Correlation Analysis between Women's Body Mass Index and Mechanical Low Back Pain

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Abstract

Background: Obesity can cause mechanical effects on spine, particularly lumbar spine, thus increased weight will cause spine, tendon and ligament muscle tensions. These problems can change lumbar curve with increased anterior pelvic tilt and hip flexion to maintain normal posture that may eventually cause low back pain. Women may experience weight gain, and it can cause low back pain. However, correlation between increased body mass index and low back pain is still debatable.

Objective: The research aimed to analyze correlation between women's body mass index and mechanical low back pain.

Method: A total of 12 patients aged 50-60 were the subjects of the research. The subjects' body mass index, pain scale and lumbosacral axis were measured. The study protocol was approved by the ethics committees of Dr. Soetomo Teaching Hospital (Surabaya, Indonesia). The correlation test was conducted using Pearson's correlation test (Significant if $p<0.05$).

Results: The research found no correlation between increased body mass index and low back pain ($p = 0.47$), while there was a correlation between increased body mass index and lumbosacral axis ($p = 0.04$). Moreover, there was no correlation between increased lumbosacral axis and low back pain ($p = 0.07$)

Conclusion: The study found that the more the body mass index increased, the lumbosacral axis also increased, whereas no correlation between body mass index and low back pain.

Keywords: *low back pain, obesity, overweight, women.*

Introduction

Weight is an expression factor of lifestyle. People with unhealthier lifestyle cannot control their dietary habits and perform their activities, therefore, they will have higher obesity risks. Obesity and overweight are forms of abnormal body mass index that highly correlate with person's life quality, and it gets worse due to musculoskeletal and systemic impairments. Overweight is a condition of excessive body fat accumulation under skin tissue. Overweight or obesity patients were reported to have medical aid due to low back pain [1].

Back pain is a clinical syndrome characterized by pain or low spine discomfort and its surrounding. More than 80% of human population have experienced back pain. Although there is a low mortality rate, the morbidity rate due to low back pain shows high value and has a very significant economic effect [2]. The causes of back pain are multifactorial, such as malignant, aging, infection, musculoskeletal, trauma and psychological processes. A total of 40% of back pain patients have experienced back pain anxiety that will affect the patient's working ability [3].

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Obese women aged 60 or more have a 22% prevalence to experience back pain. A woman will experience weight gain, and it is manifested in increased low back pain due to musculoskeletal changes or body fat that can cause changes in spine's lumbosacral axis, increased lumbar lordosis and anterior pelvic tilt as well as hip flexion [4].

Some studies found correlations between overweight and low back pain. According to World Health Organization (WHO), an estimated 1 billion people are overweight and 300 million people suffer from obesity. The National Survey conducted in 1996/1997 in capital cities across Indonesia found 8.1% overweight adult male population (≥18 years old; Body mass index (BMI) 22-27 kg/m^2) and 6.8% suffered from obesity. Moreover, 10.5% of adult female population suffered from overweight and 13.5% suffered from obesity. The sample group aged 40-49 reached its maximum overweight and obesity at 24.4% and 23% respectively in male population, and 30.4% and 43% in female population [5]. Other risk factors for low back pain are also increased with age, behavior, smoking, lack of activity and heavy work/occupational or psychosocial factors [6].

The visitation number of new patients with chronic low back pain and abnormal body mass index in Outpatient Medical Rehabilitation Clinic of Dr. Soetomo Teaching Hospital, Surabaya, Indonesia, in the last 3 months (January 2013-Maret 2013) were 1141 patients, consisting of 872 females (76.4%). Therefore, we aimed to analyze correlation between body mass index and mechanical low back pain in women patients at outpatient medical rehabilitation Clinic of Dr. Soetomo Teaching Hospital by assessing plain photo of lumbosacral axis changes in sagittal plane in upright position barefoot.

Method

The subjects were women patients with back pain and body mass index ≥25kg/m^2 who met inclusion criteria at medical rehabilitation unit of Dr. Soetomo Teaching Hospital, Surabaya, Indonesia, in June 2013. The inclusion criteria were women aged 50-60 with back pain, while the exclusion criteria were history of spinal surgery in the last 3 months, kyphosis or scoliosis, ankylosing spondylitis, rheumatoid arthritis or neurologic disease (stroke) and history of delayed spinal surgery. The subjects declared their willingness to become the subject of the study by signing informed consent. The study protocol was approved by the ethics committees of Dr. Soetomo Teaching Hospital (Surabaya, Indonesia).

The research is an observational analytic study with cross sectional, using 12 samples who met the inclusion criteria. The subject characteristics were then recorded that included age, height, weight and body mass index. Each subject was asked to do lumbosacral photography in sagittal plane in upright position barefoot. In addition, each subject was asked to show pain intensity level with visual analog scale. The correlation test was conducted using Pearson's correlation test using SPSS software (SPSS, Inc., Chicago, IL).

Results

The subjects were 12 women aged 50-60 with abnormal BMI (>25kg/m^2) and low back pain at outpatient medical rehabilitation clinic of Dr. Soetomo Teaching Hospital, Surabaya Indonesia. We measured subjects' height, weight, body mass index, lumbosacral axis and Visual analogue scale (VAS) to describe low back pain. The subjects' demographic characteristics were presented in Table 1. The subjects' average age was 54.08 (4.00), with minimum and maximum age were 50 and 60 respectively. The subjects' average height was 153.79 (3.56) cm, with minimum and maximum height were 149 cm and 161 cm respectively. Moreover, the subjects' average weight was 74.95 (11.32) kg, with minimum and maximum weight were 62 and 93 kg respectively.

Table 1. Subjects' demographic characteristics (n = 12)

Characteristics	Mean	Standard Deviation	Minimum	Maximum
Age(year)	54.08	4.00	50	60
Height (cm)	153.79	3.56	149	161
Weight (kg)	74.95	11.32	62	93

Cont... **Table 1. Subjects' demographic characteristics (n = 12)**

Body mass index (kg/m^2)	31.52	3.83	26.4	36 . 9
Lumbosacral axis (…˚)	47.16	4.50	40	54
Visual Analodue Scale	5.08	1.50	3	8

The subjects' average BMI was 31.52 (3.83) kg/m^2, with the smallest BMI was 26.4 kg/m^2 and the biggest was 36.9 kg/m^2. The subjects' average lumbosacral axis was 47.16 (4.50) degree, with the lowest and the highest lumbosacral axis were 40 and 54 degree respectively. Moreover, the subjects' average VAS-described low back pain was 5.08 (1.50), with the smallest and largest VAS values were 3 and 8 respectively.

Correlation between BMI and low back pain

The research aimed to obtain correlation data between body mass index and low back pain. The statistical analysis was conducted using SPSS 17 software for Windows with p <0.05. Pearson's correlation test showed non-significant correlation between body mass index and low back pain (Table 2), with p = 0.47 (p >0.05).

Table 2. Correlation between body mass index and low back pain

Parameter	VAS		
	r	*P*	N
Body mass index	0.23	0.47	12

Annotation:

r: correlation coefficient

p: *p* value shows significance level, significant if *p*< 0.05

Correlation between body mass index and lumbosacral axis

The study aimed to obtain correlation data between body mass index and lumbosacral axis. Pearson's correlation test showed significant correlation between body mass index and lumbosacral axis (Table 3), with r = 0.60 and p = 0.04 (p <0.05). The greater a person's body mass index, the greater the lumbosacral axis.

Table 3. Correlation between body mass index and lumbosacral axis

Parameter	Lumbosacral axis		
	r	*P*	N
Body mass index	0.60	0.04	12

Annotation:

r: correlation coefficient

p: *p* value shows significance level, significant if *p*< 0.05

Correlation between lumbosacral axis and low back pain

Pearson's correlation test showed a correlation between lumbosacral axis and VAS-described low back pain with p = 0.07 (p >0.05). All subjects showed non-significant correlation between lumbosacral axis and low back pain (Table 4).

Table 4. Correlation between lumbosacral axis and body mass index

Parameter	VAS		
	R	*P*	N
Lumbosacral axis	0.55	0.07	12

Annotation:

r: correlation coefficient

p: *p* value shows significance level, significant if *p*< 0.05

Discussion

The research was conducted in 12 patients at

outpatient medical rehabilitation clinic of Dr. Soetomo Teaching Hospital, Surabaya, Indonesia. The eligible subjects were asked to complete informed consent, were interviewed, and the process continued with taking lumbosacral x-ray with upright position barefoot in sagittal plane (at Radiology Unit of Dr. Soetomo Teaching Hospital, Surabaya, Indonesia).

The youngest subject was 50 years old, while the oldest was 60 years old. The subjects' anthropometry characteristics were height, weight and body mass index. The anthropometry measurement conducted in the study was corresponded to World Health Organization (WHO) criteria, by measuring weight and height. The measurement findings were classified as normal if BMI was 18.5-24.99 kg/m^2, overweight if BMI was 25.00-29.99 kg/m^2 and obesity if BMI was >30 kg/m^2. Figure 5.1 showed 4 overweight subjects with BMI of 25.00-29.99 kg/m^2, and 8 obese subjects with BMI of >30 kg/m^2. The prevalence rate of weight gain and low back pain in Italy was 22% in 5724 obese population aged 60 [7].

Obese menopause women aged 51-63 commonly suffered from low back pain (1). Nikolov's finding suggested that with age, women tended to have weight gain that would cause low back pain due to musculoskeletal changes. Nikolov, in his research, found a correlation between fat accumulation around the stomach and low back pain (1). He suggested that a person had a high risk of having low back pain due to posture changes to maintain upright body position.

Correlation assessment between body mass index and low back pain

The results of statistical analysis showed no correlation between increased body mass index and low back pain ($p = 0.47$). This finding was consistent with the previous studies, which found a debatable correlation between body mass index and low back pain. Previous study found a correlation between fat accumulation around the stomach and low back pain [1]. Meanwhile in other studies, there was no correlation between body mass index and low back pain. Previous studies reported that increased weight could not affect low back pain, but increased body mass index could affect a person's disability to perform daily activity [8–11]. The increased prevalence of low back pain and in some other body parts was found in the sample group aged over 50 with body mass index of >25 kg/m^2. A study conducted using questionnaire to determine if obesity was a risk factor that caused low back pain [12]. He found no correlation between body mass index and low back pain.

Previously, in some respective studies stated that obesity could weaken physical function and limit daily activities [2,13]. Meanwhile, pain also correlates with disability, thus low back pain is not only the main factor that causes disability. This finding suggested that there was a correlation between increased body mass index and weakened disability function due to pain in some body parts.

Correlation assessment between body mass index and lumbosacral axis

Lumbosacral axis is an axis created by parallel lines in sacrum superior surface and perpendicular axis line. Albert Barnett Ferguson was the first to introduce assessment method using this axis, before he published his study in Journal of Radiology in New York, 1934. The lumbosacral axis above 45 degree is called hyperlordosis, while the axis under 35 degree is called hypolordosis [2]. The spinal function evaluation and low back pain assessment used parameters including inclination, lumbar lordosis and lumbosacral axis [14].Weight gain is a world health problem.An overweight or obese person has increased spine burden, discus and other spinal structures. Thus, such heavy loads can lead to a decrease in torso's joint movement, weak abdominal muscles due to fat accumulation, and lumbosacral axis changes [2]. Previous research found a correlation between increased lumbosacral axis and body mass index in female subjects with obesity, osteoarthritis and osteoporosis [15].

From a total of 12 subjects, 33.3% of which suffered from overweight, while 66% of which suffered from obesity. These findings were consistent with the previous studies that showed significant correlations between increased body mass index and lumbosacral axis ($p = 0.04$). These data showed that the greater the body mass index, the greater the lumbosacral axis degree.

Correlation between lumbosacral axis and low back pain

Lumbosacral is a vital area for spinal mobility and has a function to sustain a person's weight. The mechanical impairment occurred in the area will cause low back pain, although there are many factors that may affect a person's lumbosacral axis including age, sex, race, genetic, body mass index, physical activity,

trauma and spinal disease. The present study found no correlation between lumbosacral axis and low back pain ($p = 0.07$).

This finding was consistent with studies conducted before in chronic low back pain patients, in which they found no correlation between low back pain and increased lumbosacral axis (14). After evaluating radiographic results of lumbar stability and lumbosacral axis based on x-ray screening, it found no lumbosacral axis nor sacral inclusion increment [14]. The results of statistical analysis showed a weak correlation between lumbar stability and lumbosacral axis.

Conclusion

The research found no correlation between increased body mass index and increased low back pain as well as increased lumbosacral axis. Moreover, there was no correlation between increased lumbosacral axis and increased low back pain.

Ethical Clearance: The study protocol was approved by the Ethical Commission to conduct basic science/clinical research in Dr. Soetomo General Hospital Surabaya, Indonesia. The present study was carried out in accordance with the research principles. This study implemented the basic principle ethics of respect, beneficence, non-maleficence, and justice.

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