ASSOCIATION BETWEEN A NEW CLASSIFICATION OF PSYCHOLOGICAL, DISABILITY AND POSTURAL INSTABILITY IN NONSPECIFIC CHRONIC LOW BACK PAIN

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ASSOCIATION BETWEEN A NEW CLASSIFICATION OF PSYCHOLOGICAL, DISABILITY AND POSTURAL INSTABILITY IN NONSPECIFIC CHRONIC LOW BACK PAIN

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Abstract: *Nonspecific chronic low back pain (CLBP) present with postural instability and psychosocial distress. Hence this study aims to investigate the relationship between new a subgrouping of CLBP, healthy control (HC) and postural sway (center of pressure total travel distance, TD). A total of seventy-four (n=74) participants were subgroup as HC (n=19, 25.7%), with individuals of this subgroup being healthy with no LBP history. The "Acceptance Subgroup (AG)" (n= 20, 27%), and individuals of this CLBP subgroup were characterized with significant lower score in the Tampa Scale for Kinesiophobia (TSK), Fear Avoidance Beliefs Questionnaire (FABQ), Pain Coping Inventory (PCI), and Roland Morris Disability Questionnaire (RMDQ). The "Mild subgroup (MG)" (n=23, 31.1%), are individuals suffered mild fear of pain avoidance, moderate pain copers and mild disability. Lastly, the "Severe subgroup (SG)" (n=12, 16.2%), who were severely suffered from fear avoidance belief, pain coping, fear of movement, and were disabled by their LBP. Results indicated there is a significant association between MG and TD (β=21.53, p<.028,). However, no association between AG, SG and TD was identified (p>.05). This study conclude that the moderate state of psychological affected and mild disability is associated with greater postural instability in individuals with CLBP. Further research is needed to unravel the impact of psychosocial in CLBP patients with postural sway problem.*

Keywords: Nonspecific chronic low back pain, psychosocial factors, postural instability, subgrouping, fear avoidance, pain coping, kinesiophobia, balance control.

1. INTRODUCTION

Low back pain is one of the most prevalent musculoskeletal disorders with huge impact on the socioeconomic problems. About 80% of the complaints cannot been recognized to specific disease or anatomic abnormality, thus have been classified as nonspecific LBP [1, 2]. Patients with LBP have different contributors to their condition and marked with differences in the course of their LBP experienced[3-5].

The symptom duration classification has some limited clinical value and lacks a multidimensional integration. This classification approach focuses only on the pathoanatomical diagnosis that contributes to the underlying mechanism[6] but provides very little information on the possible confounding impact of other factors, such as the psychosocial, neuro-physiological and physical factors [7]. The identification of the painful area of the muscle has been reported as another approach to identify the peripheral pain generator[8]. However, the major limitation of this classification is that only consider symptomatic pain areas and lacks regard for the underlying mechanism or cause of the pain which has been generated. There has been a shift in focus towards psychosocial factors instead of the peripheral in LBP [9]. Maladaptive coping strategies such as negative thinking, fear and anxiety, avoidance behavior, catastrophizing and hypervigilance are usually seen in the behavior of CLBP patients. This is confirmed by a recent study that shows non-continuous CLBP patients' psychological state being highly affected compared to that of continuous CLBP and RLBP patients. Moreover, maladaptive attitudes have also been shown to be associated with high levels of pain, disability and muscle guarding.[10, 11]

Postural sway often observed in CLBP and one of the strategies that comprises between trunk movement and coordination of lower extremities is to reduce excursion of center body of mass and minimize movement of the ankle joints. Limiting any movement of ankle joints will induce variation in gravitational moment around the spine that have controlled the trunk musculature to maintain spine alignment. In addition, numbers of studies in literature revealed that postural sway in CLBP is inconsistent. In recent cohort studied, the postural sway were found only very small different between CLBP and healthy individuals.[12]

Studies have shown that psychosocial factors significantly impact postural stability in NSCLBP patients. Oliveira et al. (2018) found that patients with high levels of pain catastrophizing and fear avoidance demonstrate increased postural sway and impaired dynamic balance performance. Similarly, Otero-Ketterer et al. (2020) noted that anxiety, depression, and other psychosocial factors exacerbate postural instability, leading to greater functional impairment. Understanding these relationships is essential for developing effective treatment strategies that address both physical and psychosocial aspects of NSCLBP.

Therefore, this study aims to explore whether the new subgroups of CLBP that is based on psychological and disability can be associated to the postural instability.

2. METHODS

A tota of 74 young adults participated in this study who are between 20-30 years old, either suffering from nonspecific CLBP or who were healthy and free from LBP. Nonspecific CLBP is defined as pain that persists more than 12 weeks in the whole lumbar region and has been confirmed with no clear anatomical cause and no recognizable medical history that could explain the complaints [13]. The LBP complaints had to be of such severity that the participant had consulted a physical therapist (PT) or medical doctor (MD) regarding the complaints. Individuals with a history of spinal surgery, spinal traumata, spinal deformities or severe orthopaedic, respiratory, inflammatory, metabolic, neurologic or cardiovascular diseases were not eligible for study participation. LBP free refers as HC is someone who not having LBP at the moment the experiments were conducted. To be considered healthy, these individuals could not suffer of have a history of severe disorders such as metabolic, neurologic, cardiovascular disorders, etc. Study participants were recruited through advertisements posted on social media, distributed in University compound and near community.

All participants provided written informed consent prior to participation in accordance with the research ethical approval obtained from the institutional research ethics committee (FERC/12/2024/UG/MR/0449).

The inclusion and exclusion criteria are presented in Table 1.

The psychological and functional factors in this study were assessed through validated and reliable self-reported questionnaires i.e. Fear Avoidance Belief (FABQ), Pain Coping Inventory (PCI), the Tampa Scale for Kinesiophobia (TSK), and Rolland Morris Disability Questionnaire (RMDQ).

2.1 FABQ

FABQ is self-reported 16-item questionnaire consisted of two subscales, FABQ-physical activity (FABQ-P) and FABQ-work (FABQ-W); FABQ-P used to assess belief and attitude towards physical activities (5 items, range 0–30), FABQ-W is focused specifically to assess the attitude towards the work (11 items, range 0–66). A low score on both subscales shows weak fear-avoidance beliefs[14].

2.2 PCI

The PCI is self-reported questionnaire to measure behavioural and cognitive pain coping technique that correspond to the active and passive pain coping mechanism in people suffering with CLBP. The PCI consists of six measures which results a total of 33 items and are scored on 4-point Likert scale , with 1 being the least frequent and 4 being most frequent. A highest score of PCI refer that individual have greater reliance on the coping strategy. The PCI has good validity and reliability in CLBP.

2.3 TSK

The TSK, which consists of 17 items was used to assess fear of movement. The TSK scores range from 17 to 68, with scores >37 indicating high fear of movement[15].

2.4 RMDQ

Functional characteristics were measured using the Rolland Morris Disability Questionnaire (RMDQ), which evaluated how LBP impacts the functioning of daily physical activities thus providing an insight into the degree of LBP-related disability [16]. The RMDQ contains 24 items of which a total score ranging between 0 (no disability) and 24 (severe disability) is calculated, a with higher score indicating a higher degrees of LBP-related disability [17]. The RMDQ has a good internal consistency, test-retest reliability, and construct validity [18-21].

Based on all these psychological and disability assessments, a new subgrouping of CLBP and HC were created. Cluster 1 was labeled as the "*Healthy Control group (HC)* (n=19, 25.7%), with individuals of this subgroup being healthy with no LBP history. Three new subgroups cluster of CLBP were generated from the dendrogram cluster memberships. Cluster 2 was labeled as the "*Acceptance Subgroup (AG)*" (n= 20, 27%), and individuals of this CLBP subgroup were characterized with significant lower score in FABQ, PCI, TSK and RMDQ. Cluster 3 was labeled as the "*Mild subgroup (MD)*" (n=23, 31.1%), and individuals of this subgroup suffered mild fear of pain avoidance, moderate pain copers and mild disability. Cluster 4 was labeled as the "*Severe subgroup (SG)*" (n=12, 16.2%), and individuals of this subgroup were severely suffered from fear avoidance belief, pain coping, fear of movement, and were disabled by their LBP.

2.5 Postural sway

To measure the standing postural sway, a Plantar Pressure Plate Utilizing the RSscan Lab Ltd. system with 4096 sensors and a scanning rate of 300 measurements per second, were used (Fig.3). The total distance (TD) refers to the overall length of the trajectory of the foot center of pressure sway. Higher trajectory of TD in 40s is indicated as higher postural instability (Figure 2). Studies showed higher postural sway in CLBP.

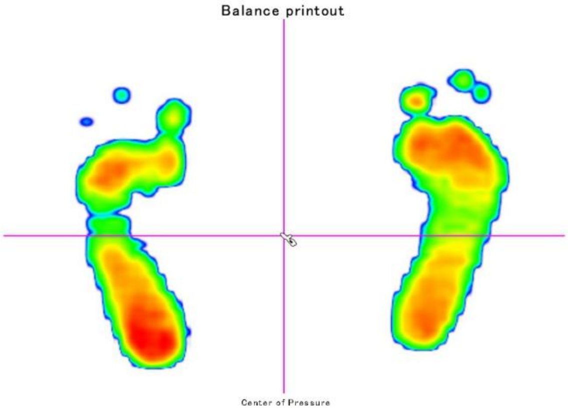

Fig. 2. Center of pressure analysis based on the travelled distance (TD) time

2.6 Statistical Analysis

Statistical analyses were performed using IBM SPSS Statistics 22 (SPP Inc., Chicago, IL, USA). The baseline descriptive statistics for age, weight, height, BMI, symptom duration, current LBP VAS, FABQ, PCI, TSK, RMDQ and TD between CLBP and HC.

All groups differences were identified and inspected for normality distribution through an observation of the 5% trimmed mean difference, skewness and kurtosis, standard error, and the Shapiro-Wilk test. The one–way ANOVA with Bonferroni post-hoc correction for parametric data and Kruskal-Wallis test for non-parametric data were used. Significance was set at $p<.05$. Lastly, the association between new subgroups of CLBP and postural sway were analyse using univariate analysis and the correlation coefficient significant was set at $p<.05$.

Fig. 3 : The starting position of the bipedal standing test. Each subject was instructed to remain stationary with barefoot for 40 s during the trial.

3. RESULTS

3.1 Demographic participants

Significant differences in gender between all subgroups. Male had a significantly more compared to female in all subgroups ($p<.05$). However, no different of age and BMI between all subgroups ($p>.05$).

Furthermore, symptom duration as well as current LBP VAS were significantly lowered in HC compared to AG, MG and SG ($p<.05$). However, the symptom duration and LBP VAS intensity has no different between AG, MG and SG ($p>.05$).

GROUP	HC	CLBP
General In-Exclusion Criteria	- Males and Females - 20-30 years old - ≥1 years post-natal - no neurological, respiratory, circulatory or severe, orthopaedic diseases - no pregnancy - no back surgery - no use of antidepressants or analgesics (except for NSAID's or paracetamol), taken two weeks prior to the testing	
Specific In and Exclusion Criteria	- healthy persons - no physical pain complaints - never asked for help or advice concerning low back pain	- persists symptom of LBP ≥12 weeks

HC= healthy control, CLBP= chronic low back pain

Fig. 1: Inclusion and Exclusion Criteria

Table 1. Differences baseline of psychological and disability characteristics between a new subgrouping of CLBP and HC

	HC (n=19)	CLBP AG (n=20)	CLBP MG (n=23)	CLBP SG (n=12)	Sig.
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	
Age (years)	23.37	22.90	23.22	23.7new 5	.267
Gender	Male = 11 Female = 8	Male = 16 Female = 4	Male = 23 Female = 0	Male = 9 Female = 3	*.002**
BMI	23.00	23.92	23.67	23.63	.705
Symptom Duration(month)	.00$^{\#}$	19.95$^{\#}$	33.65$^{\#}$	20.83$^{\#}$	*.001**
Current LBP VAS	.00$^{\#}$	4.0$^{\#}$	4.3$^{\#}$	4.75$^{\#}$	*.001**
FABQ	9.21$^{\alpha}$	16.90$^{\alpha}$	24.52$^{\alpha}$	42.75$^{\alpha}$	*.001**
PCI	57.89$^{\alpha}$	72.10$^{\alpha}$	89.60$^{\alpha}$	101.00$^{\alpha}$	*.001**
TSK	37.32$^{\alpha}$	33.65$^{\alpha}$	39.26$^{\alpha}$	47.08$^{\alpha}$	*.001**
RMDQ	1.37$^{\alpha}$	5.50$^{\alpha}$	9.17$^{\alpha}$	14.33$^{\alpha}$	*.001**
TD	33.95	36.40	55.48	29.83	.594

HC=healthy group, AG=acceptance group, MG=mild group, SG = Severe group, Sig=significant, BMI=body mass index, LBP. VAS= Low back pain visual analogue scale, FABQ=fear avoidance belief questionnaire, PCI=pain coping inventory, TSK= Tampa Scale

Kinesiophobia, RMDQ=Rolland Morris Disability Questionnaire, TD= Total distance

Significant differences were depicted in FABQ, PCI, and TSK between HC, AG, MG and SG (p<.05). FABQ, PCI and TSK score were significantly higher in SG compared to MG, AG and HC. Moreover, significantly higher score of FABQ, PCI and TSK in MG compared to AG and HC (p<.05) .

The RMDQ scores were significantly different between all subgroups and HC (p<.05). There was significantly higher score of RMDQ in SG compared to MD, AG and HC. Moreover, significantly higher score of RMDQ in MG compared to AG and HC (p<.05).
No different of TD between all groups (p>.05). All data is presented in Table 1.

Association between a new subgroups and postural sway

There is a significant association between MG and TD (β=21.53, p<.028,). However, no association between AG, SG and TD was identified (p>.05) as reported in Table 2.

Table 2. Univariate analysis on the association **between new CLBP subgroups and TD**

Total Distance (TD)				
	Mean (SD)	**β**	**90% CI**	**Sig.**
Intercept		33.95	19.79-48.10	
AG	36.40(17.37)	2.54	-17.31 – 22.21	.805
MG	55.48(51.32)	21.53	2.41 – 40.65	**.028***
SG	29.83(9.36)	-4.11	-26.86 - 18.63	.719

AG=acceptance group, MG=mild group, SG = Severe group, Sig=significant, β = relationship coefficient, SD=standard deviation, CI=confident interval.

4. DISCUSSION

This study aimed to explore the association between psychosocial factors through fear avoidance, pain coping, disability and postural sway in individuals with CLBP. This study revealed new subgrouping of CLBP in MG have more postural sway as compared to SG and AG. Individuals in SV and AG in CLBP seem less associated to the postural sway hence possible both acceptance and adapted to pain increase the posture stability.

The association between the MG and postural sway suggests that individuals with mild psychological distress exhibit greater postural instability compared to those in the SG and HC. This highlights the moderate affected by both psychological distress and disability increase the postural adjustments in CLBP patients. The only reason can be explained towards this study findings that the MG had prolonged LBP symptoms (33 months of symptom duration) than SG (20 months). This seems in line with the psychological and disability measures showed they were slightly better than SG. Persistent experience of LBP seems allow these patients have adapted to their LBP but yet exhibit with postural instability such as higher postural sway.

Intriguingly, this study found patients with highly fear avoidance, fear of movement, pain coping and disabled did not associated with postural instability in CLBP. Age factor can be plausible factor since individuals in this study was young adults. We found young adults might have different response towards their postural strategies when being attack by the persistent LBP episode. In line with literature studied found many in elder patients of CLBP suffered with postural sway then young patients with CLBP[22, 23]. This study finding might offer new insight that clinician identify the CLBP with moderate psychological and disability problem could overcome some issue related to postural stability. However, this statement should be validated in future study

The findings of this study suggest the need for further research and clinical applications to improve the understanding and management of CLBP. Future studies should expand on the current research framework by incorporating between muscle function assessments, such as electromyography (EMG) and motion analysis of the lumbar paraspinals muscle, postural sway measurements. Longitudinal studies should also be conducted to observe changes in psychosocial subgrouping and postural stability over time. Additionally, exploring other psychological variables, such as stress and different coping mechanisms, could provide a more comprehensive understanding of the factors influencing CLBP.

In clinical practice, integrating psychosocial screening tools, such as FABQ, PCI, TSK, and RMDQ, into routine in CLBP assessments can help identify individuals at higher risk of postural instability.

Rehabilitation programs should incorporate both psychological therapy and postural control training to improve treatment effectiveness. Personalizing interventions based on a patient's psychosocial and physical impairments can lead to better outcomes. Furthermore, increasing awareness among healthcare professionals regarding the importance of a biopsychosocial approach in CLBP management can enhance treatment strategies and patient care.

This study has several strengths. The use of validated psychosocial assessment tools, such as the FABQ, PCI, TSK, and RMDQ, ensures the reliability of the collected data. Additionally, incorporating objective postural sway measures, including travelled distance and ellipse area, provides a comprehensive evaluation of balance control in CLBP individuals. The subgrouping approach based on psychosocial factors adds depth to the understanding of psychological influences on postural instability.

However, certain limitations must be acknowledged. The sample size, although adequate for analysis, may limit the generalizability of findings to broader populations. Additionally, the cross-sectional nature of the study prevents conclusions about causality between psychosocial factors and postural instability. Future research should consider longitudinal studies to assess changes in these relationships over time. Furthermore, the reliance on self-reported psychosocial measures introduces potential bias, as responses may be influenced by individual perceptions and experiences.

5. CONCLUSIONS

This study provides new insight about the role of psychosocial factors such as fear avoidance, pain coping strategies, and kinesiophobia are associated to the postural instability in individuals with CLBP. Differences in psychosocial measures and postural sway were observed between subgroups, emphasizing the need of targeted interventions. The findings indicate that individuals with moderate psychological distress and highly disabled exhibited with greater postural instability, while extreme distress did not necessarily correlate with increased postural sway. Further research is needed to validate these findings and refine intervention strategies tailored to psychosocial subgroups within this population.

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