Fontys University of Applied Sciences

Effects of an Interdisciplinary and Multidisciplinary approach on pain and kinesiophobia of chronic low back pain patients: A state of the art

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Preface

This thesis represents the final step of 4 years of hard work within the physiotherapy bachelor at Fontys University of Applied Sciences. Topics for the thesis were given from school, but we had the chance to pick our own. I choose low back pain and more specifically exploring the innovative approaches as treatment options for it. Several reasons convinced me in choosing this topic. Mainly because during my internships abroad I worked with many chronic low back pain patients and therefore I felt the need to explore the topic a lot deeper. Furthermore, chronic low back pain is a multi-factorial experience which gave me therefore the possibility to explore and learn about different fields and approaches to this chronic condition.

In February 2016 I started this thesis project and from there on I invested a lot of time and energy into it. In order to be able to reach the final concept of the thesis many people invested their time to help me finalizing at its best. I would like to thank my supervisors Tim van der Stam and Mitchel van Eeden for their fundamental feedback and for their counselling during a personal very difficult period. Furthermore, I would like to thank Nicholas Quinn, Katrin Niisuke and Maximillian Cook for their time spent in improving my final thesis concept.

During this 4 years of bachelor I encountered very difficult and hard moments, periods in life which all of us need support of trustable friends. Therefore, I would like to thank Simone Benini, Nicolò Pavesi, Valentin Nerding and Francesca Bianchi for their natural friendship. Moreover, I would like to thank Arsim Buduri for his friendship and for his trust in the person I became. In all my life I have been experiencing many different forms of love, but none of them is as strong as the love I received from my family and from my closest friends. Thus, many thanks go to my huge family and friends which will always be part of me. I would also like to thank the Van Orsouw's family, without whom all of this would have not been possible. Thanks for giving me the best of you.

Furthermore, my deepest gratitude goes to Giovanna Vavassori and Giacinto Galbussera. My first source of inspiration and my best example in life. I am the mirror of all the hard work they have done in their life.

Conclusively, I would like to dedicate this thesis to two important persons in my life. Firstly to my sister, Sara Galbussera. She has always been supporting me. She will always be there for me, likewise I always be there for her.

Secondly, I want to dedicate this to the only person who will not be able to be here celebrating these moments with me. But that I am sure he is very proud of what I have been able to reach. That is why I would like to dedicate this work to Stefano Iuliano for all the years of brotherhood spent together. I miss you.

Diego Galbussera Graduation class 2016.

Abstract

Background: Chronic low back pain is one of the most common health problems worldwide. Between 60% and 90% of the people in the entire world will at some point in their lives experience low back pain. In order to tackle this disorder, innovative programmes are needed. A Multidisciplinary (MD) and an Interdisciplinary (IP) approach are among the most innovative and up to date options.

Objective: The purpose of this narrative review is to find out the effectiveness of an IP and a MD approach on pain and kinesiophobia of chronic low back pain patients.

Methods: A literature search was conducted in April 2016. Search terms, search strategy and in/exclusion criteria were set prior to the search process. Online databases Pubmed, PEDro, Science Direct and the Cochrane library were checked to look for articles with a focus on the effect of an Interdisciplinary and/or Multidisciplinary approach on pain and kinesiophobia of chronic low back pain patients.

Results: Nine articles (all published after 2010) were included in this narrative review. The results showed that an IP approach is a short and long-term effective approach to improve the pain perception in chronic LBP. They also showed that a MD approach is effective in improving the pain perception and the kinesiophobia aspect compared to conventional therapy in chronic LBP. No literature was found on the effectiveness of an IP approach on kinesiophobia of chronic LBP.

Conclusion: An IP and a MD approach seem to be effective in reducing the pain perception of chronic LBP patients. Moreover, a MD approach seems to be effective in reducing the kinesiophobia aspect. No literature was found on the effects of an IP approach on the kinesiophobia aspect. Further research is needed to validate the findings.

Key words: Interdisciplinary, Multidisciplinary, chronic low back pain, pain, kinesiophobia

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1. Introduction

Behind the economics of a strong flourishing country, lies a healthy working population which is the heart of a growing economy and innovation (1).

In the past few years, Western countries have gone through many changes which indirectly caused a shift in the context of healthcare worldwide (2–4). Health problems are changing, due to aging and ill-managed urbanization and globalization which has shifted the attention to communicable diseases, and extremely increased the burden of chronic disorders (5). These disorders require management for years or decades (6). In the European Union, 3 out of 10 European citizens suffer from chronic diseases (1).

Among all the chronic conditions low back pain (LBP) is one of the most common health problems, having consequences on an individual, on social and economic levels (7). It is a widespread and a highly debated problem in public health worldwide, being the fifth most common reason to visit a physical therapist in the US (8,9). LBP is defined as pain and discomfort situated below the costal margin and above the gluteal folds, with or without leg pain (10). Between 60% and 90% of the people worldwide will at some point in their lives experience LBP (11). In the Netherlands LBP is an extensive issue (11). In 2011 the total costs of back pain care in the Netherlands reached € 1,3 billion, being 1,5% of the total costs of the Netherlands healthcare system (12).

LBP lasting over 12 weeks it is known in the literature as chronic LBP (13). Moreover, if the specific cause of the LBP cannot be established the non-specific LBP (nsLBP) term is used. This counts for almost 90% of the LBP patients globally (11). Little is known about chronic LBP in regards to the pain mechanism behind it (14). Furthermore, chronic LBP patients are linked to psychological problems, such as psychological distress, behavioural changes, kinesiophobia (fear of movement) and lack of social or familiar support leading to avoidance behaviour (15,16). Even though biomechanical factors seem to be the primary cause of LBP, psychosocial factors have the biggest impact on the outcomes that LBP has on the individual (15–19).

All of these chronic conditions result in more complex and multi-factorial care situations which require innovative ways to tackle these disorders (4,20). A multidisciplinary (MD) and an interdisciplinary (IP) approach are among the most innovative programmes available today (20). They combine different therapeutic modalities and they rely on teams of different health care providers, such as physiotherapists, physicians, nurses, psychologists, dieticians, pharmacists and other professionals (21–24).

A MD approach combines different care providers but does not include working as an integrated team, while an IP approach does (20). Moreover, an IP approach brings improvements in the care services for adults with complex health problems. Firstly, because IP is an active and ongoing cooperation between different healthcare professionals (2,3,25). Secondly, because an IP approach accentuates pain management focusing on improving

functions, instead of pain relief (26). Some of the concepts of an IP approach include shared decision making and collective problem-solving to enable interdependent work (27). Therefore different disciplines and different types of care institutions work together in order to provide a common answer and share the responsibility to a complex and/or chronic situation (3,27,28). An IP approach has been among the most efficacious approaches in improving chronic patients' functions (20,23,26,29).

Previous studies support MD and IP as an effective treatment for chronic low back pain (20,30–33). Outcomes such as quality of life, return to work and disability were found to be improved (31,32). Reasons for improved outcomes may be that these approaches include more insight regarding the causes of LBP, which lead to different alternatives of both assessment and treatment. In fact, as stated earlier, chronic LBP represents a very multi-factorial condition which requires co-ordinated interventions from various health care professions to assist the patients in achieving their goals (9,29).

Among these professionals, physiotherapists play an important role in the management of the LBP patients (34). Physiotherapists can influence the pain experience of the patients by means of Education, Therapeutic exercises, Manual therapy, Electrotherapy and physical modalities (24,35).

The multi-factorial complexity of chronic LBP, the burden it has on the economy of most Western countries, the large amount of costs it produces, and the poor results with managing this patient group inspired this literature review. This study will take into consideration two problems frequently experienced by chronic LBP patients, which are pain and kinesiophobia. Mainly because both have a huge impact on chronic LBP patients. Moreover, pain may influence the development of kinesiophobia and vice versa the kinesiophobia may influence the pain experience (36). Furthermore, studies have shown that a high level of pain or a high level of kinesiophobia are proven risk factors for chronic LBP (36–38).

Recent studies and systematic reviews concerning the effectiveness of a MD approach have focused on the results of different outcomes variables, yet none of them have investigated the effects of such an approach on the kinesiophobia experience of chronic LBP. Moreover, in the current literature, no reviews were found investigating the effectiveness of an IP approach on chronic LBP patients. Therefore, this review intends to fill this lack of knowledge in the literature.

This review, therefore, aim to answer the following question: What is the effectiveness of an interdisciplinary and multidisciplinary approach on the pain and kinesiophobia of patients with chronic LBP?

2. Methods

This study was an independent literature study which explored the effects of an Interdisciplinary and Multidisciplinary approach on pain and kinesiophobia of patients with chronic LBP. The study was conducted during the time span from February 2016 until June 2016 as a Bachelor Thesis at Fontys University of Applied Sciences. In order to include articles on the Interdisciplinary efficacy on chronic LBP patients, this study will be presented as a narrative review.

2.1 Search strategies

The following databases were searched to find relevant articles: Pubmed, PEDro, Science Direct and the Cochrane library. Relevant articles were found by using keywords, which referred to the care provision, patient group and the outcome. The synonyms of each word were tied together using the Boolean operator OR. While the different groups of Keyword synonyms were tied together using the Boolean operator AND.

The following specific string has been used for the search of relevant articles on Pubmed database: ‘chronic low back pain’ [MeSH Terms] AND ‘Interdisciplinary’ [All fields] AND ‘pain’ [All fields] OR ‘kinesiophobia’ [All fields]. The string was remade for further research on Pubmed and on the other databases. More detailed information about the search procedure in each database can be found in Appendix I.

Articles found in the above mentioned databases which were included in the review but were not accessible in the database were searched in the Fontys search engine (http://www.biep.nu/english/) in order to try to obtain the full text of the article.

2.2 Inclusion criteria

For the selection of relevant articles for the following narrative review in/exclusion criteria were set. The main aspects which were taken into consideration were: type of patients, year of publication of the articles, patient care, outcomes and language of the study.

The in/exclusion criteria are listed below:

Inclusion Criteria:

- Articles not older than 10 years, in order to find a proper definition of an IP and MD approach in the studies
- Written in English
- Interdisciplinary or Multidisciplinary approach (any type of interventions)
- Outcome pain and/or kinesiophobia: outcome measured with valid and reliable instruments
- Full-Text articles available, free or paid ones
- Participants age older than 18 years old
- Participants with chronic LBP, as defined earlier (13)

Exclusion Criteria:

- Articles not clearly stating the type of approach used
- Different outcomes measured than pain and/or kinesiophobia
- Participants with acute LBP or suffering from serious spinal pathology

2.3 Screening and Data Selection

The steps performed during the screening and the data selection are presented in a flowchart in the results section. The first step was to screen the titles of the articles found in the different databases. If the titles indicated that it could be included, then the next step was to screen the abstracts. The abstracts were screened to find if they contained relevant information. These abstracts were read and selected by applying the in/exclusion criteria before mentioned.

The selected abstracts were read in their full format. While reading the full text, the articles were screened by the in/exclusion criteria stated. If an article was included, the Snowball method was used. Therefore, a specific search of the reference lists of the included articles was performed in order to find out more relevant articles which could bring input in the review.

2.4 Data extraction

In order to find out the effectiveness of a MD and an IP approach on pain and kinesiophobia of a chronic LBP patients, the author of this paper then performed the data extraction. The data extracted are presented in table, which consists of:

- Study Characteristics: Author and title; date of study; type of patient care and interventions; health care providers in the team; duration and frequency of interventions; follow-up periods both short-term (1 to 6 months after treatment) and long-term (6 to 12 months after treatment).
- Patient Characteristics: In/exclusion criteria, age, sex, diagnosis and duration of symptoms.
- Outcome measurement of pain and/or kinesiophobia; results of intervention and measurement tools, drop out and lost to follow-up.

2.5 Subgrouping

All the results in this narrative review are presented in four different subgroups, in order to give the reader a clear picture of the effects of each approach on each specific outcome. Therefore, the subgroups were made according to the type of care (MD or IP) and the outcome (pain or kinesiophobia) presented in the article.

3. Results

The initial search from the databases mentioned in the above method section resulted in a total of 507 articles. After the screening of the titles, 52 titles were chosen for further analysis of the abstract. Many studies regarding the effects of an IP approach on chronic LBP patients were found written in the German language (39,40). Therefore, the studies were excluded from this review. The abstracts were checked using the inclusion and exclusion criteria. Out of these abstracts, 24 articles were retrieved for a full-text manual screening. After reviewing the 24 articles, 15 were excluded based on the inclusion criteria set. Of the articles included after the former step, the duplicates were removed (n=2). Thus, nine articles were chosen according to the listed in/exclusion criteria for inclusion in this narrative review. Figure 1 illustrates the flowchart of the selection process.

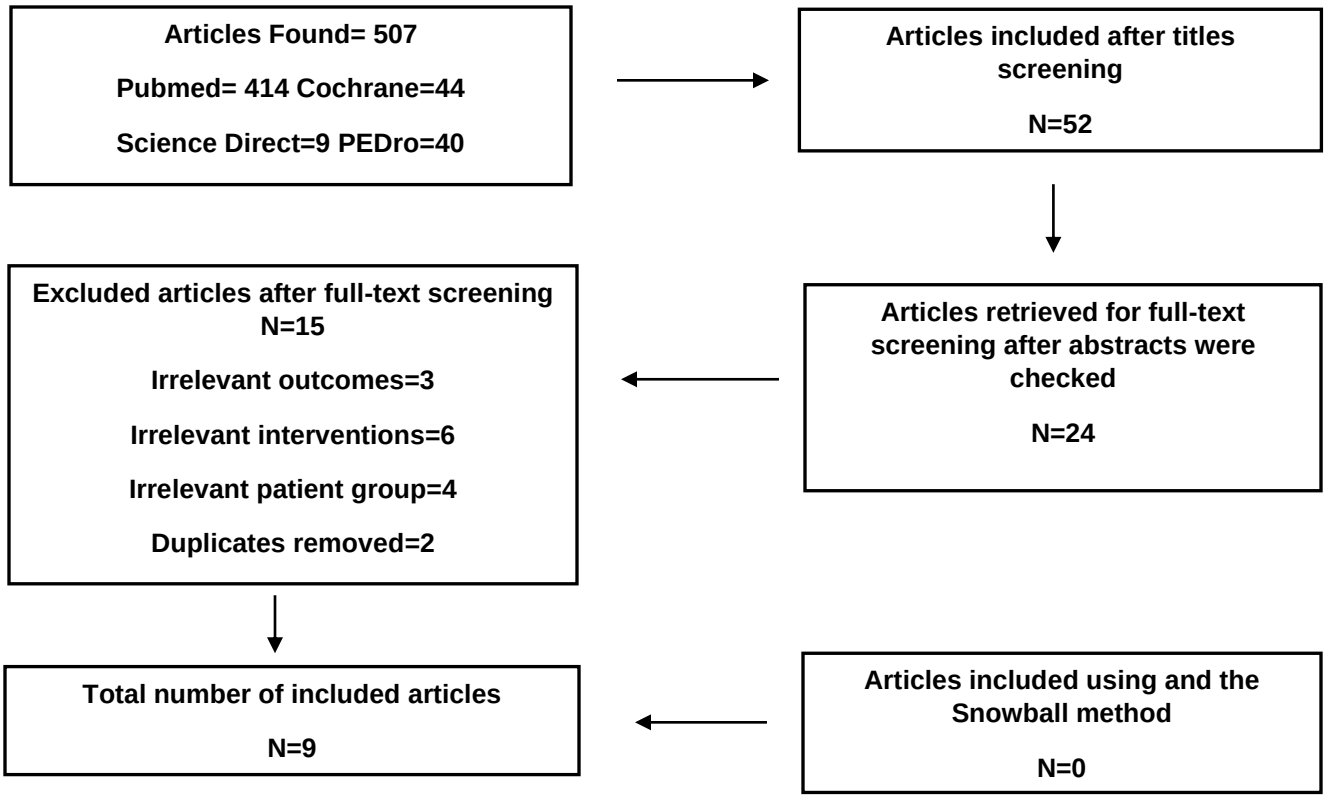

Figure 1 *Flow chart of the included articles*

3.1 Data extraction

The nine studies included in this review had a mean age ranging from 40.4 (SD 11.3) to 58.9 (SD 16.4). The studies differed in regards to the type of the patient care provided and in regards to the study design. While three of the studies (clinical audit, prospective study and quasi-experimental study) refer to an IP approach taking care of the treatments (41–43). Five Randomized Controlled Trials (RCTs) and one longitudinal study refer to a MD approach involvement (44–49). Furthermore, the studies differed in the outcome assessment. While six of the above mentioned studies have used pain as the only outcome (41–43,47–49), three RCTs took into consideration pain and kinesiophobia as well (44–46). Moreover five studies have used VAS as a measurement for the outcome of pain (41,43,47–49), while three RCTs (44–46) and the quasi-experimental study (42) have used the 11-point Numerical Rating Scale (NRS), besides the three RCTs (44–46) took the Tampa Scale (TSK) as a measurement tool for assessing the kinesiophobia outcome. A recent review came to the conclusion that, for research purposes and measuring pain in the clinical practice, VAS and NRS were the best adapted pain scales (50). Moreover studies have shown that TSK has a good reliability and validity for measuring kinesiophobia. Furthermore, a good test-retest stability was found, even with long time intervals between testing (51,52).

Moreover the nine studies presented different follow-up period (41–49). The three studies using an IP approach reported a 6 and 12 month follow-up periods. The remaining six studies utilizing a MD approach reported 12 and 24 weeks (3 and 6 months respectively), 1 year (12 months), 18 or 24 month follow-up periods. Therefore short and long term effects of both IP and MD approach are extracted from the 9 included articles. The main characteristics of the studies are presented in Table 1. More detail information about the study characteristics can be found in Appendix II.

Table 1 *Main study characteristics*

Author	Participants Sample Age Gender	Study design	Experimental group (E)	Control group (C)	Duration/ Frequency	Outcome measured	Follow-ups
Gregg et al. (41) **(2011)**	899 40.4 M=62,7%	Clinical audit	IP approach (Specific exercises + PI + stretching + FE and simulation activities. Self-management training)	N/A	6 to 12 weeks. 3 x weekly of 1 h.	-VAS	6 months
Pieber et al. (48) **(2014)**	96 48.6 F=66 M=30	Longitudinal study	MD approach (PI + ergonomic advices + healthy alimentation + PE + ET with resistance machines)	N/A	6 months. 40 training sessions of 90 mins.	-VAS	18 months
Semrau et al. (42) **(2015)**	363 E=48.9 F 54,1% C=49.3 F 48,5%	Quasi-experimental study	IP approach (PE + behavioural ET + coping with pain + relaxation + work related)	MD approach (Health education lectures + ET + back school + MG + PI + individual counselling)	22 days. E= 48 h. total. IP meeting once a week. C=48 h. 5 to 7 h. individual treatments.	-NRS	12 months
Moradi et al. (43) **(2012)**	395 44.25 F 57,5%	Prospective cohort study	IP approach (ET + ergonomic advices + PI + PE + CBT and workplace based interventions)	N/A	40 h. weekly for 3 weeks. Total of 120 h.	-VAS	6 months

Monticone et al. (46) **(2016)**	150 E=53.2 M/F 28/47 C=53.8 M/F 30/45	RCT	MD approach (Exercises to improve mobility and muscles awareness + task-oriented exercises + CBT + info on chronic conditions + relaxation + attention techniques)	Conventional therapy (ET, strengthening, stretching and postural control)	5 weeks. E= 1 h. x week with Psychologist + 2 h. x week physical training session. C= 2 h. x week physical training session.	-TSK -NRS	12 and 24 months
Monticone et al. (45) **(2014)**	20 E=58.9 M/F 3/7 C=56.6 M/F 6/4	RCT	MD approach (Stabilisation exercises + usual care + CBT)	Conventional therapy	8 weeks. E: 1 x week CBT + 2 h. x week training session. C= 2 h. x week training session.	-TKS -NRS	3 months
Monticone et al. (44) **(2013)**	90 E=48.96 M/F 18/27 C=49.71 M/F 20/25	RCT	MD approach (CBT + ET)	ET alone	5 weeks + 12 months reinforcement E=1 h x week CBT + 2 h. x week ET 1 x month meeting psychologist C= 2 h. x week ET + home exercises for 12 months (2 h. x week)	-TKS -NRS	12 months

Nazzal et al. (49) **(2013)**	100	E:49.8 C=49.4	M/F 17/33 M/F 18/32	RCT	MD approach (ET + PE + US + Tens + aerobic + stretching + flexibility + postural exercises + MG and OT)	Therapy assisted back + gluteal muscles strengthening	6 weeks total. 36 h. ET + 12 h. of OT + 12 h. of PE	-VAS	12 and 24 weeks
Roche-Leboucher et al. (47) **(2011)**	132	39.8	M=86 F=46	RCT	MD approach (Strengthening + endurance training + OT + balneotherapy + proprioceptive exercises + weekly meeting with psychologist and physiatrist. Ergonomic advice at workplace)	Flexibility and pain management + strengthening and FE + home exercises (stretching, jogging and swimming).	5 weeks. E=6 h. x day, 5 days x week. C=3 h. x week.	-VAS	12 months

C=control group; CBT=cognitive behavioural therapy; E=experimental group; ET=exercise therapy; F=female: FE=functional exercises; h=hours; IP=interdisciplinary; M=male; MD=multidisciplinary; MG=massage; N/A=not applicable; NRS=numerical rating scale; OT=occupational therapy; PE=patient education; PI=psychological interventions; PT=physical therapist; RCT=randomized controlled trials; TSK=tampa scale for kinesiophobia; US=ultra-sound; VAS=visual analogue scale.

3.2 Reported effects of the different approaches

3.2.1 Interdisciplinary approach

Gregg et al. (41) found significant differences in pain scores between assessment and discharge (p<0,001), and between assessment and follow-up (p<0,001).

In the study done by Moradi et al. (43) patients showed a significant improvement in pain scores, at discharge and at six months follow-up (p<0,0001). Effect sizes at discharge indicate clinical relevant pain relief.

Semrau et al. (42) found a significant between-group difference in favour of the IP approach only at 12 months follow-up (p=0,027). No between-group difference was found at the end of the rehabilitation (p=0,213).

3.2.2 Multidisciplinary approach

Monticone et al. (46) (2016) found a significant between-group difference on the TKS in favour of the experimental group at the end of the rehabilitation (p<0,001). In the experimental group, improvements were maintained up to two years after the end of the rehabilitation. In the control group, the baseline score on the TKS significantly improved at discharge but significant worsening was observed at one year and at two year follow-up. In regards to pain significant improvements were found in both groups (p<0,001), but the experimental group improved more and maintained the improvements at all the follow-ups.

In another study done by Monticone et al. (45) (2014), a significant reduction on the TKS was found in favour of the experimental group, which was maintained at follow-up (p<0,001). In the control group, no significant changes were observed. It was also found that pain decreased in both groups. However, improvement slightly declined at follow-up in the control group (p<0,001).

In a third study done by Monticone et al. (44) (2013), statistical analysis showed a significant between-group difference in favour of the experimental group (p<0,001). It was also found that kinesiophobia and pain strongly decreased in the experimental group. In regards to the TSK 98% of the patients in the experimental group achieved significant improvements after five weeks, and 100% after 12 weeks. While none of the control group patients did achieve it at either time point. Regarding the NRS after 12 weeks was found that the experimental group achieved a significant improvement. While in the control group only 31% of the patients achieved a significant improvement, one fifth did not achieve a significant improvement and the 49% did not experience any difference in the intensity perception.

The RCT done by Nazzal et al. (49), showed a significant between-group difference in pain scores in favour of the experimental group at the end of the treatment. After the six weeks rehabilitation, a significant difference was found between the two groups (p=0,0001).

In the study done by Pieber et al. (48) the values on the VAS decreased greatly after intervention (p<0.001), but showed a small significant increase at follow-up. Still follow-up values on VAS were significantly below baseline levels (p<0,001).

In the last study done by Roche-Leboucher et al. (47) a significant difference in pain scores was found at the end of the treatment, in favour of the experimental group (p<0,001). The improvement was kept at one year follow-up, but no significant difference was then found between the two groups.

3.3 Subgroups results

As earlier stated by the author of this review, four subgroups are made according to the different type of care and the different outcomes measured in the nine included articles.

The studies in this review can be divided into two types of patient care, IP and MD. Therefore, a synthesis of the different results of the different subgroups was performed. Because of the outcome measures of the studies consisted of kinesiophobia and pain, and because of the two types of patient care IP and MD, four separate subgroupings were made.

3.3.1 Effectiveness of an Interdisciplinary approach on pain

Three studies were included in this subgroup (41–43). The studies of Gregg et al (41); Moradi et al. (43) and Semrau et al. (42) show that an IP approach is a significantly short and long-term effective intervention to improve the pain perception in patients suffering from chronic LBP. Moreover Semrau et al. (42) show better results on long-term in favour of the IP approach compare to a MD one.

3.3.2 Effectiveness of an Interdisciplinary approach on kinesiophobia

No information in the current literature is available for this specific subgroup.

3.3.3 Effectiveness of a Multidisciplinary approach on pain

Six studies were included in this subgroup (44–49). The three different studies of Monticone et al (44–46); the studies done by Nazzal et al (49); Pieber et al. (48) and Roche-Leboucher et al. (47). They all show that a MD approach is a significantly effective programme to improve the pain perception in patients suffering from chronic LBP compared to conventional therapy.

3.3.4 Effectiveness of a Multidisciplinary approach on kinesiophobia

Three RCTs were included in this subgroup (44–46). The three different studies of Monticone et al. (44–46) show that a MD approach is a significantly effective programme to improve kinesiophobia in patients suffering from chronic LBP compared to conventional therapy.

4. Discussion

The aim of this narrative review was to find out the effectiveness of an interdisciplinary (IP) and a multidisciplinary (MD) approach on pain and kinesiophobia of chronic low back pain patients. Nine studies (41–43) showed a significant improvement in the pain perception of chronic LBP patients after an IP and a MD approach, and therefore suggesting both of the approaches to be effective. Three studies done by Monticone et al. (44–46) showed a significant improvement on the kinesiophobia aspect of chronic LBP patients after a MD approach, compared to conventional therapy. The author of this paper did not find any more evidence regarding the effectiveness of a MD approach on kinesiophobia, therefore, the author decided to include three articles in this narrative review. IP is a relatively new approach, therefore, no studies were found investigating the effect which an IP approach may have on kinesiophobia of chronic LBP patients.

Among the nine studies included in this review Moradi et al. (43) presented the highest improvements in the pain scores, with a $p<0,0001$. However, the study done by Moradi et al. (43) did not present a control group and therefore it may be hard to associate the results obtained solely to the experimental group. Furthermore, in the study done by Moradi et al. (43), the title refers to a MD approach while in the method section the author refers to an IP approach taking care of the interventions. Even though the use of the terminology is unclear, the article was included in this review and it has been considered as an IP approach. This is mainly because of the lack of articles found regarding an IP approach. The study done by Nazzal et al. (49) obtained an almost equal result ($p=0,0001$). On the other hand, in the study done by Nazzal et al. (49) while the experimental group received a total of 75 hours of treatment, the control group received only 22 hours of treatment. Such a big difference in the frequency of the treatment programme decreased the strength of the findings and it could create a risk bias in the results.

Moradi et al. (43) presented an intense programme, with more than 100 hours of treatment. Moreover, a CBT intervention was included in the study. Nonetheless, this could indicate, as previous studies (53,54) have suggested, that CBT is effective in treating pain perception in chronic LBP patient. This is mainly because CBT

targets pain perception by addressing maladaptive and negative believes, moreover CBT modifies the attitude of patients towards pain (55). Therefore, CBT should be integrated as a fundamental intervention.

Many studies (41,42,44–46) included in this review did not administrate an intense programme to the participants and they still obtained significant improvements in their outcome measurement. Therefore, treatment intensity is not a fundamental component for treatment effects, this is also supported by a recent review done by Kamper et al. (31). Furthermore, a systematic review (56) tried to investigate the influence of intensity on the effectiveness of an approach, however, no proper estimation was possible. Hence, no optimal intensity application is known yet.

In the study done by Roche et al. (47) a significant difference in VAS scores was found at the end of the treatment, in favour of the experimental group ($p<0,001$). The improvement was kept at 1-year follow-up, but no significant difference was then found between the two groups. This could mean that long term effects relate closely to changes in lifestyle. As the three studies done by Monticone et al. (44–46) showed, the experimental group maintained the improvement at the follow-ups as well (3,12 and 24 months). The three studies included CBT as part of their programme. Thus, as previous studies suggested (57–59), a proper CBT could be an important intervention to modify the long-term pain perception and to decrease the kinesiophobia aspect of chronic LBP patients as well. In fact, through CBT the patients learn how to modify their fears and they are encouraged to adopt self-management behaviours towards their perceived disability. Thus, CBT increases patients' self-efficacy which improves their positive attitude towards physical performance (55).

The study done by Semrau et al. (42) was the only article found comparing the two different approaches (IP and MD). This study showed a significant difference in favour of the IP approach but only at 12 months follow-up. In the study done by Semrau et al. (42), the IP group received a programme explicitly related to a behavioural treatment, in contrast to the control group. These results indicate that an IP approach is more effective than a MD on the long-term, especially it may indicate as well the importance of behavioural treatments to modify long-term pain perception. In fact, behavioural techniques stimulate a change towards an active lifestyle (55).

The results found in this narrative review are in line with a previous systematic review (33), which demonstrated the superiority of a MD approach compared to conventional treatment. Moreover, this review showed significant improvements in the long-term effectiveness of a MD approach on chronic LBP patients. Similar results can be found in a recent systematic review which explored the long-term effects of a MD approach (31). However, these results are in contrast to another systematic review (57), which provides evidence in the short-term effectiveness of a MD approach but not on the long-term effects on pain. Nonetheless, the review done by Van Middelkoop et al. (57) included studies which are out to-date, this could be an explanation to the different results in regards to the long-term effectiveness.

4.1 Strengths and weaknesses

The strength of this narrative review is that articles not older than 2010 were presented in this study. The results obtained in this study find a strong point in the age of the participants. In fact, according to Buchner et al. (60), fewer improvements after a MD approach can be found in participants older than 35 years. Therefore, the author of this paper assumed that even more effective results could have been obtained with younger participants. All the studies presented patients in a chronic LBP stage and have a similar mean age. Moreover, the studies use the same outcome measurement tools, which are all valid and reliable. This makes it easy to compare the results. Furthermore, the author of this review performed a quality assessment of all the articles included in this review, using different scales and checklists according to the study design of the article. All the articles scored a qualitatively good result.

A limitation of this narrative review is that it was conducted and written by only one person, which may give a narrow view on the topic. The data selection and extraction were performed individually as well. The age of the participants, even though it is a strong point of this review, is also a limitation. Mainly because this narrative review presented results only on a specific age group. Another limitation of this study is that the author of this paper did not include studies which did not clearly stated the type of approach used (either IP or MD). In fact, while the author of this review was screening different articles during the screening process, a proper use of the IP and MD terminology was not found. Many studies have used IP and MD as if they were the same type of approach. Therefore in order to further decrease bias in research, a clear use of the terminology should be applied. There should be clearly stated if the approach which has been used in the study is either IP or MD, and be coherent throughout the entire article. Another limitation of this study is that three of the nine included articles are from the same author (44–46). The three articles done by Monticone et al. (44–46) suit perfectly the aim of this narrative review. Therefore the author of this review decided to include all the three articles.

5. Conclusion

Overall, this study suggests that an interdisciplinary approach seems to be effective in reducing the pain perception of chronic low back pain patients. Furthermore, it suggests that a multidisciplinary approach seems to be more effective in reducing pain and kinesiophobia, compared to conventional therapy, of chronic low back pain patients. No literature was found exploring the effect of an Interdisciplinary approach on the kinesiophobia aspect. It must be borne in mind that this study was only conducted by one researcher. Further research is hence needed to determine the effectiveness of an interdisciplinary approach before a generalised conclusion can be drawn.

5.1 Future research

As shown, there are not many studies which have been found on the effectiveness of an IP approach on the level of pain and kinesiophobia of chronic LBP patients. Therefore, there is a need for more research into the field of IP approach in the case of patients with chronic low back pain. To see whether the effectiveness of the approach can be supported and what content of the approach is beneficial on the level of pain and kinesiophobia. Clearly defining the type of approach, the interventions, the duration and frequency, the outcome measurement tool and the type of participants would allow for a better comparison of the results. Once, the effectiveness of an IP approach has been clearly investigated. Further well designed RCT's will be then needed to compare the effectiveness of an IP and a MD approach. The studies will have to determine whether the results compensate or not for the large difference in costs of both programs.

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Appendix I –Search string

Database	Keywords	Initial result	Abstracts screened	Full-text articles screened	Excluded articles after screening full text	Included articles
Pubmed	'Chronic low back pain' [MeSH Terms] AND 'Interdisciplinary' [All fields] AND 'pain' [All fields] OR 'kinesiophobia' [All fields]	414	35	13	Duplicates (n=2) Intervention (n=3) Outcome (n=2) Patients group (n=2)	4
Pedro	'Interdisciplinary' AND 'Chronic low back pain' [Abstract and Title]	5	0	0	0	0
	'Multidisciplinary' AND 'Chronic low back pain' [Abstract and Title]	35	12	8	Outcome (n=1) Intervention (n=2)	5
Cochrane	'Interdisciplinary' AND 'Chronic low back pain' [All fields]	44	3	1	Intervention (n=1)	0
Science Direct	'Interdisciplinary' AND 'Chronic low back pain' [Title/Abstract]	9	2	2	Patients group (n=2)	0
Total		507	52	24	15	9

Appendix II-Detail study characteristics

Study characteristics	Intervention:	Duration:
Gregg et al. (2011)	3 different stages Stage one: pattern specific exercises and rest positions to reduce their pain symptoms. Moreover individual and group education on management of back pain and on psychological barriers to recovery. Stage two: exercise and stretched to improve spina mobility. Stage three: FE and vocational stimulation in a supervised gym environment. At the end home-based exercises and encouragement on self-management approach.	One hour appointment for 3 sessions weekly for a period over six to twelve week.
Subjects characteristics	Inclusion criteria: -CLBP patients -Reduce disability and presenting barriers to independence at work Exclusion criteria: -Patients with trauma, infections or systematic illness -Patients who did not complete baseline subjective questionnaire	899 participants Mean age 40.4 years (SD 11.3) 62,7% were male Mean duration of symptoms 322 days (SD 342 days, Median 208 days)
Outcome measurement	Pain: -VAS (p<0,001)	6 months follow up 1076 were referred to the clinic. Outcome measures completed by 899 (83.6%). 87/1076 withdrew early from programme, 90/1076 did not complete discharge forms.

CLBP=chronic low back pain; FE=functional exercises; p=p-value; SD=standard deviation; VAS=visual analogue scale.

Study characteristics Semrau et al. (2015)	Intervention: Team: physicians, psychologist, ST, PT, OC, masseurs, social workers, nurses and dieticians. C=Health education lectures, ET and back school, massage, PI and individual counselling. By MT. E=6 IP modules: Education (Intro, Education on LBP. Passive and active therapy options, reflection and patient experiences). Behavioural ET I and II: (Education on positive effect of ET, Lumbar stabilisation exercises, action and coping planning, reflection and increase of physical activities). Coping with pain (pain management, influence of thoughts, fear-avoidance behaviour, stress and work satisfaction, dealing with flares-ups). Relaxation (relaxation techniques and effects). Workplace related information.	Duration: Both groups average of 22 days. Total of 48 hours. C=5 to 7 hours individual treatment E=Sessions of 30 up to 90 minutes IP meeting once a week.
Subject characteristics	Inclusion criteria: -CLBP (at least 3 months) Exclusion criteria: -Below 18 years old or over 65 years -Specific cause -Reduce hearing -No german language -Severe psychiatric problems -Current application for pension	E=184 Age 48.9 SD 8 Female 54,1 % C=179 Age 49.3 SD 8.2 Female 48.5 %
Outcome measurement	Pain -NRS (IP effective in reducing pain, significant group difference at 12 months p=0,027)	12 months follow up From the 533 allocated to the interventions. Outcome measures were available for 363 participants (68.5%).

CLBP=chronic low back pain; C=control group; ET=exercise therapy; E=experimental group; IP=interdisciplinary; LBP=low back pain; MT=multidisciplinary team; NRS=numerical rating scale; OC=occupational therapy; p=p-value; PT=physical therapist; PI=psychological interventions; SD=standard deviation; ST=sport therapist.

Study characteristics Moradi et al (2012)	Intervention: ET (walking, medical training, indoor and outdoor free sports), ergonomics, psychotherapy (stress relaxation and problem solving), PE (explanation of adaption of pain and alleviating fear of movement), behavioural therapy (physical and mental coping strategies) and work-based placed intervention in individual or group sessions.	Duration: 3 weeks therapy. 8 hour sessions per 5 days a week for a total of 120 hours.
Subject characteristics	Inclusion criteria: -Age above 18 -German language -Experiencing CLBP, 3 months at least -First time to Interdisciplinary treatment Exclusion criteria: -Specific etiology of pain (e.g. tumor, trauma or infection..) -Acute LBP -Cardiovascular problems -Neurological deficit -Surgery in the 12 months before	395 patients (227 F 168 M) Female 57,5% Male 42,5% Age mean 44,25 (SD 9,1) Pain duration mean 16,4 months (SD 25.9)
Outcome measurement	Pain: -VAS (p<0,0001)	6 months follow up All patients completed their outcome measurements (100%).

CLBP=chronic low back pain; ET=exercise therapy; F=female; LBP=low back pain; M=male; p=p-value; PE=patient education; SD=standard deviation; VAS=visual analogue scale.

Study characteristics Monticone et al (2016)	Interventions: MT (2 physiatrist, 1 psychologist and 4 PT) E=Activation of Multifidicus, tranversus and obliquus abdominis muscles to improve spinal mobility and awareness. After task-oriented exercises while maintaining muscles activation to improve mobility and strength of the lumbar spine. Exercises aimed at recover balance, coordination and walking abilities. CBT to modify fear of movement beliefs, and educated to see pain as something that can be self-managed. Questionnaires were administrated in order to know patients beliefs and what to avoid. Gradually increase physical activities was suggested. Relaxation and distractive techniques were shared with the patients. Helpful ways of thinking were provided in order to master fearful situations. C=Passive spinal mobilisation, strengthening (abdominal and back), muscle stretching (back and lower limb) and muscular control training (improving postural control).	Duration: 5 weeks. 1 h session twice a week for both groups with physical trainer. Moreover E group met Psychologist once a week for 1 hour session.
Subject characteristics	Inclusion criteria: -Age above 18 -Italian language -CLBP at least 3 months Exclusion: -Specific LBP (trauma, infection, surgery..) -Patients already received CBT therapy	E=75 Age 53.2 (SD 11.1) M/F 28/47 Pain duration 21.7 (SD 15.00) months C=75 Age 53.8 (SD 10.4) M/F 30/45 Pain duration 22.7 (SD 15.9) months
Outcome measurement	Pain: -NRS (p<0,001) Kinesiophobia: -Tampa scale (p<0,001	12 and 24 months follow up. From the 150 participants, 3 subjects dropped out before the end of the study. 18 at follow-ups (9 at 12 months and 9 at 24 months) (86%). Total of E=10 and C=11. Data analysis performed on 150 patients. 11=personal problems; 8=medical complications; 2=logistic problems.

C=control group; CBT=cognitive behavioural therapy; CLBP=chronic low back pain; E=experimental group; F=female; LBP=low back pain; M=male; MT=multidisciplinary; NRS=numerical rating scale; p=p-value; SD=standard deviation.

Study characteristics Monticone et al (2014)	Interventions: MT (two physiatrist, 1 psychologist, 1 OT, two PT) E=Spinal stabilising exercises (deep muscles awareness), Stretching, Passive mobilization, postural control, CBT individual to modify fear of movements beliefs and negative feelings. Educated as seeing pain as self-managed situation and correcting attention from kinesiophobia to gradually increasing activities level. C=Passive spinal mobilisation, stretching, strengthening and postural control.	Duration: E=1 hours a week CBT and twice a week 1 hour of physical training. 8 weeks C=Twice a week 1 hour physical training. 8 weeks
Subject characteristics	Inclusion criteria: -Above 18 years -CLBP (more than 3 months) -Italian language -Referred to hospital between January and June 2013 Exclusion criteria: -Specific etiology of pain (e.g. tumor, trauma or infection..) -Cardiovascular problems -Neurological deficit -Previous CBT therapy intervention	E=10 Age 58.9 (SD 16.4) M/F 3/7 Pain duration 14.7 (SD 6.5) months C=10 Age 56.6 (SD 14.4) M/F 6/4 Pain duration 14.2 (SD 5.1) months
Outcome measurement	Pain: -NRS (p<0,001 time effect) Kinesiophobia: -Tampa scale (p<0,001)	3 months follow up. All completed their programme (100%)

C=control group; CBT=cognitive behavioural therapy; CLBP=chronic low back pain; E=experimental group; F=female; LBP=low back pain; M=male; MT=multidisciplinary; NRS=numerical rating scale; OT=occupational therapist; p=p-value; PT=physical therapist, SD=standard deviation.

Study characteristics Monticone et al (2013)	Interventions: MT (2 physiatrists, 1 psychologist and 4 PT) E= CBT (Avoid stressful situations and educate the patient on seeing pain as something which can be self-managed. Awareness of the problem and ways to react to negative thoughts. Gradually increase of activities. Discuss coping strategies and sharing goals. Passive mobilisation to improve ROM of the spine, deep muscles awareness and strengthening, stretching lower limb and back, postural control and ergonomic. C=Passive mobilisation to improve ROM of the spine, deep muscles awareness and strengthening, stretching lower limb and back, postural control and ergonomic.	Duration: 5 weeks plus 12 months reinforcement phase E=1 hour weekly of CBT and 1 hour twice a week of ET. Once a month meeting with psychologist. C=1 hour twice a week of ET. Twice a week 60 minutes exercise therapy at home.
Subject characteristics	Inclusion criteria (90 patients): -CLBP (lasting at least 3 months) -Age above 18 -Italian language Exclusion criteria: -Cognitive impairment -Acute and specific cause of LBP -Previous experience in CBT	E=45 Age 48.96 SD 7.97 M/F 18/27 Pain duration 25.25 SD 11.90 months C=45 Age 49.71 SD 7.01 M/F 20/25 Pain duration 26.33 SD 11.58 months
Outcome measurement	Pain: -NRS (p<0,001) Kinesiophobia: -Tampa scale (p<0,001)	1 year follow up. No dropped out (100%).

C=control group; CBT=cognitive behavioural therapy; CLBP=chronic low back pain; E=experimental group; ET=exercise therapy; F=female; LBP=low back pain; M=male; MT=multidisciplinary; NRS=numerical rating scale; p=p-value; PT=physical therapist, ROM=range of motion; SD=standard deviation.

Study characteristics Nazzal et al (2013)	Interventions: E=Exercises, education (lessons on anatomy, postural and lifting techniques) and pain management (10 mins US plus 30 mins TENS combined with aerobic, stretching, flexibility, postural exercises, massage, PE and OT). C=Strengthening and stretching muscles in back and gluts area. Piriformis exercises. Programme did not include abdominal area. 6 sets of 10 repetitions for body and leg lifting. 3 to 6 sets of 15 repetitions for piriformis.	Duration: 6 weeks divided in 3 periods of 2 weeks each. E= 1st period: 22 hours of exercises. 1.5 hours of playing ball games and exercises in warm water. 2 hours of baseball stick training. 10 hours of education. 2nd period: 3 times a week 2 hours of exercises at study site, and twice a week at home. 3rd period: 2 hours exercises 5 times a week. Total of 75 hours muscle training exercises. C=2 hours for 5 times a week. Total of 22 hours of muscles training exercises.
Subject characteristics	Inclusion criteria: (100 patients) -CLBP (at least 12 weeks) -Age 18-65 years Exclusion criteria: -Patients with specific/serious spine problems -Language problems	E=50 Age 49.8 SD 6.2 M/F 17/33 C=50 Age 49.4 SD 5.2 M/F 18/32
Outcome measurement	Pain: -VAS (p=0,0001)	12 and 24 weeks follow up. No drop out was recorded (100%).

C=control group; CLBP=chronic low back pain; E=experimental group; F=female; M=male; OT=occupational therapist; p=p-value; PE=patient education; SD=standard deviation; US=ultra-sound; VAS=visual analogue scale.

Study characteristics Pieber et al. (2014)	Intervention: PI, ergonomic, healthy alimentation, ET programme of major muscle groups with resistance machine for strength (keeping pelvic stabilisation at all time) and education on spinae structures. By MT team.	Duration: 6 months. Total of 40 session of 90 minutes. Six sessions on psychology, 2 sessions on ergonomic and alimentation, 1 session of education, 2 sessions weekly of ET the first 3 months and then reduce to 1 session a week the last 3 months.
Subject characteristics	Inclusion criteria: -CLBP Exclusion criteria: -Severe disorders -Surgery -Cardio respiratory diseases -Retired	96 participants F/M 66/30 Age F 48.6 SD 6.7 M 52.3 SD 6.5 Duration 1 year 4.2 %, 1-5 years 18.8%, 5-10 years 72.9%, more than 10 years 4,1 %
Outcome measurement	Pain: -VAS ($p<0.001$)	18 months follow up. From 100 participants 4 dropped out due to lack of time (96%).

CLBP=chronic low back pain; ET=exercise therapy; F=female; M=male; MT=multidisciplinary; p=p-value; PI=psychological interventions; SD=standard deviation; VAS=visual analogue scale.

Study characteristics Roche-Leboucher et al. (2011)	Interventions: E=Strengthening and endurance training (stepping, jogging, cycling). OT supervising work activities and ergonomic advice. Balneotherapy for relaxation. Weekly meeting with Physiatrist and Psychologist, and Dietician. By MT team. C=According to guidelines, by just one PT. Flexibility and pain management. Strengthening exercises and FE. Advice on home exercises twice a week (stretching, swimming and jogging).	Duration: E=6 hours a day, 5 days a week, for 5 weeks. C=1 hour 3 times a week, 5 weeks.
Subjects characteristics	Inclusion criteria: -CLBP for at least 3 months -age 18 to 50 Exclusion criteria: -Specific and severe LBP -Recent surgery -psychiatric disorders -cardiac or respiratory disorders	E=68 participants Age 40.8 SD 7.4 Men 67.7 % C=64 participants Age 38.7 SD 6.1 Men 62.5%
Outcome measurement	Pain: -VAS ($p<0.001$)	1 year follow up. From the 132 participants, 19 were missing at 1 year follow up. 15 of the C and 4 of the E. Rate of (85.6%).

C=control group; CLBP=chronic low back pain; E=experimental group; FE=functional exercises; LBP=low back pain; MT=multidisciplinary; OT=occupational therapist; p=p-value; PT=physical therapist; SD=standard deviation; VAS=visual analogue scale.