Effectiveness of preventive back educational interventions for low back pain: a critical review of randomized controlled clinical trials

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Abstract

Purpose A systematic search was conducted to study the efficiency of preventive educational interventions mainly focused on a biomechanical/biomedical model.

Methods The Pubmed electronic database and the Cochrane Library were searched based on a combination of keywords related to low back pain (LBP) and posture education. Only randomized controlled trial (RCT) studying the efficiency on outcomes directly related to LBP of a preventive intervention programme mainly based on education of proper care of the back for subjects not seeking treatment were included. References of the articles meeting

these inclusion criteria were also checked to identify other potential citations. Besides, a methodological study assessment of the included RCTs was performed.

Results Nine studies, all conducted at the workplace were included in this review. Their mean quality level was low (5.1/12) and among the four studies with a huge sample size ($n > 400$ subjects), only one had an acceptable methodological quality score (6/12). The education interventions differed widely from one study to another. No significant differences between the control and education groups were found at the follow-up in eight out of the nine studies on the incidence of back pain, disability and sick leave.

Conclusions The results of the RCTs included in this review suggest that educational interventions mainly focused on a biomechanical/biomedical model are not effective in preventing LBP. However, taking into account the methodological quality level of the RCTs as well as the very short and heterogeneous interventions often proposed, additional high-quality studies with a longer education period are needed to conclude that such interventions are inefficient.

Keywords Prevention · Education · Low back pain · Review · Back school

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Introduction

Despite growing research efforts, non-specific low back pain (LBP) remains a major public health burden throughout the industrialized world [1]. Epidemiological data indicate a point prevalence ranging from 19 [2] to 27 % [3] and a lifetime prevalence of about 60 % [2]. Although a rapid decrease in pain and incapacity often occurs within the month following the onset of symptoms

[4, 5], most patients still experience LBP and related disability 1 year after [6].

A lot of studies have attempted to identify the risk factors for the occurrence of LBP [7–9], notably, to be able to propose preventive interventions. Supposed risk factors for the onset or chronicity of LBP can be categorized into several categories [10], i.e., individual (e.g., genetic predisposition, gender, age, weight, height, body mass index, physical activity, spine mobility and smoking, etc.) [11], psychosocial factors (e.g., stress, anxiety, depression, pain behaviour, etc.) [12] which are sometimes related to the work activity (e.g., work monotony, etc.) [13] and occupational factors (e.g., lifting, bending and twisting, prolonged static posture, whole body vibration) [14]. Whereas the presence of a previous episode of LBP is recognized to be a powerful risk factor for a new one [15], literature reviews have reported only no, low, or conflicting evidence of a relation between LBP and the other supposed risk factors [16, 17].

Among the modifiable individual risk factors of LBP occurrence, the influence of the posture and gestural behaviour (e.g., the way of lifting, sitting, bending, etc.) in the daily life and/or at the workplace has been relatively poorly studied. Although a recent review has questioned the link between LBP and several mechanical factors [18], some studies have found a relation between inadequate posture and LBP. Burdorf et al. [19] reported that the observed work time with trunk flexion and rotation was associated with the occurrence of back pain. Videman et al. [20] measured the relation between the patient-handling skills and subsequent back pain and back injuries in nursing and reported that poor patient-handling skills were one of the major risk indicators for back injuries. Mundt et al. [21] focused on non-occupational lifting and concluded that frequent lifting of objects or children weighing 25 or more pounds with knees straight and back bent was associated with increased risk of herniated lumbar disc; the risk was also linked to frequent lifting with arms extended and twisting while lifting [21]. Such so called “poor postures” (i.e., using the stoop lifting technique while lifting, doing frequent trunk hyperextensions, etc.) are supposed to increase the strain on low back ligaments or on the lumbar facets and/or to increase the shear, torsional loadings and/or the compressive force on the lumbar spine resulting in increased intradiscal pressure [22–24]. Hence, such mechanical constraints could accelerate facet and intervertebral disc degeneration [25–28].

Therefore, back education sessions have been introduced and considered as relevant preventive or treatment strategies. They were first developed in Sweden in 1969 for helping patients with LBP [29] and have sometimes been called “back school” sessions. They included mainly

theoretical information, demonstration of proper body mechanics and practical exercises. They aim among other things to teach the participants about the anatomy and function of the back and to give them biomechanical and ergonomic advices to perform work or daily activities with minimal mechanical constraints (e.g., maintaining the natural lordosis, keeping a load against the trunk while carrying, avoiding the stooping technique while lifting, pivoting instead of twisting, sitting with a straight back rather than in a slump position, using ergonomic accessories, etc.). Nowadays the “back school” programmes often include not only education, but also other components such as physical exercises [30, 31]. However, educational programmes mainly or exclusively based on the proper care of the back are still in use in the general population and in workers to limit LBP occurrence.

Although several reviews concerning back pain prevention have been conducted [32–39], most of them did not focus specifically on the influence of preventive back educational programmes. Indeed, some reviews included interventions on patients with chronic LBP [32] or off work for LBP [34] or with neck pain [34] while others also studied efficiency of other preventive interventions (e.g., lumbar supports [33, 35–37], exercises [34, 36], lifting equipments [40], etc.); furthermore, some reviews included non-controlled trials [32] or trials studying specifically interventions related to manual handling/lifting [38, 39] or conducted at the workplace [36, 37, 39, 41] or trials investigating the efficacy of interventions combining a mix of techniques among whose education was not the main part [34, 41]. Besides only some of these reviews have conducted a methodological quality assessment of the included studies [35, 36, 39–41].

As a result, this article aims to review the literature about the effectiveness of preventive back education programmes mainly focused on a biomechanical or biomedical model to confirm the inefficiency of such programmes or invalidate previously stated conclusions. Only randomized controlled trials (RCTs) were included in this review to avoid bias related to non randomized comparative studies or observational studies. In order to interpret properly these RCTs, the present work also aimed to investigate their methodological quality according to the recent recommendations of the Cochrane Back Review Group [42].

Methods

Searching

The Pubmed electronic database was searched; limits included the publication date (from 1 Jan 1985 to 31 Dec 2011), language (English), type (clinical trial or RCT),

species (humans) and ages (adults, i.e., 19+ years). The search was based on a combination of keywords related to LBP (i.e., “low back pain” OR “low backache” OR “low back injury” OR “lumbar pain” OR “lumbago”) and keywords related to prevention and posture education (i.e., “prevent*” OR “awareness” OR “back school” OR “behavior*” OR “body mechan*” OR “ergonom*” OR “educat*” OR “manual handling” OR “posture” OR “sitting” OR “lifting” OR “bending” OR “twisting”).

Study inclusion criteria

Studies were included in this review if the following criteria were fulfilled:

1. *Study design* Only randomized controlled studies published in peer-review journals. Non-randomized controlled clinical trials were not included, because of the risk of bias.
2. *Participants* Subjects not seeking treatment. However, studies including not exclusively pain-free subjects (i.e., subjects with current or past LBP) were not excluded.
3. *Intervention* Only preventive intervention programmes designed for the purpose of primary or secondary prevention for LBP (studies on neck pain were excluded). Only programmes mainly based on education of proper care of the back, i.e., based on a biomedical/biomechanical approach (good posture, safe lifting, etc.) to prevent LBP were considered. Programmes including a combination of education and an other major component (e.g., physical training, coping intervention and/or ergonomics intervention at the workplace) were excluded.
4. *Outcomes* The reported outcomes were directly related to LBP (i.e., LBP occurrence, pain intensity, activity limitation, medication use, work absenteeism, visit to the primary care physician, a specialized doctor or for physical treatment). The time frame for evaluation was considered to distinguish between intermediate (less than 1 year) and long-term (at least 1 year) outcomes.

As recommended by the Cochrane Back Review Group [42], not only one database was used; hence the Cochrane database was searched to look if additional RCTs should be included in the present review based on the keywords related to LBP and prevention.

A complementary search was also conducted to identify the potential citations that could not be found by means of these searches; hence, references of the articles meeting the inclusion criteria and of the reviews on the topics (identified by the Pubmed search and a search in the Cochrane

Database of Systematic Reviews) as well as the first 100 results of a Google search were checked.

Methodological quality assessment

The study quality was assessed in accordance with the recommendations of the Cochrane Back Review Group [42]. Twelve criteria for the methodological quality assessment were considered: 1, adequate method of randomization; 2, adequate allocation concealment; 3, blinding of the patients; 4, blinding of the care provider; 5, blinding of the outcome assessor; 6, withdrawals and drop outs described and acceptable; 7, intention-to-treat analysis; 8, results from all-specified outcomes adequately reported; 9, similarity of baseline characteristics; 10, co-interventions avoided or similar between groups; 11, acceptable compliance; and 12, timing of the outcome assessment similar between groups. Two of the authors (CD and MM) scored the methodological quality of the studies included in the present review independently; any discrepancy was discussed to reach agreement.

Results

Literature search

The Pubmed search resulted in the identification of 1,350 studies; eight articles met the inclusion criteria to be included in the present review [43–50]. The search in the Cochrane Library resulted in no additional RCT to be included. In contrast, the complementary search resulted in the inclusion of one additional study [51]. The details of the nine RCT studies included in this review are presented in Table 1.

Qualitative analysis of studies

Methodological quality

Five [43, 45, 47, 49, 51] out of the nine RCTs were cluster randomized trials. The methodological quality scores are presented in Table 2. The mean level of the studies methodological quality was quite low, i.e., 5.1/12; only the studies of Daltroy et al. [43], van Poppel et al. [47] and Warming et al. [49] (quality score 6/12) as well as the one of Walsh et al. [48] (quality score 7/12) had a quality score higher than 5/12 suggesting a low risk of bias [42]. Several quality criteria for a RCT were missing (i.e., not respected or not well described) in most trials, e.g., blinding of the patients and of the care provider, an intention to treat analysis, an acceptable compliance, co interventions avoided or similar.

Table 1 Main characteristics of the RCTs included in the present review

Authors (country)	Design, participants	Intervention	Timing of the assessments and proportion of responders at the follow-up	Outcomes and main results at the end of the study
Donchin et al. [44] (Israel)	RCT. Hospital employees (from the clinical, administrative or technical professions) reporting at least three annual episodes of LBP	1. Control group (CG) ($n = 50$): waiting list (will receive the most effective programme in the future) 2. Education group (EdG) ($n = 46$): back school programme including four 90-minute group sessions within 2 weeks + a fifth session after 2 months 3. Exercise group (ExG) ($n = 46$): Calisthenics programme for 3 months including biweekly 45-minute group sessions. Exercises were based on the Williams method	At baseline, after the 3 months of intervention and after an additional 6 months of follow-up	Number of LBP episodes every month for the whole year: decrease in the ExG ($p < 0.001$), whereas no change was observed in the EdG and CG
Walsh and Schwartz [48] (USA)	RCT. Warehouse workers. Not being currently treated for back pain	1. Control group (CG) ($n = 27$): no intervention 2. Education group (EdG) ($n = 27$): 1-hour session (back pain prevention and body mechanics on the job) 3. Education + Belt group (Ed + BG) ($n = 27$): 1-hour session (cfr EdG) + subjects were asked to wear a lumbosacral orthosis during working hours for 6 months	At baseline and 6 months later. Final assessment of response rate: CG: 24/27, EdG: 24/27, Ed + BG: 25/27	Productivity: significant decrease of days lost (during the 6 months of the study vs. the previous 6 months) only in the Ed + BG group. However, no significant difference between groups ($p > 0.05$) Injury rate: no significant difference between groups ($p > 0.05$)
Reddell et al. [46] (USA)	RCT. 642 baggage handlers (fleet service clerks). Some had suffered a previous back injury, some suffered back pain	1. Control group (CG) ($n = 248$): no intervention 2. Education group (EdG) ($n = 122$): 1 h back injury prevention session including a videotape (about anatomy, biomechanics) and demonstration of correct body mechanics techniques + a “Back school” booklet given to participants 3. Belt group (BG) ($n = 145$): subjects were asked to wear the belt during work activities for 8 months 4. Education + Belt group (Ed + BG) ($n = 127$): subjects participated in a back injury prevention session (cfr EdG) + they were asked to wear a back belt for 8 months	At baseline and 8 months later. Final assessment of response rate: 642/896, CG: $n = 248$, EdG: $n = 122$, BG: $n = 57$ (+88%), Ed + BG: $n = 57$ (+70%)	Injury incidence rate: no significant differences between groups. Total number of lumbar injuries, lost and restricted workdays: no significant differences between groups. Total worker’s compensation cost: no significant differences between groups. Marginal evidence indicating that the subjects who discontinued use of the belt had higher lost day case incident rates
Daltroy et al. [43] (USA)	RCT (cluster randomized). Postal workers (clerk, mail handler). Some had suffered a previous back pain injury	1. Control group (CG) ($n = 1,894$): standard training in back-injury prevention (film) and periodic safety talks 2. Education group (EdG) ($n = 1,703$): standard training in back-injury prevention (film) and periodic safety talks, + a two-session back school totalling 3 h about safe lifting and handling, posture, pain management, exercises, on-site work-station ergonomic analysis, + 3–4 reinforcement sessions over the study period	At baseline and at the end of a 5.5-year study period	Rate of low back injury, rate of related musculoskeletal injuries, median cost per injury, time off from work per injury: no significant difference between groups

Table 1 continued

Authors (country)	Design, participants	Intervention	Timing of the assessments and proportion of responders at the follow-up	Outcomes and main results at the end of the study
Van Poppel et al. [35] (Netherlands)	RCT (cluster randomized). 312 subjects working in a cargo department of an airline company involving manual material handling. No subject with work disability included	<ol style="list-style-type: none"> 1. Control group (CG) ($n = 77$): no intervention 2. Education group (EdG) ($n = 82$): three group sessions on lifting techniques: the first (2 h) took place at the start of the intervention period and were related to anatomy and lifting techniques; the two others (1.5 h each) were given at 6 weeks (related to lifting techniques and relaxation exercises) and 12 weeks (at the workplace), respectively 3. Belt group (BG) ($n = 83$): subjects were asked to wear a back belt during working for 6 months 4. Education + Belt group (Ed + BG) ($n = 70$): Education (cfr EdG) + subjects were asked to wear a back belt for 6 months 	<p>At baseline, at the end of the interventions (at 6 months) and after an additional 3 and 6 months of follow-up.</p> <p>Responder rate at 6 months: CG: 70/77, EdG: 78/82, BG: 70/83, Ed + BG: 64/70.</p> <p>Final assessment of response rate: CG: 70/77, EdG: 73/82, BG: 66/83, Ed + BG: 59/70</p>	<p>LBP incidence: no significant difference between groups.</p> <p>Sick leave because of back pain: no significant difference between groups</p>
Kraus et al. [51] (USA)	RCT (cluster randomized). Employees of nine home attendant agencies. Some had suffered a previous back injury, some suffered back pain	<ol style="list-style-type: none"> 1. Control group (CG) ($n = 4,635$): no intervention (not informed of the study) 2. Education group (EdG) ($n = 4,300$): safety meetings: information about low back health, lifting advice 3. Belt group (BG) ($n = 3,837$): subjects were asked to wear a back belt (during work activities) during the whole study period 	<p>At baseline and 2 years later</p>	<p>Low back injury rates per 100 full-time equivalents: no significant difference between the EdG et BG groups ($p > 0.05$); these groups had a lower low back injury rate than the CG ($p < 0.05$)</p>
Jensen et al. [45] (Denmark)	RCT (cluster randomized). Eldercare workers (home care workers, nurses and nurse's aides) engaged in client care. Some had suffered a previous back pain episode	<ol style="list-style-type: none"> 1. Control group (CG) ($n = 77$): lessons unrelated to the other intervention programmes (but of same duration) 2. Education group (EdG) ($n = 65$): combination of practical classroom education (2×4 h) and instruction at the worksite on the transfer techniques (aiming to reduce the biomechanical load on the back, minimize work in asymmetric posture and prevent sudden unexpected loads) + implementation of the concept for 6 months where some instructors supervised their colleagues 3. Stress management group (SmG) ($n = 49$): training to address the work stress over 20 weeks (2-hour group sessions every 2 weeks) 	<p>At baseline and 2 years later.</p> <p>Final assessment of response rate: CG: 61/77, EdG: 53/65, SmG: 49/68</p>	<p>LBP intensity: no significant change in any of the groups</p>
Lavender et al. [50] (USA)	RCT. Employees in distribution centres. They were all at work	<ol style="list-style-type: none"> 1. Education group (EdG) ($n = 1,020$): video demonstrating various lifting techniques 2. LiftTrainer™ group (LTG) ($n = 957$): the subjects attended a new behaviourally oriented training process to improve lifting technique consisting in one to five individual 30-min training sessions with the LiftTrainer system over a 10-month period. This system can calculate instantaneously the 3-D dynamic moment (torque) vector acting on the lumbar spine and provide the participant with feedback on the peak to improve the lifting behaviours in work situations 	<p>At baseline and 1 year later</p>	<p>Incidence of low back disorder: no significant difference in injury rates between the groups.</p> <p>However, the LTG participants with a low average twisting moments (<30 Nm) at the end of the first session experienced fewer injuries than controls</p>

Table 1 continued

Authors (country)	Design, participants	Intervention	Timing of the assessments and proportion of responders at the follow-up	Outcomes and main results at the end of the study
Warming et al. [49] (Denmark)	RCT (cluster randomized). Nursing staff working in various wards of a hospital. Some participants suffered from back pain	1. Control group (CG) ($n = 75$): no intervention (usual routine) 2. Education group (EdG) ($n = 51$): transfer technique taught by use of a “train the trainers” model. Experts educated key persons from the field (for 6 days in total) who pass on the knowledge and practical skills to their colleagues during 6 months 3. Education and physical training group (Ed + PtG) ($n = 49$): Education (cfr EdG) + an 8-week programme (1 h twice per week) including aerobic and strength training	At baseline and 1 year later. Final assessment of response rate: CG: 51/75, EdG: 33/51, Ed + PtG: 35/49	Perceived LBP, pain level, disability, sick leave: no significant difference between the intervention and control groups at follow-up. No significant difference between the EdG and Ed + PtG at follow-up except for the disability score ($p < 0.05$) which decreased in the Ed + PtG

^a Discontinued use of the belt prior to the end of the study

Number of patients

The number of patients included in the studies ranged from 81 subjects [48] to 12,772 [51]; only four studies had a huge sample size ($n = 896$ [46], $n = 1,835$ [50], $n = 3,597$ [43] and $n = 12,772$ [51]); among them, only one [43] had an acceptable methodological quality score (6/12). The total number of patients in the present review was 19,545.

Description of the populations

All the studies included in the present review were conducted at the workplace. Most studies concerned workers involved in frequent lifting and handling. Four studies concerned people working in health care, i.e., subjects engaged in patient/client care as well as administrative or technical staff [44, 45, 49, 51]. Regarding participants' health, studies included asymptomatic subjects and/or people with present or previous back pain episodes unless they were on sick leave.

Description of the control groups

In six out of the nine studies, the control group had either no intervention or nothing else than “usual routine”; in one of them, participants of the control group were told they would benefit later from the best treatment (“waiting group”) [44]. In three studies the control groups attended either a single standard video session [50], a standard training in back-injury prevention (which was not described by the authors) [43] or courses unrelated to the intervention programmes (but of same duration) [45]. Whereas two studies included only a control and an education groups [43, 50], one or two additional intervention groups were included in all the other RCTs; the intervention in these groups were either completely different from the education (e.g., physical exercises, stress management, back belt) [44, 45, 51] or were a combination of both [46–49].

Description of the educational interventions

They differed widely from one study to another regarding most characteristics. The number and duration of sessions ranged from one 1-h session [46, 48] to about 8-h (five 90 min sessions [44] or two 4-h sessions [45]). Whereas little is known about the duration of the intervention in some studies [51], it appears very difficult to quantify the specific length of the education interventions in others [49]. Regarding the content, overall studies included courses about anatomy, body mechanics, safe lifting, handling or transfer techniques; no or only little information was

Table 2 Quality assessment of the randomized clinical trials included in the present review; they are classified in ascending order according to the methodological quality score (when the score is equal between two studies, the chronological order was used)

RCT included	Adequate method of randomization	Adequate allocation concealment	Blinding of the patients	Blinding of the care provider	Blinding of the outcome assessor	Withdrawals/ dropouts similar and acceptable	Intention-to-treat analysis	Results from all-specified outcomes adequately reported	Similarity of baseline characteristics	Co-interventions avoided or similar between groups	Acceptable compliance	Identical timing of the outcome assessment	Methodological quality score (0–12)
Lavender et al. [50]	1	?	0	0	?	?	?	1	?	?	0	1	3
Reddell et al. [46]	?	?	0	0	?	0	?	1	1	1	?	1	4
Kraus et al. [51]	?	1	0	0	1	?	0	1	?	?	?	1	4
Donchin et al. [44]	1	?	0	0	0	0	1	1	1	?	?	1	5
Jensen et al. [45]	?	1	0	0	?	1	0	1	1	?	0	1	5
Daltroy et al. [43]	?	1	0	0	1	?	1	1	1	?	?	1	6
Van Poppel et al. [35]	1	1	0	0	?	1	0	1	1	?	0	1	6
Warming et al. [49]	1	1	0	0	?	0	1	1	1	?	?	1	6
Walsh and Schwartz [48]	1	?	0	0	1	1	0	1	1	1	?	1	7

1, yes; 0, no; ?, unsure

provided regarding the proportion of the theoretical and practical parts of the session(s). The courses were given most often in groups by experts in the field, and they were sometimes combined to a videotape [43, 46]. In contrast, the “train the trainers model” (i.e., experts educated key persons from the field who pass the knowledge and supervise their colleagues) was used in two studies either as the only way of teaching [49] or with an aim of implementation/reinforcement [45]. In other studies, a booklet was given to the participants as an implementation method [46] or a kind of recall/reinforcement session organized later on [43, 44, 47], sometimes at the workplace [47]. Lavender et al. [50] studied the efficiency of an individual behaviourally oriented training process to improve lifting behaviours; the LiftTrainerTM system (which can calculate instantaneously the 3-D dynamic moment vector acting on the lumbar spine and provide the participant with feedback on the peak) was used to train participants to lift properly in various work situations.

Follow-up and outcomes

Whereas most studies reported the long-term results (at least 12 months of follow-up), two studies reported only the intermediate-term results, i.e., Walsh et al. (6 months) [48] and Reddell et al. (8 months) [46]. The outcomes could be classified into several categories: 1, incidence of back pain (self reported) or injury rate (based on statistics); 2, disability; 3, restricted work days and sick leave related to LBP. The outcome definitions as well as the duration of the LBP episode were sometimes poorly described.

Efficacy of intervention

The global results of the RCTs included in the present review regarding the outcomes related to LBP are presented in Table 3. No significant differences between the control and education groups were found at the follow-up in eight out of the nine studies. In contrast, Kraus et al. [51] reported a low back injury rate significantly higher in the control group than in the education group.

Discussion

The present review was conducted to assess the benefits of preventive educational interventions (mainly focused on a biomechanical or biomedical model) on incidence of back pain, disability and sick leave. Considering the results of this review, the benefits of such programmes can be questioned, as it has been in the last few years [34–36, 41]. Hence, the European guidelines for prevention in LBP do not recommend back schools based on a biomechanical

approach with emphasis on teaching lifting techniques (Level A) as well in the general population as in workers [52]. Yet, several factors might prevent from drawing such a strong conclusion.

First of all, only nine heterogeneous studies could be included in the present review. There were some potential confounders and there was no consistency to the content of the intervention and to the biomechanics principles underlying the education programmes; the endpoints also differed between studies. Although some additional studies have been included in several previous reviews [32, 34, 41], they were not considered for the present one, because they were not randomized and/or not controlled, because they included patients with neck pain or seeking care or because they aimed to investigate benefits of interventions combining education and an other important component (e.g., physical activity, major workplace adaptations, etc.). Indeed, we voluntarily focused only on preventive RCT studies including individuals who did not seek care for LBP.

Second, the mean methodological quality score of the studies included in this review was relatively low (5.1/12); only four of them had a score higher than 5/12. Indeed, the recent guidelines of the Cochrane Back Review Group suggest that only studies meeting more than 5 out of the 12 quality criteria have to be considered as having a low risk of bias [42]. Although a maximum score was not really possible, because of the nature of interventions (e.g., patient and care-provider blinding is very complex or even impossible), most of them had other significant bias or did not provide any information about important methodological criteria. Furthermore, considering the fact that these guidelines have been developed for systematic reviews, the sample size is an important methodological quality criterion which does not belong to the 12 criteria used [42]. Only four out of the nine studies included more than 200 subjects [43, 46, 50, 51]. Although the score system used in the present review was similar or the same as the one used by Martimo et al. [40] and Verbeek et al. [39], the methodological quality score was different between reviews regarding some studies. This highlights the difficulty to rate the methodological quality of a study.

Third, some education interventions were very short [46, 48, 51] (only 1 h in two studies) and could rather be considered as information intervention, because the practice time (handling task exercises, etc.) was rare or nonexistent. Although a prospective cohort study with a concurrent control group did not indicate the superiority in nurses of an intensive education combined to low tech ergonomic intervention over a 3-h instructional meeting [53], several RCTs included in the present review might have studied interventions which were too short to be beneficial.

Fourth, although no differences were observed between the educational and the control groups regarding the

Table 3 Summary of the efficiency of the educational programmes studied in the RCTs included in the present review

Study	Number of patients	Duration of the education programme (h)	Time between the baseline and final assessments (years)	Methodological quality score (0–12)	Global results (difference between groups regarding the LBP related outcomes)
Lavender et al. [50]	1,835	0.5–2.5 (one to five 30-min sessions)	1	3	No difference
Kraus et al. [51]	12,772	No details about it	2	4	Higher injury rate in the CG ($p < 0.05$)
Reddell et al. [46]	642	1	0.66	4	No difference
Donchin et al. [44]	142	7.5 (90-min sessions during 2-week-period + a fifth session after 2 months)	0.75	5	No difference
Jensen et al. [45]	191	8 (+ implementation)	2	5	No difference
Daltroy et al. [43]	3,597	3 (+3–4 reinforcement sessions)	5.5	6	No difference
Van Poppel et al. [35]	159	5	1	6	No difference
Warming et al. [49]	126	? (“train the trainer model”)	1	6	No difference
Walsh and Schwartz [48]	81	1	0.5	7	No difference

CG control group

outcomes related to LBP, most studies included in this review assessed subjects’ knowledge regarding back ergonomic principles (by means of questionnaires or practical tests) and reported a significantly higher improvement in the educational group than in the other groups [44, 48, 49]. However, the knowledge improvement does not necessarily imply that a change in daily subject habits or posture has occurred; indeed, the behaviour models suggest that only knowledge is not sufficient to induce change in behaviours that are habits [54]. Furthermore, such changes in behaviour are probably even more complex in asymptomatic subjects or subjects without past history of back pain, because they might weigh the potential costs (time) and benefits of that new behaviour without long-term thinking.

Fifth, the inefficiency of the educational interventions might also result from the workplace conditions which are sometimes not adapted, resulting in difficulty to change work habits [20]. Although this review did not aim to study specifically the preventive interventions at the workplace, no study conducted in the general population was found in the literature to be included in the present review; this might result from the difficulty of recruitment to perform a RCT. The literature analysis revealed the existence of one non-randomized study on the efficacy of a preventive back school in the general population (more than 800 volunteers) [55]. According to that study, such programme could decrease the number of doctor’s visits during the following 6 months; in contrast, the presence and intensity of back

pain, drug intake and sick leave were not influenced by the intervention.

Last, although it is unlikely to be the case in the present review, longer follow-up might have been necessary to observe preventive effects of such preventive back educational interventions. Besides, given the cumulative nature of LBP, one cannot exclude that such interventions would have been more efficient if they had been proposed earlier (e.g., when facilities were first open for workers).

The results of the RCTs included in this review do not suggest benefits of preventive educational interventions mainly focused on a biomechanical or biomedical model. Although they go in the same direction as recent reviews which have challenged the causal role of mechanical factors (lifting, carrying, occupational sitting, etc.) in LBP [56–59], they should not be used to judge the value and relevance of biomechanics in back pain prevention for several reasons, e.g., the absence of measures of compliance in the RTCs to confirm or infirm subjects had changed their daily habits.

Some among the major strengths of the present review are the study of a specific intervention (i.e., the preventive educational programmes), the inclusion of only RCT studies and the methodological quality assessment of the studies. However, a few methodological limitations can also be identified: (a) the inclusion of only RCTs might have deprived us of information on the topic. However, in the recent review of Verbeek et al. [39] about manual material handling and assistive devices for preventing back

pain in workers, RCTs and controlled clinical trials were considered; the results of the cohort studies included in their review were similar to the ones of the RCTs. (b) the heterogeneity of the included studies, notably regarding the education methods and the population (in term of LBP). Therefore, there may be limitations to the generalizability of the results of this review as subjects with current or past LBP can have different information and education needs from people without history of LBP, because they may differ in many respects (e.g., social, behavioral, cognitive and medical factors). Further research is needed to ascertain the information/education needs of different subject groups and also to study how best the intervention should be conveyed.

Conclusion and perspectives

The results of the RCTs included in this review suggest that educational interventions mainly focused on a biomechanical/biomedical model are not effective in preventing LBP. However, taking into account the methodological quality level of the RCTs as well as the very short and heterogeneous interventions often proposed, this review also points out the need of conducting additional high-quality studies with a longer education period to conclude that such interventions are inefficient. Then, a meta-analysis and a GRADE approach could be conducted to examine the quality of the evidence. Comparing such educational interventions to psychosocial information programmes based on a biopsychosocial model (which can modify the beliefs on back pain and consequences and increase the adherence to exercises [60] and seem to be effective [61]) would also be particularly relevant.

Conflict of interest None.

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