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The Association Between Activity Pacing and Pain, Discomfort, Anxiety, and Quality of Life in Chronic Musculoskeletal Disorder Patients

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Abstract

Background: Chronic musculoskeletal disorders (CMSDs) are prevalent conditions that significantly impair physical functioning, mental health, and quality of life (QoL). Activity pacing is recommended as a strategy to manage symptoms, but its effectiveness and psychological impact are not fully understood. This study explores the associations between different components of activity pacing and outcomes related to pain, psychological distress, and QoL among individuals with CMSDs. **Methods:** A cross-sectional study was conducted with 248 participants recruited from primary physiotherapy centers. Validated self-report instruments were used to assess pain intensity, pain interference, psychological distress (depression, anxiety, stress), and QoL (physical, psychological, social, environmental domains). Correlation analyses were used to examine associations between activity pacing components (activity adjustment and general engagement) and health outcomes. **Results:** Activity adjustment was positively associated with pacing consistency, planning, progression, and acceptance. It was negatively correlated with pain interference, depression, and stress, but positively associated with pain severity and anxiety. It also demonstrated positive correlations with all domains of QoL. In contrast, general engagement in activity pacing was positively correlated with pain severity, pain interference, perceived risk of overactivity, and psychological distress, and negatively associated with all QoL domains. **Conclusion:** Activity pacing strategies are differentially associated with pain and psychological outcomes. While activity adjustment appears to support better QoL and lower psychological distress, general engagement may reflect maladaptive pacing associated with greater symptom burden. These findings underscore the importance of individualized, goal-oriented pacing interventions in CMSD management.

Keywords: Chronic Musculoskeletal Disorders; Activity Pacing; Pain; Psychological Distress; Quality of Life; Rehabilitation

Background

Chronic musculoskeletal disorders (CMSDs) include a broad spectrum of conditions affecting the

musculoskeletal system, such as osteoarthritis, rheumatoid arthritis, fibromyalgia, and chronic low back pain. These disorders are characterised by persistent pain, functional limitations, and reduced quality of life. Musculoskeletal conditions are defined as injuries, damage, or pathologies involving muscles, joints, ligaments, or other supporting tissues. Increasing prevalence is attributed to factors such as occupational demands, poor posture, and repetitive daily activities. Notably, musculoskeletal issues impact nearly everyone at some point in their lives, underscoring their public health significance [1, 2]. Patients with CMSDS frequently experience anxiety due to the unpredictability of their symptoms and limitations in their daily activities.[3] It is recommended that education programs on prevention and coping strategies for musculoskeletal symptoms be implemented to improve the quality of life.[4].

Activity pacing is a commonly recommended self-management strategy for individuals with chronic musculoskeletal disorders (CMSDs), yet it remains inconsistently defined and applied in clinical practice. Notably, there is ongoing debate regarding the use of quota-based pacing to reduce pain-contingent behaviours. Pacing involves balancing activity and rest to prevent symptom exacerbation and is proposed to address maladaptive patterns such as avoidance, excessive persistence, and boom-bust cycling—characterised by periods of intense activity followed by inactivity due to symptom flare-ups. By promoting more consistent participation in meaningful activities, pacing aims to reduce symptom volatility. However, its efficacy in improving pain, discomfort, anxiety, and quality of life (QOL) in CMSD populations warrants more rigorous scientific investigation.[5, 6] Abonie found no clear strategy for improving physical activity and health-related quality of life in adults with multiple sclerosis through activity pacing and suggests that individualised guidance on efficient approaches to activity and fatigue management may benefit people with multiple sclerosis. [7, 8] Antcliff challenges the narrow interpretation of activity pacing, highlighting its multifaceted nature, including components such as goal-setting and activity planning. Despite its clinical relevance, further rigorous research is required to establish the efficacy of pacing and its impact across outcomes in chronic musculoskeletal and neurological conditions. Evidence suggests that activity pacing does not hinder participation; individuals who pace demonstrate comparable rest durations and a slightly improved balance between productive and leisure/social activities compared to overactive counterparts. These findings support the integration of pacing strategies into patient education and suggest promising treatment directions for those with chronic pain who tend toward overactivity.[6, 9]

A clinically useful operational definition of activity pacing can be structured around five empirically supported themes: activity adjustment, consistency, progression, planning, and acceptance. Evidence shows that individuals with chronic pain and fatigue who adopt pacing strategies report improvements in quality of life, psychological well-being, self-efficacy, pain, and fatigue. When self-regulation of activity is impaired—due to developmental, neurological, physical, or psychological factors—activity levels often decline, leading to further health issues. Developing self-regulatory pacing is therefore critical to sustaining physical activity. In such populations, programmatic strategies incorporating pedagogical models (e.g., ecological dynamics), structured rehabilitation, supportive environments, and assistive technologies (e.g., heart rate monitors, step counters, mobile apps) may facilitate pacing until autonomous regulation is achieved[10-12]. This study investigates the association between activity pacing and pain, psychological distress, and quality of life in individuals with chronic musculoskeletal disorders (CMSDS). Findings may support integrating activity pacing into physiotherapy, enhancing self-management and clinical outcomes. Positive results could validate its use, while negative findings may guide exploration of alternative CMSD management strategies, contributing to improved patient care.

Methods

Participants

We recruited a sample of 248 CMSD patients from local clinics and support groups. Inclusion criteria included a documented CMSD diagnosis, age between 18 and 65 years, and the ability to understand and complete the study questionnaires. Participants had provided informed consent before the commencement of the study.

Study Design

This study was a cross-sectional observational design, using non-probability sampling.

Outcome measures

Participants completed validated questionnaires to measure pain intensity, discomfort, anxiety levels, and QoL. Numeric Rating Scale (NRS): A numerical scale where participants rate their pain from 0 to 10 was used[13]; Brief Pain Inventory (BPI): A more comprehensive tool that assesses the intensity of pain and its impact on daily functioning.[14]; Kessler Psychological Distress Scale (K10): a screening for mental illness in the general population.[15] Depression Anxiety and Stress Scale (DASS): It includes both anxiety, stress and depression subscales.[16]; WHOQOL-BREF (World Health Organisation Quality of Life-BREF): A cross-culturally valid assessment of QoL.[17]; Activity Pacing Questionnaire: used across a heterogeneous group of patients with chronic pain or fatigue, the APQ-26 is multifaceted and demonstrates reliability and validity[18]; Activity Pacing and Risk of Overactivity Questionnaire: used to assess engagement in pacing[19]

Sample size

Assuming that we have a population proportion of 0.8 and an Estimated Effect Size(DEFF) of 1, the desired sample size calculated was 246 when using 5% absolute precision with a 95% level of significance.[20]

Data Analysis

Data collected were cleaned for paucity before the analysis, and the categorical variables were presented in percentages and numerical variables in terms of mean and standard deviations for the demographic and clinical outcomes. Descriptive analyses will be used for the analysis of all the measuring tools. A correlation analysis between the objective and subjective measures of activity pacing and the other variables was done, including the correlation between activity pacing and pain, the correlation between activity pacing and quality of life, and the correlation between activity pacing and stress, anxiety, and depression. Data were analyzed using IBM SPSS Statistics for Windows, version 20.0, Armonk, NY: IBM Corp.

Results

The study included 248 chronic musculoskeletal disorder patients, along with both genders (male and female), with a mean age of 41.80 ± 12.146 (range 18-65) and a duration of the condition is 21.49 ± 31.148 months (range ≥ 3 months). The sample comprised 64.5% females and 35.5% males. Most participants had completed primary or secondary education, with 24.2% being graduates and 14.5% postgraduates. Blue-collar workers represented 62.5% of the sample. Diagnoses included lower back pain (29.4%), knee pain (17.7%), neck pain (16.1%), and shoulder pain (15.7%), among others. Multiple conditions were reported by 9.7% of participants. This demographic distribution reflects a diverse group of individuals commonly affected by chronic musculoskeletal disorders (CMSDS) in clinical practice. (Table 1)

The outcome measures of the study highlight the clinical profile of participants with chronic musculoskeletal disorders (CMSDS). These findings reflect the multifaceted impact of CMSDS on patients' physical, emotional, and functional well-being. (Table 2)

The study identified nuanced associations between various components of activity pacing and clinical outcomes in individuals with chronic musculoskeletal disorders (CMSDs). Activity Adjustment was found to be positively associated with anxiety and negatively associated with social, environmental, physical, and psychological quality of life (QoL). Activity Consistency was linked with lower pain interference and depression and was positively associated with social, environmental, and psychological QoL.

Activity Progression demonstrated negative associations with pain interference and depression, as well as with environmental QoL. Activity Planning was negatively associated with pain severity and interference, and with social, environmental, physical, and psychological QoL. It also showed a positive association with anxiety. Activity Acceptance, on the other hand, was positively associated with pain severity and with improvements in social, environmental, and physical QoL, but did not show a significant association with anxiety.

Engagement in Activity Pacing was positively associated with the perceived risk of overactivity, pain intensity (as measured by the Numerical Pain Rating Scale), pain severity, depression, and anxiety. It was negatively associated with all domains of QoL—social, environmental, physical, and psychological. Similarly, the Perceived Risk of Overactivity was positively associated with engagement in pacing, pain intensity, pain severity, depression, and anxiety, and negatively associated with all QoL domains.(Table 3)

Table 1: Demographic characteristics of participants

SUBJECT CHARACTERISTIC	FREQUENCY	PERCENTAGE
GENDER		
Male	88	35.5
Female	160	64.5
EDUCATION		
0-7	75	30.2
8-12	77	31.0
Graduated	60	24.2
Post-graduate	36	14.5
OCCUPATION		
White-Coller	93	37.5
Blue-Coller	155	62.5
DIAGNOSIS		
Lower back pain	73	29.4
Neck pain	40	16.1
Shoulder pain	39	15.7
Elbow pain	10	4.0
Wrist pain	2	0.8
Hip pain	6	2.4
Knee pain	44	17.7
Ankle pain	10	4.0
Multiple conditions	24	9.7
AGE	41.80± 12.146	
DURATION OF CONDITION (M)	21.49± 31.148	

Table 2: The clinical profile of participants

<i>OUTCOME MEASURES</i>	<i>Mean ± Standard deviation</i>
Activity Pacing components	
Activity adjustment	2.62±0.76
Activity consistency	2.98±0.99
Activity progression	2.88±0.88
Activity planning	2.34±0.93
Activity acceptance	3.17±1.09
Engagement In Activity Pacing	2.88±1.72
Perceived Risk Of Over Activity	2.37±1.21
Pain Components	
NPRS	6.31±1.56
Pain Severity	5.45±1.55
Pain Interference	3.61±2.11
Quality Of Life Components	
Social Qol	47.98±10.04
Environmental Qol	109.06±18.36
Physical Qol	87.29±11.0
Psychological Qol	71.04±13.87
Psychological Components	
Depression	7.29±7.75
Stress	7.02±7.23
Anxiety	8.65±7.51

Table 3: The associations between various components of activity pacing and clinical outcomes

	Pain	Pain Severity	Pain Interfere nce	Anxiety	Depressi on	Physical Qol	Psycholog ical Qol	Social Qol	Environme ntal Qol
Activity adjustme nt	.176(.05)	.137(.031)	-.035(.578)	.295(.000)	.066(.304)	-.245(.000)	-.278(.000)	-.119(.062)	-.091(.152)
Activity consisten cy	-.153(.016)	-.190(.003)	-.292(.000)	-.080(.211)	-.227(.000)	.058(.364)	.150(.018)	.140(.027)	.314(.000)
Activity progressi on	-.129(.042)	-.235(.000)	-.311(.000)	.102(.108)	-.163(.010)	-.108(.090)	-.007(.913)	.139(.029)	.149(.019)
Activity planning	.179(.005)	.006(.931)	-.165(.014)	.339(.000)	.080(.207)	-.317(.000)	-.223(.000)	-.208(.001)	-.145(.023)
Activity acceptan ce	.036(.570)	.050(.437)	-.011(.861)	-.024(.700)	-.185(.003)	.136(.032)	-.010(.878)	.262(.000)	.154(.015)
Engagem ent in activity pacing	.225(.000)	.199(.002)	.101(.113)	.312(.000)	.262(.000)	-.156(.014)	-.176(.005)	-.144(.024)	-.128(.045)
Perceive d risk of overactiv ity	.208(.001)	.171(.007)	.050(.437)	.378(.000)	.231(.000)	-.216(.001)	-.235(.000)	-.238(.000)	-.217(.001)

Discussion

This cross-sectional observational study provides valuable insights into the demographic characteristics, clinical profiles, and interrelationships between activity pacing behaviors and various health outcomes among individuals with chronic musculoskeletal disorders (CMSDS). Participants demonstrated moderate engagement in activity pacing, with variability across its subdomains, reflecting individual adaptations to chronic pain and physical limitations.

Pain-related metrics indicated moderate levels of severity (NPRS: 6.31) and interference (Pain Interference: 3.61), emphasizing the ongoing need for effective and individualized pain management strategies. Higher pain severity was positively correlated with the perceived value of activities, suggesting that patients may prioritize meaningful tasks even when in pain. However, increased interference was linked to difficulty in progressing with activities, highlighting a potential barrier to maintaining functional independence. Notably, engagement in activity pacing was positively associated with both pain severity and interference. This suggests a complex relationship in which pacing may be employed as a coping strategy in response to pain but could also reflect heightened symptom monitoring or perceived vulnerability. These findings align with earlier studies that emphasized the dual role of pacing as both a protective and potentially stress-inducing behavior.

Subdomain analysis revealed that individuals who adjusted activities effectively were more likely to maintain consistency, progress gradually, and plan purposefully—behaviors that were inversely correlated with pain interference. These results support a model of proactive pacing, where structured management leads to better outcomes. The positive association with activity acceptance further reinforces the role of psychological flexibility in successful pain self-management. However, engagement in activity pacing and a heightened perceived risk of overactivity were negatively correlated with multiple domains of quality of life, including social, environmental, physical, and psychological well-being. These findings suggest that although pacing is used as a pain management strategy, it may also be accompanied by emotional burden or reduced participation in valued life areas. This highlights the importance of evaluating not just the presence of pacing behaviors but their functional quality and emotional consequences.

Quality of life outcomes varied across domains, with physical and psychological dimensions notably impacted. Positive correlations between activity consistency and quality of life in the social, environmental, physical, and psychological domains suggest that maintaining steady engagement in daily activities contributes to holistic well-being. Conversely, pain interference negatively influenced quality of life, underlining the need to reduce pain's impact on daily functioning. Interestingly, individuals reporting high engagement in pacing and higher perceived risk of overactivity also reported lower quality of life across all domains. This may reflect maladaptive interpretations or applications of pacing, such as excessive activity avoidance, emphasizing the need for nuanced education on pacing principles and the importance of goal-oriented rather than fear-based activity modification.

Participants reported moderate levels of psychological distress, including depression (mean = 7.29), stress (mean = 7.02), and anxiety (mean = 8.65). These psychological variables demonstrated complex relationships with pacing and pain. While depression and stress were negatively associated with beneficial pacing behaviors and positively associated with pain interference, anxiety showed positive correlations with both adaptive and maladaptive pacing components. These patterns highlight the intricate interplay between physical activity regulation and emotional health. For instance, while consistent and accepted pacing may support psychological resilience, planning and adjustment in response to anxiety could reflect over-monitoring or hypervigilance to symptoms, potentially exacerbating distress. Such nuances suggest the need

for comprehensive interventions that address not only physical functioning but also emotional coping and cognitive appraisal styles. The perceived risk of overactivity was particularly notable, showing negative correlations with all quality-of-life domains and positive correlations with depression and stress. These findings reinforce the need for balanced activity engagement that acknowledges individual limitations without reinforcing fear or avoidance.

The findings of this study are consistent with the broader literature on work-related musculoskeletal disorders (WRMSDs), particularly among physically active professionals such as physiotherapists. A high prevalence of WRMSDs (82%) was reported in this cohort, with the lower back and neck as the most affected regions, echoing prior studies by Shah and Sharma, who highlighted the mismatch between job demands and physical capacity as a contributing factor.[4]

Psychological distress is a known comorbidity in chronic pain. Attali et al. similarly reported that comprehensive pacing strategies can reduce emotional distress. However, in this study, while activity consistency and progression were linked to improved psychological outcomes, components such as planning and adjustment showed positive associations with anxiety, suggesting the possibility of maladaptive over-engagement in symptom monitoring or activity restriction.[21].

Antcliff et al. advocated for conceptualizing pacing as a dynamic, multifaceted coping strategy, not merely a slowing or avoidance mechanism. The current findings support this view, particularly as acceptance and consistency in pacing correlated positively with various quality of life domains. Misinterpretation of pacing as avoidance, as noted by Hadzic et al., may contribute to greater disability, reinforcing the importance of accurate assessment and education in pacing principles. Moreover, physical inactivity and comorbidities, as described by McPhail et al., are detrimental to quality of life. Participants in the current study with suboptimal pacing practices reported lower physical quality of life and higher pain severity, underlining the need for interventions that encourage balanced and goal-oriented activity engagement.[22-24]

The benefits of structured activity pacing interventions were further supported by Antcliff et al., whose pacing framework yielded improved behavioral and symptom outcomes. In alignment, participants in the current study who reported higher levels of activity acceptance and consistency also demonstrated better scores in psychological and environmental well-being. Qualitative insights from Scott-Dempster et al. similarly suggest that physiotherapists who adopt a more empathetic, experience-based approach facilitate better pacing implementation and adherence.[25, 26] Furthermore, Andrews et al. and Abonie et al. highlighted that properly applied pacing supports, rather than hinders, participation in meaningful activities. The current study affirms this, emphasising the importance of balanced pacing to ensure sustained involvement in work, leisure, and social roles without exacerbating symptoms.[27] [28]

This study has several limitations, including its cross-sectional design, which restricts causal inferences, and the reliance on self-reported measures that may introduce bias. Despite these constraints, the study's strengths include its use of validated instruments, multidimensional assessment of activity pacing, and its practical relevance to clinical care. The nuanced exploration of pacing subdomains such as consistency, planning, and acceptance offers valuable insights rarely addressed in previous research. Future studies should adopt longitudinal designs, incorporate objective activity measures, and explore diverse populations to strengthen external validity. Interventions should be individualised, addressing maladaptive pacing behaviours and integrating psychological support to enhance treatment outcomes. Furthermore, educational efforts targeting healthcare providers are essential to promote accurate assessment and application of activity pacing. Such comprehensive, personalised approaches can optimise the management of chronic pain and improve patients' quality of life.

Conclusion

This study contributes to the growing body of literature recognizing activity pacing as a critical coping strategy for individuals with chronic musculoskeletal disorders. The complex interplay between pacing, pain, psychological health, and quality of life indicates the need for comprehensive, individualized interventions. Healthcare professionals should aim to identify and promote adaptive pacing behaviors while addressing mental health challenges and physical limitations. Future research should focus on refining pacing assessment tools, standardizing interventions, and evaluating long-term outcomes through randomized controlled trials.

Declaration of Conflicting Interests

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