

Relationship between impaired functional stability and back pain in children: an exploratory cross-sectional study

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Summary

Questions under study: On surveys, about every fifth child in the school age reports back pain. There is a dearth of literature on the association between functional stability and back pain in children.

Objective: To examine the association between functional stability, measured with the Matthiass-test, and “back pain during the last week”.

Methods: We used data from a cross-sectional survey on third, fourth and fifth grade school-years (128 children aged between 8 and 12 years) in seven different classes in two different rural regions of Switzerland, to evaluate in an explorative manner the association between the score of the Matthiass-test and low back pain and upper back pain in the last week with two multivariable logistic regressions.

Results: The Matthiass-test score, controlled for age, sex and language region of the school, was significantly associated with low back pain in the last week (adjusted odds ratio 1.77 with an 95% confidence interval from 1.08 to 2.91) and non significantly with the upper back pain in the last week (adjusted odds ratio 1.67 with an 95% confidence interval from 0.98 to 2.81).

Conclusion: The Matthiass-test score is associated with low back pain. Because of the exploratory character of this study, these results should be regarded with caution. Whether a high score on the Matthiass-test could be a risk factor for back pain should be evaluated in prospective studies.

Key words: functional stability; children; back pain

Introduction

On surveys, about every fifth child reports back pain [1]. Factors like poor life style habits, activity behaviours, psychological factors, misconceptions about back pain, and biological and social factors can influence back pain [1–5].

Conflicting evidence exists about muscular strength as a risk factor for back pain [4]. Clinical stability or functional stability, ie the ability of the spine to maintain its pattern of displacement under physiologic loads, integrating muscular functioning, neural control and intrinsic stability from spinal column [6], is probably more important than pure strength. A widely used test to assess the capability of children to control and maintain a position of the body is the Matthiass-test (MT), in which the child has to stand upright for at least 30 seconds with straight arms holding in 90° shoul-

der flexion. The association between the results of this test and back pain in children was reported at least once: Salminen found no association between the failure in the test and low back pain [7]. Salminen used a dichotomous outcome of the MT. We wanted to evaluate, whether a different judging of this test would provide different results: therefore, we used a score built with the sum of the gives (compensatory movements) out of four different defined compensatory movements during the MT.

To explore the association between the score from the MT and the self-reported back pain during the week before the test, we used data available from cross-sectional evaluations of different properties of physical fitness and leisure related variables in different schools with 8- to 12-year-old schoolchildren.

Methods

Subjects

In two different rural regions in Switzerland, seven classes (third, fourth and fifth grade) with a total of 128 children (54% girls) were chosen as a convenience sample for this study. As the analyses in this study were performed with data available from an evaluation of different properties of physical fitness and leisure-related variables in schools, sample size was not determined by a sample size calculation but merely by available data. Four classes came from the western part of Switzerland (French-speaking children) and three classes from one village in the German-speaking part of Switzerland. The children were between 8 and 12 years old, with a median of 10 and an interquartile range from 9 to 10 years. See table 1. The schools were situated in villages with mixed socioeconomic levels. Data in the western part were collected in 2004, data in the German-speaking part in 2005. The four French-speaking classes were participating in a longitudinal intervention study (results from the longitudinal study not presented in this report). All children and all parents were informed about the study and were asked to sign an informed consent form. The study was performed following the principles of the Declaration of Helsinki [8].

Questionnaire

To assess the dependent variable "back pain in the last week", we adapted a questionnaire used in studies on back pain in children by Watson et al. [9] and Szpalski et al. [10], and we translated the questions to French and German. The dependent variables were measured with the questions: "did you have pain in the lower back during the last week", and "did you have pain in the upper back during the last week". A drawing for each of the two back regions (upper back and lower back) was shown. A visual analogue scale was presented to assess the intensity of pain. Reliability: Watson et al. used a similar questionnaire (but asking for pain in the last month and for the lower back) and a similar drawing. 80% of a subset of the children between 11 and 14 years answered the same if asked twice in two weeks, and 83% of the children reported the same back pain status when asked in an interview as they reported with the questionnaire [9]. Gunzburg et al. [11] used similar questions and found high test-retest reproducibility (Kappa values for individual questions from 0.81 to 0.95) on 9-year-old children. These studies and others, see for

example Staes et al. [12], showed good reproducibility for the recall period of one month in children. Because we used two different back regions (the mentioned studies concentrated on low back pain), it might have been too difficult for the children to recall the accurate pain location if asked for a period of one month. Therefore, we decided to concentrate on a recall period of one week.

We assessed age and gender to control for in the logistic model.

Test of functional stability

We used the MT to evaluate the ability to control and maintain a position (functional stability): the children stood in underwear in an upright position and were instructed to hold their lumbar back in a flattened position (ie slightly out of the neutral position in the direction of a lumbar kyphosis), to ensure that children were controlling the back actively (with their abdominal muscles) and minimising hyperextension and passive control. The shoulders were flexed 90°, and the arms hold straight (see figure 1). The children had to keep this position for 30 seconds. The physiotherapist observed the spine, pelvis, scapula and the arms and reported each give (compensatory movement). Compensatory movements were defined as follows: a) an anterior pelvis inclination (increase of hip flexion and lumbar lordosis), b) spinal movement towards greater lordosis or movement of the thoracic spine backwards (sway back), c) Scapula alata, and d) any change in the degree of flexion in the shoulders. We used the sum of these gives (compensatory movements) as independent variable (0 to 4). We did not find any published study reporting on inter-tester reliability for the MT in the English or German language literature. In a diploma thesis, a weighted Kappa of 0.65 (95% bias corrected bootstrapped confidence intervals 0.42 to 0.86) was found for the inter-rater agreements of two undergraduate physiotherapists rating a group of 27 children (median age 9 years, interquartile range 8 to 11, range 8 to 12) with the total score of the MT, as used in this study (unpublished data [diploma thesis Genolet and Angéloz 2006]).

Testing procedures

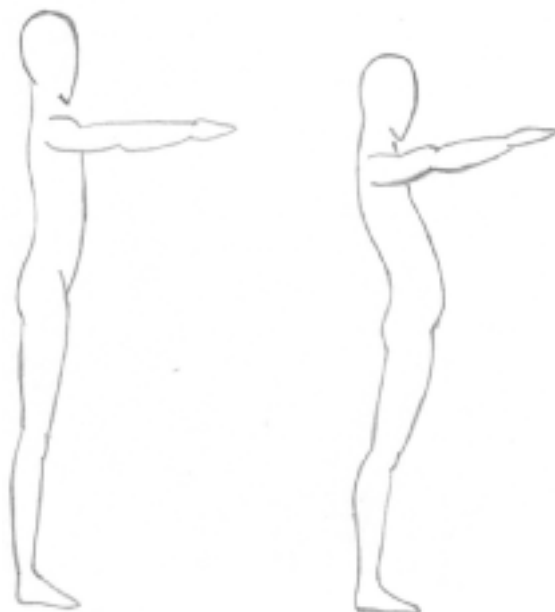
The teacher of the class and the physiotherapist were present during the time the children filled in the questionnaires themselves, and the physiotherapist helped the children if a question was unclear. No values were imputed for missing values. After filling in the questionnaires, a physiotherapist guided and evaluated the MT. He was blinded to the results from the questionnaires.

Data analysis

Descriptive statistics on demographic characteristics were expressed with the median, the interquartile range and the range. Frequencies of back pain (upper back and lower back, respectively) were reported for different ages, gender and the different numbers of the compensatory movements in the MT. We performed multivariable logistic regression for the binary (yes / no) dependent variables "pain in the upper back in the last week" (UPB), and "pain in the lower back in the last week" (LBP).

We adjusted for age, sex and for the two language-regions (French-speaking / German-speaking). The low number of cases (28 for upper back and 22 lower back) did not allow adjustment for classes (the seven classes would have required six dummy variables). Therefore, and due to important differences in the two language regions (different assessors, different language of the questionnaires), we chose to control for the language region.

Figure 1
Matthiass-test. Left side shows departure position. Right side shows one of the possible compensatory movements.



We reported the results of the multivariable logistic regression as odds ratios with the corresponding 95% confidence intervals. The analyses for the binary outcome were performed using STATA Statistical Software, Re-

lease 8 (StataCorp. 2003 Texas USA) with the command `logistic` and the option `cluster` for the language region to allow for correlations within a language region.

Results

All children of the four classes in the French-speaking part participated; two children in the German-speaking part were not allowed by their parents to participate. From the 128 participating children, 125 children were present at both test days, ie for the questionnaire and for the MT. More children reported pain in the upper back (UBP) than in the lower back (LBP): 28/124 (23%) reported UBP in the last week, and 22/123 children (18%) reported LBP (see table 1). Of the 128 children, 33 reported either pain in the upper back or pain in the lower back. More girls than boys re-

ported "back pain in the last week". However, this difference was not statistically significant.

Multivariable logistic model:

The MT score, controlled for age, sex, and language region, was significantly associated with LBP in the last week: an odds ratio of 1.77 (95% confidence interval (CI) from 1.08 to 2.91) for each compensatory movement during the MT. The odds ratio for the score of the MT with the UPB was 1.67 for each compensatory movement in the MT (95% CI 0.98 to 2.81). See table 3 for UPB and table 4 for LBP.

Discussion

In this cross-sectional study, we observed by the mean of a multivariable logistic regression that each additional compensatory movement during the MT was associated with a higher frequency of reporting back pain.

There are some limitations in this study: this was an explorative analysis and the results have to be reproduced in studies with an a priori stated hypothesis.

Because this was not a longitudinal study, no conclusion about causal associations between the functional instability measured with the MT score and back pain can be drawn. One could argue that the lack of functional stability, seen as compensatory movements during the test, results from the direct influence of the pain on the performance in the MT. However, no child complained of pain or showed pain behaviour like grimacing during the MT.

Table 1
Baseline characteristics for the children (questionnaire)

	Prevalence 125 (3 missing)
Girls	68
Boys	57
Age, median,	10
range	8 to 12
interquartile range	9 to 10
Pain in the upper back in the last week	28/124 (22.6%)
Numeric rating scale for pain of those who reported pain, median (interquartile range)	4 (2.75 to 5.25)
Pain in the lower back in the last week	22/124 (17.7%)
Numeric rating scale for pain of those who reported pain, median (interquartile range)	4 (2 to 5)
Stayed at home because of back pain once in the past	20/124 (15.6%)
Stopped physical exercise once in the past because of back pain	22/124 (17.7%)
Stopped sport once in the past because of back pain	17/123 (13.8%)
Medical or physiotherapist visit in the past because of back pain	27/124 (21.8%)
Fatigue (numeric rating scale), median (interquartile range)	1 (0 to 4)
Time on television last week, minutes (interquartile range)	150 (60 to 360)
Time playing video/computer games last week, minutes (interquartile range)	67 (15 to 180)
Sports	103/125 (82.4%)
Sports competition	61/125 (48.8%)
Active commuting	111/125 (88.8%)
Perceived heavy schoolbag	33/125 (26.4%)

Table 2

Frequencies of self-reported pain in different subgroups

Independent variable	Prevalence		Prevalence	
	UBP in the last week	No UPB in the last week	LBP in the last week	No LBP in the last week
Age				
8 years old	2	5	1	6
9 years old	9	29	6	32
10 years old	13	46	12	48
11 years old	4	14	3	14
12 years old	0	2	0	2
Gender				
Girls	19	49	16	52
Boys	9	47	6	50
Compensatory movements Matthiass-test				
0	9	41	7	42
1	10	29	7	33
2	3	19	2	20
3	6	6	6	6
Pain intensity (VAS)	Mean: 3.3 (SD 3.0)		Mean 2.5 (SD 3.0)	

Differences in the sum of the number of children in the different items are due to missing values in the questionnaires.

UBP = upper back pain, LBP = low back pain

Prevalence “UBP in the last week” = the number of children who reported back pain in the last week

Prevalence “No UBP in the last week” = the number of children who did not report upper back pain in the last week

Table 3

Multiple logistic regressions for the self-reported pain in the upper back in the last week. Number of children with complete set of variables: 123 (28 children with pain in the upper back in the last week).

	Odds Ratio	95% confidence interval
Number of gives in Matthiass-test (0 to 4)	1.67	0.98 to 2.81
Sex	2.16	0.86 to 5.38
Age	0.75	0.44 to 1.31
German spoken region	0.25	0.13 to 0.50

Coding of variables: number of gives in Matthiass test: 0 to 4, sex (0 = boy, 1 = girl), age (one unit = one year)

Table 4

Multiple logistic regressions for the self-reported pain in the lower back in the last week. Number of children with complete set of variables: 123 (22 children with back pain in the lower back in the last week).

	Odds Ratio	95% confidence interval
Number of gives in Matthiass-test (0 to 4)	1.77	1.08 to 2.91
Sex	2.71	0.61 to 12.13
Age	0.97	0.49 to 1.94
German-speaking region	0.40	0.22 to 0.72

Coding of variables: number of gives in Matthiass test: 0 to 4, sex (0 = boy, 1 = girl), age (one unit = one year)

Furthermore, we do not exactly know the real meaning of self-reported back pain [13]. What does it mean when a child reports pain? Does pain influence their quality of life? In other studies, there was a low correlation between the reporting of pain by the children and the reporting of back pain of their children by parents [9]. This implies that children even report pain in the absence of pain, or disturbance of function.

For one factor entered in a logistic model, at least 10 cases should be available. Because in this study only 22 children had pain in the lower back

and only 28 children had pain in the upper back, we could only include three variables, not to introduce the risk of overfitting. Among other factors, one important factor we did not control for was educational level of the parents. Leboeuf-Yde reported that children with parents with a low educational level reported more back pain compared to children with parents with a higher educational level (OR 1.8, 95% CI 1.1 to 2.8) [14]. Thus, educational level of the parents or social class could have been an uncontrolled confounding factor in our study.

Salminen observed no relationship between pain and the failure in the MT [7]. In his study, the test was considered as passed, if a child could hold the instructed position for 30 seconds without shifting the thorax backwards or letting the pelvis tilt forward. In contrast to Salminen, we also observed other compensatory movements of the pelvis, back, scapulae and arms. Nearly all children in our study could stay 30 seconds in the requested position (94.5%), but a lot of them made a compensatory movement (see table 2). We think that this is a more sensitive way to use the MT. However, the judgement of the MT is strongly observer-dependent [15], and its inter-tester reliability seems to be only moderate. The observer should be a person with high expertise in judgement of normal and deviant positions and movements (eg highly trained and experienced physiotherapists) and the test should be adapted to improve clinimetric properties.

Implication for the practise: based on the results of this study, we cannot advocate for or against the use of the MT in the school setting to detect children with problems related to functional stability. Predictive value of this test should be evaluated in prospective studies that are sufficiently large to allow controlling for other important factors. If further research will confirm the results of predictive studies, one could argue for an

annual or biannual screening for problems related to functional stability in the school setting.

Conclusion

Reporting “back pain during the last week” was associated with the number of compensatory movements in the Matthiass-test in this study. Despite the limitations of this exploratory study, the results justify further evaluations of the association between back pain and functional instability, measured with the Matthiass-test. Whether this score, built of compensatory movements, is just an indicator of back pain or whether the compensatory movements have a causal influence on back pain should be evaluated with longitudinal confirmatory studies with an a priori stated hypothesis.

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