THE MEASUREMENT OF LUMBAR SPINAL CURVATURE IN THAI POPULATION: RELATIONSHIP TO AGE, GENDER, AND BODY MASS INDEX

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THE MEASUREMENT OF LUMBAR SPINAL CURVATURE IN THAI POPULATION: RELATIONSHIP TO AGE, GENDER, AND BODY MASS INDEX

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ABSTRACT

Back pain may be painful and uncomfortable, but it is not usually serious. Even though back pain can affect people of any age, there are many factors that can cause the backbone to change. However, at present there are still studies that find quite a few changes in the lumbar spine. For this research, all data were obtained from Lerdsin Hospital, Bangkok. The purpose of this study was to investigate the relationship between age, gender, and body mass index (BMI) of patients admitted to Lerdsin Hospital. The lumbar area was studied using the method for measurement of the angulation in patients with Cobb's Angle method. X-Ray images were taken from 493 patients from Lerdsin Hospital, aged between 20-88 years, which were divided into four groups: 1) 20-29 years, 2) 30-39 years, 3) 40-49 years and 4) over 50 years. Means and standard deviations were calculated and compared with the relationship between age group, gender and body mass index (BMI) affecting the curvature of the lumbar spine. The results showed the curvature of the bone was for all age groups higher for females than males. The angle of the lumbar spine curvature by age was analyzed by One-way ANOVA (p>0.05). Experts estimate a basis for evaluating underlying disorder in patients to receive treatment for back pain that is in the level of risk.

KEY WORDS: LUMBAR SPINAL CURVATURE /COBB ANGLE /ONE WAY ANOVA /T-TEST

40 pages

การวัดความโค้งของกระดูกสันหลังระดับเอวในประชากรไทย: ความสัมพันธ์กับอายุ เพศและดัชนีมวลกาย

THE MEASUREMENT OF LUMBAR SPINAL CURVATURE IN THAI POPULATION: RELATIONSHIP TO AGE, GENDER, AND BODY MASS INDEX

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บทคัดย่อ

อาการปวดหลังมีหลายปัจจัยที่ก่อให้เกิดอาการปวด ซึ่งสามารถพบได้ในทุกเพศและทุกช่วงอายุ งานวิจัยนี้จะศึกษาการความโค้งของกระดูกสันหลังระดับเอวในประชากรไทย: ความสัมพันธ์กับอายุเพศและดัชนีมวลกาย ทั้งนี้ข้อมูลกลุ่มตัวอย่างทั้งหมดได้มาจากโรงพยาบาลเลิดสิน ซึ่งเป็นผู้ป่วยที่เข้ารับการรักษาด้วยอาการปวดหลังจำนวน 493 คน อายุระหว่าง 20-88 ปี โดยแบ่งผู้ป่วยออกเป็น 4 กลุ่ม 1) อายุ 20-29 ปี 2) อายุ 30-39 ปี 3) อายุ 40-49 ปี และกลุ่ม 4) อายุมากกว่า 50 ปีขึ้นไป โดยจะเปรียบเทียบหาความสัมพันธ์ของค่าความโค้งกระดูกสันหลังระดับเอวกับ อายุ เพศ ดัชนีมวลกาย จากการวิเคราะห์ข้อมูลพบว่ากลุ่มเพศหญิงมีค่าความโค้งของกระดูกสันหลังมากกว่าเพศชายในทุกช่วงอายุ นอกจากนี้ยังพบว่าเพศและดัชนีมีมวลกายส่งผลต่อความโค้งของกระดูกสันหลังอย่างมีนัยสำคัญ (p>0.05) และอายุไม่ส่งผลกระทบต่อความโค้งของกระดูกสันหลังเช่นกัน

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CHAPTER I
INTRODUCTION

Scoliosis is a disease where the patient. The appearance of spine deformities began to bend to the side and if the arc angle also known as a spinal deformity (Cobb's Angle) is over 10 degrees, which may be associated with sex, age, weight and height.

1.1 Background and Significance

This condition is a disorder of the spine. Which patients may be due to a bone doctor the family noticed incidentally or detected by a pediatrician or a general medical condition is, by definition, means a medical condition in which the spinal curve greater than 10 degrees of radiography. For the prevalence of this condition found an average of about 1%

The cause of this disorder is unknown. But that are associated with many factors, such as genetic disorders. It was found that a family with the father or mother Scoliosis. Children are born with a spinal curve of about 7-14 % and may be due. Abnormal levels of certain hormones or disorders of the nervous system or muscles.

The disease is common in young women. Than male in patients with more than a 30 degree angle, it is found more female than male, about 10 -fold.

The most important thing for an understanding of disease Crooks do not know why this bone. Is the answer that the progression of this disease is dangerous? Needed surgery or not, etc. What makes these questions is not clear to study the "nature" of this disease that if not treated. We refer to the nature of the diseases of the spine, that "Natural History".

1.2 Objective

This research data obtained from Lerdsin Hospital to find the risk of scoliosis. The back pain can be found in all age groups so have many reasons make the spine of lumbar to change. This research was to investigate the relationship between age, gender, and BMI of patients. We are using ANOVA and T-Test methods for this study to find the relationship.

1.3 Scope of work

The purpose of this study was to investigate the relationship between age, gender, height and weight of the lumbar spine in patients aged 20-88 years using the Cobb's angle and sorting patients, according to risk group by x-ray images of a patient Lerdsin Hospital the ages of 20-88 years, 493 people were admitted due to back pain. X-ray images patients by measuring the angle of the lumbar spine with at Cobb's angle. The samples were divided into 4 groups according to age and analyzed using SPSS program. All data can be analyzed with ANOVA and T-Test for finding the relationship.

1.4 Procedure

Starting from the hospital holds Lerdsin and x-ray images to measure the angle using Cobb's angle and the values of the design of the measurement table relationship from field measurements and field general hospital. In the first measurement of the angulation in patients with Cobb's angle method from the x-ray images and calculate the standard deviation of the spine. Finally find the relationships between ages, gender and BMI.

1.5 Benefits expected

A benefits expectation of this research can get knowledge in Cobb's angle and a field hospital. We can learn diagnosis of the lumbar spine and a new relationship between age, gender, height and weight in biomedical knowledge.

CHAPTER II
LITERATURE REVIEW

2.1 Spine

We will have about 206 pieces of human bone. Accounted for about 20% of the body weight. The spine is the weight of a human act. And control the movement of the body. Spine runs from the neck to the coccyx. Which are connected by muscles and ligaments. And each will have a herniated disc as well as the weight from the movement of the body, not the individual bones rubbing together.

The anatomy of the spine, usually consists of 26 pieces of bone divided

1. Cervical spine (Cervical vertebrae).
2. Spine chest (Thoracic vertebrae).
3. Lumbar spine (Lumbar vertebrae).
4. Seriously small of the spine (Sacral vertebrae), and coccyx (Coccyx).

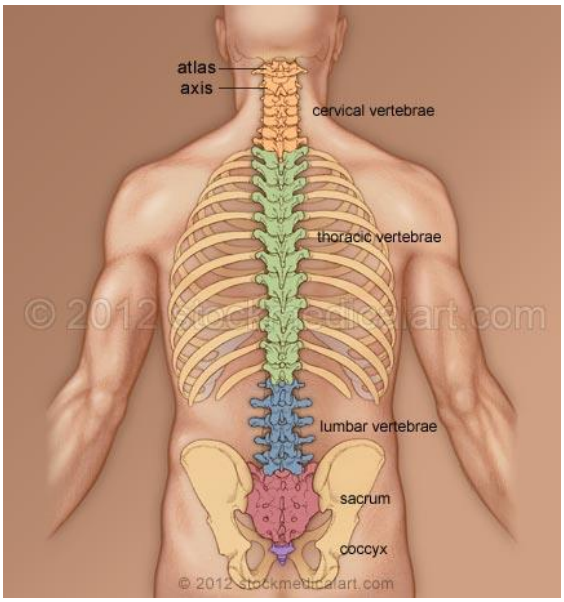

Figure 2.1 Spine within a human body as seen from the posterior view [15].

2.2 What is Scoliosis

Scoliosis is a medical condition in which a person's spine is curved from side to side. Although it is a complex three-dimensional deformity, on an X-ray, viewed from the rear, the spine of an individual with scoliosis can resemble an "S" rather than a straight line.

Scoliosis is typically classified as either congenital (caused by vertebral anomalies present at birth), idiopathic (cause unknown, sub-classified as infantile, juvenile, adolescent, or adult, according to when onset occurred), or secondary to a primary condition.

Secondary scoliosis can be the result of a neuromuscular condition (e.g., spina bifida, cerebral palsy, spinal muscular atrophy, or physical trauma) or syndromes such as Chiari malformation.

Recent longitudinal studies reveal that the most common form of the condition, late-onset idiopathic scoliosis, is physiologically harmless and self-limiting. The rarer forms of scoliosis pose risks of complications [1].

The deformity may begin in the intervertebral discs, producing distortions in the epiphyseal cartilage, which may influence the end of growth and therefore the deformity of the vertebrae, resulting in wedging and rotation of the vertebrae [2].

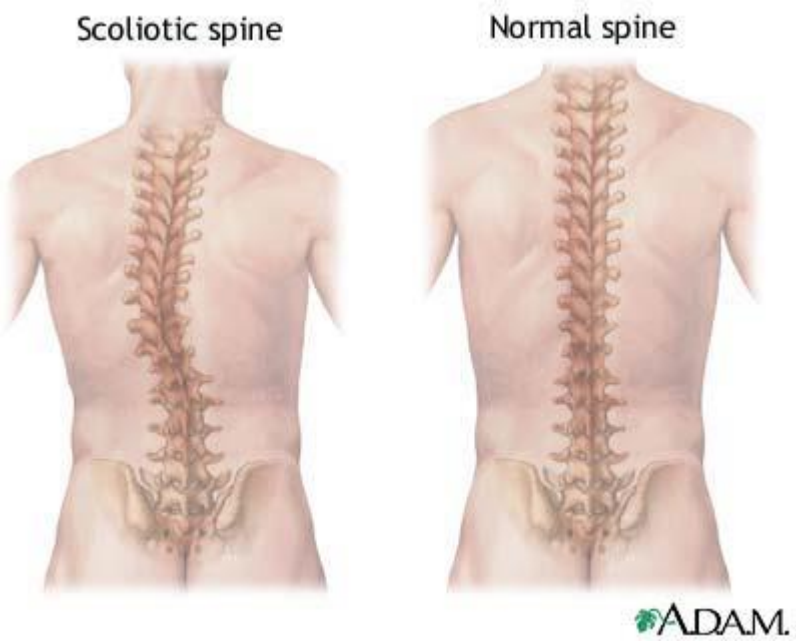

Figure 2.2 Spine of anatomy [3]

2.2 Cobb's angle

The term "Cobb's angle" is used worldwide to measure and quantify the magnitude of spinal deformities, especially in the case of scoliosis. The Cobb's angle measurement is the "gold standard" of scoliosis evaluation endorsed by Scoliosis Research Society. It is used as the standard measurement to quantify and track the progression of scoliosis. Cobb's angle was first described in 1948 by Dr. John R Cobb where he outlined how to measure the angle of the spinal curve. Hence, the term "Cobb's angle" came about, bearing his name [4,5,6].

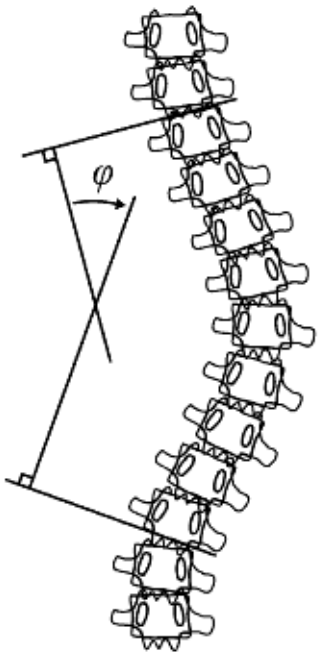

Figure 2.3 Cobb's angle [7].

Cobb's angle measurement method

2.2.1 Locate the most tilted vertebra at the top of the curve and draw a parallel line to the superior vertebral end plate.

2.2.2 Locate the most tilted vertebra at the bottom of the curve and draw a parallel line to the inferior vertebral end plate.

2.2.3 Erect intersecting perpendicular lines from the two parallel lines.

2.2.4 The angle formed between the two parallel lines is Cobb's angle.

Leilei Xu. The degeneration of the lumbar spine of Han Chinese on the relationship of age, gender, the density of bone and body mass index (BMI) by X-Ray image of a volunteer who visits the body older than 40 years and had no history of treatment for Scoliosis used in the study were found to have the disease, Scoliosis of 318 people were divided into group A is a curvature of the spine in the range between 10 -20 degrees, 273 people (85.8 %) and group B of 45 people with an arc from 21 degrees up to the researcher to group A and group B were compared. Age and BMI no significant differences between the 2 groups findings degeneration of the spine to the waist of Han Chinese aged over 40 years is 13.3 % correlated significantly with age, sex and density of bone And women and those older than 65 years and may lead to the degeneration of the lumbar spine and vertical curvature of the spine was not related to age, sex and body mass index (BMI) and bone mineral density (BMD) [8].

P. Rungthip measure the normal curve of the lumbar spine in the normal population aged 20-69 years using Thailand flexible ruler volunteers 300 people compare the average difference between the sex and lumbar spine curvature by using ANOVA. Significance level set at $P < 0.05$ was found that the angle of curvature of the lumbar spine in the age group 20-29 years had the angulation of the bone ridge. After lumbar less than other age groups statistically significant ($P < 0.01$) also showed that female gender with the angle of curvature of the lumbar spine than men statistically significant ($P < 0.01$) results showed that the angle of curvature of the lumbar spine in a sample of Thailand people are different in each group each gender and age [9].

The relationship between age and gender with the great changes in the anatomy of the spine in northern Thailand have reported a study group in northern Thailand each parameter studied vertebral body, vertebral foramen and pedicle from C3 to L5 vertebrae projects were grouped into three age groups: 21-40 year old age group 41-60 years and age groups over 60 years found the height and diameter of the top surface of the vertebral body in the spine C3 to L5 in men is greater than in females. In relation to age in males and females, a decrease of bone in various positions found the diameter of the cut surface of the vertebral body with increased age. Characteristic vertebral foramen of vertebrae C3 to L5 in Thailand's northern most horizontal diameter and the front lines - the latter in males than females changes of the vertebral for men in relation to age in males, some level of the cervical spine

with a decrease in diameter with age. Spine and the chest with an increase in diameter in the front the back of the vertebral foramen at the level of T4 only in females were found to change with age, especially in the lumbar spine only at L1 showed a decrease. The diameter of the front line the L4 level, but with the increase of the diameter of transverse pedicle manner when increasing the size of the study of pedicle diameter and angle of the left and right no statistically significant difference. Most are found in males than females. Changes in the diameter of the pedicle in relation to age found males and females are characterized by the rise and fall of the diameter of the pedicle on age. To study the changes in the characteristics of the vertebral body in relation to age was found. Changes in the characteristics of the vertebral body in the spine concave wedge shape and some level of increase in age. In the spine, the chest does not look to change in appearance, but a characteristic wedge shape change in the cervical spine concave at a certain level and compared between genders found the appearance of concave and wedge shape in females than males with increasing age [10].

Risk assessment of physical science to work by the RULA the Labour group broom Romsuk of 80 to work in establishments medium group broom Romsuk no less than 3 months, assess risks ergonomic operation standard RULA which divides risks into four levels: Level 1 is a gesture acceptable level 2 is a gesture that should be checked and may be modified Level 3 is a gesture that should be checked and corrected as soon as possible, and Level 4 is a gesture that should be corrected immediately Research using inferential statistics to determine relationships using Chi-square and Fisher's-exact test at a confidence level of 95 percent on the science of risk assessment found. Sample, 41.2 percent had positions in Level 2 and Level 3 are equal, and 17.5 percent scored at level 4, so gesture with the ergonomics department needs to be improved urgently. Department is knitting, sewing and cutting grass department. The risk level 4 and to update and track the division tie lace weight cutting department, sewing, broom, which has a risk level three factors seem to work the arms , upper arms and lower part of the hand and wrist with raised and have delineated the wrist the static strength of the muscles. Repetitive movements Trunk is bent forward is associated with the disorders of the skeletal system and the muscles around the spine and upper limb of staff statistically significant ($P < 0.05$) [11].

The research among American the relationship between age and the degree of bending of the spine due to cushion the bones moving forward to study of the treatment of the American University of Beirut Medical Center Gender Male Female Age between 19 to 84 years (average age 54.7 years) of 1,419 people with herniated disc using the Cobb method to measure the X-ray images of the patient. During bone S1-L5 and calculate coefficient (According to Pearson) between levels deflection curve of the lumbar spine, age and level of cervical dislocation. Compared to the difference between male and female values $P < 0.05$ were targeted symptoms herniated disc at L3-4, L2-3 and L1-2 was higher than patients with symptomatic disc herniation bone moves below L4-5, L5-S1 ($P < 0.0001$) were also found symptoms herniated disc correlated with age ($R = 0.302$, $P < 0.0001$) studies can identify groups of patients herniated disc symptoms by age group older than the target group will have a herniated disc at higher levels. While younger audiences may have a herniated disc below shows that the percentage increases of the herniated disc, the lumbar spine deflection curve when the patient's age. While the lower bend of the bone is starting in the 40s and continued to increase until the age of 60 years, it was also found that there is a link between muscle imbalances. The asymmetry of the joints brought sex and stresses the need to increase disc disease leads to the pressure of the spine and increasing age. This results in symptoms of cervical degenerative and moves. Which starts in the lower spine except in the case of a spinal curvature in addition to the standard evaluation by age, it leads to the degree of cervical motion beyond the projected 9 [12].

In the research of Sang Jun Kim study aims to identify a relationship between bone mineral densities (BMD) of lumbar spine, and the weight and body mass index (BMI) in 1,143 females who visited the public health center. T-Score are used in BMD, height, weight and age, menopause, diabetes and hypertension, exercising status and smoking status were inquired by interview. The patients were divided into two groups that are 362(31.7%) in the normal group and 781(68.3%) in the abnormal group. They are use the logistic regression analysis with BMI and BMD to find relationship. The results are weight, BMI and BMD had positive correlation. So that BMI according to my research [16].

Amin Allah Taheri Tizabi find the Correlation Between height, weight, BMI with standing Thoracic and Lumbar Curvature in Growth Ages. They were investigating correlation between height, weight, body mass index (BMI) with standing thoracic and lumbar curvature in growth ages. In them study had 636 healthy boys between 12-17 years. The measurements of lumbar were measured with flexible ruler a noninvasive device with the child standing in the relaxed position and used Pearson Correlation to find the correlation between height, weight and BMI. They found weight and BMI affect with lumbar curvature [17].

However, A Past study found that the study of the curvature of the lumbar spine still less and all will study the population had no history of treatment with low back pain before. Therefore, we have seen the importance of education for the angulation of patients admitted with back pain in the lumbar spine of patients. To find the angle of curvature of the lumbar spine, the relationship between age, gender and body mass index of the lumbar spine, so to check the curvature of the lumbar spine in patients. The result have to be able to adopt a common criteria used to determine the reference in evaluating patients who are treated with primary lumbar back pain to reduce costs and exposure to radiation from the x-ray machine.

CHAPTER III
RESEARCH METHODOLOGY

3.1 Materials

Procedures and methods as to how to work the preparation of this thesis from data preparation to complete the work. Section of this chapter describes how the execution of this thesis.

This research was conducted as well as patient data from the hospital Lerdsin of 493 people aged between 20 - 88 years of the adoption of X-ray images, all made to measure the lumbar spine with the Screen divider program. and implementation of information age, height, weight , body mass index and the spine angle measured for the process analysis using SPSS statistics to be used in the analysis is the statistical Independent T-Test and Statistical one- way ANOVA has been compiled from the results of the analysis and summary of the chapters 4 and 5.

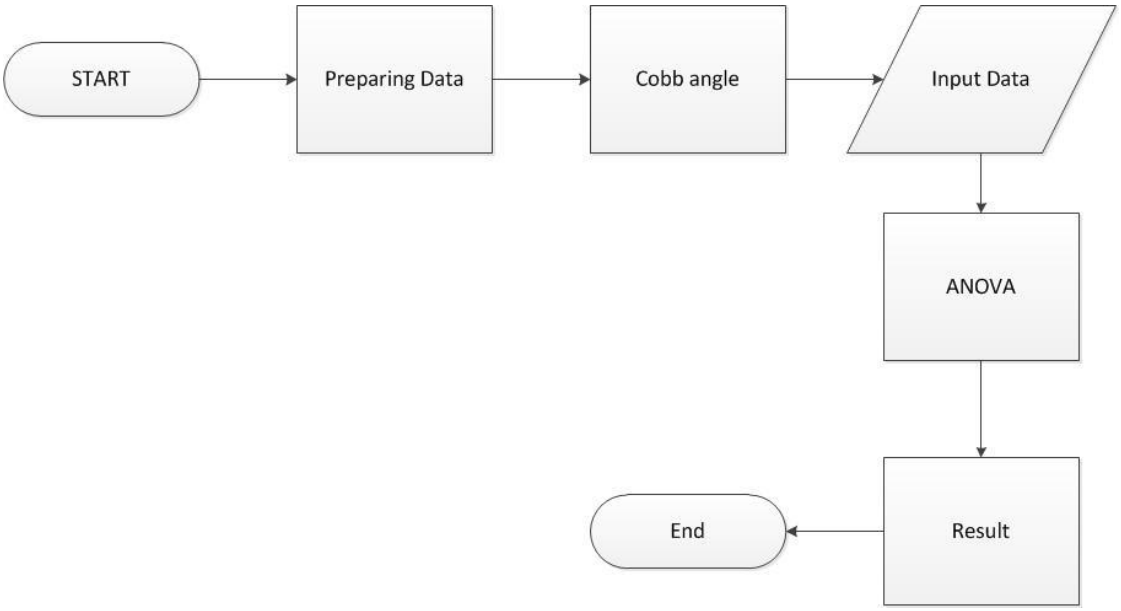

Figure 3.1 Flow chart of research methodology.

3.2 Data

All the samples were x-ray photos of patients admitted with back pain of 493 people from Lerdsin Hospital, Bangkok, aged between 20-88 years. Applied to divide the data into four groups. the age range was 20-29 years, 30-39 years, 40-49 years and over 50 years. The data analyzed statistically the relationship of the angle of curvature of the lumbar spine compared with age, gender and body mass index (BMI).

3.3 Data Collection

Measurement of lumbar angle α. Using Cobb's method, tangent lines is drawn along the superior end parted of L1and S1. Perpendiculars to each of the lines are added to form α.

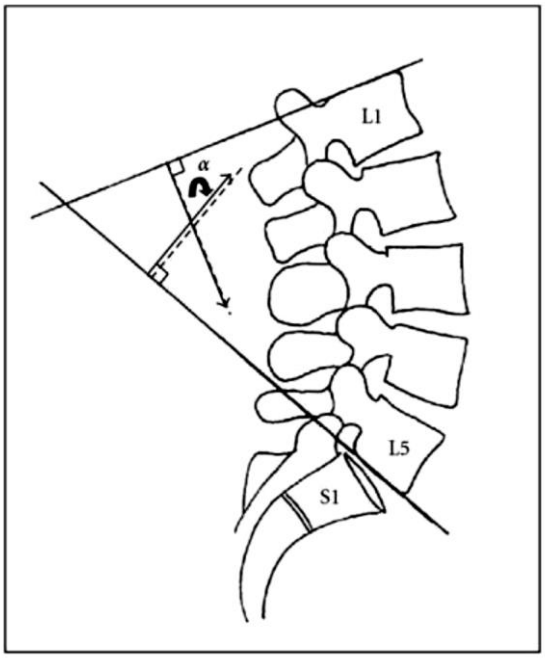

Figure 3.2 Measurement of the spine using the theory of Cobb angle [13].

Cobb angle is the angle of twisting the spine to one side, if the angle is less than 10 degrees is normal. If the angle is between 10-20 degrees need to check with a medical professional on a regular basis, if the angle between 20-40 degrees to be were admitted by the Body brace and angle up to 40 degrees without the need for surgery specialist expertise.

Table 3.1 Scoliosis step the patient's disease

Cobb's angle	Results
< 10	Not Scoliosis
10 - 20	Regular checkups
20 - 40	Body Brace
40 up	Scoliosis Surgery

3.4 Mathematics and Theory

3.4.1 Student T-test

A t-test is any statistical hypothesis test in which the test statistic follows a Student's T-test distribution if the null hypothesis is supported. It can be used to determine if two sets of data are significantly different from each other, and is most commonly applied when the test statistic would follow a normal distribution if the value of a scaling term in the test statistic were known. When the scaling term is unknown and is replaced by an estimate based on the data, the test statistic (under certain conditions) follows a Student's t distribution. So this research using equal sample sizes, equal variance.

3.4.1.1 Equal sample sizes, equal variance.

This test is only used when two sample sizes (that is, the number, *n*, of participants of each group) are equal. It can be assumed that the two distributions have the same variance. Violations of these assumptions are discussed below. The *t* statistic to test whether the means are different can be calculated as follows:

$$t = \frac{X_1 - X_2}{S_{X_1 X_2}\sqrt{\frac{2}{n}}}$$

Where (1)

$$S_{X_1X_2} = \sqrt{\frac{1}{2}(S^2{}_{X_1} + S^2{}_{X_2})}$$

Here $S_{X_1X_2}$ is the grand standard deviation (or pooled standard deviation), 1 = group one, 2 = group two.$S^2{}_{X_1}$ and $S^2{}_{X_2}$are the unbiased estimators of the variances of the two samples. The denominator of *t* is the standard error of the difference between two means. For significance testing, the degrees of freedom for this test is $2n - 2$ where *n* is the number of participants in each group.

3.4.1.2 Unequal sample sizes, equal variance.

This test is used only when it can be assumed that the two distributions have the same variance. (When this assumption is violated, see below.) The *t* statistic to test whether the means are different can be calculated as follows:

$$t = \frac{X_1 - X_2}{S_{X_1X_2}\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

Where (2)

$$S_{X_1X_2} = \sqrt{\frac{(n_1 - 1)S^2{}_{X_1} + (n_2 - 1)S^2{}_{X_2}}{n_1 + n_2 - 2}}$$

Note that the formulae above are generalizations of the case where both samples have equal sizes (substitute *n* for n_1 and n_2).

$S_{X_1X_2}$ is an estimator of the common standard deviation of the two samples: it is defined in this way so that its square is an unbiased estimator of the common variance whether or not the population means are the same. In these formulae, *n* = number of participants, 1 = group one, 2 = group two. $n - 1$ is the number of degrees of freedom for either group, and the total sample size minus two (that is, $n_1 + n_2 - 2$) is the total number of degrees of freedom, which is used in significance testing.

Equal or unequal sample sizes, unequal variances. This test, also known as Welch's t-test, is used only when the two population variances are not assumed to be equal (the two sample sizes may or may not be equal) and hence must be estimated

separately. The t statistic to test whether the population means are different is calculated as:

$$t = \frac{X_1 - X_2}{s_{\bar{X}_1 - \bar{X}_2}} \tag{3}$$

Where

$$s_{\bar{X}_1 - \bar{X}_2} = \sqrt{\frac{S^2{}_1}{n_1} + \frac{S^2{}_1}{n_2}}$$

Here s^2 is the unbiased estimator of the variance of the two samples, n_i = number of participants in group i, i=1 or 2. Note that in this case $s_{\bar{X}_1 - \bar{X}_2}$ is not a pooled variance. For use in significance testing, the distribution of the test statistic is approximated as an ordinary Student's t distribution with the degrees of freedom calculated using

$$d.f. = \frac{(\frac{S^2{}_1}{n_1} + \frac{S^2{}_2}{n_2})^2}{\frac{\left(\frac{S^2{}_1}{n_1}\right)^2}{n_1 - 1} + \frac{\left(\frac{S^2{}_2}{n_2}\right)^2}{n_2 - 1}} \tag{4}$$

This is known as the Welch–Satterthwaite equation. The true distribution of the test statistic actually depends (slightly) on the two unknown population variances [14].

3.4.2 ANOVA

ANOVA is a tremendously general type of statistical analysis, useful in both very simple and very complicated experimental designs. Basically, ANOVA is used to find out how the average value of a numerical variable—called the dependent variable or DV—varies across a set of conditions that have all been tested within the same experiment. The various conditions being compared in the experiment are defined in terms of one or more categorical variables—called the independent variables, the IVs, or the factors. In short, ANOVA is used to find out how the average value of a numerical DV depends on one or more IVs.

The complexity and usefulness of ANOVA both come from the flexibility with which an experimenter can incorporate many IVs or factors into the statistical

analysis. ANOVA is especially informative in research where many factors influence the dependent variable, because there is no limit to the number of distinct effects that ANOVA can reveal. Of course, before one can incorporate many factors into the statistical analysis, one must first incorporate them into the experimental design. It turns out that there is a lot of terminology regarding such designs, and we must identify these terms before we can begin to study ANOVA, so that we can discuss the designs properly.

One-way ANOVA assume we have response data measured in k levels of the factor, where μ_{ij} represents the value of *i*th observation (i = 1, 2, ...n_j) on the *j*th factor level (j = 1, 2, ..., k). Then we could write the model of one-way ANOVA as:

$$y_{ij} = u + t_j + \varepsilon_{ij}$$
$$j = 1,2 \ldots., k. i = 1,2, \ldots n_j \quad (5)$$

Since ANOVA testing whether the mean of two or more populations (levels) are equal. Thus, the null hypothesis is that the means of the different populations are the same and the alternate hypothesis is at least one sample's mean is different from the others. Mathematically, this is expressed as:

$$\text{H0:} \mu = \mu_1 = \mu_2 = \cdots = \mu_k$$
$$\text{H1:} \quad \mu_p \neq \mu_q \text{for some p and q } 1 \leq p \;\; q \geq k \quad (6)$$

Where μ_i is the y_{ij} the sample mean. To test the hypothesis, it should be divide the total sample variation into variation between groups and variation within groups, and then using the F-test to test whether these two variations are different.

Algebraically, we can use the respective mean square of each part to estimate the variation:

$$\sum_{j=1}^{k}\sum_{i=1}^{n_1}(y_{ij} - \bar{y})^2 = \sum_{j=1}^{k} n_j(\bar{y}_j - \bar{y}_j)^2 + \sum_{j=1}^{k}\sum_{i=1}^{n_1}(\bar{y}_j - \bar{y}_j)^2 \quad (7)$$

Where the left term is called the "total sum of squares", the second term is called the "sum of squares of treatments", which represents the variation between groups, and the third term is called "sum of squares of error", which represent the variation within groups. The equation is then commonly abbreviated to

$$SS_{Total} = SS_{Treatment} + SS_{Error} \quad (8)$$

When H_0 is true, the k levels sample data will be normally and independently distributed, with mean σ^2 and variance μ.

$$F = \frac{MS_{Treatment}}{MS_{Error}} = \frac{SS_{Treatment}/(k-1)}{SS_{Error}/(n-k)} \quad (9)$$

Thus the statistic will follow an F distribution $F_{(k-1,n-k)}$ where $MS_{Treatment}$ is the mean squares for treatments and MS_{Error} is the mean squares for error, which are both formed by dividing the sum of squares by the associated degrees of freedom respectively. Given a certain significance level α, if the F statistic exceeds the critical value $F_{(k-1,n-k,\propto)}$ which is the tabular value of the F distribution with $k-1$ and $n-k$ degrees of freedom at level α, or equivalently, the followed P value less than the significance level, the null hypothesis should be rejected.

CHAPTER IV
EXPERIMENTAL RESULT

The results of this research the measurement of lumbar spinal curvature in Thai population relationship to age, gender, and body mass index in back pain patients of Lerdsin Hospital can be provided into 4 groups;

4.1 Descriptive statistic general.

4.2 Compare mean of the lumbar spine by gender.

4.3 Compare mean of the lumbar spine by age.

4.4 Compare mean of the lumbar spine with body mass index (BMI).

4.1 Descriptive statistic general

The result in table 4.1 shows the average, minimum, maximum, Mean ± SD age was 20 years and the most was 88 years with a mean age was 48.95 ± 15.44 years, weight minimum is 35 kg and the most was 109 kg. Average weight was 60.61 ± 12.96 kg Height less at 133 cm and a maximum of 182 cm. with a mean of 161.7814 ± 8.79 BMI is low at 15.60 and up to 39.10. An average total is 23.24 ± 4.12 and 0.02 Lumbar spine minimum and maximum values of 57.60 and a total average is 25.99 ± 12.65.

Table 4.1 The result descriptive statistic general

Variable	Minimum	Maximum	Mean±SD
Age	20	88	48.95±15.44
Weight	35	109	60.61±12.96
Height	133	182	161.14±8.79
BMI	15.60	39.10	23.24±4.12
Lumbar spine	0.02	57.60	25.99±12.65

The result in table 4.2 the sample of 230 people, 493 of whom were male and 46.6 percent female, 53.4 percent of 263 people.

Table 4.2 The results percentage of gender

Gender	Samples	Percentage
Male	230	46.6
Female	263	53.4
Total	493	100

The result in table 4.3 analysis of samples divided by age group, age 20 - 29 years have 64 people representing 13.00 percent and ages of 30-39 representing 16.60 percent and the ages 40-49 year representing 21.10 percent and over 50 years representing 49.30 percent

Table 4.3 The results analysis of samples divided by age group

AGE	Samples	Percentage
20-29	64	13.00
30-39	82	16.60
40-49	104	21.10
50 UP	243	49.30
Total	493	100

The result in table 4.4 analysis of body mass index (BMI) can be divided into 4 groups; Lower 18.5 (Underweight) 52 people 10.5 percent, Normal 18.5-23.4 with 219 people 44.4 percent, Overweight 23.5-28.4 with 169 people 10.8 percent.

Table 4.4 The results analysis of body mass index (BMI)

BMI	Samples	Percentage
Lower 18.5 (Underweight)	52	10.5
18.5 – 23.4 (Normal)	219	44.4
23.5 – 28.4 (Overweight)	169	34.3
28.5 Up (Obesity)	53	10.8
Total	493	100

The result in table 4.4 compare the curvature of the lumbar spine by age group. That found age group 40-49 years have a mean of the lumbar spine curvature at 26.99 ± 12.79 degrees and the angle of curvature found in all ages were higher in females than males and found that females who are in the age range 40-49 years, which was during menopause has the highest average of 28.59 ± 11.61. In table showed the curvature of the bone was for all age groups higher for females than males.

Table 4.5 The results compare the curvature of the lumbar spine by age group

Age Interval (years)	Mean ± standard deviation (degrees)			
	N=493	Male	Female	Total
20 – 29	64	25.68 ±11.51	27.75 ± 13.09	26.39 ± 12.02
30 – 39	82	23.19 ± 12.40	28.25 ± 11.53	25.78 ± 12.16
40 – 49	104	24.88 ± 14.04	28.59 ± 11.61	26.99 ± 12.79
> 50	243	22.88 ± 11.94	27.47 ± 13.36	25.53 ± 12.96

4.2 Compare mean of the lumbar spine by gender

Table 4.5 show the comparison of the curvature of the lumbar spine by gender, by using an Independent t-test. Found males and females affect the curvature of the lumbar spine. Statistically significant at the 0.05 level. The results are consistent with research Rungthip. That female with the lumbar spine curvature than males**.** The Han Chinese research also found the curvature of the bone higher for females than males

because of the curvature of the spine bone mineral density in female than male, which is minimal. This could be the reason for the lumbar spine in females until malformations may result in disease, herniated disc later in the future.

Table 4.6 The comparison of the curvature of the lumbar spine by gender, by using Independent t-test

Average angulation mean ± SD (degrees)		**t**	***p***
Male	Female		
23.84 ± 12.36	27.87± 12.62	-3.58	0.000*

* Statistically significant at 0.05

4.3 Compare mean of the lumbar spine by age

Table 4.6 show comparison of the angle of curvature of the lumbar spine by age were analyzed by One-way ANOVA statistical significance level of 0.05 was found that the significance = 0.788* conclude that age does not affect the curvature of the lumbar spine. Usually, Back pain can be found in all ages. The cause of back pain is also caused by several reasons for example the wrong way to exercise, the seat does not work, Heavy lifting regularly or even heredity . It is the cause of the disease as well. Some people may be detected since adolescence . Some people may be born in old age have accumulated because of several factors. Therefore , age is not a disease that can indicate whether or not the disease.

Table 4.7 The comparison of the curvature of the lumbar spine by age

Curve by age	**Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**
Between group	169.725	3	56.575	0.352	0.788*
Within group	78547.366	489	160.629		
Total	78717.092	492			

* Statistically significant at 0.05

4.4 Compare mean of the lumbar spine with body mass index (BMI)

Table 4.7 show compare the angle of curvature of the lumbar spine by body mass index (BMI) were analyzed by One-way ANOVA at significance level of 0.05 was found that the significance = 0.007, indicating that the body mass index (BMI) is affecting the curvature of the lumbar spine, at least one pair is different. Therefore, the test average pairwise differences by LSD method as shown in table 4.8.

Table 4.8 The comparison of the curvature of the lumbar spine by body mass index (BMI).

Curves by BMI	Sum of Squares	df	Mean Square	F	Sig.
Between group	1917.849	3	639.283	4.070	0.007*
Within group	76799.243	489	157.054		
Total	78717.092	492			

* Statistically significant at 0.05

In table 4.8 results compare the differences between the two groups over the curvature of the spine by body mass index (BMI) found that the number of different pairs, including two pairs.

1) Patients with BMI < 18.5: underweight patients with BMI 23.5 to 28.4: overweight mean curvature of the lumbar spine was significantly different.

2) Patients with BMI 23.5 to 28.4: Overweight with 18.5 to 23.4: The average of the normal curve of the lumbar spine was significantly different.

Compare body mass index (BMI) with the curvature of the lumbar spine at the level of statistical significance at 0.05, the mean value F = 4.070, Sig. = 0.007 <0.05 conclude that the angle of curvature of the lumbar spine is different by boxing index (BMI) significantly. Therefore, the test average difference The research Least Significant Different (LSD). Test results compare the different pairs between body mass index (BMI) with the angle of curvature of the lumbar spine. Statistically significant at 0.05 showed BMI groups vary significantly. Patients with BMI Underweight and a BMI of 23.5 to 28.4 overweight, the higher the angle of curvature other patients.

Table 4.9 The comparison between the double curvatures of the lumbar spine with a body mass index (BMI).

curvature of the lumbar spine	$\overline{X}$	Under weight	Normal	Over weight	Obesity
< 18.5 Underweight	28.53	-	0.96	4.72*	4.63
18.5 – 23.4 Normal	27.57	-0.96	-	3.76*	3.67
23.5 – 28.4 Overweight	23.81	-4.72*	-3.76*	-	-0.09
>28.5 Obesity	23.90	-4.63	-3.67	0.09	-

CHAPTER V
CONCLUSION

5.1 Conclusion

Preliminary data analysis to compare the relationship between age, gender and body mass index affects the curvature of the lumbar spine. That found in the age group 40 - 49 years had the highest curvature of the bone was 26.99 ± 12.79, but is also found in all age group females were higher than males, which is consistent with the research of P. Rungthip and females in the age group 41-50 years, they have the curvature of the farthest corners of 27.24 ± 12.45 degrees, which may have caused it by who menopause. The analysis showed patients with underweight and overweight patients affect the curvature of the spine as well. Finally gender affects the curvature of the spine by the female with the curvature of the spine than men as Leilei Xu noted that the density of bone mass in females than males, may lead to the deterioration of the lumbar spine, But age does not affect the curvature of the lumbar spine.

5.2 Suggestion

Gender from a different angle. It was found males are the angles formed less than women. This means the risk of decay Scoliosis less than females. We pay attention to the female in order to find ways to cope or how to help reduce the risk of disease in women which is of interest in its study.

- Research will be more complete if applying to research a case study.
- Should be studied in a sample, such as the general staff. The need for PC might is the case with the spine road to determine the prevalence of the disease (Prevalence).
- Should have studied other variables such as occupation ride characteristics. Behavior in lifestyle Exercise and a follow-up to determine the precise cause of the disease.

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APPENDIX

THE RESULT OF THE MEASUREMENT OF LUMBAR SPINAL CURVATURE IN THAI POPULATION: RELATIONSHIP TO AGE, GENDER, AND BODY MASS INDEX

Screen divider program can measure distances, Cobb's angles, and confirm parallel lines, for any image or schematic that's on your computer screen.

Select the desired image X-ray measurements of the Cobb's angle with the Screen divider program by placing a straight line parallel to the bone, L1-L5, the program will calculate the angle, Cobb's angle is shown.

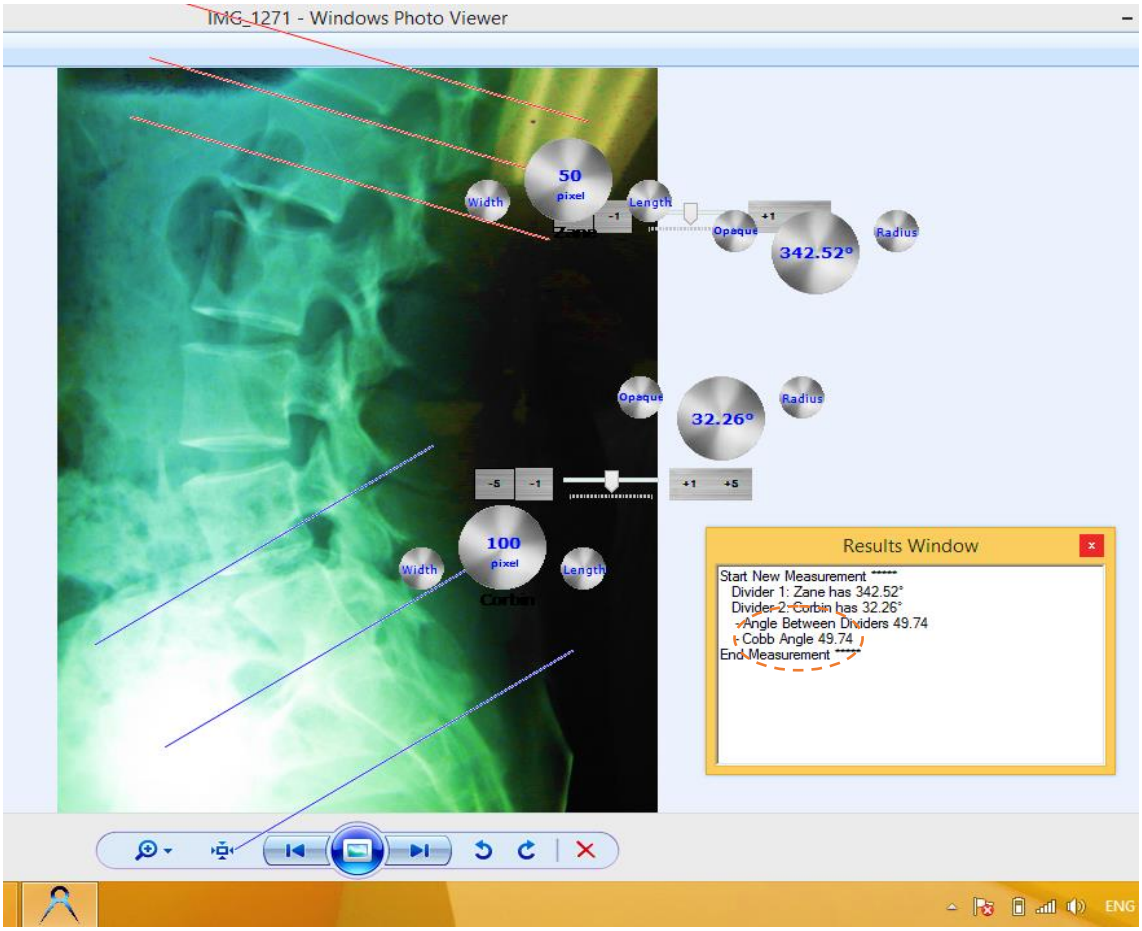
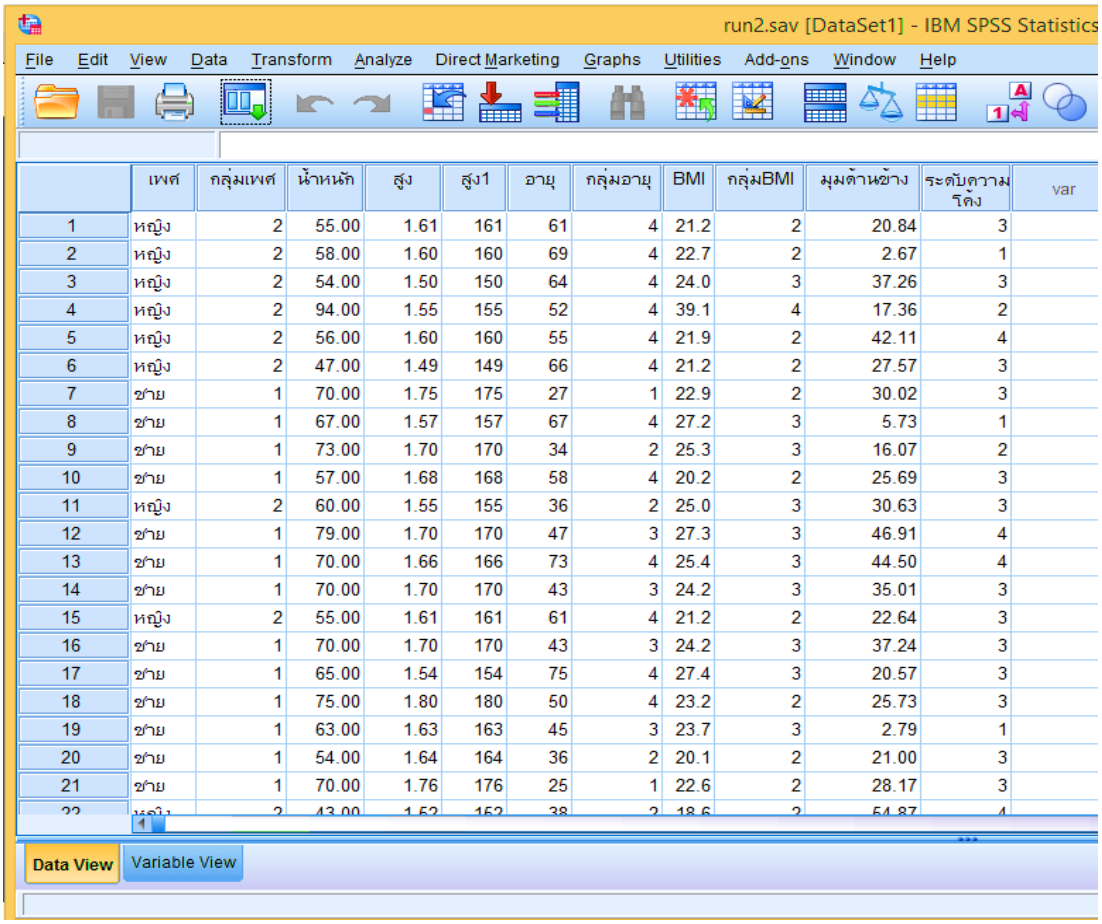


Figure 1 The process measure angle by screen divider program

SPSS Statistics is a software package used for statistical analysis. Import all the data into the SPSS program to divide the group gender, age group, BMI group, and other information necessary to analyze.



	เพศ	กลุ่มเพศ	น้ำหนัก	สูง	สูง1	อายุ	กลุ่มอายุ	BMI	กลุ่มBMI	มุมด้านข้าง	ระดับความโค้ง	var
1	หญิง	2	55.00	1.61	161	61	4	21.2	2	20.84	3	
2	หญิง	2	58.00	1.60	160	69	4	22.7	2	2.67	1	
3	หญิง	2	54.00	1.50	150	64	4	24.0	3	37.26	3	
4	หญิง	2	94.00	1.55	155	52	4	39.1	4	17.36	2	
5	หญิง	2	56.00	1.60	160	55	4	21.9	2	42.11	4	
6	หญิง	2	47.00	1.49	149	66	4	21.2	2	27.57	3	
7	ชาย	1	70.00	1.75	175	27	1	22.9	2	30.02	3	
8	ชาย	1	67.00	1.57	157	67	4	27.2	3	5.73	1	
9	ชาย	1	73.00	1.70	170	34	2	25.3	3	16.07	2	
10	ชาย	1	57.00	1.68	168	58	4	20.2	2	25.69	3	
11	หญิง	2	60.00	1.55	155	36	2	25.0	3	30.63	3	
12	ชาย	1	79.00	1.70	170	47	3	27.3	3	46.91	4	
13	ชาย	1	70.00	1.66	166	73	4	25.4	3	44.50	4	
14	ชาย	1	70.00	1.70	170	43	3	24.2	3	35.01	3	
15	หญิง	2	55.00	1.61	161	61	4	21.2	2	22.64	3	
16	ชาย	1	70.00	1.70	170	43	3	24.2	3	37.24	3	
17	ชาย	1	65.00	1.54	154	75	4	27.4	3	20.57	3	
18	ชาย	1	75.00	1.80	180	50	4	23.2	2	25.73	3	
19	ชาย	1	63.00	1.63	163	45	3	23.7	3	2.79	1	
20	ชาย	1	54.00	1.64	164	36	2	20.1	2	21.00	3	
21	ชาย	1	70.00	1.76	176	25	1	22.6	2	28.17	3	
22	หญิง	2	43.00	1.52	152	38	2	18.6	2	54.87	4	

Figure 2 The demographic data from Lerdsin Hospital

Analyzing the data to compare the relationship between the curvature of the lumbar spine with gender by statistic Independent Sample T-Test.

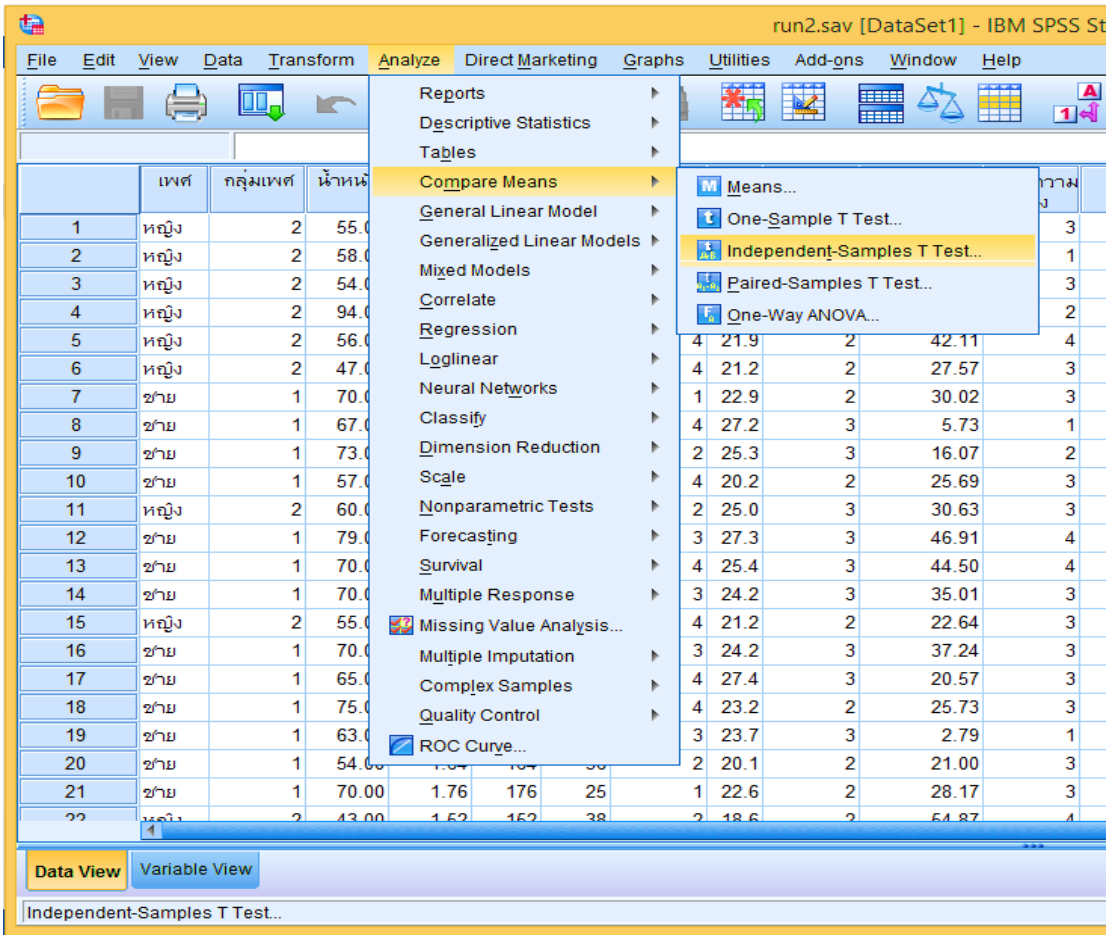


Figure 3 Analysis gender group by Independent T-Test

Select the variables used for the relationship. Select information angulation side, insert in test variable (s) and in the Grouping variable (s) select gender group. It uses statistical variables because there are only two groups and the two groups are independent of each .

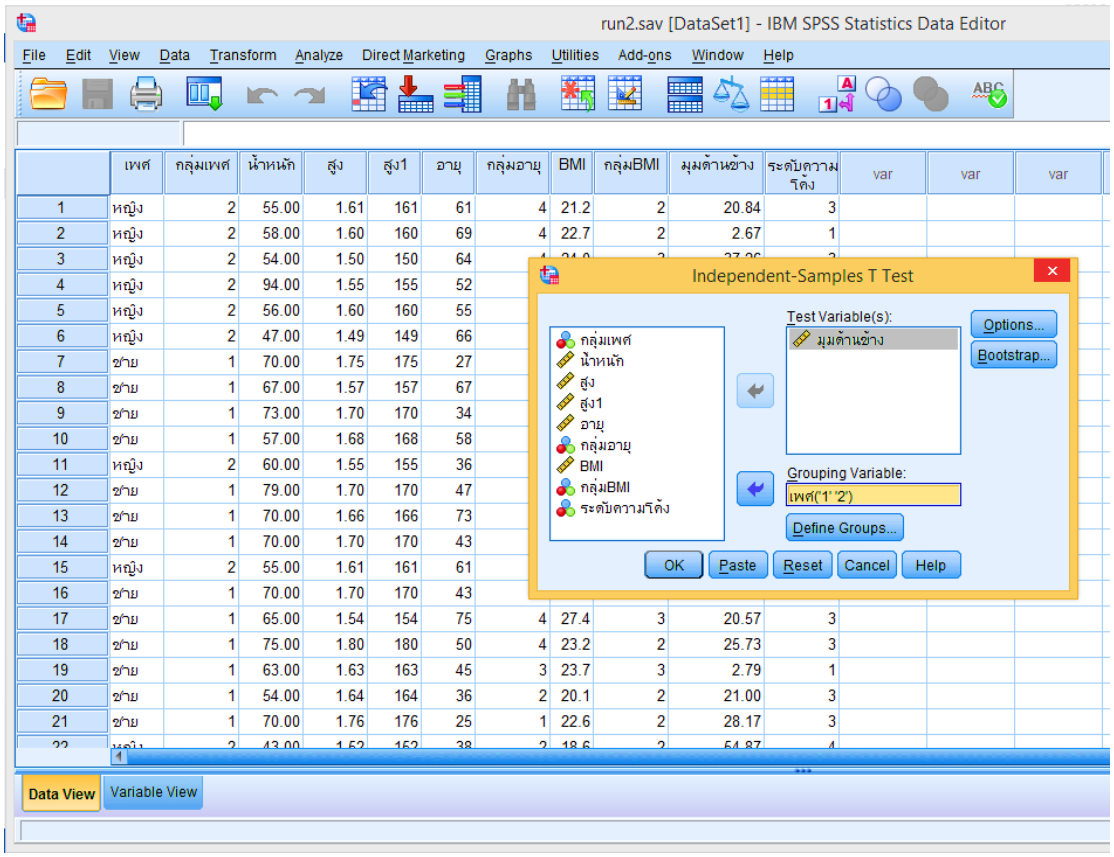


Figure 4 Select the variables used for the relationship.

Analysis of the data showed Significant = 0.00 show that gender affects the curvature of the spine significantly.

T-Test

[DataSet1] C:\Users\wisuchana\Desktop\เปเปอร์และข้อมูลที่ใช้จริง\SPSS\run2.sav

Group Statistics

	กลุ่มเพศ	N	Mean	Std. Deviation	Std. Error Mean
มุมด้านข้าง	ชาย	230	23.8363	12.35624	.81475
	หญิง	263	27.8707	12.62451	.77846

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
มุมด้านข้าง	Equal variances assumed	.030	.863	-3.575	491	.000	-4.03437	1.12848	-6.25163	-1.81712
	Equal variances not assumed			-3.580	484.810	.000	-4.03437	1.12686	-6.24851	-1.82024

Figure 5 The results gender group by Independent T-Test

Compare analysis the curved spine of lumbar with body mass index (BMI) to the relationship by using One Way ANOVA.

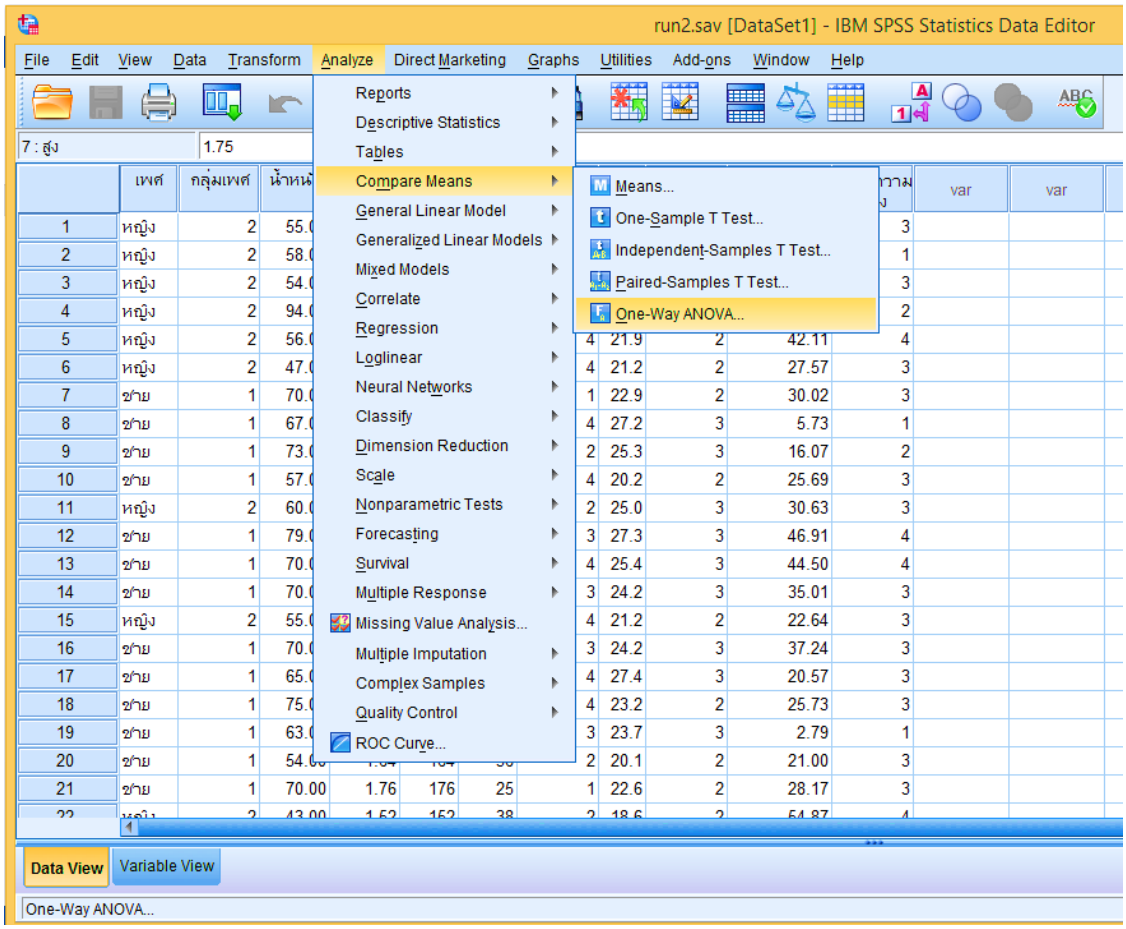


Figure 6 Analysis BMI by One Way ANOVA

The results of the statistical analysis by One Way ANOVA are significant = 0.007 means that the body mass index (BMI) affects the curvature of the lumbar.

ANOVA

มุมด้านข้าง

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1917.849	3	639.283	4.070	.007
Within Groups	76799.243	489	157.054		
Total	78717.092	492			

Post Hoc Tests

Multiple Comparisons

Dependent Variable: มุมด้านข้าง
LSD

(I) กลุ่มBMI	(J) กลุ่มBMI	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
<18.5 Underweight	18.5 - 23.4 Normal	.96315	1.93324	.619	-2.8353	4.7616
	23.5 - 28.4 Overweight	4.72401*	1.98735	.018	.8192	8.6288
	>28.5 Obesity	4.63101	2.44613	.059	-.1752	9.4372
18.5 - 23.4 Normal	<18.5 Underweight	-.96315	1.93324	.619	-4.7616	2.8353
	23.5 - 28.4 Overweight	3.76086*	1.28314	.004	1.2397	6.2820
	>28.5 Obesity	3.66786	1.91844	.056	-.1015	7.4373
23.5 - 28.4 Overweight	<18.5 Underweight	-4.72401*	1.98735	.018	-8.6288	-.8192
	18.5 - 23.4 Normal	-3.76086*	1.28314	.004	-6.2820	-1.2397
	>28.5 Obesity	-.09300	1.97296	.962	-3.9695	3.7835
>28.5 Obesity	<18.5 Underweight	-4.63101	2.44613	.059	-9.4372	.1752
	18.5 - 23.4 Normal	-3.66786	1.91844	.056	-7.4373	.1015
	23.5 - 28.4 Overweight	.09300	1.97296	.962	-3.7835	3.9695

*. The mean difference is significant at the 0.05 level.

Figure 7 The results body mass index (BMI) and Least Significant Difference (LSD)

Compare analysis the curved spine of lumbar with age the relationship by using One Way ANOVA.

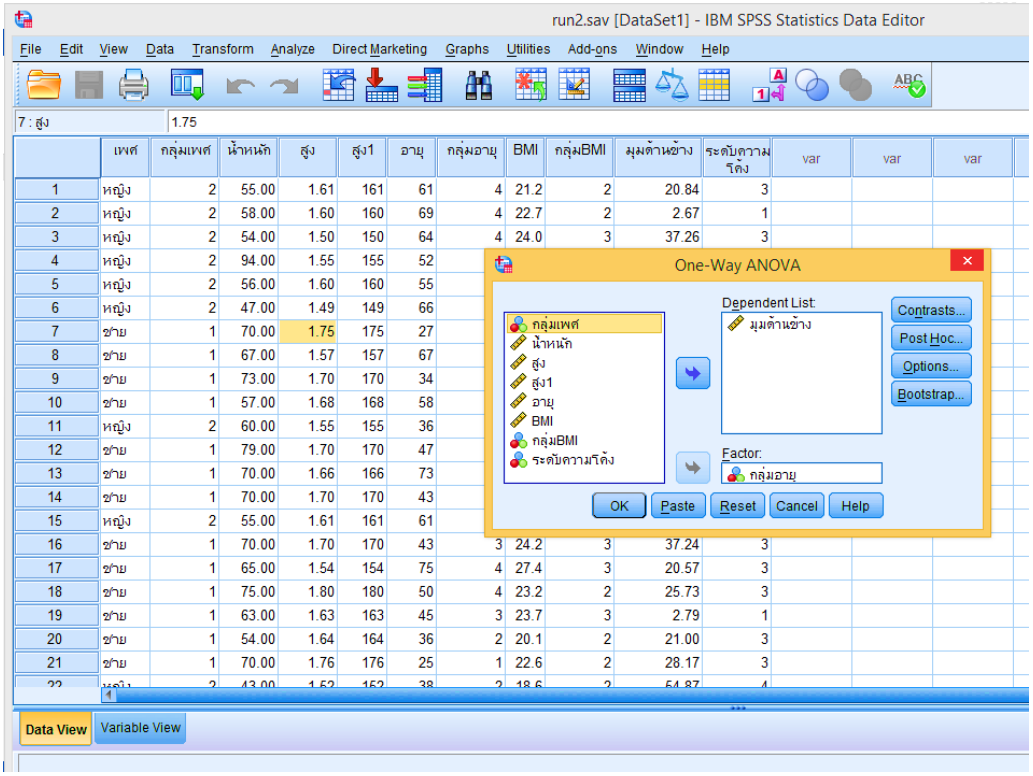


Figure 8 Analysis age groups by one way ANOVA

The results of the statistical analysis by One Way ANOVA are significant = 0.788 means that age not affects the curvature of the lumbar spine.

Oneway

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ANOVA

มุมด้านข้าง

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	169.725	3	56.575	.352	.788
Within Groups	78547.366	489	160.629		
Total	78717.092	492			

Figure 9 The results age group by One way ANAVA

Paper of The measurement of lumbar spinal curvature in Thai population : relationship to age, gender, and body mass index

The measurement of lumbar spinal curvature in Thai population : *relationship to age, gender, and body mass index*

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***Abstract*—** Back pain can seriously affect all age groups. There are many factors for causing the changing backbone of the people. However, at present there are still studies quite a few changes in the lumbar spine. Therefore, all data are obtained from Lerdsin hospital. The purpose of this study is to investigate the relationship between age, gender and body mass index of the patients are admitted because of back pain using method for measuring the angulation of the bone with Cobb's Angle method. X-Ray images of the patient's Lerdsin hospital are 493 of people aged between 20-88 years which they can be divided into four groups: 1) 20-29 years, 2) 30-39 years, 3) 40-49 years and 4) over 50 years. The calculations of mean and standard deviation are compared with the relationship between age, gender and body mass index (BMI) affecting the curvature of the lumbar spine. The results show that the first, second, third and fourth groups are approximately at 26.39 ± 12.02 degrees (64 people), 25.78 ± 12.16 degrees (85 people), 26.99 ± 12.79 degrees (106 people) and 25.53 ± 12.96 degrees (243 people), respectively. For the third group, the curvature of the bone is highest all of the age groups, and females are higher than males. It is found that the angle of curvature of the lumbar spine by age are analyzed by One-way ANOVA (p>0.05). The results of the age do not affect the curvature of the lumbar spine and they show patients with underweight and overweight patients. It makes effects of the curvature of the spine that females are more than males. Experts estimate a basis for evaluating underlying disorder patients to receive treatment for back pain that is in the level of risk.

Keywords- Lumbar spinal curvature, Cobb Angle, One Way ANOVA , T-Test

I. INTRODUCTION

Issue of back pain can affect all age groups. Idiopathic scoliosis is the most common form of scoliosis. It is not found in the newborn. But it happens in childhood or adolescence [1] In addition, there are still have many factors the backbone can make scoliosis, genetics is believed to play a role as in present, standing or sitting for 8 consecutive hours day [2], repetitive movements and leaned forward and eating behaviors work activities a stance that is not working properly. Even sitting on the floor for a long time. It may be a factor that causes abnormal curvature of the spine.

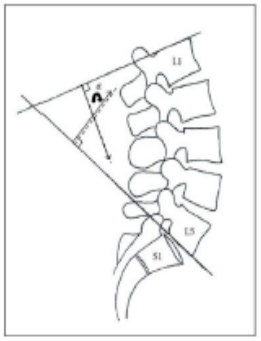

Figure 1. Measurement of lumbar angle α. Using Cobb's method, tangent lines are drawn along the superior end pated of L1and S1. Perpendiculars to each of the lines are added to form α. 1 [3]

Method of measure the curvature of the spine from past research found that the theory of measuring Cobb's Angle with the precision and high reliability [4], many research he led the way Cobb's Angle was used to measure angles [5-6] [Figure 1].

The past research studies on the curvature of the lumbar spine in which to study the Leilei Xu. Degeneration of the lumbar spine of Han Chinese on the relationship of age, gender, the density of bone and body mass index (BMI) using X-Ray image of a volunteer aged older than 40 years and have no history of previous treatment for Scoliosis. They have 318 people divided into two groups, group A is a curvature of the spine in the range between 10 -20 degrees, 273 people (85.8 %) and group B 45 people more than 21 degrees. The researcher compared to group A and group B using Age and BMI. The results are no significant differences between the 2 groups findings degeneration of the spine to the waist of Han Chinese aged over 40 years is 13.3 % correlated significantly with age, sex and density of bone in women and those older than 65 years, may lead to

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the degeneration of the lumbar spine and vertical curvature of the spine was not related to age, sex and body mass index (BMI) and bone mineral density (BMD) [7].

P. Rungthip measure the normal curve of the lumbar spine in the normal population aged 20-69 years using Thailand flexible ruler volunteers 300 people compare the average difference between the sex and lumbar spine curvature using ANOVA. Significance level set at P <0.05 was found the angle of curvature of the lumbar spine in the age group 20-29 years had the angulation of the bone ridge. After lumbar less than other age groups statistically significant (P <0.01) also showed female gender with the angle of curvature of the lumbar spine than men statistically significant (P <0.01). The results showed the angle of curvature of the lumbar spine in a sample of Thailand people are different in each group each gender and age [8].

However, A Past study found that the study of the curvature of the lumbar spine still less and all will study the population has no history of treatment with low back pain before. Therefore, we have seen the importance of education for the angulation of patients admitted with back pain in the lumbar spine of patients. To find the angle of curvature of the lumbar spine, the relationship between age, gender and body mass index of the lumbar spine. So to check the curvature of the lumbar spine in patients. The results have to be able to adopt a common criteria used to determine the reference in evaluating patients, who are treated with primary lumbar back pain. To reduce costs and exposure to radiation from the x-ray machine.

II. MATERIALS AND MEDTHOD

This research used samples of x-ray images of patients who receive treatment with low back pain Lerdsin hospital of 493 people aged between 20-88 years of data to be used in the study were age division height, weight, the angle of curvature of the lumbar spine on Table I, II and the group divided the sample into four groups based on age range, as shown in Table III, this is a selected sample of patients never received of surgical disorders of the lumbar spine.

Table I. shows the number of samples. (N = 494)

Gender	Samples	Percentage
Male	230	46.6
Female	263	53.4
Total	493	100

Table I shows the sample of 230 people, 493 of whom were male and 46.6 percent female, 53.4 percent of 263 people.

Table II. Shows the characteristics of the sample each variable.

Variable	Minimum	Maximum	Mean±SD
Age	20	88	48.95±15.44
Weight	35	109	60.61±12.96
Height	133	182	161.14±8.79
BMI	15.60	39.10	23.24±4.12

Table II shows the characteristics of all groups of sample. Aged between 20-88 years with a weight of 35-109 kg, height is between 133-182 cm and a body mass index (BMI) between 15.60 to 39.10 kg/m^2.

Table III. Shows the mean lumbar spine angulation between male and female were divided by age.

Age Interval (years)	Mean ± standard deviation (degrees)			
	N=493	*Male*	*Female*	*Total*
20 – 29	64	25.68 ± 11.51	27.75 ± 13.09	26.39 ± 12.02
30 – 39	82	23.19 ± 12.40	28.25 ± 11.53	25.78 ± 12.16
40 – 49	104	24.88 ± 14.04	28.59 ± 11.61	26.99 ± 12.79
> 50	243	22.88 ± 11.94	27.47 ± 13.36	25.53 ± 12.96

Table III shows age group 40-49 years have a mean of the lumbar spine curvature at 26.99 ± 12.79 degrees and the angle of curvature found in all ages were higher in females than males and found that females who are in the age range 40-49 years, which was during menopause has the highest average of 28.59 ± 11.61.

III. STATISTICAL DATA ANALYSIS

This study, the data are normally distributed, so the statistics One-way Analysis of variance (ANOVA) with a confidence of 95% in the analysis of the relationship of the curvature of the lumbar spine with age and BMI using Cobb's angle. Then use the statistical Least Significant Different (LSD) to model membranes is the big difference between double and statistics Independent t-test to compare the differences between males and females affect the curvature of the spine for analyzed by using SPSS to determine the level of significance at p <0.05.

Table IV. Shows a comparison of the curvature of the lumbar spine by sex, by using Independent t-test.

Average angulation mean ± SD (degrees)		t	*p*
Male	*Female*		
23.84 ± 12.36	27.87± 12.62	-3.58	0.000

* Statistically significant at 0.05

Table IV found that males and females affect the curvature of the lumbar spine. Statistically significant at the 0.05 level.

Table V. Shows a comparison of the curvature of the lumbar spine by body mass index (BMI).

Curves by BMI	Sum of Squares	df	Mean Square	F	Sig.
Between group	1917.849	3	639.283	4.070	0.007*
Within group	76799.243	489	157.054		
Total	78717.092	492			

* Statistically significant at 0.05

Table V compares the angle of curvature of the lumbar spine by body mass index (BMI) were analyzed using One-

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way ANOVA at significance level of 0.05 was found the sig = 0.007, indicating that the body mass index (BMI) is affect the curvature of the lumbar spine, at least one pair is different. Therefore, the test average pairwise differences by using LSD method as shown in Table VI.

Table VI. Shows a comparison between the double curvatures of the lumbar spine with a body mass index (BMI).

curvature of the lumbar spine	$\bar{Y}$	Under weight	Normal	Over weight	Obesity
< 18.5 Underweight	28.53	-	0.96	4.72*	4.63
18.5 – 23.4 Normal	27.57	-0.96	-	3.76*	3.67
23.5 – 28.4 Overweight	23.81	-4.72*	-3.76*	-	-0.09
>28.5 Obesity	23.90	-4.63	-3.67	0.09	-

Table VI shows the results compare the differences between the two groups over the curvature of the spine by body mass index (BMI) found that the number of different pairs, including two pairs.

1) Patients with BMI < 18.5: underweight patients with BMI 23.5 to 28.4: overweight mean curvature of the lumbar spine was significantly different.

2) Patients with BMI 23.5 to 28.4: Overweight with 18.5 to 23.4: The average of the normal curve of the lumbar spine was significantly different.

Table VII. Shows a comparison of the curvature of the lumbar spine by age.

Curve by age	Sum of Squares	df	Mean Square	F	Sig.
Between group	169.725	3	56.575	0.352	0.788*
Within group	78547.366	489	160.629		
Total	78717.092	492			

Table VII comparison of the angle of curvature of the lumbar spine by age were analyzed by One-way ANOVA statistical significance level of 0.05 was found that the sig = 0.788 conclude that age does not affect the curvature of the lumbar spine.

IV. RESULTS

Compare age and the curvature of the lumbar spine by using a One-way ANOVA at significance level of 0.05 , the mean value F = 0.352, Sig. = 0.788> 0.05 conclude that age does not affect the curvature Lumbar spine [Figure 7].

Compare body mass index (BMI) with the curvature of the lumbar spine at the level of statistical significance at 0.05, the mean value F = 4.070, Sig. = 0.007 <0.05 conclude that the angle of curvature of the lumbar spine is broken different by body mass index (BMI) significantly. Therefore, the test average difference by Least Significant Different (LSD) [Table 6]. Testing results are compared with the different pairs between body mass indexes (BMI) with the angle of curvature of the lumbar spine. Statistically significant at 0.05 showed that BMI groups vary significantly. Patients with BMI Underweight and a BMI of 23.5 to 28.4 overweight, the higher the angle of curvature other patients.

Compare the angle of curvature of the lumbar spine with sex differences found that the Sig = 0.000 results from the male and female affects the curvature of the lumbar spine statistically significant at the 0.05 level.

V. CONCLUSION

Preliminary data analysis to compare the relationship between age, gender and body mass index affects the curvature of the lumbar spine. That found in the age group 40 - 49 years had the highest curvature of the bone was 26.99 ± 12.79, but is also found in all age group females were higher than males, which is consistent with the research of P. Rungthip and females in the age group 41-50 years, they have the curvature of the farthest corners of 27.24 ± 12.45 degrees, which may have caused it of who menopause. The analysis showed patients with underweight and overweight patients are affected the curvature of the spine as well. Finally gender affects the curvature of the spine by the female with the curvature of the spine than men as Leilei Xu noted that the density of bone mass in females than males, may lead to the deterioration of the lumbar spine, But age does not affect the curvature of the lumbar spine.

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