

ORIGINAL ARTICLE

## Higher Body Mass Index and Waist Circumference Have Correlation With the degree of Curvature of Hyperlordosis in Young Adult

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### ABSTRACT

**BACKGROUND :** Health problem that caused by higher BMI have grown broadly. Musculoskeletal disorders due to higher BMI will cause an excessive burden on the lumbosacral joints. Moreover, excess waist circumference can also lead to malformation of lumbar curvature.

**Purpose:** This study aims to determine the relationship between higher Body Mass Index (BMI) and excess waist circumference with the higher curvature in young adult.

**Method:** This study used observational study with cross-sectional design involving 88 students who performed measurement of body weight, height, and waist circumferences, also lumbar curve examination. The measurement of waist circumference was done by circling the flexible tape on waist. For the measurement of the lumbar curve, each respondent is measured by a flexible ruler.

**Results:** chi square test obtained  $p = 0,000$  in high BMI with the increasing of lumbar curve and  $p = 0,000$  in excess waist circumference with the increasing of lumbar curve. So, there is a correlation between higher BMI and excess waist circumference with the increase of lumbar curve in the young adults.

**Conclusions:** In this study showed that higher BMI and excess waist circumference have correlation with the increase of lumbar curve in the students.

**Keywords:** *body mass index, waist circumference, tape measure, hyperlordosis, flexible ruler.*

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## INTRODUCTION

Higher Body Mass Index (BMI) is recognized as a major public health problem. Basic Health Research Indonesia (Riskesdas) in 2013, showed the prevalence of obesity in adult age group was 15.4% and overweight by 13.5%, then the prevalence of the Indonesian population with the higher BMI were 28.9%. In Indonesia and other developing countries, health issues related to obesity has grown widely, while the first this problem is more prevalent in advanced countries.<sup>1</sup> BMI is categorized as underweight ( $16-18.5\text{kg/m}^2$ ), normal ( $18.5-25\text{kg/m}^2$ ), overweight ( $25-30\text{kg/m}^2$ ), and obese ( $>30\text{kg/m}^2$ ). In this study, higher BMI included overweight and obese.

Obesity will have an impact on various health complications such as cardiovascular disorder, neurovascular disorder, also associated with various musculoskeletal disorder, including impairment of the spine. According to Parjoto, higher rate of BMI can increase the load of the lumbosacral joints, so it will causes the malformation of the lumbar's curve (hyperlordosis).<sup>2</sup> The prevalence of musculoskeletal disorder reached 40%. In Indonesia estimated prevalence rate 37%.<sup>3,4</sup>

According to Soontharee, the Body Mass Index will affect the lumbar angle. This research was comparing the angle between the upper and lower lumbar angle on adults who have a normal body mass index (BMI) and excess body weight, also excess waist circumference. The re-

sult from this study showed there is a significant relationship between Body Mass Index with an increase of lower lumbar angle, however excess waist circumference shows no association with the increase of lumbar angle (hyperlordosis).<sup>5</sup>

According to the previous studies, lumbar's angle is significantly larger on individuals with higher Body Mass Index (BMI). The occurrence of hyperlordosis in individuals with higher rate of BMI is due to compensation to improve balance.<sup>6</sup>

The gold standard for examine hyperlordosis is using X-ray. X-rays are useful to detect body's deformity. Level radiation exposure is considered safe for mostly adults. But it is not recommended in children because it can causes the dangers of radiation. Tizabi et al developing a safe diagnostic tool used to measure hyperlordosis. It is called flexible ruler, which is faster, cheaper, and more simple.<sup>8</sup>

Flexible ruler is a ruler covered with plastic depicted in 40, 50, and 60 cm can be bent in one area and can retaining the shape of the bend. So this tool can be used for measure the increase in lumbar lordosis and thoracic kyphosis with high enough validity ( $\text{ICC} = 0.97$ ).<sup>8,9</sup> Based on the above explanation, researchers' want to research further about the relationship of higher BMI and waist circumference with the increased lumbar curve (hyperlordosis) by using flexible ruler measurement method.

## METHOD

This research was conducted in the students of Faculty of Civil Engineering batch 2015, University of Indonesia, Depok, started from August to September 2017. This research used observational analytics with cross-sectional approach. The variables were measured at the same time. The goal is to know the relationship between higher BMI and waist circumference with the increase of lumbar curve (hyperlordosis) in students. Respondents will be measured for the body weight, height, waist circumference, then examined lumbar's curve.

In this study, the sampling technique used consecutive non-random sampling according to the size of the sample that is calculated and according to the inclusion criteria and exclusion criteria in this study. The inclusion criteria in this study were both male and female students, who understood and followed the instruction, healthy, and willing to be researched. The exclusion in this study was the presence of pregnant, weight lifter, marathon running athlete, rugby athletes, soccer athletes, having spondilolisthesis, low back pain, spinal degenerative disorders, and abnormalities of bone structure.

In this study data collection obtained through primary data collection from questionnaires and measurement. Questionnaire that be used including sociodemography. The measurement of BMI was done by measure the body weight and height. The measurement of waist circumference was done by take a regular breath, so the stom-

ach is in a normal state, then circling the tape measure loosely from the midpoint between arcus costae and suprailiaca around the stomach.<sup>10</sup> For the measurement of the lumbar curve, respondents were positioned standing in a relaxed position without use any footwear. The lumbar curve of each respondent is measured by a flexible ruler and the results draw into plain white paper.

## RESULTS

In this study the number of respondents who included are 88 people with the number of female was 30 (34,1%) and men was 58 (65,9%). The range of age was 20-24 years.

**Table 1. Respondent Characteristic**

Variable	N	%
<b>Body Mass Index</b>		
Normal	37	42,0
Overweight	27	30,7
Obese	24	27,3
<b>Waist Circumference</b>		
Normal	59	67,0
Excess	29	33,0
<b>Lumbar Curve</b>		
Normal	51	58,0
Hyperlordosis	37	42,0

From table 1, it can be seen that more than half of respondents do not have normal body mass index. 24 from 88 respondents or 27.3 percent respondents have higher BMI. For the high-

er curvature in hyperlordosis from 88 respondents, there were 37 respondents or 42.0 percent. However, in the waist circumference was find 29 respondents or 33.0 percent in excess waist circumference.

Chi-Square Analysis Researcher used bivariat data analyzed with chi-square using SPSS (Statistical Package for the Social Sciences) and obtained the following results:

**Table 3. The Relationship between High Body Mass Index (BMI) with Hyperlordosis**

Body Mass Index	Lumbal Curve		Total	p Value
	Normal	Hyperlordosis		
Normal	1 ( 83,8%)	6 (16,2%)	37 ( 100%)	0,000*
Overweight	16 ( 59,3%)	11 ( 40,7%)	27 ( 100%)	
Obesse	4 (16,7%)	20 ( 83,3%)	24 ( 100%)	

\*p<0,05 = significance (Chi-Square)

Based on the table above, the P value of high Body Mass Index (BMI) and hyperlordosis is 0.000, with the significance value is <0.005. This means there is significance relationship between high Body Mass Index (BMI) with hyperlordosis in students.

**Table 4. The Relationship between Waist Circumference with Hyperlordosis**

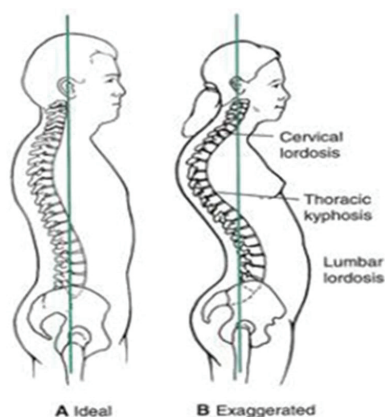
Waist Circumference	Lumbal Curve		Total	p Value
	Normal	Hyperlordosis		
Normal	44 ( 74,6%)	15 ( 25,4 %)	59 ( 100%)	0,000*
Excess	7 (24,1 %)	22 ( 75,9 %)	29 (100%)	

\*p<0,05 = significance (Chi-Square)

Based on the table above, the P value of waist circumference and hyperlordosis is 0.000, with the significance value is  $<0.005$ . This means there is significance relationship between excess waist circumference with hyperlordosis in students.

## DISCUSSION

Lumbar lordosis is a shifted of lumbar curvature toward the anterior body. In normal standing position, the lumbar curvature will be in the midline when viewed from the lateral side of the body. But in the hyperlordosis, the midline of lumbar curvature will be more posterior of the body (figure 1).<sup>10</sup>



**Figure 1. Normal Position and Hyperlordosis Position**

The focus of this study was the relation between body mass index and excess waist circumference associated with an increase of the lumbar curve (hyperlordosis). The high body mass index was measured by measuring body weight and height, while to measure the waist circumference was using the tape measure.<sup>11,14</sup> The lumbar curve is measured using a flexible ruler.<sup>15</sup>

Waist circumference with the increased lumbar curve in this study found a significance relationship. Some research also showed the relation of waist circumference and increased of lumbar curve. In high BMI, there was a weakness of the abdominal muscle that will change the gravitational line and the center of gravity forward, so that the curve of lumbar will compensate to shifting forward from the body midline.<sup>12,16,19</sup>

Based on the body mass index, the respondents in this study showed the significant result with the increased of lumbar curve (hyperlordosis), where the P Value was 0.000. With an increase lumbar curve, vertebral bone biomechanism will be changed through increased body load on facet joints and increased strength shifting from the lumbosacral junction, resulting in misalignment. Increased lumbar curve in individual obesity occurs because of compensation to improve balance.<sup>5,6</sup>

## CONCLUSION

Based on this study, that was obtained in young adult, there were a correlation between higher BMI and excess waist circumference with the increased of curvature in hyperlordosis.

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