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Review

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Low Back Pain in Childhood and Adolescent Phase: Consequences, Prevalence and Risk Factors – A Revision

Beatriz Minghelli*

Research in Education and Community Intervention (RECI), School of Health Jean Piaget Algarve, Piaget Institute, Portugal

***Corresponding author:** Beatriz Minghelli, PhD, Research in Education and Community Intervention (RECI), School of Health Jean Piaget Algarve, Piaget Institute, Escola Superior de Saúde Jean Piaget/Algarve Enxerim – 8300-025, Silves, Portugal, Tel: 250-721-7535; E-mail: beatriz.minghelli@silves.ipiaget.pt

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Abstract

Low back pain (LBP) has become a growing and serious public health problem in children and adolescents, presenting a relatively high prevalence during school age, representing a significant negative impact, being commonly associated with the demand for health care, medication use, increasing absenteeism and with a decrease in quality of life. Because of that, the presence of LBP can lead to very high economic consequences, both due to direct financial costs and due to absenteeism. Most cases of LBP are due to non-specific causes; however, the role of these risk factors is still controversial. Several factors may be involved in the pathogenesis of LBP, such as physical, genetic, mechanical, behavioural, and environmental factors. The school environment, including the postures adopted by students and the transportation of backpacks, and some lifestyle habits are factors that can also contribute to the development of these musculoskeletal disorder. Against this scenario, it´s necessary to promote intervention actions with the objective of promoting and preventing health, considering that most health problems and risk behaviors, which are associated with the environment and lifestyles modifiable risks, can be minimized, or prevented by increasing health literacy; this intervention actions mus involved not only students but the entire school community.

Keywords: Low back pain; Adolescent; Prevalence; Risk factors

Low Back Pain and its Consequences

LBP (LBP) is characterized by the presence of symptoms in the lower back that include pain, muscle tension or stiffness [1], not consisting of any disease [2].

Lumbar pain is a symptom that may or may not be associated with a disease, and approximately 80% to 85% of the LBP episodes have no known cause [2].

LBP affects more than 80% of individuals at some point in their lives, occurring in similar proportions across all cultures and interfering with quality of life [2,3].

Acute LBP is the most common form and is usually self-limited, lasting less than three months, regardless of treatment. Chronic back pain is a more complex problem, which often has a strong psychological overlap [2].

In adults, LBP is the most frequent cause of morbidity and disability and the problems that this disorder can cause involve the impediment of the exercise of some professions by the generated incapacity, which causes individuals to request medical leave, which causes costs for the individual and for society [4,5]. In Portugal, it is estimated that the annual costs associated with chronic back pain represent €739.85 million per year [6].

Occupational LBP is the major cause of absenteeism and disability, accounting for most cases of premature disability and early retirement applications. For employers, LBP in their workers leads to reduced productivity and increased costs for unworked days, for the payment of health insurance and for disability compensation payments. In this context, LBP is one of the main reasons for medical consultations, hospitalizations, and surgical interventions, and is associated with a significant economic and social impact [4,5].

LBP has become a growing and serious public health problem in children and adolescents, presenting a relatively high prevalence during school age [3,7]. This disorder is very common in adolescents in general, since they participate in a large number of activities, without a good level of strength in the abdominal musculature and in the spine extensors, and with a limited flexibility of the hamstring muscles [8]. The period of rapid growth is a risk factor for the development of LBP in adolescents [9,10].

LBP in young adults has a significant negative impact, being commonly associated with the demand for health care, medication use, increased absenteeism [11,12] and with a decrease in quality of life [11]. One out of six adolescents with LBP seeks medical assistance [13].

Jones et al. [14] study evaluated 500 students aged 10 to 16 years and found that most students who presented acute LBP didn´t show any disability as a consequence. However, 13.1% of students who presented with recurrent LBP exhibited disabilities, 23.1% visited a doctor because of pain, 30.8% reduced physical activity, and 26.2% missed classes at school because of LBP.

The results of Gunzburg et al. [15] revealed that 23% of students with LBP had sought a medical service or physiotherapist because of this disorder, allocating a greater effort to the health system. The research by Watson et al. [16] revealed similar results, where 24% of students with LBP reported that they had sought a doctor the previous year because of LBP symptoms.

In this context, the presence of LBP can lead to very high economic consequences, both due to direct financial costs and due to absenteeism, be it in the school during adolescence or work in adulthood.

Hestbaek et al. [17] carried out a prospective study with eight years of follow-up aiming to describe the evolution of LBP from adolescence to adulthood. The results of the study indicated to LBP in adolescence as a significant risk factor for the development of LBP in adult life. Thus, the evaluation of pain in children and adolescents is of fundamental importance not only because it impairs their health as a young person, but predisposes them to the development of chronic pain in adulthood [10,13].

Prevalence of Low Back Pain: At the Moment, in the Last Year and Throughout Life

As mentioned previously, LBP is a growing public health problem in children and adolescents, since its prevalence has been increasing over the years [3,7,18]. The presence of LBP in Finnish adolescents was much more common in 1999 than in 1991 and even more present in 2001 compared to 1999. Substantial changes in lifestyles may have contributed to this LBP increase in such as increased time spent on the use of computers and electronic games [18].

A recent meta-analysis [19], which included 59 articles, found that the punctual prevalence of LBP obtained in 10 studies was 12%), the mean annual prevalence obtained in 13 studies was 34% and the mean lifetime prevalence obtained in 30 studies was 39% in children and adolescents.

Louw et al. [20] performed a systematic review involving LBP prevalence studies in African adolescents and the results pointed to a mean punctual prevalence of LBP among adolescents of 12%, annual prevalence was 33%, and the lifetime prevalence of 36%.

Diepenmaat et al. [21] evaluated 3,485 Dutch adolescents aged 12 to 16 during the years 2002 and 2003 and found a prevalence of LBP in only 7.5% of adolescents.

The study by Vitta et al. [22] evaluated 1,236 students in São Paulo, Brazil, aged 11 to 14 years, and found a prevalence of LBP of 19.5% in the last year i.e., 2007.

The results of the study by Watson et al. [16] in 1,446 adolescents aged 11 to 14 years in the Northwest of England revealed a prevalence of LBP in the month prior to the study of 24%. Jones et al. [14] found a lifetime prevalence of LBP of 40.2% in a sample of 500 adolescents aged 10 to 16 years of North West England, an annual prevalence of 13.1% and punctual (previous week) of 5.5%.

Sato et al. [23] evaluated 43,630 students aged 9 to 15 years from the city of Niigata, Japan. The point prevalence of LBP was 10.2% and the lifetime prevalence was 28.8%.

Masiero et al. [24] evaluated the annual prevalence (in 2005) of LBP in 7,542 Italian adolescents from 13 to 15 years of age; 1,180 (20.5%) adolescents reported one or more episodes of LBP.

Kristjansdóttir [25] evaluated 2,173 Icelandic adolescents between the ages of 11 and 16 and found an annual prevalence of LBP in 44.1% of the students, and the prevalence of weekly at the time of the study was 20.6 %.

The study by Tiira et al. [26] included 1,987 18-year-old Finnish students, where 50% of girls and 42% of boys reported having had low back pain during the previous year.

Harreby et al. [27] evaluated 1,389 Danish adolescents aged 13 to 16 years and the results showed a lifetime prevalence of LBP of 58.9% and an annual prevalence of 50.8%. Recurrent moderate to severe LBP was recorded in 19.4% of adolescents.

A prospective study by Sjolie [28] evaluated lumbar pain in 88 Norwegian adolescents 14 and 15 years old at baseline and 85 adolescents after 3 years. LBP was reported by 58% of the adolescents at the beginning of the study and by 39% after the study period.

Feldman's research [10] evaluated, during 1995 and 1996, 502 high school students in Montreal, Canada. Three distinct evaluations were carried out at six months' intervals. Of the 377 adolescents who didn´t complain of LBP in the initial evaluation, 65 developed LBP throughout the year, with a lifetime LBP incidence of 17%.

The longitudinal study of Poussa et al. [9] was followed by 430 Finnish adolescents, who were examined five times: at 11, 12, 13, 14 and 22 years of age. The lifetime LBP incidence increased from 18.4% in girls and 16.9% in boys to 78.9% and 78.4%, respectively. The lifetime prevalence of LBP increased from 17%, with the mean age of 14 years, to 76%, with the mean age of 22 years.

Minghelli et al. [29] study evaluated a sample of 966 adolescents from southern Portugal, aged between 10 and 16 years, and the results revealed that 152 (15.7%) students had LPB at the present time, 456 (47.2%) had experienced it in the last year, and 600 (62.1%) had lifetime prevalence of LBP.

Low Back Pain Etiology

Several factors, such as genetic, psychosocial, physiological, anthropometric and environmental, among them ethnicity, age [30-32], sex [31,33], smoking [30,31], obesity, sedentary activities such as television watching and computer use, physical activity, adoption of inappropriate postures and transportation and excess weight in school backpacks have been identified as risk factors for LBP. The role of these factors in the development of LBP is still controversial, and since the etiology of LBP is multifactorial, the interaction between these risk factors should also be analyzed. Given this, there is still no solid evidence that the modification of these factors has a preventive effect on LBP in adolescents [31,33].

Non-modifiable risk factors

The relationship between the presence of nonspecific LBP among parents and their children has been significantly associated in several cross-sectional studies, indicating a possible role of genetic, environmental and/or psychosocial factors in the development of LBP [34].

There is evidence of a relatively strong genetic component in the development of LBP, both in the young and in the adult [30], where the genetic influences on pain may be related to the degeneration of the intervertebral disc [35]. Additionally, there is also evidence that the family context, in a broad way, can play an important role in attitude and the perception of pain [24,34].

The Masiero et al. [24] study found a positive association between the presence of LBP and family history (OR=1.75, 95% CI 1.53-2.00).

The investigation by Yao et al. [36] included 1,214 Chinese adolescents, and the results revealed that family history was related to the presence of LBP (OR=2.57, 95% CI: 1.85-3.58), however the Kovacs et al. [37] study, performed in adolescents living in the island of Majorca (Spain), didn´t verify this relationship.

The study by El-Metwally et al. [38] conducted between 1995 and 1998 from a sample of 1,790 pairs of 11-year-old Finnish twins born between 1984 and 1987 found no statistically significant differences in monozygotic pairs and dizygotic of both sexes, suggesting little genetic influence. The results obtained from the genetic model suggest that 41% of the total variance in LBP could be attributed to shared environmental factors within families and 59% to unique environmental factors (not shared). The results of this study suggest that genetic factors play a small role in the presence of LBP in adolescents, and the symptoms appear to be related to an interaction between shared and non-shared environmental factors.

Regarding ethnicity, the Olsen et al. [39] study evaluated 1,242 American adolescents aged 11 to 17 years, with a prevalence of LBP in 30.4% of the sample, where adolescents with 15 years of age and black race showed a higher prevalence of LBP when compared to Caucasians of the same age (47% versus 31%). The same was observed by Onofrio et al. [40] who verified that non-Caucasian adolescents were those that showed a higher prevalence of LBP (OR=1.4; 95% CI: 1.0-1.9; p=0.05).

There is increasing evidence that psychological and psychosocial factors also play an important role in the etiology of LBP [33]. The feeling of psychological distress [9,41,42] and depression may contribute to persistent LBP in adolescents [9]. The study by Diepenmaat et al. [21] found that depressive symptoms were associated with LBP, and Watson et al. [16] observed strong associations of LBP with emotional problems.

The literature shows that both the prevalence and the incidence of back pain increase with age [14,16,25,34,43,44]. Older children may be more exposed to physical and environmental aggression because of their increasing range of activity in terms of frequency and intensity than younger children. In addition, older children tend to show a greater propensity for pain because of their uncertainties in conceptualizing a multitude of bodily sensations associated with puberty that are not related to actual problems that effectively threaten health [45].

Kristjansdottir and Rhee [45] applied a self-administered questionnaire on 2,173 Icelandic adolescents between the ages of 11 and 12 and between 15 and 16 years old and found that the group of older individuals reported back pain more frequently than the younger group.

Shehab and Al-Jarallah [44] found that the prevalence of LBP was higher with increasing age, where at 10 years 31% of adolescents reported lower back pain compared to 74% with ages of 18 years; there was an increase in LBP after 12 years of age, possibly reflecting pubertal growth and increased spinal stress due to a longer duration of sitting in school.

Several studies have suggested that the prevalence of LBP is higher in girls than in boys [22,24,27,28,40,46] although there is still no consensus in the literature on the role that sex plays in LBP [24,33,34].

As examples, the Kovacs et al. study [37] found a higher prevalence of female LBP (OR=1.11; 95% CI: 1.04-1.19; p<0.001), as well as Masiero et al. [24] (OR=1.94; 95% CI: 1.71-2.21; p<0.001).

On the other hand, the results of some studies have shown that boys have a higher risk of presenting LBP [38,47] or that there aren´t statistically significant differences between the sexes [14,25,45,48,49].

The higher prevalence of LBP in females is probably due to a distinct pain threshold and the different way in which both sexes perceive pain [24], greater spine flexibility in females compared to males [24,34] and pubertal growth such as the hormonal changes induced at puberty that can affect attitudes or perception of pain [24].

The prevalence of LBP may be higher in girls, but it is also possible that the existence of pain may be more acceptable for girls who complain of pain than for boys [21]; there is a tendency in boys to omit or deny symptoms associated with LBP because they don´t care about them [50].

As for pubertal growth, girls begin puberty before boys [48,51], and may reflect a direct relationship between the rapid growth of musculoskeletal structures and LBP [48]. However, in the Jones et al. [43] study no association was observed between LBP and menstruation in girls.

Modifiable risk factors

Factors like a sedentary and unhealthy lifestyle in young people associated with self-reported low back pain include smoking, obesity, and sedentary lifestyle [30].

Few studies have investigate the relationship between tobacco consumption and back pain in children and adolescents [34]. Some studies haven´t found a positive association between LBP and smoking [24,36,37,40]. However, the Feldman et al. [10] study found an association between smoking and back pain (OR=2.20; 95% CI: 1.38-3.50), an association also observed in other studies [27,45,52,53].

The explanation for this relationship between smoking and LBP could be explained by reduced oxygenation of spinal structures caused by smoking [30,54], or by a long-term effect on the nervous system that aggravates musculoskeletal pain. The consumption of tobacco causes the degeneration of the intervertebral disc due to its malnutrition caused by nicotine, through the reduction of blood flow followed by local hypoxia [45,53], however this fact may not apply in childhood and adolescence. Moreover, this habit may be indirectly related to psychological or social problems that are the main causes for the development of severe LPB [45].

Regarding the anthropometric parameters, the literature presents an association between LBP and some anthropometric parameters, namely body mass index (BMI), however this fact is not fully understood [34]. Although there´s some evidence that adolescents with LBP may be overweight, there is little evidence to suggest that BMI is associated with the onset of LBP symptoms [33].

Obesity, which usually results in waist circumference increased, may alter the spine curvature and result in back pain [2]. In addition, obesity may increase the mechanical load on the spine [30,54-58], increasing the compression force on the structures of the lumbar spine during several activities and decreasing the mobility of the spine, which may interfere with nutrition of the disc intervertebral [54,57,58]. In addition, obesity is often associated with dyslipidemia, which plays an important role in the development of atherosclerosis in obese individuals, which can lead to malnutrition of the intervertebral disc cells, potentially predisposing it to degeneration [54,57].

Obesity can also cause LBP through chronic systemic inflammation, as it is associated with increased production of cytokines and acute phase reactants and with the activation of the proinflammatory pathways, which in turn can lead to pain [54,57].

Another possibility that a high BMI is associated with LBP can be explained by a psychological tension due to non-satisfaction with the present aspect, with stress being the direct cause of LBP [58].

There´s also the hypothesis that an individual with LBP may be predisposed due to physical inactivity or inability to exercise; to gain weight thus increasing their BMI with LBP being a factor that may contribute to the development of obesity. It may also be assumed that obesity alone has no influence on LBP but that certain types of obesity may be present in individuals with a sedentary lifestyle, this combination of several sedentary habits that cause LBP [30,55,56].

A review of the literature has shown that the data available at this time are controversial, with no evidence of the association between LBP and obesity [59].

Leboeuf-Yde et al. [55] realized a cross-sectional study on a sample of 29,424 twin individuals aged between 12 and 41 years. Low-weight individuals reported a lower prevalence of LBP (OR<1) than those with higher weight, however, this positive association between BMI and LBP wasn´t significant when monozygotic twins, who were different in classification weight, were studied.

Several studies have found a statistically significant association between LBP and BMI [27,46,52,54,57,58]. Mikkonen et al. [41] evaluated 1,660 Finnish adolescents aged 7 to 19 years and found that overweight was associated with persistent LBP in adolescence.

Other studies didn´t find a positive association between the presence of LBP and BMI [16,24,36,37,40,48,60]. Kovacs et al. [37] evaluated 7,048 adolescents between the ages of 13 and 15 on the island of Mallorca, Spain, and found no association between LBP and BMI. The investigation by Korovessis et al. [61] evaluated 3,411 students aged 9 to 15 years and the results showed that BMI wasn´t related to the presence of LBP.

In addition to the development of obesity, the constant practice of sedentary activities is also associated with the presence of back pain. Several studies have demonstrated a significant relationship between time to watch television and LBP [44,45,62]. In Sjolie study [62], LBP was associated with time spent watching television or using the computer for more than 15 hours a week; this association may be due to the prolonged sitting position and/or poor posture adopted when watching television and/or lack of physical activity [25,44,48], or, perhaps, back pain may lead them to be less active [44].

Some studies haven´t found associations between the amount of sedentary activity, that is, watching television and using computers, and LBP [21,27,28,36,40,62], that is, there isn´t evidence of a causal relationship between a sedentary lifestyle and LBP, neither in the young nor in the adults [30].

A sedentary lifestyle can lead to reduced muscle strength and flexibility, as well as having an adverse effect on proprioception, all of these contributors to an unstable spine, thus being more prone to injury [30].

The practice of physical activity in a continuous and properly performed way, can prevent LBP, promoting the improvement of flexibility and muscular strength [22,24,27,34,48], however the results of the literature on the relationship between LBP and spine mobility and flexibility, as well as muscular strength are still contradictory [31,36]. The Sjolie study [63] found that LBP reported during the previous year was associated with physical activity performed less than three times a week.

The Mikkelsson et al. [41] study found that school-age boys who participated in physical activities had a lower risk of recurrent LBP (OR=0.61; 95% CI: 0.42-0.88) than those who didn´t.

Wedderkopp et al. [63] found that high levels of physical activity in childhood (starting at age 9) appear to protect against future LBP in early adolescence (at 12 years of age). Less active children were three times more likely to start LBP after a period of three years later.

It is considered that physical activity can function as a protective factor avoiding back pain by improving strength and musculoskeletal flexibility, as previously reported [22,25]. However, a spine subjected to high physical demands may also present a disadvantage [30].

Sjolie research [62] found that the practice of physical leisure and physical activities were considered common situations that cause LBP, being reported by 24% and 18% of adolescents, respectively. Shehab and Al-Jarallah [44] found that LBP was associated with increased physical activity.

Inappropriate postures adopted by students in the classroom and at home can also be considered a factor for the development of LBP. Sjolie's investigation [62] found that the most common situations that caused LBP were manual work (70%) and sitting at school (48%) and the Bockowski et al. [7] study found that the incorrect posture, especially sitting position, was associated with the presence of LBP in 13.9% of hospitalized adolescents. Grimmer and Williams [48] also found associations between recent LBP and the amount of time spent in seated posture. In this way, the school environment is also a factor that can contribute to the development of LBP, especially in adolescents where school furniture isn´t adjusted to the anthropometric dimensions of its users, leading to the adoption of inappropriate postures in classrooms, where they are the largest part of the time [64].

The excessive weight and the transport form of the school backpack are also factors that can contribute to the development or aggravation of back pain, however the studies also present divergences in their results. There is evidence that transporting a heavy backpack may result in anterior trunk flexion and there are indications that backpacking may induce other postural adaptations. The increase in weight in backpacks leads to changes in posture in an attempt to maintain balance [65].

Trevelyan and Legg [66] found that carrying the backpack on one shoulder was associated with the presence of LBP in the last 7 days, in the month prior to the study and at the moment (p<0.05). The results of Yao et al. [36] study revealed that the feeling of discomfort due to transport of the backpack (OR=1.38; 95% CI: 1.11-1.72) was positively correlated with the self-reported presence of LBP, however, there weren´t associations between excess weight of the backpack and its transport with the presence of LBP (p>0.05). The study by Heuscher et al. [67] suggests that the increase in backpack weight is associated with an increase in the prevalence of annual LBP, as well as the research by Sheir-Neiss et al. [46] where the excessive backpack weight was associated with back pain (OR=1.98, p<0.0001).

Grimmer and Williams [48] study found associations between recent LBP and backpack load and the time spent carrying it, and in the study by Skaggs et al. [12] the back pain was also associated with the use of the backpack with excess weight (p=0.001).

Minghelli et al. [29] study showed that students who sit with the spine incorrectly positioned presented 2.49 greater probability of having LBP, students using improper positions for watching TV or playing games have 2.01 greater probabilities, and those who adopt an incorrect standing posture have a 3.39 greater chance of experiencing LBP.

Muscle fatigue is thought to be the major contributor to the pain felt by students during the use of backpacks, however, a study that has been complemented with the assessment of muscle activity through electromyography in adolescents is unknown [68].

Several studies didn´t find an association between the method of transporting the school material [12,15,37,44,61,62,69] and its excess weight [42,42,43,66] with the presence of LBP.

Conclusion

Against this scenario, it´s necessary to promote intervention actions with the objective of promoting and preventing health, considering that most health problems and risk behaviors, which are associated with the environment and lifestyles modifiable risks, can be minimized or prevented by increasing health literacy.

The prevention of the disease requires an advance action, based on the knowledge of the natural history of the disease, implying the epidemiological knowledge for the control and the reduction of the risk of diseases. In this way, prevention and education projects are based on scientific information and normative recommendations, considering also that investments in prevention are generally less expensive than those applied in the management and treatment of the disease [70].

In this context, a set of initiatives should be promoted, considering awareness actions and strategic activities, in concert with various elements internal and external to schools, in the context of the prevention of LBP.

The performance of health professionals in schools should therefore involve a salutogenic approach in order to create in schools a stimulating environment of creativity and a critical sense, not just an intervention aiming at changes in risk factors. It´s necessary to give empowerment and motivation so that children and young people and the entire school community are responsible for their health choices.

Conflict of Interest

None

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