sKMANPUB AI and Tech in Behavioral and Social Sciences Vol. 4 No. 2 (2026): 1-10

Article history:
Received 17 January 2026
Revised 19 March 2026
Accepted 24 March 2026
Published online 01 April 2026

Effectiveness of ACT Therapy Using a Digital Workbook on Intensity of Pain and Pain Acceptance in Patients with Chronic Pain Disorder

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A r t i c l e I n f o

Article type:
Original Research

How to cite this article:
Mohseni Nia, Z. S., Abbasi, Z., Alidoost Abarghoei, F., Hosseini, F. S., & Khalkhal, F. (2026). Effectiveness of ACT Therapy Using a Digital Workbook on Intensity of Pain and Pain Acceptance in Patients with Chronic Pain Disorder. *AI and Tech in Behavioral and Social Sciences, 4*(5), 1-10.
https://doi.org/10.61838/kman.aitech.5383

A B S T R A C T

Chronic pain is a prevalent and debilitating condition that significantly impacts patients' quality of life. Acceptance and Commitment Therapy (ACT) has proven effective in managing chronic pain, but access to face-to-face therapy remains limited. This study investigated the effectiveness of ACT delivered via digital workbooks on pain intensity and pain acceptance in patients with chronic pain disorders. This semi-experimental study employed a pre-test, post-test, and follow-up design with two groups. The sample consisted of 62 participants (30 in the experimental group and 32 in the control group) recruited from mental health clinics in Tehran. Participants were randomly assigned to either the experimental group, which received a 10-week ACT intervention via digital workbooks, or the control group, which received routine medical care. Data were collected using the Visual Analog Scale (VAS) for pain intensity and the Persian version of the Chronic Pain Acceptance Questionnaire (CPAQ). Data were analyzed using Mixed Analysis of Variance (Mixed ANOVA) with SPSS software (version 26). The results indicated a significant reduction in pain intensity and a significant increase in pain acceptance in the experimental group from pre-test to post-test, with these effects maintained at the three-month follow-up. In contrast, no significant changes were observed in the control group. The Mixed ANOVA revealed significant interaction effects between time and group for both pain intensity ($F(1.85,112.85) = 38.90$, $p<0.001$, $\eta 2 = 0.39$) and pain acceptance ($F(1.92,117.12) = 48.75$, $p<0.001$, $\eta 2 = 0.45$). The findings suggest that ACT delivered via digital workbooks is an effective intervention for reducing pain intensity and enhancing pain acceptance in patients with chronic pain. This digital format offers a scalable, accessible, and cost-effective alternative to traditional therapy, potentially improving outcomes for individuals with chronic pain disorders. Future research should explore long-term effects and compare digital ACT with other therapeutic modalities.

Keywords: *Acceptance and Commitment Therapy, Digital Workbook, Chronic Pain, Pain Intensity, Pain Acceptance, Randomized Controlled Trial.*

1. Introduction

Chronic pain is a pervasive and complex health condition characterized by persistent nociceptive or neuropathic sensations lasting beyond the normal healing time, typically defined as persisting for more than three to six months (Gatchel et al., 2014). It represents one of the most significant public health challenges of the 21st century, affecting approximately 20% to 30% of the global population and imposing a substantial burden on healthcare systems, productivity, and overall quality of life (Gaskin & Richard, 2012; Vickers et al., 2019). Unlike acute pain, which serves as a protective biological mechanism, chronic pain often becomes a disease entity in itself, characterized by maladaptive neuroplastic changes, central sensitization, and an intricate interplay between biological, psychological, and social factors (Nijs et al., 2021). The multifaceted nature of chronic pain extends far beyond the physical sensation, frequently leading to severe comorbidities such as depression, anxiety, sleep disturbances, and social isolation, which in turn exacerbate pain perception and disability (Turk & Wilson, 2022). Consequently, the management of chronic pain has shifted from a purely biomedical model focused on tissue repair and pharmacological intervention to a biopsychosocial model that emphasizes functional improvement and psychological flexibility (McCracken & Vowles, 2014).

Within this biopsychosocial framework, psychological interventions have emerged as cornerstone treatments for chronic pain management. Among these, Acceptance and Commitment Therapy (ACT) has gained substantial empirical support as an effective evidence-based practice. Originally developed by Steven C. Hayes in the late 1980s and rooted in Relational Frame Theory (RFT), ACT is a mindfulness-based behavioral therapy that aims to increase psychological flexibility (Hayes et al., 2012). Psychological flexibility is defined as the ability to remain in contact with the present moment, regardless of unpleasant private experiences such as pain, anxiety, or sadness, while acting in accordance with deeply held values and goals (Hayes et al., 2012; Twohig & Levin, 2017). In the context of chronic pain, ACT posits that the suffering associated with pain is not caused by the pain sensation itself, but rather by the individual's struggle to control or eliminate the pain, leading to experiential avoidance and behavioral inflexibility (Vowles et al., 2019). By encouraging patients to accept pain as a transient experience rather than fighting against it, and to commit to value-driven actions despite the presence of pain, ACT helps break the cycle of pain catastrophizing and disability (McCracken & Gauntlett-Gilbert, 2017).

The core processes of ACT, often referred to as the "hexaflex," include acceptance, De-fusion, being present, self-as-context, values, and committed action (Hayes et al., 2012). Numerous randomized controlled trials (RCTs) and meta-analyses have demonstrated the efficacy of ACT in reducing pain interference, improving quality of life, and decreasing psychological distress in individuals with various chronic pain conditions, including lower back pain, fibromyalgia, and headache disorders (Aung et al., 2020; Boettcher et al., 2014; Veehof et al., 2016). For instance, a recent meta-analysis by Aung et al. (2020) involving over 2,000 participants found that ACT resulted in moderate to large effects on pain interference and psychological flexibility, outperforming wait-list controls and often showing non-inferiority to cognitive-behavioral therapy (CBT). Similarly, Boettcher et al. (2014) reported significant reductions in pain-related distress and improvements in work productivity among chronic pain patients receiving ACT. These findings underscore the potential of ACT as a vital therapeutic tool in the multidisciplinary management of chronic pain.

Despite the robust evidence supporting the efficacy of face-to-face ACT for chronic pain, access to such specialized care remains a significant barrier for many patients. Geographic limitations, long waiting lists, high costs, and the physical mobility challenges inherent in chronic pain conditions often prevent individuals from receiving timely and consistent psychological support (Kroenke et al., 2021). In response to these accessibility challenges, digital health interventions, particularly those utilizing mobile health (mHealth) technologies, have emerged as promising alternatives. Digital delivery of psychological therapies offers the potential to scale evidence-based treatments, reduce costs, and provide flexible, on-demand support to a broader population (Carlbring et al., 2018). Among various digital formats, guided self-help interventions using digital workbooks have shown particular promise. Unlike fully automated apps, guided digital workbooks provide a structured therapeutic protocol accompanied by limited professional support, typically via email or messaging platforms, thereby maintaining the therapeutic alliance while enhancing scalability (Kazantzis et al., 2017).

The integration of ACT principles into digital workbooks involves translating the core therapeutic

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exercises—such as mindfulness practices, cognitive Defusion techniques, values clarification, and committed action planning—into accessible, user-friendly digital formats. These digital workbooks often incorporate interactive elements, multimedia content, and progress tracking features to enhance engagement and adherence (Hollis et al., 2017). Recent studies have begun to explore the effectiveness of digital ACT interventions for chronic pain. For example, a pilot study by Lundgren et al. (2021) demonstrated that a guided digital ACT workbook significantly reduced pain acceptance and improved quality of life in patients with fibromyalgia. Similarly, a randomized trial by Klem et al. (2022) found that a web-based ACT program for chronic pain patients led to significant improvements in psychological flexibility and reductions in pain catastrophizing compared to a wait-list control. However, the literature on digital ACT for chronic pain remains fragmented, with studies varying widely in design, dosage, delivery mode, and outcome measures.

Furthermore, while traditional face-to-face ACT has been extensively validated, the specific mechanisms through which digital delivery influences outcomes in the context of chronic pain are not fully understood. It is unclear whether the therapeutic gains observed in digital formats are comparable to those achieved in traditional settings, or if specific adaptations are necessary to account for the lack of non-verbal cues and immediate therapist feedback (Andersson et al., 2020). Additionally, there is a paucity of recent high-quality randomized controlled trials that specifically isolate the effect of *digital workbooks* as the primary delivery medium for ACT in chronic pain populations. Most existing studies either combine digital interventions with other modalities or focus on broader pain management strategies without isolating the specific contribution of digital ACT workbooks (Bendelin et al., 2021; Richards et al., 2018). This gap in the literature limits the ability of clinicians and policymakers to make informed decisions about the implementation of digital ACT interventions in routine care.

Therefore, the present study aims to investigate the effectiveness of Acceptance and Commitment Therapy delivered via digital workbooks on chronic pain management. Specifically, this randomized controlled trial seeks to evaluate the impact of a structured digital ACT workbook intervention on key outcome measures, including pain intensity, pain interference, psychological flexibility, and quality of life, compared to a control group receiving standard care. By employing a rigorous experimental design, this study aims to provide empirical evidence regarding the efficacy of digital ACT workbooks as a scalable and accessible intervention for chronic pain. The findings of this study will contribute to the growing body of knowledge on digital mental health and offer practical insights for healthcare providers seeking to expand access to effective psychological interventions for chronic pain patients.

The significance of this research lies in its potential to inform the development and implementation of scalable, cost-effective, and accessible psychological treatments for chronic pain. As healthcare systems worldwide grapple with the increasing prevalence of chronic conditions and the need for sustainable care models, digital interventions offer a viable pathway to bridge the treatment gap. By demonstrating the effectiveness of digital ACT workbooks, this study supports the integration of technology-enhanced psychological therapies into standard care pathways, ultimately aiming to improve the lives of millions of individuals suffering from chronic pain. Furthermore, this study adheres to the Consolidated Standards of Reporting Trials (CONSORT) guidelines to ensure transparency, reproducibility, and methodological rigor (Schulz et al., 2010). Through a meticulous evaluation of the intervention's impact, this study endeavors to clarify the therapeutic value of digital ACT and highlight areas for future research and clinical practice.

2. Methods and Materials

Research Design

This study employed a semi-experimental design with a pre-test, post-test, and follow-up phase, utilizing two groups: an experimental group and a control group. The research followed a non-equivalent control group design, where participants were assigned to either the experimental or control group based on availability and willingness, followed by random assignment within those clusters to ensure balance. The experimental group received Acceptance and Commitment Therapy (ACT) via digital workbooks, while the control group received routine medical care without psychological intervention. Outcome measures were assessed at three time points: baseline (pre-test), immediately after the 10-week intervention (post-test), and three months post-intervention (follow-up) to evaluate the immediate and sustained effects of the treatment.

Participants

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The target population comprised adult patients diagnosed with chronic pain disorders attending pain management mental health clinics in Tehran. The sample size was calculated using G*Power software (version 3.1) for a repeated measures ANOVA, assuming a medium effect size (f = 0.25), a power of 0.80, and an alpha level of 0.05. The calculation indicated a minimum of 34 participants per group. To account for potential attrition, 80 participants were initially recruited and assigned to two groups of 40.

Randomization was conducted using a computer-generated random number sequence to assign participants to the experimental and control groups. **Inclusion criteria** were: (1) age between 18 and 65 years; (2) a formal diagnosis of a chronic pain disorder (e.g., chronic low back pain, fibromyalgia, chronic migraine) lasting for at least six months, confirmed by a medical specialist; (3) ability to read and write in Persian; (4) access to a smartphone or computer with internet connectivity for the digital intervention; and (5) stability in medication dosage for at least four weeks prior to the study. **Exclusion criteria** included: (1) history of severe psychiatric disorders (e.g., schizophrenia, bipolar disorder, active substance abuse) that could impair engagement; (2) acute medical conditions requiring immediate hospitalization or surgery; (3) pregnancy or breastfeeding; and (4) cognitive impairments that would hinder the completion of digital tasks.

During the intervention period, attrition occurred in both groups. In the experimental group, 5 participants dropped out due to technical difficulties with the digital platform, 3 for personal reasons, and 2 due to relocation. In the control group, 4 participants dropped out due to lack of interest, 2 for personal reasons, and 2 due to relocation. Consequently, the final analysis included 30 participants in the experimental group and 32 in the control group. Data from the remaining participants were analyzed using the per-protocol approach.

Research Procedure

Following ethical approval, potential participants were screened for inclusion criteria. Those who met the criteria were invited to provide informed consent and complete the baseline assessments (pre-test). Subsequently, participants were randomly assigned to the experimental or control group.

The **experimental group** received the ACT intervention via a structured digital workbook platform. Over ten weeks, participants accessed one module per week. Each module included psychoeducational videos, interactive exercises, and downloadable worksheets. Participants were required to complete the weekly activities within seven days. A clinical psychologist provided brief feedback via email twice a week to address technical queries and encourage adherence, but did not provide direct psychotherapy.

The **control group** continued with their standard medical care (e.g., medication management, routine physiotherapy) and received no additional psychological intervention. They were asked to maintain their usual routines.

Both groups completed the post-test assessments immediately after the ten-week intervention period. The follow-up assessments were conducted three months later via an online survey platform to assess the durability of the treatment effects.

Instruments

Data were collected using the following standardized instruments:

1. **International Classification of Diseases (ICD-10) Diagnostic Interview :**A structured clinical interview based on ICD-10 criteria was used to confirm the diagnosis of chronic pain disorders. The ICD-10 diagnostic criteria have been widely validated in clinical settings for identifying chronic pain conditions such as chronic low back pain (G89.4) and fibromyalgia (M79.7), ensuring high diagnostic reliability and validity (World Health Organization, 1992).
2. **Visual Analog Scale (VAS) for Pain Intensity :** This tool consists of a 10-cm horizontal line anchored by "no pain" on the left and "worst pain imaginable" on the right. Participants mark their current pain level. The Persian version of the VAS has demonstrated excellent psychometric properties, with high internal consistency (Cronbach's alpha > 0.90) and strong test-retest reliability, making it a valid and reliable measure for assessing pain intensity in Persian-speaking populations (Farzad et al., 2012; McCracken et al., 2004).
3. **Chronic Pain Acceptance Questionnaire (CPAQ) :**This 20-item scale measures two subscales: activity engagement (persistence in valued activities despite pain) and pain willingness (willingness to experience pain). The Persian version, validated by Asadi et al. (2018), showed high internal consistency (Cronbach's alpha = 0.85) and good construct validity. The original

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English version has also established robust psychometric properties (McCracken & Gauntlett-Gilbert, 2017).

Intervention Protocol

The experimental group received a 10-week ACT intervention delivered via digital workbooks, based on the standard ACT protocol for chronic pain (Hayes et al., 2012). The intervention was structured into ten weekly modules, each containing specific exercises:

- **Week 1: Introduction to ACT and the Hexaflex.** Participants learned about the ACT model, psychological flexibility, and the concept of the "pain trap." Activities included an introductory video and a worksheet identifying areas of life affected by pain.
- **Week 2: Cognitive De-fusion.** Participants practiced techniques to distance themselves from painful thoughts. Exercises included the "Leaves on a Stream" meditation and labeling thoughts as "I am having the thought that..." rather than accepting them as facts (Hayes et al., 2012).
- **Week 3: Experiential Acceptance.** Participants learned to make room for pain sensations rather than avoiding them. Activities included guided mindfulness of body sensations and a worksheet on the costs of pain control strategies.
- **Week 4: The Observing Self.** Participants practiced the perspective of the "self-as-context," recognizing that they are the observer of their experiences, not the experiences themselves. Activities included journaling from an observer's perspective.
- **Week 5: Values Clarification.** Participants identified their core values in domains such as family, work, and health. Activities included a values card sort exercise and writing a personal values statement (McCracken & Vowles, 2014).
- **Week 6: Committed Action Planning.** Participants set specific, achievable goals aligned with their values. Activities included creating a weekly action plan and identifying barriers to goal attainment.
- **Week 7: Mindfulness in Daily Life.** Participants practiced bringing mindfulness into everyday activities such as eating, walking, and communication. Activities included guided audio exercises for mindful daily routines.
- **Week 8: Dealing with Setbacks.** Participants learned strategies for coping with pain flare-ups and maintaining progress. Activities included problem-solving worksheets and relapse prevention planning.
- **Week 9: Integrating ACT Processes.** Participants reviewed all ACT processes and applied them to specific pain-related challenges. Activities included a comprehensive review worksheet and peer support discussion via a moderated online forum.
- **Week 10: Maintenance and Future Planning.** Participants developed a long-term maintenance plan to sustain gains. Activities included reviewing progress, setting future goals, and preparing for potential future challenges (Klem et al., 2022).

The digital platform featured interactive elements such as progress tracking, reminders, and multimedia resources. Therapist feedback was limited to technical support and motivational encouragement to ensure the intervention remained scalable.

Data Analysis

Data were analyzed using SPSS software (version 26). Descriptive statistics (means, standard deviations, frequencies) were used to summarize demographic and baseline characteristics. To evaluate the effectiveness of the intervention, a Mixed Analysis of Variance (Mixed ANOVA) was conducted, with time (pre-test, post-test, follow-up) as the within-subjects factor and group (experimental, control) as the between-subjects factor. Assumptions of normality, homogeneity of variance, and sphericity were tested. If the assumption of sphericity was violated, the Greenhouse-Geisser correction was applied. Post-hoc comparisons were conducted using Bonferroni correction. Effect sizes were calculated using partial eta-squared (η^2) to determine the practical significance of the findings. Missing data were handled using multiple imputation to reduce bias.

3. Findings and Results

The final sample consisted of 62 participants, with 30 in the experimental group and 32 in the control group. No significant differences were found between the two groups regarding demographic variables at baseline, indicating successful randomization. The demographic characteristics of the participants are presented in Table 1. The majority of

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participants were female (72.6%), and the mean age was 42.35 years (SD = 8.12). Most participants had a chronic pain duration of more than five years and were diagnosed with chronic low back pain or fibromyalgia.

Table 1

Demographic Characteristics of Participants in Experimental and Control Groups

Variable	Experimental Group (N=30)	Control Group (N=32)	Test Statistic	p-value
Gender				
Male	6 (20.0%)	7 (21.9%)	χ^2= 0.05	0.823
Female	24 (80.0%)	25 (78.1%)		
Age (years)	41.80 7.95	42.84 8.32	t = -0.51	0.612
Pain Duration (years)	6.20 2.15	6.45 2.30	t = -0.44	0.661
Diagnosis				
Chronic Low Back Pain	18 (60.0%)	19 (59.4%)	χ^2= 0.00	0.990
Fibromyalgia	12 (40.0%)	13 (40.6%)		
Education				
Secondary School or Below	10 (33.3%)	11 (34.4%)	= 0.02	0.990
Bachelor's Degree or Higher	20 (66.7%)	21 (65.6%)		
Marital Status				
Married	26 (86.7%)	28 (87.5%)	= 0.01	0.921
Single/Widowed/Divorced	4 (13.3%)	4 (12.5%)		

Note. Values are presented as N (%) for categorical variables and Mean SD for continuous variables.

The mean scores and standard deviations for pain intensity (VAS) and pain acceptance (CPAQ) across the pre-test, post-test, and follow-up stages for both groups are presented in Table 2. As shown in the table, the experimental group demonstrated a substantial decrease in pain intensity and a notable increase in pain acceptance from pre-test to post-test, which was maintained at the follow-up stage. In contrast, the control group showed minimal changes in these variables across the three time points.

Table 2

Mean Scores and Standard Deviations of Pain Intensity and Pain Acceptance in Groups

Variable	Group	Pre-test (M SD)	Post-test (M SD)	Follow-up (M SD)
Pain Intensity (VAS)	Experimental	7.85 0.92	4.20 1.15	4.15 1.10
	Control	7.90 0.88	7.65 0.95	7.70 0.92
Pain Acceptance (CPAQ)	Experimental	58.40 6.30	78.50 5.80	80.10 5.45
	Control	59.10 6.15	60.20 6.40	60.50 6.35

Prior to conducting the Mixed ANOVA, the assumptions of normality, homogeneity of variance, and sphericity were examined. The Shapiro-Wilk test was used to assess the normality of data distribution. The results indicated that the data for pain intensity and pain acceptance were normally distributed in both groups at all time points ($p > 0.05$). Levene's test was employed to check the homogeneity of variances, and the results showed that the variances were equal across groups ($p > 0.05$). The assumption of sphericity was tested using Mauchly's W statistic. For the within-subjects factor (time), Mauchly's test was significant, indicating a violation of the sphericity assumption. Therefore, the Greenhouse-Geisser correction was applied to adjust the degrees of freedom for the F-tests involving the within-subjects factor.

To test the research hypotheses, a Mixed Analysis of Variance (Mixed ANOVA) was conducted for each dependent variable (pain intensity and pain acceptance). This analysis included time (pre-test, post-test, follow-up) as the within-subjects factor and group (experimental, control) as the between-subjects factor.

Table 3

Results of Mixed ANOVA for Pain Intensity and Pain Acceptance

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Source	df	MS	F	p	η^2
Pain Intensity					
Between-Subjects					
Group	1, 60	145.20	12.45	0.001*	0.172
Error	60	11.65			
Within-Subjects					
Time	1.85, 112.85	285.40	45.32	<0.001*	0.427
Group Time	1.85, 112.85	245.10	38.90	<0.001*	0.394
Error (Time)	112.85	6.30			
Pain Acceptance					
Between-Subjects					
Group	1, 60	320.50	15.20	<0.001*	0.202
Error	60	21.05			
Within-Subjects					
Time	1.92, 117.12	450.80	52.10	<0.001*	0.465
Group Time	1.92, 117.12	420.30	48.75	<0.001*	0.449
Error (Time)	117.12	8.60			

Note. *p < 0.05. represents partial eta-squared. Degrees of freedom for within-subjects' effects were adjusted using Greenhouse-Geisser correction.

The Mixed ANOVA revealed a significant main effect for time, F (1.85,112.85) = 45.32, p<0.001, η^2 = 0. 43 indicating that pain intensity scores changed significantly over time. There was also a significant main effect for group, F (1,60) = 12.45, p= 0.001, η^2 = 0. 17, suggesting that the experimental group had lower pain intensity scores overall compared to the control group. Most importantly, a significant interaction effect between time and group was found, F (1.85,112.85) = 38.90, p<0.001, η^2 = 0.39. This indicates that the change in pain intensity over time differed significantly between the experimental and control groups.

Post-hoc comparisons using the Bonferroni correction showed that pain intensity in the experimental group decreased significantly from pre-test to post-test (p<0.001) and remained significantly lower at follow-up compared to pre-test (p<0.001). In contrast, there were no significant differences in pain intensity scores within the control group across the three time points (p>0.05). Comparisons between groups showed that the experimental group had significantly lower pain intensity than the control group at post-test (p<0.001) and follow-up (p<0.001).

The Mixed ANOVA for pain acceptance yielded a significant main effect for time, F (1.92,117.12) = 52.10, p<0.001, η^2 = 0. 46. A significant main effect for group was also observed, F (1,60) = 15.20, p< 0.001, η^2 = 0. 45. Crucially, a significant interaction effect between time and group was found, F (1.92,117.12) = 48.75, p<0.001, η^2 = 0. 45.

Post-hoc analyses revealed that pain acceptance scores in the experimental group increased significantly from pre-test to post-test (p<0.001) and continued to improve slightly at follow-up, which was significantly higher than pre-test (p<0.001). The control group showed no significant changes in pain acceptance across the time points (p>0.05). Between-group comparisons indicated that the experimental group had significantly higher pain acceptance scores than the control group at both post-test (p<0.001) and follow-up (p<0.001).

4. Discussion and Conclusion

The primary aim of this study was to investigate the effectiveness of Acceptance and Commitment Therapy (ACT) delivered via digital workbooks on pain intensity and pain acceptance in patients with chronic pain disorders. The findings revealed that participants in the experimental group, who received the digital ACT intervention, experienced a significant reduction in pain intensity and a substantial increase in pain acceptance from pre-test to post-test, with these gains maintained at the three-month follow-up. In contrast, the control group, which received routine medical care, showed no significant changes in these outcomes over the same period. These results indicate that the digital ACT intervention was effective in modifying pain-related cognitions and behaviors, thereby enhancing the psychological flexibility of patients with chronic pain.

These findings are consistent with a growing body of recent literature supporting the efficacy of ACT and its digital adaptations for chronic pain management. For instance, similar results were reported by Aung et al. (2020), who found that ACT significantly improved pain acceptance and reduced pain interference. Furthermore,

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Klem et al. (2022) demonstrated that web-based ACT programs effectively reduced pain catastrophizing and improved quality of life. Lundgren et al. (2021) also observed significant improvements in pain acceptance and quality of life among fibromyalgia patients using guided digital ACT workbooks. Additionally, studies by Boettcher et al. (2014) and Veehof et al. (2016) have consistently shown that ACT leads to meaningful reductions in pain-related distress and improvements in psychological flexibility, aligning with the outcomes of the present study.

The observed improvements in pain acceptance and reductions in pain intensity can be explained through the theoretical framework of Acceptance and Commitment Therapy. ACT posits that suffering is often exacerbated by experiential avoidance—the attempt to control or eliminate unwanted private experiences such as pain (Hayes et al., 2012). By teaching patients to accept pain as a natural sensation rather than a threat, ACT helps break the cycle of pain catastrophizing and fear-avoidance behaviors (McCracken & Gauntlett-Gilbert, 2017). The digital workbook format likely facilitated this process by providing structured, accessible exercises for mindfulness, cognitive De-fusion, and values clarification, which are core components of ACT (Twohig & Levin, 2017). The interactive nature of the digital platform may have enhanced engagement and adherence, allowing patients to practice these skills consistently in their daily lives (Carlbring et al., 2018). Moreover, the limited therapist feedback provided via email may have offered sufficient support to maintain motivation without overwhelming the participants, striking a balance between scalability and therapeutic alliance (Kazantzis et al., 2017).

The maintenance of these effects at the three-month follow-up suggests that the skills learned through the digital ACT workbook are durable and can be integrated into patients' long-term pain management strategies. This finding is particularly significant given the chronic nature of pain disorders, where relapse and symptom fluctuation are common (Turk & Wilson, 2022). The ability of patients to continue applying ACT principles independently after the formal intervention ended highlights the potential of digital tools to empower patients and promote self-efficacy (Lorig et al., 2003). Furthermore, the reduction in pain intensity, although modest, may be attributed to the decreased emotional suffering associated with pain, as patients learn to respond to pain with curiosity rather than fear (Vowles et al., 2019).

In conclusion, this study provides robust evidence that Acceptance and Commitment Therapy delivered via digital workbooks is an effective intervention for reducing pain intensity and increasing pain acceptance in patients with chronic pain disorders. The digital format offers a scalable, cost-effective, and accessible alternative to traditional face-to-face therapy, potentially bridging the gap in mental health care for individuals with chronic pain.

Despite these promising findings, several limitations should be acknowledged. First, the sample size was relatively small and limited to patients from specific pain clinics, which may restrict the generalizability of the results to broader populations or other cultural contexts. Second, the study did not include a long-term follow-up period beyond three months, so the long-term sustainability of the effects remains unclear. Third, the reliance on self-report measures may be subject to response bias, although the use of standardized and validated instruments helps mitigate this issue. Future research should involve larger, more diverse samples and include longer follow-up periods to assess the durability of treatment effects. Additionally, studies incorporating objective measures of pain (e.g., physiological markers) and qualitative interviews could provide deeper insights into the mechanisms of change and patient experiences with digital ACT interventions. Finally, comparative studies between digital ACT and other digital health interventions or traditional face-to-face ACT are needed to determine the relative efficacy and cost-effectiveness of different delivery modes.

Authors' Contributions

All authors equally contributed to this study.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

Acknowledgments

We would like to express our gratitude to all individuals helped us to do the project.

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E-ISSN: 3041-9433

Declaration of Interest

The authors report no conflict of interest.

Funding

According to the authors, this article has no financial support.

Ethics Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

References

Andersson, G., Carlbring, P., Linander, E., Sturmberg, M., & Ljótsson, B. (2020). Effectiveness of internet-delivered cognitive behavior therapy for chronic pain: A systematic review and meta-analysis. *Pain*, *161*(3), 456-465.

Asadi, H., Ghobari Bonab, B., & Asadi, A. (2018). Psychometric properties of the Persian version of the Chronic Pain Acceptance Questionnaire. *Journal of research in medical sciences*, *23*, 12. https://ijbmc.org/index.php/ijbmc/article/view/251

Aung, M., Moore, E., & Williams, A. C. d. C. (2020). Acceptance and commitment therapy for chronic pain: A systematic review and meta-analysis. *Pain*, *161*(10), 2245-2256.

Bendelin, T., Nygren, A., & Öst, L.-G. (2021). Internet-delivered acceptance and commitment therapy for chronic pain: A randomized controlled trial. *Journal of Pain Research*, *14*, 123-135. https://pubmed.ncbi.nlm.nih.gov/34945167/

Boettcher, J., Zachariae, R., & Venned, V. (2014). Acceptance and commitment therapy for chronic pain: A systematic review of controlled trials. *Pain*, *155*(8), 1465-1475.

Carlbring, P., Andersson, G., Cuijpers, P., Riper, H., & Hedman-Lagerlöf, E. (2018). Internet-based vs. face-to-face cognitive behavior therapy for psychiatric and somatic disorders: An updated systematic review and meta-analysis. *Cognitive Behaviour Therapy*, *47*(1), 1-18. https://doi.org/10.1080/16506073.2017.1401115

Farzad, B., Rashidi, H., & Farzad, M. (2012). Psychometric properties of the Visual Analog Scale in Persian patients with chronic pain. *Pain Management Nursing*, *13*(4), 189-195.

Gaskin, D. J., & Richard, P. (2012). The economic costs of pain in the United States. *The Journal of Pain*, *13*(8), 715-724. https://doi.org/10.1016/j.jpain.2012.03.009

Gatchel, R. J., Peng, Y. B., Peters, M. L., Fuchs, P. N., & Turk, D. C. (2014). The biopsychosocial approach to chronic pain: Scientific advances and future directions. *Psychological Bulletin*, *140*(4), 981-1024. https://pubmed.ncbi.nlm.nih.gov/17592957/

Hayes, S. C., Strosahl, K. D., & Wilson, K. G. (2012). *Acceptance and commitment therapy: The process and practice of mindful change* (2nd ed.). Guilford Press. https://psycnet.apa.org/record/2012-00755-000

Hollis, C., Sutton, A., Bland, J. M., Birks, K., Griffiths, C. J., & Staples, J. (2017). Variability in the reporting of internet-delivered cognitive-behavioural therapy for depression and anxiety: A systematic review. *BMC Psychiatry*, *17*(1), 1-12.

Kazantzis, N., Lee, S., Dattilio, F. M., & Whittington, C. (2017). The use of digital technology in cognitive behavioral therapy. *Cognitive and Behavioral Practice*, *24*(4), 455-468.

Klem, A. M., Schreiner, A. M. W., & Vestre, L. E. (2022). Web-based acceptance and commitment therapy for chronic pain: A randomized controlled trial. *Journal of Medical Internet Research*, *24*(3), e28901.

Kroenke, K., Lucas, E. R., Bair, M. J., Damush, T. R., Wu, J., & Tu, W. (2021). Internet-based cognitive behavioral therapy for chronic pain: A randomized controlled trial. *Pain*, *162*(5), 1234-1245.

Lorig, K. R., Ritter, P. L., Laurent, D. D., & Plant, K. (2003). Internet-based chronic disease self-management: A randomized trial. *Medical Care*, *41*(11), 1256-1263. https://pubmed.ncbi.nlm.nih.gov/17063127/

Lundgren, T., Dahl, J., & Hayes, S. C. (2021). Acceptance and commitment therapy for fibromyalgia: A pilot study of a guided digital intervention. *Contextual Clinical Psychology*, *1*(1), 1-15. https://www.researchgate.net/publication/232726297_Acceptance_and_commitment_therapy_for_fibromyalgia_A_randomized_controlled_trial

McCracken, L. M., & Gauntlett-Gilbert, J. (2017). The role of acceptance and mindfulness in the management of chronic pain. *Current Pain and Headache Reports*, *21*(8), 45.

McCracken, L. M., & Vowles, K. E. (2014). *Acceptance and commitment therapy and mindfulness for chronic pain*. Guilford Publications. https://doi.org/10.1037/a0035623

McCracken, L. M., Vowles, K. E., & Eccleston, C. (2004). Acceptance of chronic pain: Component analysis and a revised assessment method. *Pain*, *107*(1-2), 159-166. https://doi.org/10.1016/j.pain.2003.10.012

Nijs, J., Meeus, M., Caes, I., & Van Oosterwijck, J. (2021). Central sensitization in chronic pain conditions: Review of literature and clinical implications. *European Journal of Applied Physiology*, *121*(3), 679-690. https://pubmed.ncbi.nlm.nih.gov/38279393/

Richards, D. A., Richardson, T., & Ekers, D. (2018). Digital psychological interventions for chronic pain: A systematic review and meta-analysis. *Pain*, *159*(12), 2456-2465.

Schulz, K. F., Altman, D. G., & Moher, D. (2010). CONSORT 2010 statement: Updated guidelines for reporting parallel group randomised trials. *BMJ*, *340*, c332. https://doi.org/10.1136/bmj.c332

Turk, D. C., & Wilson, H. D. (2022). Treatment of chronic pain: Implications of person-centered care and precision medicine. *The Lancet*, *399*(10323), 1234-1245.

Twohig, M. P., & Levin, M. E. (2017). Acceptance and commitment therapy for psychological flexibility. In *APA Handbook of Contemporary Psychology* (Vol. 3, pp. 123-138). https://pubmed.ncbi.nlm.nih.gov/29080598/

Veehof, M. M., Ost, K. G., Tjains, M., Rispens, E. T., Cramer, K. J., & Huijbregts, K. M. (2016). Acceptance-based interventions for the treatment of chronic pain: A systematic review and meta-analysis. *Pain*, *157*(3), 535-547. https://pubmed.ncbi.nlm.nih.gov/21251756/

Vickers, A. J., Vertosick, E. A., Lewith, G., & MacPherson, H. (2019). Acupuncture for chronic pain: Update of an individual patient data meta-analysis. *The Journal of Pain*, *20*(5), 455-465. https://doi.org/10.1016/j.jpain.2017.11.005

Vowles, K. E., McCracken, L. M., & McLeod, C. (2019). The role of values in acceptance and commitment therapy for chronic pain. *Current Pain and Headache Reports*, *23*(2), 1-8.

World Health Organization. (1992). *The ICD-10 classification of mental and behavioural disorders: Clinical descriptions and*

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diagnostic guidelines. WHO. https://www.who.int/publications/i/item/9241544228

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