pain in adolescents who used electronic devices for long periods of time. The presence of symptoms of musculoskeletal pain in this study

was reported by 65.1% of adolescents, being more prevalent in the thoracolumbar spine (46.9%), followed by pain in the upper limbs, representing 20% of complaints. The average time of use of computers and electronic games was of 1720 and 583 minutes per week, respectively. The excessive use of electronic devices proved to be a risk factor for cervical and lumbar pain and for pain in other regions. Some consequences of musculoskeletal pain include psychological suffering, limited activities and limited social participation. In addition, individuals who have musculoskeletal pain in adolescence are more likely to experience pain in adulthood (Andreucci, 2017). Accordingly, this study aims to investigate the association between the use of digital screens and musculoskeletal pain. Therefore, a systematic review study was carried out as a research strategy, as this type of study seeks to identify the existing evidence in the literature related to this topic. This research will support the planning of practices for actions aimed at adolescent health.

MATERIALS AND METHODS

This systematic review was registered in PROSPERO (n° CRD42020155525) and was conducted in accordance with the guidelines of Transparent Reports of Systematic Reviews and Meta-Analyses (PRISMA Statement). The PICO guiding question of the research was the following: “Is screen time associated with musculoskeletal pain in adolescents?” (P = Adolescent; I = longer screen time; C = shorter screen time; O = musculoskeletal pain).

Eligibility Criteria: This review included the following studies: observational epidemiological studies (cross-sectional, case-control, cohort) that assessed the association between screen time and musculoskeletal pain in adolescents. There was no restriction on the date of publication, though there was a restriction regarding the language of the studies (Portuguese, English and Spanish only) and age group studied (between 10 and 19 years old). Reports or case series, letters to the editor, literature reviews, theses and dissertations were also excluded.

Search strategy: Articles available in the following databases were included: National Library of Medicine (Medline / Pubmed), Latin American and Caribbean Literature in Health Sciences (LILACS), Scientific Electronic Library Online (Scielo), Cochrane Library and Scopus. The descriptors used in the advanced search were “Adolescents”, “Musculoskeletal Pain”, “Screen Time” and their synonyms recognized by the Mesh and Desc vocabulary. Initially, 766 articles were found. 59 articles were excluded as duplicates, totaling 707 articles for having their title and abstracts read. The selection of articles was based on abstracts and titles and performed independently by two trained and calibrated researchers (S.S.S and M.A.C.), i.e. a peer review. Disagreements were resolved by a third reviewer (M.V.H) with discussion and consensus. After this phase, 13 articles were selected for complete analysis of the text.

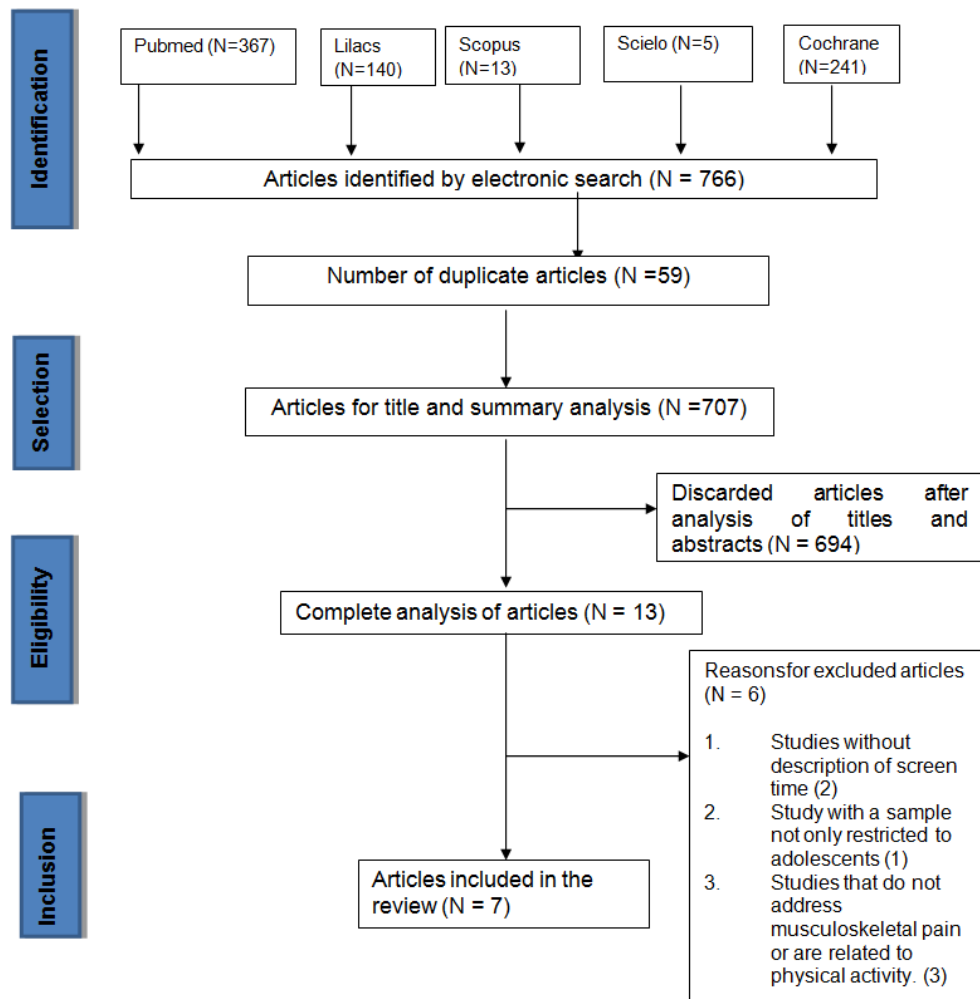


Figure 1. Identification of studies included in the final sample

This analysis was carried out independently by each of the two researchers and disagreements were again resolved by a third reviewer with discussion and consensus. When a study had missing data or additional information was needed, the corresponding author was contacted. Six studies were excluded as they did not meet the inclusion criteria, totaling seven studies included in the systematic review (Figure 1).

RESULTS

The strategies that were used for this review were adapted according to each of the databases, based on their specificities of access. 367 articles were found in Pubmed, 140 in LILACS, 13 in Scopus, 5 in Scielo and 241 articles in Cochrane. After the analysis, 59 articles were excluded because they were repeated in the 700 databases, or as they did not include the theme or the inclusion criteria. As for the temporal distribution, 29% of the studies were carried out in 2017; 29% were carried out in 2015 and 42.9% in 2014, 2012 and 2011. No studies were found in the years of 2016, 2018 and 2019.

highlighting the authors, year, country of origin, age group, sample, study design and results.

DISCUSSION

This review sought to analyze the association between musculoskeletal pain and the time spent using digital screens in adolescents. There were differences in the results of the studies analyzed, in which it is believed that the difference in the prevalence levels found is justified by the disparity in the methodological approach and sample criteria of the studies. In addition, studies have shown to be heterogeneous in terms of the factors related to the type of education (public and private), which directly interferes with socioeconomic status; as well as in terms of cultural issues in each country; and the link between the type of questionnaire (associating different types of digital screens) and the temporal analysis of responses (pain in the last 3 months and the last 6 months). The study carried out by Saueressig et al.⁹ found no association between musculoskeletal pain and the use of digital screens.

Table 1. Presentation of articles according to author, year, place, age group, sample, study design and results

Author/Year	Location	Age Group	Sample	Study Design	Results
Sekiguchi et al. (2017)	Japan	6-15 years old	6.143	Cross-sectional study	An association was observed with the time of use of television > 4h (p = 0.008) and video game > 3h (p = 0.003) with the presence of musculoskeletal pain. 11.1% reported pain in one anatomical location, 6.9% in two locations, and 7.5% in three or more locations.
Queiroz et al. (2017)	Brazil	10-19 years old	299	Cross-sectional study	An association with cell phone usage time > 2h (p = 0.003) and use of at least two screens (computer, internet, video games, television) > 3h (p = 0.011) was observed with the presence of musculoskeletal pain. Pain prevalent in the back (66%), neck (49%), lower limbs (41%), shoulders, arms (31%) and wrist / hands (19%).
Silva et al. (2015)	Brazil	14-19 years old	961	Cross-sectional study	An association was observed between the use of computers (use over 28.6 hours per week) and electronic games (use over 9.7 hours per week) with the presence of cervical (p = 0.007) and low back pain (p = 0.047). Pain present in the thoracolumbar spine (46%), followed by the upper limbs (20%), cervical spine (18.5%) and scapular region (15.8%).
Saueressig et al. (2015)	Brazil	14-19 years old	262	Cross-sectional study	Despite the excessive use of computers and electronic games, the study found no association with musculoskeletal pain. Pain present in the thoracolumbar spine (42.1%), followed by the cervical and scapular spine (36.2%).
Suris et al. (2014)	Switzerland	6-19 years old	3.067	Longitudinal Study	An association between internet use (computers and cell phones) > 4h was observed with the presence of musculoskeletal pain (OR *: 1.36 [1.00: 1.84]). The most common anatomical location of pain was in the back, with use > 4h (aOR **: 1.46 [1.04: 2.05]).
Hakala et al (2012)	Finland	12-16 years old	436	Cross-sectional study	An association was observed between the computer and the presence of musculoskeletal pain > 14h per week ([OR] = 2.9-4.4). Moderate to severe pain present in the shoulders and neck (21%); head (20%); and eyes (14%); and moderate / severe inconvenience to everyday life was reported in the head (29%), neck pain (21%) and low back pain (16%)
DeVitta et al. (2011)	Brazil	11-14 years old	1.236	Cross-sectional study	An association was observed between television and the presence of musculoskeletal pain > 2h (p = 0.01 and aOR = 1.86). Pain present in the lumbar region (19.5%).

* OR: Odds Ratio ** aOR: Adjusted Odds Ratio

As for geographic distribution, 57.15% of the surveys were located in South America (Brazil), while 28.5% were carried out in Europe and 14.35% in Asia. Regarding the study design, 6 were Transversal and 1 was Longitudinal. Table 1 provides a panoramic view of the studies on screen time and musculoskeletal pain selected in this systematic review,

This result is in disagreement with the other studies in this review (Hakala, 2012; Silva, 2015; Queiroz, 2017; Suris, 2014; DeVitta, 2011; Sekiguchi, 2017; Boström, 2008; Smith, 2009; Jacobs, 2009), being only in agreement with a study conducted in Brazil (Zapata, 2006). According to the authors, the explanation for this finding is a result of the underdevelopment

state of the country where the research was carried out, since it is evident that the usage time of electronic devices is quite high in developed countries which increases the risk of musculoskeletal pain (Milde-Busch, 2010; Hakala, 2006; Punamäki, 2007 and Saueressiget, 2015). In addition, the study points out that the non-association between musculoskeletal pain and the use of screens was due to the use of the self-administered questionnaire, in which the interviewees' bias can be considered, either over or underestimating their responses. Despite the limitations of the study, the results found highlight the possible emergence of pain based on the gender and age of the adolescents⁹. Musculoskeletal pain was greater in girls, except in the study by Hakala et al.³ who referred to the prevalence of pain in boys in the lower back. The differences between genders can be explained by social and educational aspects, since it is observed that women are generally more careful about health-related issues and, consequently, would report possible pain or symptoms more frequently.^{9,10} In addition, the presence of hormonal changes in girls during puberty can influence the results (Saueressiget, 2015 and Shan, 2013). Likewise, studies indicate (Hakala, 2012 and Saueressiget, 2015), that girls tend to practice less physical activity than boys, leading to a sedentary lifestyle and spending most of their time in front of electronic devices and causing musculoskeletal pain. In adolescents, musculoskeletal pain is also multifactorial (Queiroz, 2017). There are several risk factors for musculoskeletal pain, such as gender, age and the use of electronic devices. Other risk factors may be associated with these symptoms during the growth process, such as sport with strength training and recreational activities (Queiroz, 2017 and DeVitta, 2011). Among the studies analyzed, the location of musculoskeletal pain resulting from the use of mesh was greater in the thoracolumbar region (Saueressiget, 2015 and Silva, 2015), followed by the back (Queiroz, 2017 and Suris, 2014) and the cervical region (Queiroz, 2017 and Smith, 2009). The location of musculoskeletal pain in the thoracolumbar region and back can be explained by the inadequate posture of adolescents when using digital screens, especially notebooks and smartphones (Saueressiget, 2015 and Silva, 2015). According to the study by DeVitta et al. (DeVitta, 2011) this specific location occurs due to prolonged sitting time and / or incorrect postures, inadequate and poorly organized furniture and / or sedentary lifestyle. In addition, pain in the cervical region can be explained due to overload by tilting the head while using the device. The study by Saueressig et al. (Saueressiget, 2005), points out that the prevalence of pain in the cervical region can be due to the level of stress among adolescents, especially those who are in the preparatory phase for college entrance exams and other extracurricular activities. Other anatomical locations described in the literature are the shoulders, as a result of the overload due to the effort to hold the device in the same position and in the hands and fingers due to the repetitive movements of typing⁷. Musculoskeletal pain is directly proportional to the usage time of digital screens (Hakala, 2012; Silva, 2015; Queiroz, 2017; Suris, 2014; DeVitta, 2011 and Sekiguchi, 2017). In the literature, the values used as a reference point for the characterization of the high periods of time for using electronic devices vary between 2 and 5h / day. Therefore, it can be inferred that the time spent using digital screens in the evaluated studies is high. According to previous studies, the total time spent by adolescents in one week using digital screens can vary between 80 and 840 min. This variation can be explained by the level of technological and economic development of a given country or region. The study

by Hakala et al., for example, indicates that the use of digital screens for 14 hours or more during the week (corresponding to ≥ 2 hours / day) is related to moderate to severe pain, affecting the daily lives of adolescents, as well as their quality of life. On the other hand, the study by Queiroz et al., associates the presence of musculoskeletal pain with screen time, stating that these pains are greater with the simultaneous use of two screens (computer, internet, electronic games, television). The study by Suriset al.¹³ corroborates these findings by stating that the simultaneous use of screens over 4 hours a day causes musculoskeletal pain. Therefore, depending on the type of mesh and its frequency, musculoskeletal pain can vary in intensity and anatomical location.

Conclusion

There is an association between musculoskeletal pain and time spent using digital screens. The easy access to digital screens, as well as the information they provide, contributes to the excessive use of these devices that cause musculoskeletal pain. Finally, it is important to emphasize that it is essential to carry out studies that develop strategies for the promotion of health and quality of life of adolescents.

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