

Systematic Review of the Comparative Effectiveness of Cognitive-Behavioural Therapies for Chronic Pain

Başak İNCE[®]

Department of Psychology, Istanbul
Arel University, Istanbul, Turkey

Abstract

Despite the shown effectiveness of Cognitive-Behavioural Therapies (CBT) for chronic pain, it is not clear which CBT approach is more effective and which components or combinations of CBT account for a better treatment outcome. In this regard, this study aimed to systematically review the studies investigating the effectiveness of all forms of CBT for the treatment of individuals with chronic pain. For this purpose, randomised controlled clinical trials on adults with chronic pain published between the years of 2006 and 2016 have been searched in the Google Scholar, Web of Science and EBSCO databases by using the keywords “chronic pain”, “pain disorders”, “cognitive behavioural therapy” or “treatment”. Following database search, 24 trials were identified based on the eligibility criteria. Primary outcomes were demonstrated to be pain intensity, disability, self-efficacy, and pain control, whereas secondary outcomes were related to emotional difficulties. In terms of comparative effectiveness, findings revealed that all forms of CBT are significantly more effective than physical treatments, particularly for emotional problems. However, no statistically significant differences were found for the comparison of traditional CBT and mindfulness and acceptance-based treatments. Findings further underlined that some forms of CBT appeared to produce greater improvements in some of the outcome measures. Findings of this review emphasise that what is in fact responsible for the positive outcome while delivering CBT for chronic pain is still not clear. Thus, future research should focus on identifying specific components and underlying mechanisms of CBT in order to maximize treatment outcome.

Keywords: Chronic pain, cognitive behavioural therapies, mindfulness, acceptance

Öz

Kronik Ağrı İçin Bilişsel-Davranışçı Terapilerin Karşılaştırmalı Etkililiğinin Sistemik İncelemesi

Kronik ağrı için Bilişsel-Davranışsal Terapilerin (BDT) etkililiği gösterilmesine rağmen, hangi BDT yaklaşımının daha etkili olduğu ve hangi BDT bileşenlerinin veya kombinasyonlarının daha iyi bir tedavi sonucuna yol açtığı açık değildir. Bu bağlamda, bu çalışmada kronik ağrısı olan bireylerin tedavisinde kullanılan tüm BDT yaklaşımlarının etkililiğini inceleyen çalışmaların sistemik olarak gözden geçirilmesi amaçlanmıştır. Bu amaçla, 2006-2016 yılları arasında Google Akademik, Web of Science ve EBSCO veri tabanlarında yayınlanmış kronik ağrısı olan yetişkinler üzerinde yapılan randomize kontrollü klinik çalışmalar “kronik ağrı”, “ağrı bozuklukları”, “bilişsel davranışçı terapi” veya “tedavi” anahtar kelimeleri kullanılarak taranmıştır. Veri tabanı araştırmasının ardından uygunluk kriterlerini karşılayan 24 çalışma tespit edilmiştir. Birincil sonuçların ağrı yoğunluğu, yeti yitimi, öz-yeterlik ve ağrı kontrolü olduğu, ikincil sonuçların ise duygusal zorluklarla ilişkili olduğu gösterilmiştir. Karşılaştırmalı etkililik açısından bulgular tüm BDT yaklaşımlarının, özellikle duygusal problemler için, fiziksel tedavilerden önemli ölçüde daha etkili olduğunu ortaya koymuştur. Bununla birlikte, geleneksel BDT ile farkındalık ve kabul temelli tedavilerin karşılaştırılmasında istatistiksel olarak anlamlı bir fark bulunmamıştır. Bulgular ayrıca, bazı BDT yaklaşımlarının sonuç ölçütlerinin bazılarında daha fazla iyileşme sağladığına dikkat çekmiştir. Bu derlemenin bulguları, kronik ağrı için BDT tedavisi uygulanırken olumlu sonuçtan sorumlu olan bileşenin hala net olmadığını vurgulamaktadır. Bu nedenle, gelecekteki araştırmalar, tedavi sonucunu en üst düzeye çıkarmak için BDT'nin belirli bileşenlerini ve altına yatan mekanizmalarını belirlemeye odaklanmalıdır.

Anahtar Kelimeler: Kronik ağrı, bilişsel davranışçı terapiler, farkındalık, kabul

Correspondence / Yazışma:
Başak İNCE, Department of Psychology,
Istanbul Arel University, Istanbul/
Turkey

E-mail: b.ince@windowslive.com

Received / Geliş: September 05, 2019

Accepted / Kabul: March 10, 2020

Online published / Çevrimiçi yayın:
July 04, 2020

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<http://www.jcbpr.org/>

Cite this article as: İnce, B. (2020). Systematic Review of the Comparative Effectiveness of Cognitive-Behavioural Therapies for Chronic Pain. J Cogn Behav Psychother Res, 9(3), 248-259. <https://doi.org/10.5455/JCBPR.64324>

INTRODUCTION

As a widely acknowledged world-wide and life-long experience, the pain has been described as ‘an unpleasant sensory and emotional experience associated with actual and potential tissue damage or described in terms of such damage’ (IASP, 1986 as cited in Verhaak, Kerssens, Dekker, Sorbi, & Bensing, 1998). Pain has been divided into two main categories, namely acute pain and chronic pain. Acute pain is considered to be a consequence of a specific injury or tissue damage which lasts a short time and disappears when damage heals (Patterson & Jensen, 2003; Leeuw, 2008). On the other hand, chronic pain is defined as a pain that lasts longer than three months which leads to deterioration and disability (Patterson & Jensen, 2003; Leeuw, 2008). Chronic pain is considered to be a significant health concern due to the existence of continuous physical pain and be associated with physical and psychosocial disabilities (Hylands-White, Duarte, & Raphael, 2017). It has been stated that source and/or cause of the pain might not necessarily be known in order to call it as chronic pain (Hylands-White et al., 2017). Most frequently reported chronic pain types are low back pain, osteoarthritis, rheumatoid arthritis fibromyalgia, headache, and abdominal pain (Leeuw, 2008; Breivik, Collett, Ventafridda, Cohen, & Gallacher, 2006; Menzies, Taylor, & Bourguignon, 2006).

A large number of studies have demonstrated that chronic pain is not a simple (single) problem, but a complex problem including biological, psychological and social aspects (Shahni, Shairi, AsghariMoghaddam, & Zarnaghash, 2013). Individuals who suffer from chronic pain frequently experience adverse physical and psychosocial consequences. It has been shown that psychological and social components become more crucial compared to biological components with increased chronicity of pain (Shahni et al., 2013). More specifically, chronic pain leads to decreased daily life functioning including physical and social functioning, demoralization, disturbed sleep, increased need for health care and use of medications, and school or work absenteeism (Veehof, Oskam, Schreurs, & Bohlmeijer, 2011; Ersek, Turner, Cain, & Kemp, 2008; Shahni et al., 2013; Voerman et al., 2015). Furthermore, evidence has been demonstrated that chronic pain has comorbid psychological problems, mainly depression and anxiety (Dworkin et al., 2005; Veehof et al., 2011; Ersek et al., 2008; Voerman et al., 2015).

Chronic pain has been known to influence a great number of individuals regardless of their age group (Hechler et al., 2014; Kress et al., 2014). Given deteriorating and disabling nature, chronic pain has been considered as a significant public health issue which requires treatment (Veehof et al., 2011). Literature has suggested that both physical and psychological interventions are available for the treatment of chronic pain. It has been stated that use of analgesics, physical therapy, surgery, transcutaneous electrical nerve stimulation are the most common physical and medical-based treatments that aim to reduce pain-related problems (Hayes & Duckworth, 2006). Since, in addition to physical problems, pain causes great numbers of psychosocial difficulties which are associated with the increased risk of chronicity of pain, integrating psychosocial components into the treatment of chronic pain becomes more important (Shahni et al, 2013).

The aim of psychological treatments for chronic pain is not directly reducing pain intensity. Rather, a common rationale of the psychological treatments for chronic pain is to target the consequences of pain on individuals’ life by achieving adaptive behavioural change (Buhrman et al., 2013). A substantial body of literature has investigated the efficacy and effectiveness of psychosocial interventions for chronic pain. According to meta-analytic studies, cognitive-behavioural therapies (CBT) appears to be one of the most promising interventions in terms of reduction in intensity of pain, pain-related interference, disability and affect, and enhancement of activity level, coping and quality of life (Morley, Eccleston, & Williams, 1999; Hoffman, Papas, Chatkoff, & Kerns, 2007).

The main purpose of the CBT for chronic pain is decreasing frequency of pain-related symptoms (e.g., intensity and interference) (Shahni et al. 2013; Davis, Zautra, Wolf, Tennen, & Yeung, 2015). It also aims to enhance coping, physical and psychosocial functioning (Thieme & Gracely, 2009; Ehde, Dillworth, & Turner, 2014). For these purposes, core beliefs and automatic thoughts related to causes and consequences of pain are identified and challenged during the treatment (Lunde, Nordhus, & Pallesen, 2009). Furthermore, CBT identifies maladaptive and unfavourable pain-related behaviours (e.g., avoidance and catastrophising) and replace them with more adaptive ones. Sense of personal control and self-efficacy, an association between mood and activity, and problem-solving skills are other aspects which are also addressed (Lunde et al., 2009; Veehof et al., 2011; Ehde et al., 2014). In

order to achieve these aims, CBT uses both cognitive (e.g., cognitive restructuring and problem-solving skills) and behavioural techniques (e.g., relaxation and operant learning) (Lunde et al., 2009; Thieme & Gracely, 2009; Veehof et al., 2011; Davis et al., 2015).

Hoffman and his colleagues (2010) have emphasized that CBT is an umbrella term for interventions targeting maladaptive cognitions and behaviours which in turn result in the development of emotional distress. In this regard, the CBT approach is investigated within three waves based on the main focus of treatment and its components. Behavioural therapies with a focus of conditioning and learning principles (e.g., exposure therapies and behaviour modification) are categorised within the first wave. Cognitive therapies with the focus on cognitive appraisal and restructuring (e.g., classic CBT, Cognitive Therapy and Rational Emotive Behavioral Therapy) are considered to be within the second wave. Finally, the third wave of CBT includes Mindfulness-Based Cognitive Therapy, Acceptance and Commitment Therapy and Dialectic Behaviour Therapy (David & Hofmann, 2013). Even though each of these interventions benefits from different therapeutic techniques, there are major similarities in all CBT protocols (Hoffman, Sawyer, & Fang, 2010).

Likewise, traditional CBT which has been acknowledged as an effective and recommended treatment for chronic pain, evidence also provides promising support for mindfulness-based and acceptance-based interventions (APA, 2006/2011; Turner, Anderson, Balderson, Cook, Sherman, & Cherkin, 2016). Mindfulness-based treatment protocols underline that focusing on the present moment and having non-judgmental awareness result in being in a mental state (Hoffman et al., 2010). In this regard, emotional well-being can be enhanced with the increased awareness of that our automatic cognitive and behavioural responses to emotions, sensations, and thoughts cause the development of emotional problems. Thus, the objective of these treatments is to prompt the awareness and acceptance of one's physical sensations, emotions and thoughts about the pain. Since emotional problems are maintained and deteriorated due to the utilisation of experiential avoidance strategies, a further goal is to teach individuals to react reflectively in the case of unpleasant feelings and situations (Hoffman et al., 2010).

Acceptance and Commitment Therapy (ACT) takes the concept of acceptance as the core of the treatment. During the therapy, patients are encouraged to accept their

unpleasant and negative emotions and thoughts instead of trying to change them. ACT approach suggests that acceptance is achieved by cognitive defusion technique that eliminates experiential avoidance through renouncement of control over feelings and thoughts. This technique also helps individuals to establish mindful and non-judgmental viewpoints about themselves and their environments (Hoffman et al., 2010). ACT benefits from behavioural strategies that are also used in CBT. For instance, problem-solving skills, exposure exercises and role-playing are shared components of ACT and CBT (Hoffman et al., 2010).

It has been widely known that the traditional CBT aims to change the content of thoughts. Nevertheless, the goal of the ACT is to change awareness about thoughts and relationships between them (Hayes & Duckworth, 2006). Moreover, mindfulness-based treatments aim to achieve that individuals accept that thoughts are "mental events", and these thoughts do not need to be real or represent the self (Hoffman et al., 2010; p. 705). Evidence has demonstrated that pain-related anxiety, pain catastrophising and helplessness lead to decreased adaptation to chronic pain while self-efficacy, coping, acceptance and readiness to change are the factors which increase adaptation to the pain (Keefe, Rumble, Scipio, Giordano, & Perri, 2004). Despite CBT has been shown to be an effective approach for the treatment of chronic pain, it is not clear which components or combinations of CBT account for the positive outcomes more on the above-mentioned factors (Leeuw, 2008). In this regard, the current review study aims to address the following questions:

1. Which CBT approach is more effective for chronic pain treatment: Traditional CBT or the third wave CBT approaches (e.g., mindfulness-based and acceptance-based interventions)?
2. Whether CBT approaches are more effective than medical and/or physical approaches for chronic pain treatment?
3. What components and techniques are more effective for chronic pain treatment?

METHOD

While conducting this systematic review, the PRISMA-Statement (Liberati et al., 2009; Moher, Liberati, Tetzlaff, & Altman, 2009) was taken into consideration.

Search Strategy

Google Scholar, Web of Science and EBSCO databases were searched in order to identify relevant peer-reviewed journal articles published between 2006 and 2016. The following terms were used in searches: “chronic pain” or “pain disorders” and “cognitive behavioural therapy” or “treatment”.

Inclusion and exclusion criteria

Inclusion and exclusion criteria were based on the PICOS.

Criteria: participants, interventions, comparators, outcome and study design in accordance with the recommendation of the PRISMA statement (Moher et al., 2009).

Participants: Studies including individuals older than the age of 18 years old with a chronic pain problem were included. Studies were excluded if the subjects suffered from cancer-associated pain or participants were younger than the age of 18 years old.

Interventions: In order to be included, studies must have participants who were randomly assigned to at least one of the CBT oriented active treatment condition for the treatment of pain and related problems (e.g., acceptance and commitment therapy, behaviour modification therapy etc.)

Comparators: As a comparison group, studies with an active control group in which participants either received medical and/or physical treatment (e.g., physiotherapy, pharmacological treatment etc.) or another CBT oriented treatment rather than mainly tested CBT intervention were included.

Outcome: Studies were considered to be eligible if they included a measure based on Initiative on Methods, Measurement, and Pain Assessment in Clinical Trials (IMMPACT)’s recommendations, pain intensity/frequency/duration, physical functioning and emotional functioning (Dworkin et al., 2005). Outcomes on psychological factors associated with chronic pain like fear of pain, catastrophising, helplessness, coping, self-efficacy, acceptance and readiness to change were also included (Keefe et al., 2004).

Study design: Only randomized controlled clinical trials comparing at least two active face-to-face treatments were included.

RESULTS

937 articles through the systematic search in Google Scholar, Web of Science and EBSCO databases have been identified. Following the screening for studies meeting the eligibility criteria, 24 RCT studies were analysed in this systematic review. Table 1 presents the information about the studies included in the review which are listed in an alphabetic order based on the first authors’ name.

Methodological Characteristics of Reviewed Studies

Sample

Participants of the studies included in this review consisted of people aged between 18 and 89 years old. Type of pain of that these people were suffering were musculoskeletal pain, chronic low back pain, rheumatoid arthritis, fibromyalgia, chronic nonspecific low back pain, non-specific neck pain, chronic fatigue syndrome, chronic headache, chronic temporomandibular disorder pain, chronic non-malignant pain, and not specified chronic pain. The sample size of the studies was found to change between 28–342 participants.

Treatment and comparison groups

Therapies based on cognitive behavioural principles were compared with psychoeducation, physiotherapies, exercise therapies, medical treatments, pain management interventions and mindfulness-based and acceptance-based therapies. Of 24 studies, 10 of them reported the effectiveness of more than two intervention groups whereas others compared only two interventions.

Outcome measures

Studies included in this review reported both pre and post-treatment data, however, Núñez et al. (2011) reported only follow-up data. All studies relied on self-report data as primary and secondary outcome measures. While most of the studies administered visual analogue scale or numeric rating scale for pain intensity/frequency/duration, studies administered different outcome measures due to having different focuses on treatment protocols. More specifically, studies tested effectiveness of various treatments on pain-related disability (e.g., Roland Morris Disability Questionnaire, Pain and Impairment Relationship Scale, and Northwick Park Questionnaire), fear of pain (e.g., The Pain Anxiety Symptom Scale and The Tampa Scale for Kinesiophobia), pain acceptance (e.g., Chronic Pain Acceptance Questionnaire and Acceptance and Action

Table 1: Summary of the studies included in the review

Study	N	Pain Type	Intervention Type	Mode of Delivery	Number of Sessions	Length of Sessions	Primary Outcomes	Secondary Outcomes	Findings
Cherkin et al. (2016)	342	Chronic Low Back Pain	Cognitive and Behavioral Therapy (CBT; n=113); Mindfulness-based Stress Reduction (MBSR; n=116); Usual Care (UC; n=113)	Group	8 sessions	120-min	RMDQ (disability); GCPS (pain intensity); SF-12 (quality of life)	PHQ (depression & anxiety)	Both MSBR and CBT showed greater improvements in outcome measures with no significant differences compared to UC. CBT showed greater improvement in depression and anxiety.
Christiansen et al. (2010)	60	Chronic Pain	CBT (n=30); Treatment as usual (TAU; n=30)	Individual	3 sessions	30-min	HADIQ (pain disability); FCE (functionality); NRS (pain severity)	N/A	CBT group showed significantly more improvement than TAU group.
Davis et al. (2014)	143	Rheumatoid arthritis	Cognitive Behavioral Therapy for Pain (CBT-P; n=52) Mindfulness Awareness and Acceptance Therapy (M; n=47) Arthritis Education (E; n=44)	Group	8 sessions	120-min	NRS (pain, fatigue, disability); CSQ (catastrophising); ASES (self-efficacy)	PNAS-EF (anxiety)	M was the most effective in decreasing catastrophising, fatigue, disability and anxious affect. CBT and E were more effective in increasing pain control compared to M. E increased catastrophising.
Falcao et al. (2008)	60	Fibromyalgia	CBT (n=25); Routine Medical Visits (RMV; n=26)	Group	10 sessions	Not reported	VAS (pain intensity); FIQ (pain impact); SF-36 (medical outcomes)	BDI (depression); STAI (anxiety)	Groups did not differ in terms of improvement in outcome measures. However, CBT was superior to RMV in terms of improvement in depression and resulted in less need for medication.
Garcia et al. (2006)	28	Fibromyalgia	Cognitive Behavioral Treatment (C-B; n=7); Pharmacological Treatment (Ph; n=7); Combination (C-B + Ph; n=7); Non-treatment; (NT; n=7)	Individual	9 sessions	Not reported	FIQ (pain impact); NTP	HADS (depression & anxiety)	C-B group showed the greatest improvement in fibromyalgia severity and HADS. Combined treatment was not more effective than others.
Kerns et al. (2013)	128	Chronic Pain	Tailored cognitive-behavioral therapy (TCBT; n=68) Standard CBT (SCBT; n=60)	Individual	10 sessions	60 min	NRS (pain severity); MPI; PBCL (pain symptoms)	BDI (depression)	No significant differences between groups were found.
Leuw et al. (2008)	85	Chronic Low Back Pain	Exposure in vivo treatment (EXP; n=42) operant graded activity (GA; n=43)	Individual	EXP – 16 sessions; GA – 26 sessions	60-min	RMDQ (disability); TSK (fear of movement); PCS (catastrophising); QBPDS (disability);	BDI (depression)	No significant differences between groups were found.
Macedo et al. (2012)	172	Chronic Nonspecific Low Back Pain	Motor Control Exercise (MCE; n=86); Graded Activity (GA; n=86)	Individual	14 sessions (12 initial 2 booster sessions)	60-min	CSQ (coping); ÖLBSQ (pain symptoms); PASS-20 (pain anxiety); IPAQ (physical activity); NRS (pain intensity); RMDQ (disability); LSPAQ (instability)	N/A	No significant differences between groups were found.
Magalhaes et al. (2015)	66	Chronic Low Back Pain	Graded Activity (GA; n=33); Physiotherapy Exercise (PE; n=33)	Individual	12 sessions	60-min	NRS (pain intensity); RMDQ (disability); MPBQ (pain symptoms); HRQoL (quality of life); TSK (fear of movement)	N/A	No significant differences between groups were found.
Menzies et al. (2006)	48	Fibromyalgia	Guided Imagery plus Usual Care (GI; n=24); Usual Care (UC; n=24)	Individual	6 sessions	20-min audiotape	SF-MPQ (pain symptoms); FIQ (pain impact); ASES (self-efficacy)	N/A	No significant differences between groups were found for pain related measures. Functional status and self-efficacy significantly improved more in GI.
Monticone et al. (2012)	80	Non-specific neck pain	Physiotherapy alone (PT; n=40); Physiotherapy plus cognitive-behavioural therapy (PTcb; n=40)	Individual	12 sessions	50 min	NPDS (disability); NRS (pain intensity); SF-36 (quality of life)	N/A	No statistically significant difference was found.

Table 1 continued: Summary of the studies included in the review

Study	N	Pain Type	Intervention Type	Mode of Delivery	Number of Sessions	Length of Sessions	Primary Outcomes	Secondary Outcomes	Findings
Monticone et al. (2013)	90	Chronic Low Back Pain	Cognitive Behavioural Therapy and Exercise Training (CBT+E; n=45); Exercise Training (E; n=45)	Individual	5 sessions	60-min	RMDQ (disability); TSK (fear of movement); NRS (pain intensity); SF-36 (quality of life)	N/A	CBT+E showed statistically more improvement in all measures compared to E.
Nicholas et al. (2013)	141	Chronic Pain	Pain Self-Management (PSM; n=49); Exercise-Attention Control (EAC; n=53); Waiting List Control (WLC; n=39)	Group	8 sessions	120-min	RMDQ (disability); PRSS (pain intensity, distress, catastrophising); TSK (fear of movement); PSEQ (self-efficacy)	DASS-21 (depression & anxiety)	PSM group made more significant improvements in pain distress, disability, depression, fear-avoidance beliefs, catastrophising, pain self-efficacy and functional reach. PMS maintained improvement in all measures at follow-up except depression and self-efficacy.
Núñez et al. (2011)	115	Chronic fatigue syndrome	Combination of Graded Exercise Therapy and Cognitive Behavioural Therapy (GET+CBT; n=58); Treatment as Usual (TAU; n=57)	Group	CBT – 18 sessions + GET 21 sessions	90-min CBT + 60-min GET	SF-36 (medical outcomes); SHAQ (quality of life); FIS (impact)	HADS (depression & anxiety)	Only 12 months follow up results were reported in this study. All treatments showed similar improvements. GET+CBT showed statistically more significant improvement in SF-36 pain dimension.
Pincus et al. (2015)	89	Low Back Pain	Contextual Cognitive Behavioural Therapy (CCBT; n=45); Physiotherapy (n=44)	Individual	8 sessions	60-min	TSK (fear of movement); BPI (pain symptoms), CPAQ & AAQ-II (acceptance), RMDQ (disability), SF12, & EuroQol-5D (quality of life) PGIC (readiness to change)	HADS (depression & anxiety)	CCBT showed greater improvements.
Smeets et al. (2006a)	223	Nonspecific Chronic Low Back Pain	Active Physical Treatment (APT; n=53) Cognitive Behavioral Treatment (CBT; n=58) Combination Treatment (CT; n=61) Waiting List (WL; n=51)	Group + Individual	30 sessions	APT 75-min; CBT 30-min	RMDQ (disability); VAS (pain intensity); MPQ (pain related symptoms)	BDI (depression)	APT, CBT and CT showed significant improvement in functional limitations, main complaints and pain intensity measured by using the VAS. Depression significantly reduced only in APT. Pain Rating Index did not improve in any group.
Smeets et al. (2006b)	211	Nonspecific Chronic Low Back Pain	Active Physical Treatment (APT; n=52) Cognitive Behavioral Treatment (CBT; n=55) Combination Treatment (CT; n=55) Waiting List (WL; n=49)	Group + Individual	30 sessions	90-min	RMDQ (disability); VAS (pain intensity)	BDI (depression)	APT, CBT and CT were equally effective for reduction in pain related outcome measures. Only APT reduced depressive symptoms.
Smeets et al. (2009)	172	Chronic Low Back Pain	Active Physical Treatment (APT; n=53) Graded Activity with Problem Solving Training (GAP; n=58) Combination Treatment (CT; n=51) Wait List (WL; n=51)	Group + Individual	10 sessions	90-min	RMDQ (disability); Euro-QoL (quality of life)	N/A	Disability and quality of life were improved in all groups, but no statistically significant differences between combined treatment and the single treatment modalities were found. Single treatments showed higher reduction in RDQ at follow-up.
Thieme et al. (2006)	125	Fibromyalgia	Operant Behaviour Therapy (OPT; n=43); Cognitive Behaviour Therapy (CBT; n=42); Attention-Placebo (AP; n=40)	Group	15 sessions	120-min	FIQ (pain impact); MPI (pain symptoms); PRSS (catastrophising); TBS (pain behaviours)	N/A	CBT and OPT groups were significantly more effective than AP but not from each other. CBT group showed greater reduction in affective distress and catastrophising. OPT showed greater reduction in functional limitations, pain behaviours, and solicitous spouse behaviour. CBT and OPT groups showed similar reductions in pain intensity and coping.

Table 1 continued: Summary of the studies included in the review

Study	N	Pain Type	Intervention Type	Mode of Delivery	Number of Sessions	Length of Sessions	Primary Outcomes	Secondary Outcomes	Findings
Thompson et al. (2016)	57	Chronic Neck Pain	Progressive Neck Exercise Programme (PNEP; n=28) Interactive Behavioural Modification Therapy (IBMT; n=29)	Group	4 sessions	90-min IBMT, 40-min PNEP	NPQ (disability); NRS (pain intensity); PCS (catastrophising); TSK (pain related fear); PVAQ (awareness); CPSS-pf (self-efficacy)	N/A	No significant group differences was found for disability. Significantly more improvements were found for pain intensity, pain related fear and self-efficacy in IBMT.
Thorn et al. (2007)	34	Chronic Headache	Cognitive Restructuring followed Cognitive Coping (CR; n=15) Cognitive Coping followed Cognitive Restructuring (CP; n=19) Wait List Control (WLC)	Group	10 sessions	90-min	VAS (pain intensity); PCS (catastrophising); HMSE (self-efficacy); PASS (pain related anxiety)	BDI (depression); BAI (anxiety)	Significant changes in outcome measures were found compared to WL. No significant effect of order of treatment was found. Changes in catastrophising, pain specific anxiety and self-efficacy were maintained at follow-up.
Turner et al. (2006)	158	Chronic Temporomandibular Disorder Pain	Cognitive Behavioral Pain Management (PMT; n=72); Self-care management (SCM; n=76)	Individual	8 sessions	Not reported	GCPS (interference and intensity); MFIQ (jaw use limitations); SOPA (pain attitude); SES (self-efficacy); CSQ & CPCI (coping)	BDI (depression)	PMT group showed clinically and statistically more significant improvement than SCM. Groups did not differ in terms of changes in pain intensity and coping.
Turner et al. (2016)	342	Chronic Low Back Pain	Cognitive and Behavioral Therapy (CBT; n=112); Mindfulness-based Stress Reduction (MBSR; n=116); Usual Care (UC; n=113)	Group	8 sessions	120-min	RMDQ (disability); FFMQ-SF (mindfulness); PCS (catastrophising); CPAQ (acceptance); PSEQ (self-efficacy)	N/A	Catastrophizing decreased more in the MBSR group. Self-efficacy, mindfulness improved similarly in CBT and MBSR, but more than UC.
Wetherell et al. (2011)	114	Chronic Nonmalignant pain	Cognitive and Behavioral Therapy (CBT; n=57); Acceptance and Commitment Therapy (ACT; n=57)	Group	8 sessions	90-min	BPI & MPI (pain symptoms); SF-12 (medical outcomes); PASS (pain related anxiety); CPAQ-R (acceptance); SOPA (pain attitudes)	BDI (depression)	No significant differences between groups were found for any outcome measures. However, while CBT was found to be more credible, ACT was found to be more satisfactory.

Abbreviations: acceptance and action questionnaire (AAQ-II); arthritis self-efficacy scale (ASES); Beck anxiety inventory (BAI); Brief Pain Inventory (BPI); Brief Pain Inventory Short Form (BPI-SF); Chronic Pain Acceptance Questionnaire (CPAQ); Chronic Pain Acceptance Questionnaire-Revised (CPAQ-R); Chronic Pain Coping Inventory (CPCI); Chronic Pain Self-Efficacy Questionnaire Physical Function Subscale (CPSS-pf); Coping Strategies Questionnaire (CSQ); Depression Anxiety Stress Scales (DASS21); EuroQol-5D (EQ-5D); Fatigue Impact Scale (FIS); Fear-Avoidance Beliefs Questionnaire (FABQ); Fibromyalgia Impact Questionnaire (FIQ); Five Facet Mindfulness Questionnaire (FFMQ); Functional Capacity Evaluation (FCE); Graded Chronic Pain Scale (GCPS); Hannover Activities of Daily Living Questionnaire (HADLQ); Headache Management Self-Efficacy Scale (HMSE); Health Related Quality of Life (Euro-Qol); Health-related Quality of Life (HRQoL); Hospital and Anxiety and Depression Scale (HADS); Icelandic Quality of Life Scale (IQL); International Physical Activity Questionnaire (IPAQ); Lumbar Spine Physical Activity Questionnaire (LSPAQ); Mandibular Function Impairment Questionnaire (MFIQ); Modified Pain Beliefs Questionnaire (MPBQ); Modified Patient Global Impression of Change (PGIC); Multidimensional Pain Inventory (MPI); Neck Pain Disability Scale (NPDS); Northwick Park Questionnaire (NPQ); Number of Tender Points (NTP); Numeric Rating Scale (NRS); Numeric Rating Scale (NRS); Oswestry Disability Index (ODI); Örebro Low Back Pain Screening Questionnaire (ÖLBSQ); Pain Anxiety Symptom Scale -20 (PASS-20); Pain Behaviour Checklist (PBCL); Pain Catastrophising Scale (PCS); Pain Health Questionnaire (PHQ); Pain Self-Efficacy Questionnaire (PSEQ); Pain Vigilance and Awareness Questionnaire (PVAQ); Pain-Related Self-Statement Scale (PRSS); Patient Specific Complaints (PSC); Positive and Negative Affect Scale-Expanded Form (PNAS-EF); Quebec Pain Disability Scale (QBPDS); Roland Morris Disability Questionnaire (RMDQ); Self-Efficacy Scale (SES); Short Form 12 (SF12); Short Form Health Status Inventory (HSI-SF); Short Form Health Survey (SF-36); Short-Form McGill Pain Questionnaire (SF-MPQ); Stanford Health Assessment Questionnaire (SHAQ); State-Trait Anxiety Inventory (STAI); Survey of Pain Attitudes (SOPA); Tampa Scale for Kinesiophobia (TSK); Tübingen Pain Behaviour Scale (TBS); Visual Analogue Scale (VAS); Not available (N/A).

Questionnaire), pain awareness (e.g., Pain Vigilance and Awareness Questionnaire and Five Facet Mindfulness Questionnaire), pain coping (e.g., Coping Strategies Questionnaire and Chronic Pain Coping Inventory), self-efficacy (e.g., the Headache Management Self-Efficacy Scale and Pain Self-Efficacy Questionnaire), quality of life (e.g., Health-Related Quality of Life and Icelandic Quality of Life Scale), pain catastrophising (e.g., Modified Pain Beliefs Questionnaire and Pain Catastrophising Scale) by administering different instruments. Despite differences in pain-related outcome measures, changes in depression and anxiety

symptoms were mostly tested with similar instruments (e.g., Hospital and Anxiety and Depression Scale, Depression Anxiety Stress Scales, Positive and Negative Affect Scale-Expanded Form and Pain Health Questionnaire).

Components and Application of Cognitive Behavioural Based Therapies

Whereas some studies applied manualised CBT for chronic pain (e.g., Garcia et al., 2006, Kerns et al., 2013, and Cherkin et al., 2016), other studies applied some of CBT

components only (e.g., Menzines et al., 2006, Leuw et al., 2008, and Nicholas et al., 2013). Moreover, some of the studies administered third-wave cognitive behavioural therapies such as mindfulness-based interventions (e.g., Davis et al., 2014, Björnsdottir et al., 2015, and Turnet et al., 2016) and acceptance-based interventions (e.g., Wetherell et al., 2011).

Regarding the delivery type of the treatments, it was found that 11 of the studies delivered treatments in individually, 10 of them delivered in a group format and 3 of them included both individual and group sessions. Regarding the 'number of sessions', numbers of treatment sessions were found to change between 3 to 30 sessions. Length of each session was changed between 20 minutes to 120 minutes. Treatment packages consisted of relaxation training, cognitive coping, activity pacing, problem-solving technique, guided imagery, Socratic dialogue, cognitive restructuring, psychoeducation, body scanning, breathing meditation and strategy identification.

Findings of the Reviewed Studies

Of 24 studies individual with chronic pain, 15 studies compared the effectiveness of CBT treatment packages with medical and physical treatments. Whereas four studies tested comparative effectiveness of CBT and mindfulness-based treatments, only one study included acceptance and commitment therapy as a comparison group. The rest of the studies compared different components of CBT (e.g., exposure in vivo, graded activity, guided imagery) as a treatment protocol.

Of 24 studies comparing the effectiveness of two or more interventions including all forms of physical and psychological treatments, 11 studies found that there were no statistically significant differences between treatment groups regarding pain-related outcome measures. Findings of eight studies revealed that treatments including CBT components resulted in better treatment outcomes compared to other treatments. Three studies showed that CBT based interventions were superior to other treatments for improving emotional functioning only, in other words decreasing depression and anxiety symptoms. Regarding symptom-specific improvements, it was observed that sleep problems, catastrophising, fatigue, and disability than provided better outcome in mindfulness and acceptance-based treatments compared to CBT. However, CBT was shown to be more effective in decreasing pain control, pain intensity, depression and anxiety in comparison

to mindfulness-based and acceptance-based treatments. Furthermore, one study indicated that CBT is more credible treatment while ACT is more satisfactory. Pain intensity, pain-related fear, pain distress, self-efficacy, functional status, disability and catastrophising improved more in CBT treatments compared to physical and medical treatments. In terms of reduction of depressive symptoms, while two studies showed physical treatment reduced depression more, another study showed CBT treatment provided a better outcome. Moreover, regarding the comparison of single and combined treatment, it was found that individuals who received single treatments showed better improvement than the others.

Only seven studies reported the effect size of the interventions on outcome measures. Effect sizes of the interventions were shown to change between small to large, where the most of them had a moderate effect size (Table 1).

DISCUSSION

The aim of this review study was to provide an empirical summary of comparative effectiveness of cognitive behavioural therapies (CBT) approaches for individuals with chronic pain. Review of existing studies provided support for the idea that CBT is one of the most effective and preferred approaches for the treatment of symptoms associated with chronic pain. In accordance with previous literature, the findings of the present study supported that cognitive and behavioural based treatments produce better treatment outcomes for chronic pain when compared with physical and medical treatments (Thieme & Gracely, 2009). Findings further revealed that CBT based treatments are particularly more effective for decreasing symptoms associated with emotional difficulties (e.g., anxiety and depression) among patients with chronic pain.

Consistent with previous research, the present study demonstrated that all forms of CBT lead to an improvement in both physical and emotional functioning of individuals with chronic pain (Vowles, Wetherell, & Sorrell, 2009). Although no statistically significant differences were observed between traditional CBT and mindfulness-based and acceptance-based interventions, it has appeared that some forms of CBT work better than others for some of the pain-related symptoms. More specifically, studies that administered interventions based on traditional CBT found greater improvement for depression, anxiety, pain intensity and pain control. Besides,

mindfulness-based and acceptance-based interventions resulted in more reduction in sleep problems, fatigue, disability, and catastrophising. Despite these differences, equivalent effects were observed for self-efficacy in all forms of CBT.

Since all forms of CBT resulted in improvement in pain-related symptoms and associated emotional problems but in different degrees, it is plausible to assume that all of these interventions work through similar, but also different strategies. Finding that all forms of CBT show somehow identical influences is reasonable given that all of them benefit from the administration of similar therapeutic techniques. In this regard, an explanation for how one therapy provides a better outcome than the other while administering the same technique can be the fact that they are actually differentiated in their purposes. For instance, both traditional CBT and mindfulness-based interventions benefit from relaxation techniques in order to deal with the meaning of pain (e.g., acceptance in mindfulness-based intervention and cognitive restructuring in CBT) (Turner et al., 2016). On the other hand, while traditional CBT aims to reinterpret the meaning of pain experience, mindfulness and acceptance-based interventions aim to refocus on attention from pain (Davis et al., 2014). Moreover, notwithstanding commonalities about benefitting from exposure techniques, exposure used in acceptance-based treatment is different than the one used in the traditional CBT. Acceptance-based treatments aim to create more flexible and broader emotional repertory by being in the moment and acting value-based whereas the purpose of CBT is to increase the ability to stay and deal with a stressful situation (Hayes & Duckworth, 2006). In this sense, one can argue that if it is the technique itself that works or the purpose of the application of a specific technique that makes the difference. Also, another question arises here about which distinct working mechanisms of traditional CBT and mindfulness, as well as acceptance-based interventions, lead differences in outcome. Hence, future studies exploring the underlying mechanism of improvement in CBT for chronic pain are necessary.

It has been previously established that single treatments are more cost-effective and provide greater cost-utility when compared to a combination of two or more treatments (Smeets et al., 2009). In accordance with this, the current study demonstrated that individuals who received single treatments showed better improvement than the

others who underwent combined treatment modalities. Furthermore, it was observed that there are various CBT protocols used in the reviewed studies with a variety of “doses” including session numbers and duration which were all found to be effective. For instance, the present study showed that patients with chronic pain benefit from both brief (e.g., 3 sessions) and long-term (30 sessions) treatment protocols. Consequently, it is assumed that brief single treatments are likely to lead positive treatment outcomes for chronic pain patients. In addition to being compatible with the principle of parsimony, it is believed that these kinds of treatments can be cost-effective as well.

Regarding the method of delivery, the present review underlined that both individual and group treatments were shown to be effective. Group treatments are known to contribute to social support and encouragement in treatment which in turn decrease problems associated with pain as well as increase quality of life (Monticone et al., 2013). Furthermore, delivering treatments in a group would be more cost-effective. Despite these advantages of group treatments, there is less chance of meeting individual needs. Since pain is a personal and complex experience, it is essential to target the needs of the individual during the treatment (Menzines et al., 2006). It has been further suggested that treatments which take characteristics of patients into account would lead to greater treatment outcome (Veehof et al., 2011). Considering that each delivery method has its own advantages, future studies would benefit from an investigation of comparative effectiveness of individual and group treatments in order to explore which format is superior to the other.

The current review study has several limitations that should be acknowledged. First of all, the number of studies in the review process was limited due to including three databases only and a period of 10 years. Secondly, multiple variations of cognitive behavioural therapies and administration of varied outcomes measured in the reviewed studies limit our ability to draw a concrete conclusion. Moreover, most of the studies in this review relied on self-report outcome measures which are likely to suffer from desirability bias. Finally, since this study only focused on studies conducted on people older than 18 years old, discussions on the effectiveness of cognitive behavioural therapies were limited to adults.

Despite the limitations, this study also has some strengths that worth mentioning. For instance, even though most of the research compared effectiveness of CBT only with

either usual care or wait-list controls (Ehde et al., 2014), this study reported comparison of CBT based interventions with other active interventions. Also, it is believed that the findings and arguments of this study provide important directions for improving existing CBT based treatment protocols.

In conclusion, besides demonstrated effectiveness of cognitive behavioural therapies, there is no clear explanation for which specific treatment components are responsible for the improvement in which specific complaints. For instance, a treatment protocol which was proven to be effective may include all of the cognitive restructuring, exposure and relaxation at the same time. Although a person benefits from this treatment protocol, it is generally not known which of these techniques are in fact responsible for the positive outcome. Hence, future studies should investigate which specific components of cognitive behavioural based treatments, a dose of therapy or methods of delivery produce maximum benefit for chronic pain patients. Exploring what works for whom and under which condition would be helpful for reducing health-care costs and drop-out rates as well as increasing treatment outcomes.

Peer-review: Externally peer-reviewed.

Conflict of Interest: The authors declare no conflict of interest.

Financial Disclosure: No financial disclosure was received.

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