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Lumbar Lordosis during Pregnancy and Its Correlation with Low Back Pain

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ABSTRACT
Background- The journey of pregnancy, with which the transition to motherhood begins is a very crucial journey. Various physiological and anatomical changes are observed during pregnancy. Postural changes are amongst the most commonly observed changes during pregnancy. The lumbar lordosis angle can either increase or decrease during pregnancy. The postural changes gradually stress the muscles and ligaments which is said to be responsible for low back pain during pregnancy. The aim of this study is to assess the lumbar lordosis during 2nd trimester of pregnancy and to correlate it with the occurrence of low back pain. Methodology - In this study pregnant women in their second trimester were included. The lumbar lordosis angle was measured using Flexible ruler. The intensity of low back pain was measured using NPRS. Collected data were entered in excel sheet and analyzed using descriptive statistics. Result - Total 200 participants were analyzed for the study. The correlation between lumbar lordosis angle during second trimester with low back pain (P value = 0.964), with parity (P value = 0.210) was not significant. The correlation of lumbar lordosis angle during 2nd trimester with body mass index (P value< 0.001) was significant. Conclusion - Thus, this study concluded that lumbar lordosis angle during second trimester is not significantly correlated with low back pain and parity but it is significantly correlated with body mass index.
Keywords: *Pregnancy, Lumbar lordosis, Low back pain, Flexible ruler, NPRS*

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INTRODUCTION

In a woman's life, pregnancy is one of the happiest moments as well as of the highest importance. The journey of pregnancy, with which the transition to motherhood begins is a very crucial journey and most of the females' view experiencing pregnancy and having children in a positive aspect [1].Various physiological and anatomical changes are observed during pregnancy [2]. Amongst all these changes the musculoskeletal changes can give rise to very cumbersome symptoms. This is due to the stress placed on the body by the growing uterus and the variations in the biomechanics, hormones, and vascular changes. The soft tissues get compressed by the tendency during pregnancy of fluid retention. The increasing joint laxity is observed due to the alterations in the hormonal levels [3] and even the ligament softening can be seen due to the variations in hormonal levels, leading to the increased mobility of the joints of the pelvis [4]. There occurs exaggerated lordosis of the lower back [4-6] forward flexion of the neck and downward movement of the shoulders [5,6] joint laxity in the anterior and longitudinal ligaments of the lumbar spine [5], increased mobility of pelvic joints due to softening of ligaments caused by hormone [4]. During pregnancy low back pain is experienced by more than two-thirds of pregnant women [7]. Pregnancy-related low back pain normally increases in intensity during pregnancy and in the third trimester [8]. In pregnant women, there is a gain in body weight by 11-16 kg [9] which imposes greater loads on joints, tendons, and ligaments [10]. Yoo et al reported that 50.9% of women experienced low back pain during

pregnancy, and women that report a previous history of back pain are imposed to a greater risk of pregnancy-related back pain [8]. The cause of low back pain during pregnancy may be considered as a combination of various factors such as mechanical, hormonal, circulatory, and psychosocial [11]. The factors underlying low back pain during pregnancy are the influence of specific hormones and postural changes [7]. Wang et al stated that the onset of low back pain can be during any period of pregnancy. There are various factors that contribute to low back pain like age of the mother, past history of back pain, pain during menstruation, pain during a previous pregnancy [12].

Franklin and Conner-kerr found no relation between postural change and back pain [13], whereas Ostgaard et al suggested that depth of lumbar lordosis is related to the back pain during pregnancy [14]. There are various methods to measure lumbar lordosis during pregnancy such as Spinal Mouse, BackMapper, Lateral photograph, Spine scanner, Metrecom Skeletal Analysis System, Flexible ruler, and 3D orthoscreen [7-17]. Radiograph is the gold standard method to measure lumbar lordosis but as it cannot be used on pregnant women population so flexible ruler used to obtain accurate results. The flexible ruler was used by Kouhkan et al for measuring lumbar lordosis angle in pregnant women [17-18]. First time flexible ruler was described by Takahashi and Atsumi and Burdett et al concluded that the result of flexible ruler was closer to x-ray [19-20]. The changes in degree of lumbar lordosis and its correlation with low back pain during pregnancy are still unclear. Thus, the purpose of this study is to demonstrate the correlation of lumbar lordosis angle during pregnancy and to find out its correlation with low back pain.

MATERIAL AND METHODS

This study is registered with clinical trial of Indian registry (CTRI no: REF/2021/06/044350). The participants were recruited from Antenatal care OPD of Dhiraj Hospital. They were given explanation about the procedure, and after their agreement to participate in the study, they were asked for written informed consent. Lumbar lordosis angle and subsequently NPRS was recorded for all the participants.

Method to measure the lumbar lordosis angle Firstly, the participant was asked to stand barefoot and was asked to expose the lower back. Then they were asked to stand with a normal relaxed posture such that the feet were placed shoulder width apart and the hands relaxed and hanging freely by the side, and they were asked to take equal weight on both the feet, and face straight and instructed to maintain a straight posture throughout the procedure and not to move. The therapist was sitting on a stool placed exactly behind the participant. After assuming the position, the therapist first palpated the posterior superior iliac spine (PSIS), then in the midway between the 2 PSIS, the S2 spinous process was palpated and marked. Then by palpating in the upward direction, spinous process of S1 was marked, followed by the palpation of L5 spinous. The iliac crests were palpated bilaterally and in the midway of the two iliac crests, L4-L5 interspace was located. Then 3 spinous processes in the upward direction from L4-L5 interspace were palpated and then L1spinous was located and marked. While measuring, constant commands of maintaining a straight posture was given. It was ensured that the flexible ruler was straight before using it. Then the therapist placed the flexible ruler between the two points marked i.e. S2 and L1 and it was pressed gently and mouldedto the curvature of the participant's spine. Then the flexible ruler was taken away from the spine, while confirming that the ruler is not demoulded at all and then carefully the flexible ruler was placed on the graph. The curve was traced on the graph paper [17,30].

To calculate the angle (Θ), a line was drawn connecting L1 and S2 (l) and this line (l) indicates the length of the curvature. The deepest part of the curvature indicates (h)-(figure 2). Below mentioned equation was used to calculate the angle (Θ) with following formula:

$\Theta = 4 \times [\arctan (2h/l)]$

Degree of Lumbar lordosis and Numerical Pain Rating Scale were taken as outcome measures. Tools used were Weighing machine, Stadiometer, Flexible ruler.

RESULT AND DISCUSSION

Pregnancy leads to various physical adjustments, resulting into discomfort during pregnancy [21,22], and the low back pain is one of the most cumbersome symptoms experienced during pregnancy. It has been stated that in Canadian women 58% experienced low back pain during pregnancy [23], a study conducted in Nepal found that the prevalence of low back pain and or pelvic pain during pregnancy was 34% [24], and the present study also found that 51 percentage of women experienced low back pain during pregnancy.

The postural changes gradually stress the muscles and ligaments which is said to be responsible for low back pain during pregnancy [22]. The tendency of considering low back pain as a usual occurrence during pregnancy and thus avoiding it and not reporting it to the health care provider, might be the reason behind the dearth of research and lack of provision of treating it.

Bullock et al conducted a study and concluded that the changes in the posture of the body during pregnancy is not related to the intensity of low back pain [22]. Similar results were provided by Franklin and Conner-kerr and the present study is in accordance with this finding [13]. In this study, lumbar lordosis angle during 2nd trimester is not correlated with the occurrence of low back pain as the 51% of women who experienced low back pain during pregnancy had mean lumbar lordosis angle almost similar to the 49% of women who did not experience low back pain. The p-value of 0.964 shows that the correlation between angle of lumbar lordosis during second trimester and low back pain is not significant. The enlarging uterus and the increase in size of the breast increases the weight distribution anteriorly and along with other factors eventually leads to changes in the posture [8]. As stated by Glinkowski et al [11] it is during the third trimester that the greatest changes in posture occurs and is accompanied by more severity of pain. It was also stated by Bullock et al [22] mentioned that the changes in the hormones and their effects on the soft tissues might be causative for the early production of the low back pain. Relaxin causes increased elasticity of the ligaments which itself makes it more prone to injuries. The mobility of muscles and joints is increased by estrogen and progesterone [25]. This shows that increased mobility of the musculoskeletal system can lead to pain at various joints.

In the present study, the mean of the lumbar lordosis angle in the women in their first pregnancy is almost similar to that in parous women. The p-value of 0.210 for the correlation of the angle of lumbar lordosis angle in second trimester with parity signifies that they are not significantly correlated. As stated by Kouhkan et al [17] estrogen and progesterone stay for at least 6months postpartum and thus these hormones might be responsible for the increased curvatures of the spine even after the delivery. Joanne et al [26] in their study mentioned that for 12 weeks postpartum the spinal curvatures remain increased. Dumas et al [27] stated that lumbar lordosis during pregnancy was affected by parity as in women who were not in their first pregnancy, lordosis continued to increase, however in nulliparous women first it increased, and then decreased. So, they concluded that the parity is considered to affect the lumbar lordosis during the last 2 months of pregnancy. All of this support the findings of the present study that the lumbar lordosis angle during second trimester is not significantly correlated to parity.

In our study, we found that from the women in their first pregnancy, 51 women had low back pain and 47 of parous women had low back pain. The p-value of 0.087 for the correlation of low back pain in second trimester with parity suggests that the correlation is not statistically significant. The relationship between pain and gravida is not significant [22]. Wang et al mentioned that low back pain during pregnancy is not affected by the number of pregnancies [12]. These reports are similar to the findings of the present study which is stating that the relationship between low back pain in second trimester and parity is not significant. But on the contrary, some authors suggest that low back pain and parity are associated with each other, meaning that the more the parity, the more the occurrence of low back pain during pregnancy [9,16]. Rabiee and Sarchamie suggested that the disability due to low back pain increased with more parity [23]. The occurrence of low back pain and pelvic pain increased with the increasing parity [28]. In the present study it is found that the lumbar lordosis angle in the second trimester shows that in 43.1% of women lumbar lordosis angle is found to be more as the BMI increases. Pauk and Swinarska [29] found that as the BMI increased in women from the 2nd trimester to the 3rd trimester, the lumbar lordosis angle also increased. So, BMI and lumbar lordosis angle are positively correlated. This is in line with the present study. Moreover, authors suggest that a higher BMI leads to more back pain during pregnancy [9,16] and women suffer more disability during pregnancy if their BMI is higher [23].

We hope the findings of this study will help the women's health physiotherapists to understand the importance of diagnosing and appropriately managing the low back pain experienced during pregnancy.

Table 01: Demographic Data of the participants

Descriptive Statistics					
	N	**Minimum**	**Maximum**	**Mean**	**SD**
Age	200	17	38	23.52	3.838
GA (Week)	200	13	28	20.785	3.4083
Parity	200	0	7	.71	.889
Height	200	140.0	175.0	151.903	5.7585

Weight	200	35.0	81.0	49.142	8.1253
BMI	200	15.60	37.99	21.28	3.28
NPRS (Current pain)	200	0	3	.18	.569
NPRS (Best pain)	200	0	6	.94	1.195
NPRS (Worst pain)	200	0	7	1.80	2.085
Lumbar Lordosis Angle	200	15.240	104.899	50.891	15.007

Table 02: Frequency table for parity

Parity	Frequency	Percent
0	96	48.0
1	76	38.0
2	22	11.0
3	5	2.5
7	1	.5
Total	200	100.0

Table 3: Correlation of lumbar lordosis angle during 2nd trimester with low back pain

	LBP	N	Mean	SD	Std. Error Mean	p-Value
Angle	Yes	102	50.9380	13.8553	1.3718	.964
	No	98	50.8426	16.1913	1.6355	

Table 4: Correlation of lumbar lordosis angle during 2nd trimester with parity

	Parity	N	Mean	Std. Deviation	Std. Error Mean	P Value
Angle	Women in their first pregnancy	96	49.5046	13.9617	1.4249	.210
	Parous	104	52.1712	15.8713	1.5563	

Table 5: Correlation of low back pain during 2nd trimester with parity

			LBP		Total	P Value
			Yes	No		
Parity	Nulliparous	Count	55	41	96	.087
		% Count	57.3%	42.7%	100.0%	
	Parous	Count	47	57	104	
		% Count	45.2%	54.8%	100.0%	
Total		Count	102	98	200	
		% Count	51.0%	49.0%	100.0%	

CONCLUSION

This study concluded that the lumbar lordosis angle during 2nd trimester is not significantly correlated with low back pain and parity. The lumbar lordosis angle during 2nd trimester is significantly correlated with BMI.

DECLARATIONS

Acknowledgement – Author acknowledges all the participants for their support.

Conflict of Interest – We declare that there is no conflict of interest.

Authors contribution - This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Ethics Statement – This study was approved Sumandeep Vidyapeeth Institutional Ethics Committee (SVIEC/ON/Phys/BNPG20/D21012).

Informed consent – Informed consent was taken from all the participants.

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