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A Sedentary Lifestyle in Children Causes an Increased Risk of Pain

Jaimey Danielson-McKeague

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Abstract

Background: Healthy behavior in children is a concerning topic of discussion especially with the obesity epidemic continuing to grow in the United States. "Not only does a sedentary lifestyle have implications for physical fitness, per se, it also has profound implications for physical, cognitive and psychosocial development."[1]

Methods: An exhaustive literature search was conducted using CINAHL, Clinical Key, MEDLINE-PubMed, MEDLINE-Ovid and Web of Science using the keywords: sedentary lifestyle, pain and children/ adolescence. GRADE was utilized in assessing the quality of the evidence.

Results: A total of three articles met the eligibility criteria and were included in this systematic review. The results demonstrate a correlation between a sedentary lifestyle and pain complaints in children. The first study, Vierola et al[2] was an observational study that demonstrated a higher sedentary lifestyle and lower cardiorespiratory fitness results in more pain complaints in children. The second study, Brindova et al[3], proved adolescents who watched television or used the computer for more than 3 hours had an increased risk of reporting multiple pain complaints as compared to children who watched television less than 2 hours per day. The third study, Lopez et al[4], demonstrates boys who spent more time watching TV and using their computers had a significantly higher incidence of reporting low self-perceived health suffering from pain.

Conclusion: Studies reveal the positive association of a sedentary lifestyle and decreased health and pain complaints in children. However, additional studies need to be conducted to further evaluate this correlation.

Keywords: *Sedentary lifestyle, pain, children/ adolescence*

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A Sedentary Lifestyle in Children Causes an Increased Risk of Pain

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Biography

Jaimey Danielson-McKeague is from Northern California. She obtained her undergraduate degree in Athletic Training from San Diego State University in San Diego, CA. She then went on to work as a Medical Assistant at a Podiatry clinic in the state of Washington before continuing to the Physician Assistant program at Pacific University of Oregon. She plans to stay in the pacific northwest to continue her career as a PA.

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Table I: Quality Assessment of Reviewed Articles								
Study	**Design**	**Downgrade Criteria**					**Upgrade Criteria**	**Quality**
		Limitations	**Indirectness**	**Inconsistency**	**Imprecision**	**Publication bias**		
Vierola et al.	**Observational**	**Not Serious**	**Not Serious**	**Not Serious**	**Not Serious**	**Not Likely**	**None**	**Low**
Brindova et al.	**Observational**	**Not Serious**	**Not Serious**	**Not Serious**	**Not Serious**	**Not Likely**	**Dose-Response Gradient**	**Moderate**
Lopez et al.	**Observational**	**Not Serious**	**Not Serious**	**Serious.**	**Not Serious**	**Not Likely**	**None**	**Very Low**
.No correlation within in the female population								

Table 2 Logistic regression models of sedentary behaviour with health complaints among children adjusted for age and gender, Health Behaviour in School-aged Children study collected in Slovakia in 2010

	Headache	Backache	Sleeping difficulties	Feeling low	Irritability	Feeling nervous
Watching TV						
Less than 2 h	1	1	1	1	1	1
2–3 h daily	1.08 (0.95–1.22)	0.94 (0.82–1.08)	0.92 (0.80–1.06)	0.90 (0.80–1.02)	1.05 (0.94–1.18)	1.03 (0.92–1.15)
More than 3 h	1.26 (1.09–1.46)**	1.07 (0.91–1.26)	1.07 (0.91–1.23)	1.18 (1.02–1.37)*	1.21 (1.05–1.38)*	1.17 (1.02–1.34)*
Work with PC or play PC games						
Less than 2 h	1	1	1	1	1	1
2–3 h daily	1.18 (1.05–1.32)**	0.98 (0.86–1.12)	1.02 (0.89–1.16)	1.12 (1.00–1.27)	1.21 (1.08–1.35)**	1.10 (0.99–1.23)
More than 3 h	1.67 (1.45–1.90)***	1.28 (1.10–1.49)**	1.43 (1.24–1.66)***	1.46 (1.27–1.67)***	1.54 (1.35–1.75)***	1.52 (1.34–1.73)***

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

List of Abbreviations

PANIC . . . . . .Physical Activity and Nutrition in Children
HBSC . . . . . Health Behavior in School-aged Children

A Sedentary Lifestyle in Children Causes an Increased Risk of Pain

BACKGROUND

Sedentary behavior in children can lead to a domino effect of bad habits and detrimental effects in the future. “Not only does a sedentary lifestyle have implications for physical fitness, per se, it also has profound implications for physical, cognitive and psychosocial development.”[1] More and more kids are spending their free time watching TV, playing video games and spending time on the computer instead of spending time outside and participating in physical activity. Kids are no longer seen on the streets playing games with their friends or riding their bikes around the neighborhood.[1] This may be due to the lack of security that parents feel of not wanting to put their children at risk; however, moving around and being physically active as a child is critical. Without this experience children are denied a vital part of their childhood and development which will affect them throughout adulthood. In the past decade, society has become increasingly technology oriented with Facebook, Instagram, Twitter, video games and watching television, leading to a decrease in physical and social activity. In the UK, there was an annual decline of 25% of children who travelled to school via walking or cycling in the 1980s and a 40% decline in the 1990s.[1] Additionally, there can be some component of responsibility with the parents and their influence as role models for their children. Parents who tend to be sedentary themselves can influence their offspring to follow suit. It is important to give children the opportunity to develop good eating, physical and social habits.

The human body is meant to move, that is why we have fluid joints which enable us to be active. If physical activity is not encouraged or performed than the body deteriorates, becomes weak, joints stiffen and pain ensues. Lack of activity reduces lean muscle mass making it more difficult to perform activities of daily living such as bathing, grocery shopping, getting out of

bed, etc. Regular exercise is needed to maintain healthy muscles and strong bones, decreasing the risk of chronic diseases such as osteoporosis. There is also a mental component to regular exercise. People who maintain an active lifestyle are more capable of "maintaining a sense of emotional well-being"[2] and are less likely to be depressed or have mood swings. It is important to develop these healthy habits early on in life because as a child our bones, ligaments, muscles and joints are continuing to develop.[2]

With these sedentary behaviors becoming common, children may be at an increased risk for developing physical and psychological pain, such as headaches, irritability, feeling low, depression, musculoskeletal pain and abdominal pain. Additionally, it is well established that sedentary lifestyles have an increased incidence of developing chronic illnesses, such as obesity, diabetes, hypertension and chronic pain. These chronic diseases are usually carried throughout adulthood and cause many comorbidities, decrease quality of life and increase healthcare cost. Not only is this a health issue, but it has been shown to contribute to a large part of the socioeconomic burden. Physical activity is an easy and cheap fix for an extremely expensive problem.[3]

This is a global and national epidemic where medical providers can have a huge impact on making a change.[3] Educating parents and guardians who have children is crucial to start making a difference. The purpose of this analysis is to conduct a systematic review on studies that discuss the association between a sedentary lifestyle and pain in children, answering the question: can a sedentary lifestyle in children cause an increased risk of pain?

METHODS

An exhaustive literature search was performed using the databases CINAHL, Clinical Key, MEDLINE-PubMed, MEDLINE-Ovid and Web of Science. The following search terms were used: "sedentary lifestyle," "pain" and "children or adolescence." Articles were included if the study asked populations specifically about pain and health issues, was conducted on humans and was published in English. Articles were also included if it focused on children or adolescents with a sedentary lifestyle who were experiencing pain. Studies were excluded if they focused only on low back pain as an outcome or if the study was performed before the year 2000. Articles were assessed for quality using the Grading of Recommendations, Assessment, Development, and Evaluation (GRADE).[4]

RESULTS

A comprehensive search of related articles was performed. A total of 63 articles were identified from the keyword searches, 10 were identified and assessed for relevancy. Of the 10 articles, 3 articles fit the inclusion criteria for this review. The 3 studies[5-7] being analyzed are all observational, prospective cohort studies that discuss the correlation between a sedentary lifestyle and pain in children. (See Table 1.)

Vierola et al

This observational study[5] used baseline data from the Physical Activity and Nutrition in Children (PANIC) study. There were 739 children invited to participate ranging from 6-8 years old. Of the 739 children, 512 responded to participate and only 439 children had completed data and were able to be used in the study. The participants did not differ in age, sex or body mass

index. The participants and the parents or legal guardians of the participants gave informed consent prior to beginning.[5]

This study assessed 5 different components including: pain, sedentary behavior, physical activity, cardiorespiratory fitness/body size, composition and maturity. Pain was assessed via a questionnaire which was designed to assess pain in a general population and was filled out by the participants' parents. Questions were taken from the Finnish Association for the Study of Pain to include questions such as: "Did your child have pain in the last 3 months and how often in the last 3 months?" They were also asked to note the location of the pain: head, neck, shoulders, abdomen, chest, pelvis, back, upper limbs or lower limbs. Pain was defined as frequent if it occurred greater than once a week and it was defined as multiple pain if the pain was in 2 or more areas in the last 3 months. Parents were also asked if their children have been taking pain medications due to pain. Only 201 children (106 girls and 95 boys) had data on the use of pain medications.[5]

Next, sedentary behavior was assessed. The PANIC questionnaire was used and filled out by the participants' parents. Items assessed included screen-based behaviors, academic tasks, games, arts and crafts, listening to music and sitting and lying for rest. Each item was assessed separately and calculated by adding the time spent in each behavior. The total amount was expressed in minutes per day for weekdays and weekends. Time sitting in class during the school day was excluded from the calculations.[5]

Then, physical activity was assessed and calculated. The PANIC questionnaire was utilized and assessed by the frequency and duration of each individual activity the child participated in. The frequency and duration of the individual activities were multiplied and expressed in minutes per day.[5]

Additionally, cardiorespiratory fitness was analyzed using a maximal exercise stress test. The participants were asked to perform maximal cardiovascular exercise using cycle ergometer and increasing workload capacity. "Maximal workload in watts divided by lean body mass in kilograms [was used] as a measure of cardiorespiratory fitness."[5]

Finally, body size, composition and maturity was assessed in the participants. Children were without shoes and wearing light clothing, fasted overnight and emptied their bladder prior to height and weight measurements. Body fat percentage was calculated with a Lunar dual-energy X-ray absorptiometry device. Overweight and obese children were identified using age and sex-specific BMI scores.[5]

The data revealed that children in the highest sex-specific one-third of total sedentary behavior, including sedentary behavior related to arts and crafts, games and academic tasks, had a 1.95 times increased risk of pain complaints as compared to the children within the lower third category of total sedentary behavior. Children with a higher cardiorespiratory fitness showed to have a 46% decreased risk of complaining of pain and a 50% decreased risk of headaches than children categorized in the lower cardiorespiratory fitness group. Interestingly, children in the highest sex-specific third of body fat content had a 44% decreased risk of pain complaints than children in the lower third of body fat content. Children in the highest and middle third of body fat percentage had a decreased incidence of multiple pain complaints than those in the lower percentage of body fat composition (49% and 46%, respectively). Additionally, children in the highest and middle third had a decreased incidence of lower limb pain (48% and 43%, respectively). Children who were considered obese and overweight did not have any association with complaints of any specific pain conditions. There was also no association between physical activity frequency, duration and pain complaints.[5]

Brindova et al

This observational study[6] used data from the Health Behavior in School-aged Children study (HBSC). There were 108 schools that were contacted to participate in the study and 106 responded. Of the schools that decided to participate, 1 class was selected at random from fifth to ninth grade from each school to get a representative sample. Children who were younger than 11 or older than 15 were excluded to make the sample more homogenous. After all said and done, a total of 8042 children participated in the study.[6]

Questionnaires were administered to the participants by a trained research assistant in the absence of a teacher present. Physical activity, screen-based behavior and physical and psychological health complaints were measured. Physical activity was assessed via a questionnaire by asking the number of days of moderate to vigorous activity (any activity that causes increased heart rate and breathlessness) was performed within the week. "Responses were in a range from 0 to 7 days, and based on the WHO recommendation were classified into three categories as follows: (1) active less than 2 days, (2) active at least 3 days, (3) active every day."[6]

Next, screen-based behavior was assessed by the amount of time spent watching or playing games on the television (Xbox, PlayStation, etc.) and working or playing on the computer. Each activity was asked separately with the same 9 responses: none, 0.5 hours per day, 1 hour per day, 2 hours, 3 hours, 4 hours, 5 hours, 6 hours or 7 or more hours per day. "Using the recommendations of the American Academy of Pediatrics they were classified into three categories as follows: (1) active less than 2 hours per day, (2) active 2-3 hours per day, (3) active more than 3 hours per day."[6]

Finally, 8 different physical and psychological health complaints were assessed including, headache, stomachache, backache, feeling low, irritability/ bad temper, feeling

nervous, sleeping difficulties and feeling dizzy. Responses included never experiencing pain, experiencing pain every month, every week, more than once a week or every day. These groups were dichotomized into 2 groups of those who had pain complaints every week or more and those who experience pain less than every week.[6]

As shown in Table 2[6], adolescents who watched television for more than 3 hours had an increased risk of reporting headache, feeling low, being irritable or feeling nervous as compared to children who watched television less than 2 hours per day. Similarly, children who worked or played on the computer for greater than 3 hours per day reported an increased incidence of health complaints. There was a 1.3 times increased incidence of back pain, 1.4 times increased complaints of sleeping difficulties, 1.5 times higher incidence of feeling low, nervous or being irritable and a 1.7 times increased incidence of headache complaints as compared to children who spent less than 2 hours per day on the computer either doing homework or playing games.[6]

Lopez et al

This is an observational study[7] which randomly selected 2293 children from 16 educational centers from 8 Andalusian provinces. There was a "two-phase, proportional cluster sampling, using the database of the census of the Andalusian Autonomous Community as a reference."[7] Twenty schools were chosen to participate in the study and whole classes from each school was selected at random. The participants, parents and teachers were given a detailed verbal description and instructions on how the study was designed and written consent was given.[7]

This study assessed self-perceived health, pain, well-being, physical activity and sedentary lifestyle via the Health Behavior in School-Aged Children (HBSC) questionnaire. The

questionnaire assessed the participants self-perceived health by asking a single question: "You would say that your health is poor, reasonable, good, excellent."[7]

Pain was also assessed by a single question: "In the last 6 months, how often have you felt the following: headache, stomachache, backache, feeling low, irritable or bad temper, feeling nervous, difficulty sleeping, or dizzy?"[7] Responses were dichotomized into 2 categories: never or sometimes.[7]

Well-being was assessed by asking the participants, on a scale from 1 to 10 where would you place yourself, 1 being the lowest and 10 being the highest sense of well-being. Responses were dichotomized to separate the teens who answered the highest self-perceived well-being into sometimes or always.[7]

Physical activity was assessed based on moderate to vigorous activity performed for at least one hour per day in the previous week as well as in a typical week. The responses were dichotomized into 2 items, inactive or low and active or high physical activity.[7]

Lastly, sedentary lifestyle was assessed by asking the participants the amount of time in hours they spent watching TV, using the computer and spending time on homework on weekdays and weekends. There were 9 options available to choose from: 0 hours, half an hour, 1 hour, 2 hours, 3 hours, 4 hours, 5 hours, 6 hours, and 7 hours. These options were classified further into 3 options as less than 2 hours per day, 2-3 hours, and greater than 4 hours per day.[7]

The data shows that boys who spent more time watching TV and playing on the computer had a significantly higher incidence of reporting low self-perceived health compared to the boys who reported excellent well-being. Additionally, boys who report more time spent watching TV

or on the computer have a significant increase in reports of suffering from pain. The study did not find any association between sedentary lifestyle and pain in girls.[7]

DISCUSSION

Are children at an increased risk of developing pain if they have an increased sedentary lifestyle? According to the 3 studies[5-7] analyzed, the correlation between a sedentary lifestyle in children and health complaints is evident. Vierola et al[5] observed that an increased sedentary lifestyle, decreased cardiorespiratory fitness and decreased body fat content increased the likelihood of prepubescent children complaining of pain. Brindova et al[6] found similar results of children who spent more than 3 hours per day watching television or playing on the computer had an increased incidence of pain (see Table 2). Additionally, Lopez et al[7] correlated that boys who had a high sedentary lifestyle and low physical activity were more likely to perceive their health as low.

In Vierola et al[5] the finding of a high body fat percentage and lower pain complaints was not to be expected. If a child has a higher percent body fat it is assumed that they are either overweight or obese which is commonly associated with increased musculoskeletal pain and headaches; however, this study observed the opposite. One reason for this finding may be due to the age of the children who were participating. The children were mostly prepubertal which can account for a lack of significant body change which occurs after puberty. Only 2% of the children participating in the study had gone through puberty, only 14% of the participants were overweight and of those, 5% were considered obese.[5] It is thought that since these children have only had a short exposure to the increased weight that they have not developed the negative effects of musculoskeletal pain and the other pains that comes with increased weight. It is also suggested that increased adipose tissue helps protect tendons and ligaments in children.[5]

Children who have a lower body fat percentage do not have the extra layer of protection resulting in more pain to their bodies.

Brindova et al[6] discusses different pain complaints in relation to different types of sedentary behavior a child displays. For example, an adolescent who spends most of their time watching television versus a child who plays more computer games will have different kinds of pain. It is shown that children who spend more time on the computer have more health complaints as compared to children who spend more time watching television.[6] Additionally, based on the screen-based behavior different areas of the body are affected. For example, TV and computer use was shown to increase headaches, shoulder, neck and back pain. This phenomenon may be due to lack of proper posture and slouching among children while performing these sedentary behaviors. Another finding that all three studies[5-7] found was that physical activity cannot counteract the amount of time being sedentary. Therefore, if a child spent 4 hours per day sitting, physical activity would not cancel out their sedentary behavior.

All studies[5-7] were cross-sectional and observational in nature, restricting the ability to account for all factors and set many limitations on the quality of the studies. Two of the three studies[5,7] were unable to account for the chronology of pain, whether the pain was due to a sedentary lifestyle or if the sedentary lifestyle was caused by the pain. One of the three studies[6] performed a baseline assessment of the children and excluded anyone who had prior pain or a current health issue before beginning the study. Additionally, all three studies[5-7] used self-reported data via questionnaires. One of the studies[5] had the parents of the participants fill out a questionnaire and the other two studies[6,7] used trained researchers to give the questionnaires to the participants. Since obtaining subjective information via questionnaires is often the only route

of collecting data for pain and sedentary behavior there is likely to be some underreporting or over reporting of the participant's behaviors that needs to be addressed and accounted for.

Even though, the correlation between sedentary behavior and pain in children is significant, additional studies need to be completed to adequately assess for all the possible variables that could have affected the outcome of pain in children. Although, variability existed throughout the three different studies,[5-7] they had similar ideas and similar results to one another. The age groups for each studied varied slightly from each other. Vierola et al[5] specifically looked at prepubescent children, ages 6 to 8, whereas, Brindova et al[6] and Lopez et al,[7] observed children from 11 to 15 years and 12 to 16 years old, respectively.

Despite these limitations to the studies there were also some strengths. All three studies[5-7] had a large representative sample of the population which had an equal number of girls and boys participating. There were also some statistically significant data with suitable confidence intervals and P values that were below 0.05. The seriousness of this problem needs to be understood for future studies to be conducted to show additional correlations, then research can focus on appropriate interventions to address sedentary lifestyles and increased risk of pain.

CONCLUSION

Children begin their growth and development from day one. Their development is influenced by their environment, education, genetics, social life and even by the level of education of their parents and guardians. These factors are exacerbated throughout the entirety of the child's life. It is important to engage children in good, healthy behaviors before they begin to develop bad habits, such as playing video games or watching television all day. As media and technology continues to grow in popularity in our society, more and more kids have increasing

access to smartphones, tablets, and iPads at a younger age. Children develop social, motor, and cognitive skills by being active and engaging with other kids, rather than being cooped up indoors in front of a screen. There are many benefits to an active lifestyle, including, less medical issues, enhanced mood, decreased stress, increased self-confidence and a higher overall quality of life. Medical providers can use the association of sedentary activities and increased risk of pain and health complaints to educate parents of the importance of a well-balanced healthy lifestyle for their children.

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