Comparison of Spinal Curvatures of Women Had Given Multiple Times and Never Given Birth

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ABSTRACT

Background: It is known that the amount of load loaded on the body affects the spine and spinal curvature. It was thought that the spine could be affected during each pregnancy experienced by the women. The spine measurements of women who gave birth and those who did not were compared.

Material and Method: This research study was conducted in 2021, with the approval of Van YYU Non-Interventional Clinical Ethics Committee, the spines of women who came to Van YYU Dursun Odabaşı Medical Centre Gynecology and Obstetrics Outpatient Clinic were examined by means of the Spinal Mouse device. Posture was assessed by a single investigator with the SM device in two different positions: upright and extension. Thoracic kyphosis (TK), lumbar lordosis (LL), sacral kyphosis (SK) angle values and sagittal vertical position (SDP) posture of the whole spine were evaluated. A total of 100 women in the age range of 30-35 years, 50 women who had never given birth and 50 women who had given at least three births were included in the study. T-Test was used to compare group means in terms of continuous variables.

Results: As a result of the findings obtained, the average weight of women who gave birth and never gave birth was p=0.001 as a result of statistical analysis and it was found significant. There was a difference in angular values between the two groups, with LL [p=0.001] and SK [p=0.003] measurements taken in the extension position in the measurements taken in the upright position, a significant result was obtained in the TK [p=0.040] and LL [p=0.001] values.

Conclusions: It is seen that every birth process experienced negatively affects the posture of women. Therefore, women who have given birth should be made aware of the necessary exercise and physical activity in order to control and protect the spine health.

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1.INTRODUCTION

The columna vertebralis (spine) is a mobile and flexible column on the axis of the body, which, together with the skull and breast bones, forms the skeleton axiale. It plays a role in the movement of the head, neck and trunk [1]. The upright posture of the columna vertebralis is in a certain static order and is called "posture". Posture is also expressed as a component of all posture points of the body [2]. Columna vertebralis can stand upright with the support of various soft tissues such as muscles, ligaments and capsules [3,4]. Posture is very important for body health and appearance. There are various factors affecting posture. These are factors such as race, heredity, gender, nutrition, environmental factors, socio-economic status, psychological status, soft tissue deformation, fractures and deformation of the normal position angle of the joint [5,6]. The concept of gender among these factors draws attention to the difference between men and women. It has been reported that pregnancy, which is a physiological process especially for women, may play a role in postural changes [7,8].

Pregnancy is a period in which many hormonal and anatomical changes affect the musculoskeletal system. Changes in the musculoskeletal system such as lordosis, kyphosis, anterior and posterior longitudinal ligament changes, increased joint laxity, increased strain and mobility in the sacroiliac joint and symphysis pubis may be observed due to pregnancy [9]. Women experience a sudden decrease in abdominal circumference and body weight after giving birth. However, it is reported that it may take 3-6 months after delivery for the female body and spinal posture to return to pre-pregnancy values after the end of pregnancy [10].

Pregnancy may cause changes in spinal curvature and posture. It has been found that there are some differences in the characteristics of the spine, degree of lordosis and kyphosis values during pregnancy [11,12]. The growing uterus shifts the centre of gravity of the body forward. Expanding lordosis bends the sacrum forward, putting pressure on the joints, intervertebral discs and ligaments of the lumbosacral spine [7]. The increasing and changing mass distribution of the trunk can shift the centre of gravity forward and lumbar lordosis can occur with pelvic tilt forward [13]. An increase in cervical lordosis has also been reported to compensate for these changes in the thoracic region [14,15].

In this study, it was thought that spinal posture would be affected more as the number of births increased. For this purpose, it was aimed to compare the spinal posture of women who had never been pregnant and women aged 30-35 years who had given birth at least three times with the spinal mouse device and to determine whether there was a difference between the groups.

2. MATERIALS AND METHOD

1.1. Study Design

A total of 100 volunteer female participants between the ages of 30-35 (This age range was chosen because of the deformations that may occur with advancing age) who had never given birth and who had given at least three births were included in the study and two groups with the following characteristics were formed. Sample size, "Sample with Unknown Universe (Population Volume) The calculation was determined by the formula (n=t2pq /d2). According to the literature review, it was determined that the "effect size value is 0.1" (Ohlin and Rösner). Accordingly; Primary Type Error 5 (t=1,96), Power of the Test (Power) 80% and effect size value was taken as 0,1 unit and the minimum sample size was calculated as n=96. Thus, considering the study process, it was envisaged to work with 100 women. Two comparisons were made in the study the group consists of two normally distributed main masses randomly selected. None of the women participating in the study had a history of abortion or miscarriage. On the other hand, approximately 90% of the women who participated in the study lived in rural areas and did not have any occupation.

1. Group [n:50]: X. X.X. Medical Center Gynecology and Obstetrics outpatient clinic consists of women who have never given birth.

2. Group [n:50]: Women who had given at least three births (normal or caesarean section) in the Gynaecology and Obstetrics outpatient clinic of X.X.X. Medical Centre and who had been at least twelve months since the last birth (It has been reported that postural changes that develop in the body during pregnancy enter the recovery phase in the third month after delivery and return to the systemic pre-pregnancy function by the sixth month [21]. Considering this, it was thought that the results after twelve months may be more reliable).

2.2. Procedures and Outcome measures

People were asked about their ages and notes were taken. This study was conducted using the Spinal Mouse M365, a radiation-free non-invasive device that is increasingly used in the clinical evaluation of the vertebral column (Idiag, Volketswil, İsviçre) [16,17,18,19,20].

In this study, spine measurements were only in the sagittal plane, thoracic kyphosis (TK), lumbar lordosis (LL), and sacral kyphosis (SK) angle values and sagittal upright position (SDP) posture data of the

spine were evaluated. With the measurements made, the values of thoracic curvature (T1-T2 to T11-T12), lumbar curvature (L1 to L5), sacral curvature (S1 to S5), and angular upright position of the entire spine were determined. It was evaluated with the SM device by a single investigator in two different positions: extension ve upright

To take the measurements in accordance with the standards, a measurement speed study was carried out for 2 weeks to gain the habit of hand [18,19].

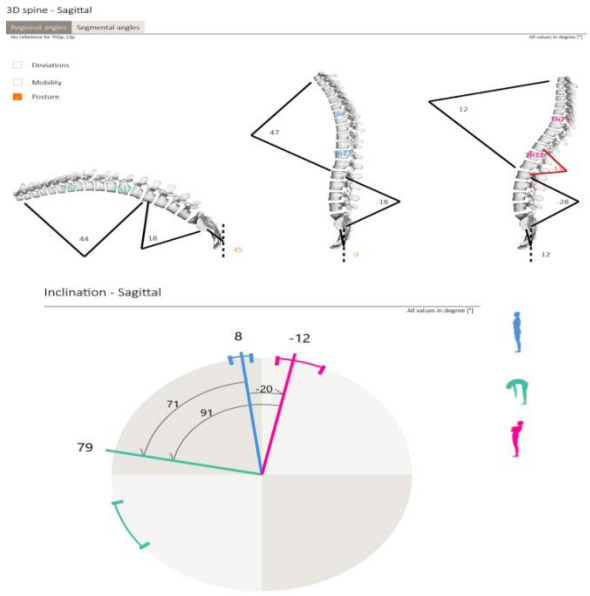

Figure 1. An examaple of the measurement taken in the sagittal plane with Spinal Mouse.

2.3. Statistical analysis

The descriptive statistics for the continuous variables of the age, height, body weight values of the participants and the measurements taken in anatomical, flexion and extension positions were determined as Average, Standard Deviation, Minimum and Maximum values. The normality of the distribution of the data was tested with the Kolmogorov-Smirnov Test, and the homogeneity of the variances was tested with the Levene test. In two-group comparisons in terms of continuous variables, the t-test was used for the cases that met the normal distribution conditions, and the Mann-Whitney U test was used for the cases that did not meet the normal distribution conditions.

3. RESULTS

Age, body weight and heightmean value and standard deviation of the subject (Table 1). The body weights of the groups included in the study were measured as 61.58 kg in those who did not give birth and 69.42 kg in those who gave birth. It is seen that the average body weight is higher in women who have given birth. According to the results of the analysis, it was determined that there was a statistically significant difference [p=0.001] between women who had given birth and women who had never given birth [p<0.05]. In addition, the number of births of the women participating in the study was at least 3 and at most 9, and the time elapsed since the last birth was at least 1 and at most 10 years.

Table 1: Mean age, weight and height distribution.

	Group	n	Mean±Std. deflection	p
Age (years)	NGB	50	33.34±0.688	0.837
	GB	50	33.40±1.938	
Body weight(kg)	NGB	50	61.58±8.031	**0.001**
	GB	50	69.42±11.947	
Height (cm)	NGB	50	162.52±4.929	0.922
	GB	50	162.42±5.265	
NGB: Not Giving Birth; GB: Giving Birth				

The results of TK, LL, SD and Angle of the spine measurements taken in the extension position are given in Table 2.. The mean TK angles of the two study groups were (29.50±13.281) in women who had never given birth and (31.80±14.483) in women who had given birth. As a result of the analysis, the p probability value was 0.410 and was not found to be statistically significant. When LL angles were analyzed, the highest mean (-18.64±13.641) belonged to women who had given birth. The mean LL angle of women who had never given birth was (-11.14±6.854) and there was a significant difference between the two groups (p=0.001). The mean SD value was (-14.38±11.537) in women who had never given birth and (1-6.04±15.258) in women who had given birth and there was a significant difference between the groups [p=0.003].When evaluating the mean extension angle positions, there was no significant difference observed between those who have never given birth (-13.28±6.902) and those who have given birth (-11.50±4.743) [p=0.136].

Table 2: Comparison of TK, LL, SK, and angle measurements in the extension position of the spines of the groups participating in the study

	Group	n	Mean±Std. deflection	p
Extension TK	NGB	50	29.50±13.281	0.410
	GB	50	31.80±14.483	
Extension LL	NGB	50	-11.14±6.854	**0.001**
	GB	50	-18.64±13.641	
Extension SK	NGB	50	-14.38±11.537	**0.003**
	GB	50	-6.04±15.258	
Extension Angle	NGB	50	-13.28±6.902	0.136
	GB	50	-11.50±4.743	
NGB: Not Giving Birth; GB: Giving Birth				

The comparisons of TK, LL, SK and ANGLE in the measurements taken in the upright position of the spine are given in Table 3. It was determined that TK angles had a higher mean of (48.46±13.961) in women who had given birth and (43.32±12.743) in women who had never given birth. There is a significant difference between the mean values obtained [p=0.040]. It is seen that the highest mean value in LL angles belongs to women who have given birth with (-18.16±11.182), while the mean value of LL angle in women who have never given birth is (-11.56±5.096) and there is a statistically significant difference between the two groups [p=0.001]. SK values were (3.40±3.276) in women who had never given birth and (3.84±10.925) in women who had multiple births and the difference between the groups was not significant [p=0.786]. The mean SDP of the spine of the groups was calculated as (3.00±2.850) in women who had never given birth and (2.44±5.023) in women who had given birth and there was no significant difference between them at 5% significance level [p=0.495].

Table 3: In the upright position of the spines of the groups participating in the study, TK, LL, SK and Comparison of SDP measurements

	Group	n	Mean±Std. deflection	p
Upright TK	NGB	50	43.32±12.743	**0.040**
	GB	50	48.46±13.961	
Upright LL	NGB	50	-11.56±5.096	**0.001**
	GB	50	-18.16±11.182	
Upright SK	NGB	50	3.40±3.276	0.786
	GB	50	3.84±10.925	
Upright SDP	NGB	50	3.00±2.850	0.495
	GB	50	2.44±5.023	
NGB: Not Giving Birth; GB: Giving Birth				

4. DISCUSSION

The reason for the excess body weight in women who have given birth is that the amount of fat retained by the body increases with each birth and the person cannot return to his/her old weight after birth. However, although it is stated that the postural changes that develop in the body during pregnancy enter the recovery phase in the third month after birth and systemically return to the pre-pregnancy function until the sixth month, it is stated that some permanent changes occur in the mother's body [21]. In this study, body weight was found to be statistically significant in women who gave birth compared to those who did not give birth (p= 0.001). It is clear that there is a positive correlation between body weight after each pregnancy period (No similar study was found to discuss our findings. Therefore, similarities and differences could not be compared)

The increase in lumbar lordosis, which is one of the common postural changes in pregnancy, causes changes in the proximal and distal lumbar regions. Dorsal kyphosis increases to compensate for lumbar lordosis. In this context, pregnancy has been reported to be a risk factor for future disc herniations or existing disc pathologies may worsen during pregnancy [22]. In the measurements taken in the upright position of the spines of the groups participating in the study, the angle values of the women who gave birth to many children and those who did not were found to be TK (48.46º, 43.32º), LL (-18.16º , -11.56º), SD (3.84º, 3.40º) and upright SDP (2.44º, 3.00º). The findings showed that as the number of births increased, the TJ angle value increased, whereas the LL angle values were not within normal limits and decreased. In the measurements of the spine of the groups participating in the study in the extension position, the angle values of the women who had multiple births and the women who did not give birth were found to be TK (31.80º, 29.50º), LL (-18.64º, -11.14º) and SD (14.38º, -6.04º). Considering these values, it was observed that lumbar lordosis angles were not within normal physiological limits and were less in both groups.

The lumbar spine, which is affected by hormonal and postural changes during pregnancy, will cause more loading and strain due to weight gain. This situation leads to recurrent and sometimes chronic health problems that negatively affect the comfort and activities of women during pregnancy and after delivery [26]. Okanishi et al. [24] , Spinal Mouse device was used to calculate the mean of spinal curvature, sacral inclination, thoracic and lumbar curvature, and inclination of nonpregnant and pregnant women. The study showed that the lumbar spinal curvature is straight or the lumbar lordosis and sacral posterior slope are reduced in pregnant women. They reported that during pregnancy, women have a rounded back posture shaped by the placement of the upper body backwards from the lower body. In addition to the changes that occurred during pregnancy, conditions such as an increase in thoracic kyphosis, scapular protraction, and internal rotation in the upper extremity were observed. It has also been reported that cervical anterior tilt (inclination) and an increase in cervical lordosis are observed because of enlargement of the thorax [14]. It has been reported that lumbar lordosis and pelvic tilt rates increase during pregnancy, and lateral deviation in spinal posture is observed during pregnancy [25,7]. According to literature information, decreased lumbar lordosis angle is among the factors that cause low back pain [27.28.29]. It has been reported that thoracic kyphosis, which increases during pregnancy, also increases after delivery [27]. Dumas et al [23] examined pregnant women with lateral photography method and reported that pregnancy has an increasing effect on thoracic kyphosis, although no numerical data could be determined. Betsch et al [7] calculated that pregnancy has an increasing effect on thoracic kyphosis using topographic measurement

devices and numerical data. In our study, a significant difference was observed at 5% significance level between the two groups in terms of LL and SC in the measurements taken in the extension position [p<0.05], while no significant difference was observed in TK and Angle measurements [p>0.05]. In this context, TK angles of both groups were within normal physiological limits (20º - 45º) and not significant [p>0.05], while LL and SK angles were statistically significant [p<0.05]. Accordingly, a significant difference was found between the two groups in terms of TK and LL at 5% significance level [p<0.05]. TK angles (48.46º, 43.32º), LL angles (-18.16º, -11.56º) and SD angles (3.84º, 3.40º) were found in the measurements taken in the spine upright position of the groups participating in the study. According to the comparison results, SD and LL angles were found to be significant [p=0.040, p=0.001]. According to these data, it can be said that there is an increase in lumbar lordosis after birth.

5. CONCLUSION

In this study, the spinal postures of women who had given birth and women who had never given birth were evaluated with SM in the sagittal plane. The data show that the increasing number of births has a negative effect on the postural posture values in the spine. Women who have given birth have a high degree of lumbar lordosis and thoracic kyphosis. In this study, it can be said that the measurements made in the flexion position had no effect on the determination of spinal curvature. The results of this study could not be compared with the literature and discussed since there are no publications on whether the lumbar lordosis that occurs during pregnancy persists in the postnatal period and if so, at what level. The women who participated in this study were between 30 and 35 years of age. Changes in the spine in women who have given birth to a large number of children at advanced ages, especially in the geriatric period, should be determined in future studies. We think that these results will be a source for future studies on spinal posture. It is seen that the number of studies based on the long-term physical health problems of women that may develop after birth and may cause hidden morbidity is quite insufficient. Based on this study, we think that pilot applications supported by new field studies are needed to control and protect the spine health of women who have given birth more than once. It is thought that the Spinal Mouse device, which will be used in the measurement and analysis of spinal postures, may be an alternative to radiation-containing imaging devices and may facilitate the evaluation of the structure of spinal postures in the field of health.

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Conflict of Interest: This study is the doctoral dissertation article of G.S. Advisers H.K. and D.D.
There is no conflict of interest between the authors.
Ethical Approval: In order to conduct the research, Van Yüzüncü Yıl University Non-Interventional Clinical Research Ethics Committee (Decision no: 2021/01-01, Date:15.01.2021) necessary permission was obtained. The participants who participated in this study were informed verbally and then a voluntary written consent form was obtained.
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