

## *Original Paper*

# Relationship between Body Mass Index and the Sub-Dimensions of the Brief Pain Inventory in Chronic Pain Patients

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### **Abstract**

*Individuals with chronic pain find it hard to exercise which often results in an elevated Body Mass Index (BMI). Often these individuals only have mild to moderate structural or biomechanical reasons to explain their pain yet their fear of pain seems to influence their functional capacity before any biomechanical mechanism actually prevents them doing so.*

*A retrospective analysis of 25 individuals with a diagnosis of chronic pain (>3 months duration) to establish anthropometric measures, pain severity and Brief Pain Inventory (BPI) questionnaire including the affective sub-dimension score (REM: relations with others, enjoyment of life, and mood) and the activity subdimension score (WAW: walking, general activity, and work) were assessed.*

*BMI was shown to have a significant effect on the overall daily functional BPI score as assessed using ANOVA,  $F(4,110) = 29.4, p < 0.05$ , with an effect size  $w = 0.5$ . Turkey HSD tests to compare all groups identified a significant relationship between BMI and (i) pain ( $p < 0.05$ ), (ii) REM ( $p < 0.05$ ), and (iii) sleep ( $p < 0.05$ ).*

*These results would suggest that individuals who are overweight and who show higher REM scores on the BPI assessment may benefit from early psychological counselling rather than physical therapy.*

### **Keywords**

*chronic pain, Body Mass Index (BMI), Brief Pain Inventory (BPI)*

## 1. Introduction

Individuals with chronic pain complain that their pain can limit the range and duration of physical movement. This limitation ultimately results negatively on caloric energy expenditure and thereby increases the risk of increasing Body Mass Index (BMI) to an extent that many individuals with chronic pain are overweight (BMI 25-29) or obese (>30) (Barofsky, 1997; Creamer, 2000; Pells, 2008). While it is accepted that pain exists in those with a high BMI, pain intensity (MacLellan et al., 2017; Li et al., 2018) has rarely been included as a primary outcome in any specialized multidisciplinary Weight Management Services (WMS).

Despite the fact that many individuals blame their elevated BMI as a barrier to exercise and pain is “seen” as the reason to avoid exercise, it is not uncommon to find these individuals only have mild to moderate structural or biomechanical reasons to explain their pain. It may be that their fear of pain may influence their functional capacity before any biomechanical mechanism actually prevents them.

Our hypothesis is that there is a psychological shift in the mindset of chronic pain patients with a raised BMI that re-enforces their belief that they are unable to exercise before any significant structural issue. The Brief Pain Inventory (BPI) has become one of the most widely used measurement tools for assessing clinical pain. It allows patients to rate the severity of their pain and the degree to which their pain interferes with common dimensions of feeling and function.

The primary objective is to examine the relationship between increased BMI and the elements of Brief Pain Inventory that report the “sensory” dimension of pain (intensity, or severity), the “reactive” dimension of pain (interference with daily function) and sleep.

## 2. Methodology

### 2.1 Patient Selection

With ethical approval a retrospective analysis of the patient database at our chronic pain clinic was undertaken to establish cases of chronic pain (>3 months) and a raised BMI. Inclusion criteria included: (i) all individuals (18 years or older) attending a chronic pain clinic with chronic pain of 3 months or more;

(ii) who had completed the Brief Pain Inventory questionnaire (BPI);

(iii) had their BMI recorded (or had the height and weight available to calculate the BMI);

(iv) had a clinical diagnosis or probable diagnosis confirmed in their notes.

Relative exclusion factors were individuals who were not capable of reading or speaking fluent English, or those who were unable to have their weight or height measured. The same research nurse was able to answer any issue the individual had in relation to the questionnaire. The process took approximately 5-7 minutes.

## 2.2 Anthropometric Measures and Demographic Information

Anthropometric measures included height (centimeter), weight (kilogram), BMI (kilogram per square meter) were collected as part of the routine clinic. Obesity levels were classified according to World Health Organisation (1995): Overweight 25 to 29 kg/m<sup>2</sup>; class I obese 30 to 34.99 kg/m<sup>2</sup>; class II obese 35 to 39.99 kg/m<sup>2</sup>; and class III obese >40 kg/m<sup>2</sup>.

## 2.3 Pain Measures

Pain severity at worst was assessed with the validated Numeric Rating Scale (NRS), and specific questions regarding pain location (e.g., low back, knee, and up to 3 other pain sites) were included.

## 2.3 Brief Pain Inventory (BPI)

The Brief Pain Inventory (BPI) has become one of the most widely used measurement tools for assessing clinical pain (Tan et al., 2004; Cleelman, 1989). It allows patients to rate the severity of their pain and the degree to which their pain interferes with common dimensions of feeling and function. Accordingly, the BPI questionnaire includes items to assess the “sensory” dimension of pain (intensity, or severity) and the “reactive” dimension of pain (interference with daily function). This offers a practical clinical measurement tool to capture the functional limits.

Individuals completed the BPI as part of their clinical work up. The BPI is a simple assessment which uses a Linkert scale (from zero to 10; zero being very poor and 10 being excellent). It takes 5 minutes to complete. The BPI questionnaire provides an overall impact score (total BPI) and two additional scores, the affective sub-dimension score (REM: relations with others, enjoyment of life, and mood) and the activity subdimension score (WAW: walking, general activity, and work). The individuals reported sleep disturbance is assessed within the BPI.

## 2.4 Statistical Analysis

The anonymized and coded data were entered into the Statistical Packages (StatPlus/excel) for the Social Sciences (V. 20) and subsequently cleaned. A profile of patient demographics and characteristics was reported using descriptive statistics. This profile was categorized according to obesity classification (i.e., class I-III) and number of pain sites (i.e., none, 1 pain site, 2 pain sites, and 3 or more pain sites). Following Kolmogorov-Smirnov tests for normality, comparisons between baseline profiles based on obesity classification and number of pain sites was assessed with  $\chi^2$  and nonparametric Kruskal-Wallis H tests.

## 3. Results

A total of 25 consecutive cases were examined and 23 adults (mean age 45.3 ± 9.8 years, 12 Male and 11 Female) with chronic pain of 3 months or more duration were included in the study. Chronic back pain was the commonest condition reported (61%). The demographic details are outline in Table 1. The mean BMI was 28.9 ± 4.9 kg/m<sup>2</sup> and almost half (47.8%) were graded as morbidly obese >30kg/m<sup>2</sup> BMI (Table 1).

BMI was shown to have a significant effect on the overall daily functional BPI score as assessed using ANOVA,  $F(4,110) = 29.4$ ,  $p < 0.05$ , with an effect size  $w = 0.5$ . Turkey HSD tests to compare all groups identified a significant relationship between BMI and (i) pain ( $p < 0.05$ ), (ii) REM ( $p < 0.05$ ), and (iii) sleep ( $p < 0.05$ ) (Table 2.).

The WAW score was not significantly related to BMI. All individuals who reported poor sleep pattern showed a significant relationship between BMI, REM and WAW.

**Table 1. Demographics and Pain Intensity Scores**

Gender (n)	Male = 12    Female = 11
Age (mean $\pm$ SD) years	Male 42.8 $\pm$ 6.2 years    Female 47.8 $\pm$ 12.0 years
BMI Grade	
Over weight (20-24.9 kg/m <sup>2</sup> )	17.3% (4)
Grade I (25-29.9 kg/m <sup>2</sup> )	34.7% (8)
Grade II (30-34.9 kg/m <sup>2</sup> )	39.1% (9)
Grade III (35-39.9 kg/m <sup>2</sup> )	8.7% (2)
Primary Source of the Chronic pain	
Cervical Spine (Neck)	13% (3)
Lumbar Spine (Lower Back Pain)	61% (14)
Peripheral Pain (Arm/hand/leg)	26% (6)
Average Pain Score (0-10)	6.09 $\pm$ 2.6
(Range)	(3-8)
REM Mean ( <i>REM: relations with others, enjoyment of life, and mood</i> )	28.91 $\pm$ 21.5
WAW mean ( <i>WAW: walking, general activity, and work</i> )	52.3%
Average Sleep %	17.50 $\pm$ 7.0

**Table 2. Turkey HSD Testing (Where <0.05 Represents a Significant P-Value; n.s Represents a Non-Significant P-Value)**

	BMI	Average Pain	REM score	Sleep	WAW score
BMI		<0.05	<0.05	<0.05	n.s
Average Pain	<0.05		n.s	<0.05	n.s
REM score	<0.05	n.s		<0.05	n.s
Sleep	<0.05	<0.05	<0.05		<0.05
WAW score	n.s	n.s	n.s	<0.05	

#### 4. Discussion

The key finding of this study is that chronic pain and higher BMI grade negatively impacts on both the “sensory” dimension of pain (intensity, or severity) and the “reactive” dimension of pain (interference with daily function) as captured by the BPI. The fear avoidance model of pain is well recognized in chronic pain patients (Currie et al., 2004) but we believe that we highlight the possible impact an individual’s BMI levels may have on this relationship for the first time.

The finding that BMI significantly influenced the affective sub-dimension (i.e., REM: relations with others, enjoyment of life, and mood) to a greater extent than the activity subdimension (i.e., WAW: walking, general activity, and work) supports our hypothesis and suggests that there is a psychological shift in the mindset of chronic pain patients with a raised BMI that re-enforces their belief that they are unable to exercise before any significant structural issue emerges.

Intuitively one might have considered that the increased physical effort needed to mobilize in individuals who are overweight would be influenced before or at the same time as the affective elements. Our results suggest that the psychological factors may play an earlier and important role in limiting the rehabilitation of those with BMI. The impact psychological factors have on those with chronic pain is well reported and fear related to the intensity and persistence of pain is associated with disability (Currie et al., 2004). This is often referred to as the fear-avoidance model (Roelof et al., 2007; Perrot et al., 2018). Kinesiophobia is one of the most extreme forms of fear of pain due to movement or re-injury (Woby et al., 2005; Houben et al., 2005). Both fear avoidance beliefs and kinesiophobia are relevant factors regarding chronic pain complaints in the general population (Perrot et al., 2018). The Tampa Scale of Kinesiophobia (TSK) is a psychometric, clinically-oriented diagnostic, prognostic and monitoring tool used to assess fear of movement/re-injury across different clinical conditions and patient populations (Picavet et al., 2002; Comachio et al., 2018). Our results would suggest that more formally exploring TSK levels and its relationship to BMI scores in those with chronic pain may need to be considered in the future.

The relationship between BMI and sleep in our study reflects previously reported data in this area.

##### 4.1 Limits

As with all retrospective studies we accept that there is a risk of incomplete data sets and this can undermine the strength of the study. However, in this study the clinical data was routinely recorded in our medical notes by a small number of staff in the pain unit. They were familiar with the data collection technique and we believe this increases the quality of the dataset. The dataset was screened and collected systemically by one researcher to ensure completeness. We also had a strict criteria adherence and of the 25 concurrent charts examined only 2 charts failed to meet the full inclusion criteria.

The BPI is a subjective assessment. Objectively assessing the variables using a Timed Up and Go test (TUAG) or a 500 meter Walk Test (500mWT) could be added in the future. Greater insight in to the

individuals concerns about weight loss and this insight could help understand the outcomes. The inclusion of the Tampa Scale of Kinesiophobia for future assessment could provide greater understanding needs and improve the data in future studies.

## 5. Conclusions

In the short term our results would suggest that individuals who show higher REM scores on the BPI assessment may benefit from early psychological counselling. Individuals who have both a raised REM and WAW score on the BPI would be expected to need advice regarding physical rehabilitation.

When clinical resources are restricted this office “assessment” may help decide which resource to use, when to use it and it might assist in a more systematic use of the pain management resources. As the prevalence of obesity continues to rise this hypothesis needs to be tested.

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