Journal of
Obesity & Weight Loss Therapy

Saito et al., J Obes Wt Loss Ther 2012, 2:3
DOI: 10.4172/2165-7904.1000126

Research Article Open Access

Effects of Obesity and Gender on Chronic Pain Severity in a Community Based Cohort

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Abstract

Introduction: Obesity and chronic pain are common problems affecting quality of life for many men and women, however, little is known about gender specific effects of obesity on chronic pain severity. This study examines the relationship between chronic pain severity and Body Mass Index (BMI) in male and female patients from a community neurology clinic.

Methods and materials: Cross-sectional analysis of 232 men and 224 women presenting sequentially to a community based general neurology clinic for evaluation of chronic pain.

Results: In the combined group of men and women, BMI correlated with pain severity score for neck (R-square = 0.08, SE = 2.9, p = 0.01), back (R-square = 0.07, SE = 2.9, p < 0.01), and joint pain (R-square = 0.08, SE = 3.1, p < 0.01), but not for headache or whole body pain. In men, BMI correlated with pain severity score for neck (R-square = 0.18, SE = 3, p = 0.03), back (R-square = 0.16, SE = 2.9, p < 0.01), and joint pain (R-square = 0.12, SE = 2.5, p < 0.01), but not headache pain. In women BMI correlated with pain severity score for back (R-square = 0.07, SE = 2.9, p < 0.01), and joint pain (R-square = 0.05, SE = 3.5, p = 0.02), but not for headache or neck pain.

Conclusions: Obesity affects severity of chronic pain in a variety of pain locations. Reduction in body mass index may be one method for reducing chronic pain severity in men and women.

Keywords: Obesity; Chronic pain; Body mass index; Gender

Introduction

Chronic pain is a common condition in the United States and other countries that adversely affects quality of life [1-7]. According to the International Association for the Study of Pain, pain is an unpleasant sensation that is associated with actual or potential tissue damage [8]. Sensations of this type that persist for three months or greater are considered to be chronic pain as opposed to acute pain [1]. Obesity and gender are two factors known to affect the severity and distribution of chronic pain in the general population; however, gender specific effects of obesity have not been frequently studied in chronic pain. Additionally, health related effects of obesity are of particular interest at this time due to the increase in prevalence of obesity in recent years [9].

Obesity is one factor associated with both greater pain severity and higher prevalence of chronic pain [10,11]. Obesity increases risk for chronic knee, hip, and lower back pain, as well as greater frequency of migraine headache attacks and chronic daily headaches [11-14]. Obesity is a particularly important risk factor at this time due to the rising rates of obesity in the general population and due to the positive relationship between obesity and pain-related disability [9,15]. Associations such as these have even caused some to suggest that calculation of body mass index (BMI) should become a routine part of the screening evaluation for chronic pain patients [15].

Gender is also identified as a factor significantly affecting pain perception and response among adults [16]. Compared to men, women are reported to have lower thresholds for detection and less tolerance for noxious stimuli [17]. The differences in pain perception between males and females are suggested to result from a combination of physiologic, sociocultural, and psychological variables. For instance, chronic pain disorders are more commonly diagnosed in women than men [18]. Additionally, pain thresholds have been demonstrated to follow the hormonal changes of the menstrual cycle in women possibly related to changes in opioid receptor activation in brain regions associated with pain perception [16,19].

In this study we examined gender differences in the effect of body mass index on self reported pain severity in adults who presented to a community based neurology practice for evaluation of chronic pain. Because chronic pain and obesity share specific co-morbidities [20-22], we also obtained information on presence of co-morbid chronic medical conditions such as diabetes and hypertension, allowing the influence of these potential confounders to be accounted for in the relationship between BMI and chronic pain severity and distribution. The information in this study would be of interest to neurologists, pain specialists, and primary care physicians treating adults with obesity and chronic pain conditions.

Methods and Materials

Permission to perform this study was obtained from the Ventura County Medical Center Institutional Review Board. Participants were adults, over the age of 18 years, who presented sequentially to a community based general neurology clinic for assessment of pain of three months or greater duration during a two year period from July 2009 to July 2011. All participants underwent a standardized workup

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Received March 08, 2012; **Accepted** April 18, 2012; **Published** April 20, 2012

Citation: Saito E, Leonard A, Nakamoto B, McMurtray A (2012) Effects of Obesity and Gender on Chronic Pain Severity in a Community Based Cohort. J Obes Wt Loss Ther 2:126. doi:10.4172/2165-7904.1000126

including measurement of height and weight, a history and physical examination and neurological examination by a board certified neurologist, and assessment of chronic pain level. Presence of chronic medical conditions such as hypertension and diabetes were determined by self report during the history and physical examination. Body mass index (BMI) values were calculated according to standard published methods [23].

Chronic pain assessments were conducted by a board certified neurologist. All participants experienced sensations meeting the definition of pain as defined by the International Association for the Study of Pain [8], and reported pain duration of 3 months or greater in accordance with previously published definitions of chronic pain [1]. Patients were assessed for location and severity of chronic pain using a 0-10 point scale in accordance with other published studies [24]. Body regions assessed included head, neck, and back, joint and generalized or whole body pain. Patients were excluded from participation in the study if they had a history of traumatic head injury, learning disability, or known structural brain disorder.

Continuous demographic factors and other continuous variables were compared between groups using two-tailed t-tests. Frequency of occurrence of categorical variables was compared between groups using chi-square analysis. Patients in the "underweight" BMI category were combined with patients in the "normal" BMI category to make a category designated "underweight/normal" due to too few underweight participants to permit analysis as an independent group. Linear regression models were constructed for each chronic pain location for men and women together and for separate gender specific models, using pain severity score as the dependent variable. All statistical calculations were performed using Microsoft Excel and Open Epi.

Results

A total of 456 patients were assessed, 224 females and 232 males. The mean age of the female patients included in the study was 49.3 years (SD = 10.1), and the mean age of male patients was 48.5 years (SD = 11.1). No significant differences were detected for demographic variables including age, duration of chronic pain, ethnicity distribution, or presence of co-morbid hypertension and diabetes mellitus. (Table 1) BMI distributions also did not significantly differ between the groups.

		Male	Female	Sig
Number		232	224	N/A*
Age (SD)**		48.5 (11.1)	49.3 (10.1)	p = 0.5
Ethnicity (A, C, H)***		68,139,25	69,125,30	p = 0.6
Diabetes: Present, Absent		37,195	31,193	p = 0.5
Hypertension: Present, Absent		88,144	86,138	p = 0.9
Mean Duration in Months (SD)**		91.1 (107.0)	104.2 (101.3)	p = 0.2
Mean Pain Level (SD)**		7.0 (3.0)	7.0 (3.2)	p = 0.9
All	Underweight/Normal	52	47	p = 0.8
	Overweight	69	73	
	Obese	111	104	
Asian	Underweight/Normal	22	16	p = 1.0
	Overweight	15	20	
	Obese	30	32	
Caucasian	Underweight/Normal	25	22	p = 0.4
	Overweight	46	43	
	Obese	68	60	
Hispanic	Underweight/Normal	4	8	p = 0.6
	Overweight	8	10	
	Obese	13	12	

*N/A = non-applicable
**SD = standard deviation
*** A = Asian, C = Caucasian, H = Hispanic

Table 1: Demographic Characteristics.

Overall mean chronic pain severity score did not differ significantly between males (7.0, SD = 3.0), and females (7.0, SD = 3.2). Distributions of chronic pain location also did not differ between male and female patients, even when stratified according to BMI category. Male and female patients were then analyzed separately. In the male patients no significant association was detected between chronic pain location and BMI category. In the female patients the percentage with neck pain was significantly greater in the underweight/normal BMI category (42.4%) compared to the overweight (19.7%) and obese (14.3%) categories ($p = 0.03$).

For the combined group consisting of both men and women, BMI category was positively related to pain severity for neck ($p = 0.03$), back ($p < 0.01$), joint ($p < 0.01$), and whole body pain ($p = 0.02$), but not headache pain (Table 2). When analyzed separately in gender specific groups, obese men demonstrated greater mean pain severity for neck ($p = 0.03$), back ($p < 0.01$), and joint pain ($p < 0.01$), but not headache pain (Table 2). In female patients obesity was significantly associated with greater mean chronic pain severity scores for back ($p < 0.01$), joint ($p = 0.03$), and whole body pain ($p < 0.01$), but not for headache or neck pain (Table 2).

In the overall group with men and women combined, linear regression showed that pain severity score correlated with BMI for neck pain (R-square = 0.08, standard error = 2.9, $p = 0.01$), back pain (R-square = 0.07, standard error = 2.9, $p < 0.01$), and joint pain (R-square = 0.08, standard error = 3.1, $p < 0.01$), but not for headache or chronic whole body pain. Linear regression models were then constructed separately for men and women comparing BMI with chronic pain severity score as the dependant variable. In the separate linear regression models, chronic pain severity in men correlated with BMI for neck pain (R-square = 0.18, standard error = 3.0, $p < 0.01$), back pain (R-square = 0.16, standard error = 2.9, $p < 0.01$), and joint pain (R-square = 0.12, standard error = 2.5, $p < 0.01$), but not headache pain. A regression calculation for whole body pain in men could not be performed due to an insufficient number of subjects. In women

Gender	Location	Under-weight/ Normal	Overweight Mean (SD)*	Obese Mean (SD)*	Sig
Men and Women	Head	7.8 (1.4)	7.1 (2.7)	7.9 (2.8)	p = 0.6
	Neck	6.1 (3.0)	6.3 (3.4)	8.0 (2.3)	p = 0.03
	Back	6.1 (3.1)	6.6 (3.2)	8.2 (2.5)	p < 0.01
	Joint**	6.4 (2.9)	5.8 (3.4)	7.7 (3.0)	p < 0.01
	Whole Body	7.0 (0.0)	NS***	9.3 (0.8)	p = 0.02
Men	Head	8.0 (1.7)	7.1 (2.6)	8.3 (1.8)	p = 0.5
	Neck	4.6 (3.8)	6.1 (3.7)	7.7 (2.2)	p = 0.03
	Back	4.8 (3.7)	6.6 (3.2)	8.1 (1.9)	p < 0.01
	Joint**	6.1 (3.4)	6.9 (2.5)	8.3 (1.8)	p < 0.01
	Whole Body	NS***	NS***	8.5 (0.5)	NS***
Women	Head	7.7 (1.1)	7.1 (2.8)	7.6 (3.3)	p = 0.9
	Neck	7.2 (1.6)	6.5 (3.2)	8.5 (2.4)	p = 0.1
	Back	7.4 (1.3)	6.5 (3.2)	8.3 (2.9)	p < 0.01
	Joint**	6.7 (2.3)	5.1 (3.7)	7.2 (3.6)	p = 0.03
	Whole Body	7.0 (0.0)	NS***	10.0 (0.0)	p < 0.01

*SD = Standard Deviation.
**Includes: shoulders, elbows, wrists, finger joints, hips, knees, ankles, toe joints.
***NS = Not sufficient number of subjects (<2).

Table 2: Mean Chronic Pain Severity by Location and BMI Category.

chronic pain severity correlated with BMI for back pain (R-square = 0.07, standard error = 2.9, $p < 0.01$) and joint pain (R-square = 0.05, standard error = 3.5, $p = 0.02$), but not for headache or neck pain. A regression calculation for whole body pain in women also could not be performed due to an insufficient number of subjects.

Discussion

Obesity and chronic pain are very common conditions that affect quality of life for many people worldwide. The results of this study suggest that obesity affects chronic pain severity even in patients who have suffered from chronic pain for many years. Additionally, the findings of this study are of particular importance at this time due to the recent rise in prevalence of obesity in this country. The associations demonstrated in this study between greater chronic pain severity and obesity in a variety of chronic pain locations suggest that men and women suffering from chronic pain in areas such as the neck, back, joint and whole body may benefit from weight reduction as a means for decreasing chronic pain severity levels.

Chronic pain is a very common condition diagnosed in the United States and around the world. A recent study of National Health and Nutrition Examination Survey (NHANES) data from 10,291 people living in the United States between 1999-2002 demonstrated prevalence estimates of 10.1% for back pain, 7.1% for pain located in the legs/feet, 4.1% for pain in the arms/hands, 3.5% for headaches, 11% for pain located in a body region, and 3.6% for widespread or generalized pain [1]. Another recent study using World Health Organization (WHO) data collected from primary care patients being treated in Asia, Europe, and the Americas found that 22% of primary care patients reported persistent pain, with variation across centers ranging from 5% to 33% [21]. In Australia, a telephone survey of 2092 randomly selected households in the Northern Sydney Health Area in 1998 showed prevalence rates for chronic pain of 22.1% with a high rate of 27% for pain related disability [25]. Numerous other studies have reported similar results for the prevalence of chronic pain in countries such as Canada, Spain, Taiwan, and others as well [3-7].

Obesity is a rapidly increasing problem that contributes to greater frequency and severity of chronic pain conditions [9]. According to a recent study of NHANES data, the majority of non-pregnant adults aged 20-90 years living in the United States are now either overweight or obese [9]. In the United States, several studies have linked obesity to greater frequency of chronic pain in the general population. Recently Hitt et al. [10] demonstrated a positive relationship between body mass index and frequency of chronic pain in adults living in the southeastern United States. In this study, adults were classified into groups based on BMI score, with Class I obese having BMI 30-34.9, Class II obese having BMI 35-39.9, and Class III obese having BMI of 40.0 or greater. They found that Class I obese individuals were 1.762 times as likely to experience chronic pain as underweight and normal individuals [10]. The odds then increased with greater levels of obesity, with Class II obese being 1.888 times as likely, and Class III obese were 2.297 times as likely to experience chronic pain compared to underweight and normal individuals [10].

Another study in the United States using NHANES data of 5724 adults age 60 years or older showed higher prevalence of pain in the knee, hip, and lower back among obese participants compared to underweight and desirable weight individuals [11]. Several studies have demonstrated a relationship between obesity and headaches, including greater frequency of migraine headache attacks and greater prevalence of chronic daily headache in the obese compared to normal weight individuals [12-14]. In one recent study an association between obesity and greater pain severity was demonstrated in adults with migraine headaches [13]. This differs from the results of our study which did not identify a significant relationship between obesity and severity of chronic headache pain in either men or women. However, our study included all patients reporting chronic headache pain and was not restricted to migraine sufferers alone, so it is possibly that while this relationship exists for migraine headaches other types of headaches are not similarly affected.

Gender is another factor that is reported to significantly affect prevalence, severity and even perception of pain [16]. A recent meta-analysis evaluated the effect of gender on perception of a variety of painful stimuli including thermal, pressure, and electrical stimuli [17]. For all types of stimuli, women were found to report higher pain severity at lower thresholds of noxious stimuli and have less tolerance than males, with the effects for thermal stimuli being the smallest [17]. Additionally, gender specific differences in pain perception, as measured by threshold for detection and tolerance to painful stimuli, have been suggested to result from a combination of both physiologic and non-physiologic variables. One suggested physiologic etiology for instance is changes in opioid receptor activation in brain regions associated with analgesia that cause measurable differences in pain thresholds related to the hormonal changes of the menstrual cycle in women with lower pain thresholds occurring around the time of menses [16,19]. Finally, it has been suggested that evidence for the presence of non-physiologic variables contributing to gender differences in chronic pain is demonstrated by the more common diagnosis of chronic pain disorders in women than men, indicating sociocultural and psychological variables such as unwarranted psychogenic attributions by healthcare providers may play a role as well [18].

This study is limited by several factors. Our study population was a convenience sample of patients presenting to a local community based neurology clinic. Consequently the patient population followed local demographics and was lacking in representation of people of African American and other ethnicities. Also there were insufficient numbers of underweight individuals represented and analysis of this BMI category as an independent group was not possible. This study did not include information on the cause or etiology of the chronic pain, which is a potentially confounding variable that consequently was not able to be accounted for in the analysis. The use of a purely subjective scale for assessment of pain severity rather than an objective method for determination of pain thresholds is another potential limiting factor. Additionally, neuroimaging of the brain was not performed and it is possible that changes in brain structures such as the thalamus or cortical regions may be present and relate to different pain perceptions. Finally the cross sectional study design allows for information from only one time point and does not provide follow up or long term information, or information necessary to establish causality.

As rates of obesity rise in the general population, understanding the effects of obesity on severity of chronic pain is a topic of increasing importance. The associations identified in this study between chronic pain severity and obesity in men and women suggest that weight reduction may be one method for decreasing chronic pain severity in obese individuals. Further study is needed including neuroimaging assessment of cortical and sub cortical structures involved in pain perception. The information in this study would be of use to neurologists, pain specialists, and also primary care physicians who commonly treat adults with obesity and chronic pain.

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