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Epidemiology of Non-Specific Back Pain in Children and Adolescents: a Systematic Review of Observational Studies

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Abstract

Objectives: The aim of this study was to determine the prevalence and incidence of NSBP, and to identify its predisposing factors in children and adolescents. Study Design: Systematic review.

Materials and methods: A review of English articles was performed between 2005 and March 2012 using the following databases: PubMed, CINAHL and Web of Science. Inclusion criteria: published in peer-reviewed journals, written in English, samples aged between 6 and 18 years, with NSBP, and contained information of prevalence, incidence or predisposing factors. Two independent reviewers were involved in all phases. The methodological quality was assessed, using a standardized instrument.

Results: From the 1087 studies identified, only 35 fulfilled the inclusion criteria. Their methodological quality showed an average score of 10, 32 out of 15. Great variability's in the definition of NSBP and in reported prevalence periods were found. Meta-analysis suggest NSBP prevalence's of 24, 33% (95%CI: 18, 22%-31, 7%) – last month; between 17, 4% and 51, 3% - last 3 months; between 15, 6% and 61, 1% - last 6 months, between 17, 1% e 54, 1% - last year. The results regarding the incidence of NSBP were not conclusive, nor was it possible to identify consistent and conclusive evidence in the associations between NSBP and the different analyzed factors.

Conclusions: The results presented in this study indicate a relatively high prevalence of NSBP in young population. There is a scarcity of studies concerning predisposing factors and also disagreements in the results. Further research is required, using prospective cohort designs.

Keywords: Back pain; Children/adolescents; Prevalence; Incidence; Predisposing factors; Systematic review

Introduction

Non-specific back pain (NSBP), defined as pain without specific cause or pathology [1], is a common complaint among young people that has been related with low back pain in adults [2]. Several studies have reported that the first symptoms of NSBP took place during childhood and adolescence, and continue into adulthood [2,3], with established associations between back pain in children and adults [4-6]. Recent research findings also showed that a great percentage of adults who search for health care services due to back pain, refer to having had pain episodes in their adolescence [2,3]. Accordingly, the history of back pain appears in the literature as a strong indicator of back pain in adulthood.

In the last decade research studies indicated that the prevalence of NSBP in the early stages of life has increased significantly and is now close to the percentage found in adulthood [4,7-10]. The most recent review of the incidence and prevalence of low back pain in the children and adolescents (aged 7-18 years) included 35 studies, and founded that the prevalence of pain varied between 7 and 62% [11]. A meta-analysis conducted by McBeth and Jones [12], reported a prevalence of low back pain in adolescents of approximately 33%. Moreover, the prevalence may be underestimated due to the absence of a specific diagnosis [13].

Despite its unknown etiology a great variety of potential predisposing factors have been significantly associated with back pain in this population, including environmental, genetic, mechanic, behavioral and psychosocial [8]. Accordingly, the development of back pain in early stages of life has been often related to the relationship between the influence of the environment where the adolescent lives (e.g. school and home), the intrinsic risk factors and lifestyle [14]. However, the specific contribution of each factor for back pain, the way they interact, the multifactorial nature of the NSBP, and the methodological flaws associated with the study designs such as the lack of longitudinal studies, has limited the knowledge of the causal relationship between predisposing factors and back pain [15].

Therefore to better understand the epidemiology of NSBP in children and adolescents, this systematic review aimed to identify the prevalence and incidence of non-specific back pain in children and adolescents, and to identify predisposing factors for NSBP.

Materials and Methods

This review followed the Meta-analysis of Observational Studies in Epidemiology group (MOOSE) recommendations for reporting meta-analyses of observational studies [16].

Three electronic databases were searched (PubMed- MEDLINE, CINAHL and Web of Science) using the following combination of keywords: (child* OR adolescent* OR schoolchild* OR student*) AND (thoracic spine OR dorsal spine OR lumbar spine OR back OR cervical spine) AND (pain OR discomfort OR back pain OR musculoskeletal

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disorder) AND (causality OR cohort study OR cross-sectional study OR epidemiology OR epidemiologic factor* OR follow-up study OR incidence OR incidence study OR prevalence OR prevalence study OR prospective study OR risk OR risk factor* OR survey) NOT (arthritis OR fractures OR scoliosis OR rheumatic disorders).

Inclusion criteria included articles published in peer-reviewed journals, in English language, between January 2005 and March 2012 as well as their reference lists. Titles and abstracts of eligible articles were independently screened by two reviewers (LR; MJ) using the following inclusion criteria:

1. The study design had to be a cohort, case-control, or cross-sectional.
2. Study samples should be aged 6 to 18 years, withdrawn from the general population, with NSBP. Samples from specific populations (e.g., practicing a specific sport, obese population or others) were excluded.
3. Non-specific thoracic, dorsal, upper back, mid-back or low back pain had to be assessed in the study. Studies that comprised only individuals with cervical and shoulder pain were excluded. Studies reporting back pain characteristics among a cohort of individuals with known pathologies (e.g. osteoporosis, fractures) or diagnosed structural deformities (e.g. scoliosis) were also excluded.
4. Studies had to report data at least one of the following parameters: prevalence, incidence, predisposing factors for back pain. Studies reporting lifetime prevalence were excluded because children easily forget the episodes of back pain and therefore it is considered unreliable [17,18].
5. The outcome of the studies should include the examination of associations between predisposing factors and the presence of back pain. Outcomes could be self-reported or clinically evaluated.

Disagreements between reviewers were resolved by consensus. When disagreement persisted, a third independent reviewer (EC) was consulted and a final decision was made. The full text of potentially relevant papers was then assessed against the same criteria. A flowchart of the selection process is shown in Figure 1.

Study quality assessment

Selected articles were evaluated for methodological quality, by two independent reviewers (LR; EC), using the Critical Review Form – Quantitative Studies [19]. Based on 15 dichotomous quality appraisal criteria (yes - 1/no - 0), there were assessed methodological bias (including, selection, measurement and confounding bias), clinical importance of the results, conclusions and implications for clinical practice.

A quantitative score was obtained by summing the total of 15 criteria. Disagreements between the reviewers on individual items were identified and discussed and a third reviewer (CN) was consulted if necessary.

Data extraction and analysis

Two independent reviewers (LR; CN) extracted the data using a

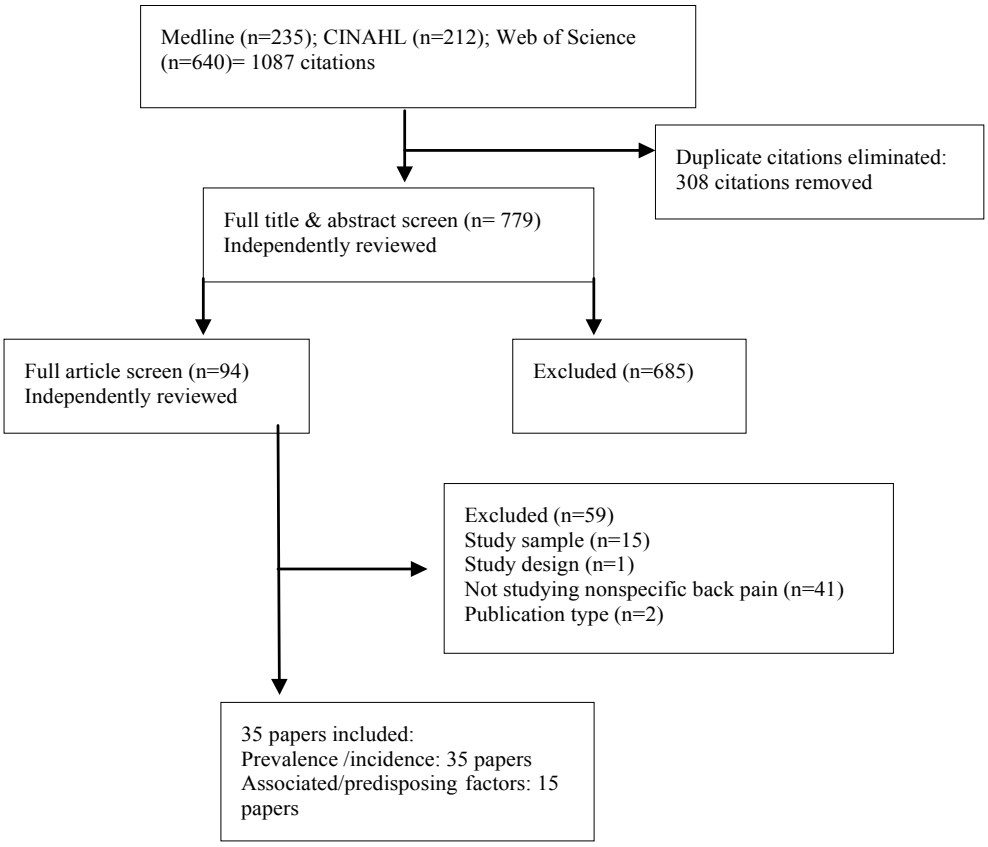

Figure 1: Flowchart of the search strategy and selection of studies to estimate prevalence/incidence and association between back pain and predisposing factors.

customized form. The extracted data consisted of: authors, study design, study population, participation rate, sample characteristics (size, age, nationality), outcomes, data collection tools, and study's results (prevalence rate, correlations values between predisposing factors and back pain; and risk estimations). Data extraction was separately conducted for incidence and prevalence rates and for predisposing factors for back pain.

To conduct the meta-analysis, studies were grouped according to time prevalence in 1-month, 3-months, 6-months and 1-year prevalence, respectively. In what regards to pain location, the prevalence was estimated on the basis of the prevalence values related to pain in the back or any pain in the spine/back.

For each period of prevalence (one, three or six months, and one year) the differences in the duration of pain, or age intervals were not considered. When the prevalence was presented by gender or age, a global weighting prevalence was computed. Since episodes of back pain are easily forgotten by the children [17,18], statistical analyses of the association between back pain and risk factors were limited to 1 month prevalence of pain.

Statistical analysis

Extracted data was analysed for prevalence, incidence and predisposing factors, grouped by different time periods (1-month, 3 and 6 month and 1-year). When possible, study results were pooled in statistical meta-analysis using the Comprehensive Meta Analysis software 2.0 [20]. Heterogeneity was assessed through the Q statistics and the I2 index, with the I2 representing the percentage of degree of variation among studies (0 means that heterogeneity was absent, and larger I2 indicates a higher probability of heterogeneity).

Fixed effects models were used to compute mean prevalence rates and 95% confidence intervals (95%CI). When heterogeneity was present random effects models were used. Publication biases were tested by the Funnel Plot and Begg's and Egger's tests.

When Meta-Analysis was not possible, because of the absence of information or due to heterogeneity between studies, a narrative synthesis of the findings was carried out.

Results

The literature search resulted in 1087 citations, but only 35 studies met the inclusion criteria and were included for full review and data extraction.

Study characteristics

Twenty-one studies were conducted in Europe (60%), 7 were carried out in Oceania, 4 in Asia, 2 in Africa and 1 in North America, all including males and female and with ages between 6 to 18 years. Sample size ranged from 55 [21] to 34,423 participants [22].

There was considerable variation in the methods used to define back pain, ranging from pain location (any pain on the back or spine, low back, upper back, mid back, thoraco-lumbar back), pain duration and frequency of the episode, pain severity and prevalence period.

The most common prevalence periods were 1- month (22 studies) [8,21-41], 6-months (7 studies) [34,42-47], followed by 3-months [48-51] and 1-year prevalence [9,31,34,52] with four studies each. Table 1 summarizes the characteristics of the included studies (author/year, study design, sample characteristics, the pain definition used and measuring tools).

Methodological quality assessment

Of the 35 papers included in the review, 29 (83%) were cross-

Author/year	Design	Sample characteristics			Pain definitions (all self-reported)	Measures tools
		Nationality	n	Age		
Andersen, LB, et al. (2006)*[23]	1	Danish	9413	17,1	**Low or mid back pain in the** present **or during the last month**	Questionnaire
Auvinen, J. et al. (2008) [42]	1	Finish	5999	15-16	**Low back** pain during the **last 6 months**	Questionnaire
Auvinen, JP. et al. (2010) [43]	2	Finish	9215	16 and 18	**Low back** pain during the **last 6 months**	Questionnaire
Auvinen, JP. et al. (2008) [44]	1	Finish	6945	16	**Low back** pain during the **past 6 months**	Questionnaire
Ayanniyi, O. et al. (2011) [24]	1	Nigerian	3185	18-Oct	**Present back pain**	Questionnaire
Chiang, H. et al. (2006)*[21]	1	American	55	13-14	**Low back** pain in the **previous two weeks**	Questionnaire
Cudre-Mauroux, N. et al. (2006)*[25]	1	Swiss	128	12-Aug	**Low back and upper pain in the last week**	Questionnaire/ drawing figure
Diepenmaat, ACM, et al. (2006)*[26]	1	Dutch	3485	16-Dec	**Low pain ≥ 4 days** in the **last month**	Questionnaire/ manikin pictures
Erne, C, and Elfering, A (2011) [27]	1	Swiss	189	13-Oct	**Low back pain/upper back pain for 1 day or longer in the last 4 weeks**	Questionnaire/ drawing figure
Geldhof, E. et al. (2007)*[28]	1	Belgium	105	8,5-12,5	Occurrence of **pain or discomfort, continuous or recurrent, in the thoraco-lumbar zone in the past week**	Questionnaire/ drawing figure
Grimmer, K. et al. (2006a) [14]	2	Australian	434	13-17	**Low back pain in the previous week**	Questionnaire/ body chart
Grimmer, K. et al. (2006b) [29]	2	Australian	436	13-17	Upper **back pain in the previous week**	Questionnaire/ body chart
Hakala, PT. et al. (2006) [45]	1	Finish	6003	14, 16 and 18	**Low back pain during de past 6 months about once a month**	Questionnaire/ body chart
Heaps, N. et al. (2011)*[30]	1	Australian	1608	14	**Back Pain in the past month**	Questionnaire
Jordaan, R. et al. (2005)*[31]	1	South-African	1123	13-18	**Low back pain or discomfort now**	Questionnaire/ drawing figure
Kaspiris, A, et al. (2010) [52]	1	Greece	692	14-Jul	**Low back pain in the last year**	Questionnaire/ picture

Kjaer, P. et al. (2011) [32]	2	Greece	479	9, 13 and 15	**Spinal pain in the moment, in the past week, or within the past month**	Interview
Korovessis, et al. (2010) [46]	1	Greece	688	14-18	**Low back pain or discomfort in the previous 6 months**	Questionnaire/ Pain drawing manikin
Masiero, et al. (2008) [9]	1	Italian	7442	13-15	**Low back pain in the last year**	Questionnaire
Mikkonen, et al. (2008) [47]	2	Finish	1987	16 and 18	**Low back pain during the past 6 months**	Questionnaire/Pain drawing manikin
Mogensen, et al. (2007)*[33]	1	Danish	439	13-Dec	**Back problems (pain in the day of the study, in the week, or in the month preceding) in any area of the spine**	Questionnaire
Mohseni-Bandpei, MA. et al. (2007)*[34]	1	Iran	4813	14-Nov	**Low back pain within last month**	Questionnaire
Murphy, et al. (2007)*[8]	1	English	679	14-Nov	**Low back and upper back pain within last month for 1 day or more**	Questionnaire/ Manikin
O'Sullivan, et al. (2008) [35]	1	Australian	1608	14	**Back pain in the last month**	Questionnaire
Pellise, F. et al. (2009) [37]	1	Spanish/ Swiss	1470	15	**Low back pain within last month for 1 day or more**	Questionnaire/ Manikin
Perry et al. (2009)*[36]	1	Australian	1608	14	**Back pain in the last month**	Questionnaire
Roth-Isigkeit, et al. (2005) [48]	1	Germany	751	18-Jun	**Back pain in the preceding 3 months**	Questionnaire
Sato, et al. (2008)*[21]	1	Japan	34423	15-Sep	**Low back pain (in the day of the study)**	Questionnaire
Sato, T. et al. (2011) [38]	1	Japan	26766	15-Sep	**Low back pain (in the day of the study)**	Questionnaire
Skoffer, (2007) [49]	1	Danish	546	15-16	**Low back pain in the preceding 3 months**	Questionnaire
Trevelyan, and Legg, (2011)*[40]	1	New Zealand	245	14-Nov	**Experiencing back pain within last 7 days or last month for 1 day or more**	Questionnaire/ Manikin
Trevelyan, and Legg, (2010)*[39]	1	New Zealand	245	14-Nov	**Experiencing back pain within last 7 days or last month for 1 day or more**	Questionnaire/ Manikin
Turk, et al. (2011)[50]	1	Slovenia	190	11-15 and17-18	**Pain or discomfort in the lower back in the last 3 months for 1 day or more**	Questionnaire
Wedderkopp, et al. (2009)*[41]	2	Danish	364	9 and 12	Occurrence of **pain or discomfort in the back in the last month**	Interview
Yao, et al. Spine (2011) [51]	1	China	2083	18-Oct	**Back pain in the preceding 3 months**	Questionnaire/ Manikin

*Studies included for the analysis of the results regarding predisposing factors for non-specific back pain.

Table 1: Characteristics of the included studies.

sectional surveys and 6 (7%) were prospective cohort studies. The major limitations in the quality of the studies were related to response rates below 80%, inadequate sample size justification, lack of information regarding informed consent or concerning with reliability and validity of the outcome measures used, poor description of the clinical implications of the results and misreport of the study's limitations. Strengths of the studies were related to appropriate report of the study design, statistical significance of the results and implications for clinical practice.

1-month back pain prevalence: Twenty-two studies reported 1-month prevalence. Assuming a fixed-effects model the NSBP prevalence estimated was 16, 07% (95%CI: 15, 81%; 16, 33%; p<0,001). Using a random-effects model the prevalence estimated was 24, 33% (95%CI: 18, 22%; 31, 7%; p<0,001). Homogeneity was not satisfied (Q=5796, 038; p<0,001; I2 = 99, 67%). Forest Plot (with Random Effect model) is shown in Figure 2. Begg's and Egger's tests failed to identify publication bias (Begg's test, p=0, 67; Egger's test, p=0,1). To measure the stability of the results, sensitivity analysis was used and the stability confirmed (Figure 2).

3-month, 6-month and 1-year back pain prevalence: From the 35 studies selected, 4 studies reported a 3-month prevalence, 7 a 6-month prevalence, and 4, one-year prevalence. NSBP prevalence for each period was estimated by a fixed– effects model with the following results: 3-months: 33, 74% (95%CI: 32, 18%; 35, 33%; p<0,001); 6 months: 42, 32 (95%CI: 41, 78%; 42, 86%; p<0,001); 1-year: 21,93% (95%CI: 21, 24%; 22, 64%; p<0,001) and with a random-effects model (3-months: 37,97% (95%CI: 27,81%; 49,31%; p<0,001); 6 months: 38, 55 (95%CI: 27, 14%; 51, 37%; p<0,001); 1-year: 25, 76% (95%CI: 16, 67%; 37, 56%; p<0,001). Based on Q statistics and I2, homogeneity cannot be assumed (3-months: Q=104, 2425; p<0,001; I2 = 97, 12%; 6- months: Q=3090, 801; p<0, 001; I2 = 99, 8%; 1 year: Q=435, 7774; p<0, 001; I2 = 99, 31). Stability problems were identified in all the analysed periods and they have remained with the removal of any of the included studies. Based on these results it has been decided to carry out a narrative synthesis of the prevalence estimates rather than the meta-analysis.

Narrative synthesis

In the 3-months period, the NSBP prevalence ranged from 17, 4% [51] to 51, 3% [49]. In the past 6 month the NSBP prevalence ranged from 15, 6% [34] to 61, 1% [44] and in the last year NSBP prevalence ranged from 17, 4% [34] to 54, 1% [31]. Table 2 shows the 3, 6 months and 1-year prevalence for NSBP according to the self-report period of back pain of NSBP assessed in each study and age.

Back pain incidence

Of the 35 studies analyzed only two studies reported incidence [15, 29]. Grimmer et al. followed a sample of 434 children during a period of 5 years (1999-2003), and found a percentage of new cases of 7,2% for males and 10,4% for females [15].

In another longitudinal study conducted by the same research group, the authors followed a sample of 436 children, aged 13, during 5 years and founded that incidence decreases in females between 14 and 17 years of age, but increases in males, who present a higher incidence at the age of 16 [29].

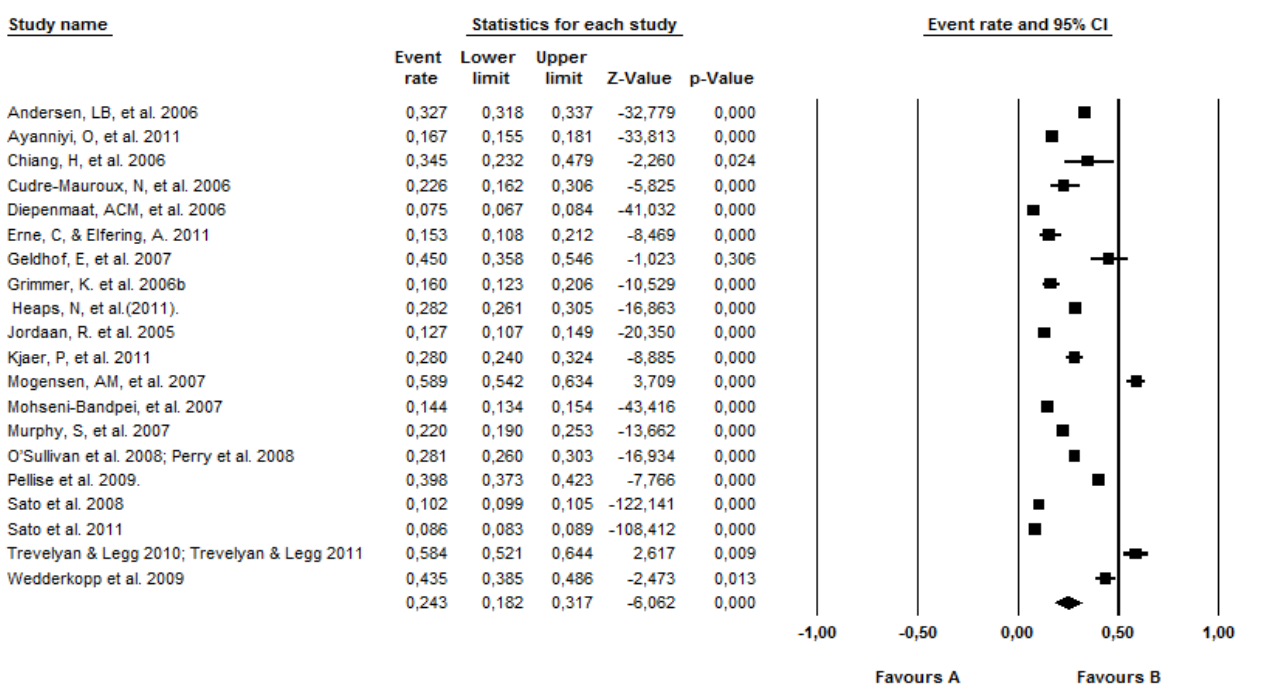

Figure 2: 1-month prevalence for nonspecific back pain and 95% confidence interval from the individual studies and Forest Plot (Random Effects Model).

Author/year	n	Back Pain Definition	Percent Prevalence for age (years)												
			6	7	8	9	10	11	12	13	14	15	16	17	18
3-months prevalence															
Roth-Isigkeit, et al., 2005	751	Self report back pain in the preceding 3 months									30,2				
Skoffer, 2007	546	Self report low back pain in the preceding 3 months										51,3			
Turk et al., 2011	190	Self report pain or discomfort in the lower back in the last 3 months for 1 day or more								43					44
Yao et al., 2011	2083	Self report low back pain in the preceding 3 months							17,4						
6-month prevalence															
Auvinen, J. et al., 2008	5999	Self report low back pain during the last 6 months										38,6			
Auvinen et al., 2010	9215	Self report low back pain during the last 6 months											41,7		54,3
Auvinen et al., 2008	6945	Self report low back pain during the past 6 months											61,1		
Hakala et al., 2006	6003	Self report low back pain during de past 6 months about once a month									19,8		28,6		28,1
Korovessis et al., 2010	688	Self report low back pain or discomfort in the previous 6 months											40,7		
Mikkonen et al., 2008	1987	Self report low back pain during the past 6 months											42		56
Mohseni-Bandpei et al., 2007	4813	Self report low back pain during the last 6 months								15,6					
1 -year prevalence															
Jordaan et al., 2005	1004	Self report low back pain or discomfort, in the last year								36,4	46,2	52,3	48,4	54,1	
Kaspiris et al., 2010	692	Self report low back pain in the last year						22,1							
Masiero et al., 2008	7542	Self report low back pain in the last year								20,5					
Mohseni-Bandpei et al., 2007	4813	Self report low back pain in the last year							17,4						

Table 2: 3-month, 6-month and 1-year prevalence of NSBP for children and adolescents aged 6 to 18 years.

Predisposing factors for nonspecific back pain in children and adolescents

Fifteen studies investigated different predisposing factors for back pain in children and adolescents. The potential predisposing factors included a multitude of factors that for clarity were grouped in 5 categories: 1) physical/anthropometric factors (age, gender, body mass index and physical qualities); 2) psychological and emotional factors (depression, psychological distress, etc); 3) Social and family factors (parents educational level; parents self-reported pain; familiar structure); 4) Lifestyles factors (Alcohol and tobacco consumption, physical activity); 5) and mechanical factors (postural behavior, school

bag weight and transportation, time spending watching television, computer use).

In general, the inconsistency founded in the use of conceptual definitions and related measurement tools for the same variable and the multitude of variables of very different natures that have been explored, limited the comparison between studies. Moreover, the examination of the relationship between these factors and NSBP showed conflicting results among studies.

Eleven studies looked for significant correlations between the physical/anthropometric factors and the self-report of BP. The findings of these studies showed conflicting evidence for age [25,28,31,34], gender [23,25,26,28,30,31,34,36,38], body mass index [21,34,36] and physical qualities, such as muscle strength [23,36] or muscle endurance [23], muscle control [25] or the maximum level of VO2 [23].

Three studies reported findings of significant association between a range of psychosocial and emotional factors and BP [26,30,40]. Significant associations with NSBP were found for "Internalizing and externalizing behavior" (both sexes), "self-worth" and "Family functioning" (girls only) [30], emotional symptoms and hyperactivity [40], depressive symptoms [26,30] and stress experienced [26].

From the two studies that had explored the association between social and family factors and NSBP [8,26], none had reported statistically significant findings. Lifestyles factors were analyzed in seven studies [21,23,26,30,33,34,41]. Heaps et al. [30] founded statistically significant associations between alcohol and tobacco consumption and NSBP. There were conflicting evidence about the relationship between the level of physical activity and NSBP [21,26,34,41]. No association was found between the practice of physical activity or sports and NSBP [23,33].

Finally a number of mechanical factors were associated with NSBP. NSBP in children and adolescents has been shown to have a significant association with school bag carrying time [21], carrying the bag on one shoulder [40], twisting the back for more than 10 min during a class [8] and position and time spent watching television, or doing the homework [34]. Conflicting results have also been reported for the weight of the school bag [8,34,40] and time spending watching television [26,34]. No association was founded between postural behavior [28] and computer use [26,34] with NSBP.

In summary, it was not possible to identify consistent and conclusive evidence of the association between back pain and the different predisposing factors reported in the literature.

Discussion

The purpose of this systematic review was to determine the prevalence and incidence of non-specific back pain in children and adolescents and to identify its predisposing factors.

A total of 35 studies specifically designed for children and adolescents with NSBP were included. Similar to previous reviews, this systematic review founded considerable methodological heterogeneity between studies, particularly related to the prevalence period and case definition [11,15,17]. The absence of a clear specification of the minimum episode duration required for a case to be counted limited a more conclusive understanding of the pain prevalence among children and adolescents. Recently, an international Delphi study concluded that definitions for prevalence studies of back pain should include, at least, the location of back pain, symptoms observed, time frame of the measure, and severity [53].

The period recommended for investigating back pain prevalence is the first month after its occurrence, because it has been suggested that children easily forget pain. This fact also has been associated with underestimate reports of pain prevalence [17,18]. Despite the limitations reported, back pain prevalence estimates presented in this systematic review are high and consistent with others reported in the literature of NSBP in children and adolescents [11,15,17].

The small number of studies reporting NSBP incidence limited its analysis. From de 6 studies analysed only the studies from Grimmer and colleagues report incidence values [14,29]. Moreover one study refers to the annual incidence of Low Back Pain [14] and the other to the annual incidence of Upper Back Pain [29].

In summary, the methodological heterogeneity founded across the primary studies, as well as the scarcity of data available, restrained the possibility to conduct a more conclusive analysis, namely a Meta-analysis.

Predisposing factors for nonspecific back pain

Of the 35 studies included in this review, 15 aimed to identify predisposing factors for back pain in children and/ or adolescents. From the 15 studies identified, 14 were based in cross-sectional studies. This constitutes a major limitation to the studies' findings since this kind of design only allowed for the association between predisposing factors and NSBP to be examined. It is therefore not possible to establish any causal relationship between variables and outcome.

Another key finding of this review was the extent of heterogeneity in the potential predisposing factors and outcomes across studies. The variation of the type and definition of the potential predisposing factors examined across studies as well as the reduced number of articles identified which analyze the same factor (just one article in many cases), make the comparison between studies difficult and a meta-analysis impossible. Thus, it was not possible to reach consistent conclusions about the predisposing factors for back pain in children and adolescents.

Considering the physical/anthropometric factors, this review found conflicting evidence between age, gender, BMI and physical qualities.

These findings confirmed the results reported in other studies/ reviews [4,55] suggesting a lack of evidence to support the value of these factors in the study of NSBP in children and adolescents

The same conclusion can be draw considering the association between lifestyles and behaviors and NSBP. The inconsistency in the findings founded in this review for the level and duration of physical activity contradicts previous reviews that had suggested that physical activity level/time of practice was a predisposing factor for the development of NSBP. Moreover, no association was found between the practice of physical activity or sports and BP [23,33].

Like in previous reviews, new data confirmed that there is no association between the family/social factors studied and NSBP. Contrariwise, several psychological and emotional factors showed significant associations with BP in children and adolescents [26,30,40]. However, based on this review no definite conclusions can be drawn due to design limitations. Psychological and emotional factors of varying nature inhibit a more definitive conclusion about the potential relevance of these factors to the BP. Moreover, the studies were few in number and were of poor quality. Psychological and emotional factors require more rigorous investigations to determine their relationship with NSBP in this population.

Finally, this review's findings founded that several different mechanic factors have showed statistically significant associations with NSBP, namely the school bag carrying time [21], carrying the bag on one shoulder [40], twisting the back for more than 10 min during the lesson/class [8] and the position and time spent watching television, or doing the homework [34]. However, these findings were based on one or two studies and no definitive conclusion can be draw.

In summary, the findings of this review emphasize a lack of evidence to support or refute the association between back pain and the different predisposing factors reported in the literature.

Conclusion and Implications for Clinical Practice

The results of this systematic literature support the high prevalence of NSBP in young population and corroborate the current idea that NSBP is an important clinical condition at this age.

The scarcity and conflicting evidence of the research findings about potential predisposing factors and the methodological flaws identified in the studies limited a more consistent conclusion of this review. Future research should concentrate both on case definition and on improving the methodological quality of the studies. The use of a standardized definition of NSBP is a recommendation endorsed by a recent international consensus [53,54] to enable better comparisons between countries, and ultimately lead to a deeper understanding of this clinical condition in children and adolescents. Prospective studies are also needed to further clarify these unclear and conflicting results especially on predisposing factors that can be used by the health professionals in preventing NSBP through health programs.

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