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Correlation between Work Related Low Back Pain in Pregnant Physical Therapists and Lumber Curvature Angle

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Abstract: low back Pain (LBP) considered as a common problem with a high work-related life and point prevalence among physical therapists (PTs). It is clearly affects daily activities so resulting in decreased non-work-related activities, sick leaves, decreased number of working hours and even changing therapists work setting**.** The aim of the study is to investigation the relation between work related low back pain (WRLBP) in PTs during pregnancy and lumber curvature angle. Fifty one healthy, primgravid pregnant PTs at 20th weeks gestation (WGs) with a single fetus were randomized into two groups. Group A received physical therapy antenatal advices plus preventive strategies for WRLBP. Group B received only physical therapy antenatal advices. Both groups were evaluated at 20, 24 and 32 WGs. The outcome measures were lumber curvature angle, self reported pain intensity, there was no statistical significant difference in lumber curvature angle between mean value of group (A and B) at 24,32 WGs (p =0.247),(p =0.391) respectively. And that there was statistically insignificant difference between group (A and B) at 24 and 32 WGs with (p = 0.408),(p =0.458) respectively in pain intensity. However, there was statistical significant positive correlation between pain intensity measured by McGill pain Questionnaire (MPQ) and lumbar curvature angle at 24 WGs (r=0 .918**, p=.000) and at 32 WGs (r=0.923**, p=.000) for both groups.

This study conclude that the lumber curvature angle increase with WRLBP during pregnancy in pregnant PTs.

Keywords: Work related low back pain, pregnancy related low back pain, pregnancy, lumber curvature, physical therapist.

Introduction

WRLBP known as job related aches pain in low back region[1]. The lower back is the most commonly affected anatomical area among PTs ranging between 45% and 79.6%.[2-5]. The occupational hazards and job factors that include lifting or transferring dependent patients[6], in appropriate handling of patients using inappropriate body mechanics and wrong techniques[7, 8], daily exposure to a work routine without intervals and repetitive series of movements which demand much effort, as in the daily work routine of therapists could according to Feuerstein et al. (1993)[9] cause muscular, tendon and ligament lesions, favoring the appearance of lumbar spine disturbances[10].

Female therapists have a higher incidence of injuries than their male counterparts [11]. As females in general are physically weaker than males this may predisposing them at a disadvantage during patient care tasks particularly when lifting and transferring patients [8]. Also, pregnancy- related stress increases female exposure to pain in lower back region[11]. Bork et al. (1996)[8] Reported that spinal posture changes and joint structure weakness related to a history of pregnancy increases the risk for WRLBP.

During pregnancy, increased levels of certain hormones result in softening and relaxation of the joints and subsequent musculoskeletal changes. Also, increased weight during pregnancy may significantly increase the force across joints such as hip and knee by 100%. As the gravid uterus increases, the center of gravity shifts anteriorly resulting in increased lumbar curvature which contributes to high prevalence of LBP[12].

Relationship between LBP and lumber curvature angle has been reported in healthy people and in pregnant women none of these studies measured the relationship between WRLBP during pregnancy and lumber curvature. Therefore, aim of this study was to determine the relationship between WRLBP in pregnant PTs and lumber curvature angle.

Materials and Methods

1. Participants:

Fifty one healthy, non smoking, primgravid pregnant PTs at 20th weeks gestation with a single fetus were selected from departments of physical therapy in Kafr El Shikh general hospital to participate in this study. Their age ranged from 20 to 35 years old with body math index(BMI) <30kg/m2 at participation in this study. All pregnant PTs were selected without any complications. Any pregnant PT with any history of LBP or pelvic pain, any medication affects back pain or pelvic pain, history of any back trauma, history of any medical condition affects back pain, history of any surgery in the back region or the lower extremities and risk pregnancy were excluded from this study.

The study was approved by Research Ethical Committee, Faculty of Physical Therapy, Cairo University (No: P.T.REC/012/00487). The study protocol was explained to all pregnant PTs, who had signed an informed consent form.

The pregnant PTs randomly assigned to one of 2 groups using computer generated random numbers. Allocation was concealed in sequentially numbered opaque envelopes. Group A consisted of 26 pregnant PTs who received antenatal advices plus preventive strategies for WMSDs. Group B consisted of 25 pregnant PTs who only received the same ante natal advices.

2. Measures:

Anthropometric measures:

Weight-Height scale was used to measure the weight and height of each pregnant PTs before starting the study and at 24 and 32 weeks gestation. Then, the maternal BMI was calculated according to the following formula:

$BMI = weight\ (kg) / height\ square\ (m)^2$

Measurement of pain intensity

Pain intensity was measured for each pregnant PT through MPQ. At 24 and 32 WGs.

McGill Pain Questionnaire (MPQ):

It is a pencil and paper instrument designed to measure different aspects of pain. it contains 78 pain descriptor items categorized into 20 subclasses, each containing 2–6 words that fall into 4 major subscales: sensory (subclasses 1–10), affective (subclasses 11–15), evaluative (subclass 16), and miscellaneous (subclasses 17–20) [13]. MPQ is sensitive, valid, reliable and multidimensional questionnaire[14].

Measurement of trunk curvature:

Lumber curvature was evaluated by using flexible curve ruler for each pregnant PTs. They asked to stand in an erect posture with the lower extremities slightly apart while keeping her head facing forward and arms beside her body, The flexible curve ruler was placed over the spinous processes of the lower back (T12-L1 and L5-S1) and shaped to fit its contour, then the flexible rule was removed without distortion.

The outline of the curve was traced on a paper and the marking that corresponded to the T12-L1 and L5-S1 levels were named (L) the length of the line drawn was measured to the nearest millimeter. The length of a perpendicular line drawn from the deepest part of the curve to line (L) named (H) was measured to the nearest millimeter. The lumbar curvature was measured at 20, 24 and 32 weeks gestation using the following equation : lumber curvature = 4 x [Arctan 2H/L][15].

3. Interventions:

Ante natal advices (for both groups):

All pregnant PTs received advices about exercise and travelling, sleep and rest, diet, cloths, baths, care of beasts, bowel habit, sexual intercourse, warning sign and lifting advices.

Preventive strategies for WRLBP (for group A only):

Each pregnant PT in group A received preventive strategies to prevent WRLBP amongst pregnant PTs include six themes: Departmental or Organizational (factors relating to how a department or organization is run),Work load & work allocation (factors relating to how the work is distributed & how staff manage their workloads),Work Environment & Equipment (factors relating to the physical environment and resources), Physical Condition or Capacity (factors relating to an individual’s physical capacity & what is required to maintain this),Education and Training (factors relating to education and training).

Statistical analysis:

Results are expressed as mean ± standard deviation (SD). Comparison of means: by using T-test and ANOVA test were used for comparison within groups and in between groups. The data were coded, entered and processed on computer using. Correlation between WRLBP in pregnant physical therapists and lumber curvature in both groups (A & B) was performed using Spearman's rho correlation Statistical Packaged for Social Science: IBM SPSS Statistics for Windows, Version 22.0. was used. The level P ≤ 0.05 was considered the cut-off value for significance.

Results

Demographic characteristics:

The demographic characteristics of pregnant PTs shown in Table 1. None of these variables showed significant differences between both groups (P > 0.05).

Table 1.Demographic characteristics of the pregnant PTs.

	Group A (n = 26) mean ± SD	Group B (n = 25) mean ± SD	P value
Age (yrs.)	25.23± 2.89	25.92± 3.08	0.414
Height (cm)	158.35 ± 4.82	159.40± 5.58	0.473
Weight (kg) at 20 WGs	65.15 ± 6.46	66.12 ± 7.796	0.631
Weight (kg) at 24 WGs	67.81 ± 6.41	68.6 ± 8.01	0.698
Weight (kg) at 32 WGs	73.08 ± 6.59	73.56 ± 8.08	0.816
BMI (kg/m^2) at 20 WGs	25.96 ± 1.99	25.9 ± 2.08	0.914
BMI (kg/m^2) at 24 WGs	27 ± 1.94	26.8 ± 2.27	0.736
BMI (kg/m^2) at 32 WGs	29.04 ±1.94	28.92 ± 2.08	0.834
P > 0.05 = non-significant NS= Not significant at p >0.05.			

Lumber curvature measurement

There was a highly statistical significant difference in the lumber curvature angle at 20, 24 and 32 WGs in groups (A and B) (p-value =0.000). At 24 WGs, there was no statistical significant difference between mean value of group (A and B) (p =0.247) and at 32, there was no statistical significant difference between the mean value of group (A and B) (p =0.391). (Table 2)

Table 2. Inter- and intra-group comparison of lumber curvature angle in pregnant PTs

		Group A (n = 26) mean ± SD	Group B (n = 25) mean ± SD	P value*
Lumber curvature angle	20 WGs	34.2 ± 5.69	34.22 ± 7.09	0.993
	24 WGs	39.96 ± 9.75	43.73 ± 13.03	0.247
	32 WGs	46.56 ± 13.23	50.3 ± 17.41	0.391
	P value**	0.000 **	0.000**	
*Inter-group comparison; **intra-group comparison of the results. P > 0.05 = non-significant; P < 0.05 = significant; P < 0.01= highly significant.				

Assessment of pain intensity:

There was statistically highly significant difference in pain intensity in both groups (A and B) with (p-value =.001) (p-value =0.000) respectively. Comparison between two groups showed that there was statistically insignificant difference between group (A and B) at 24 and 32 WGs with (p = 0. 0.408),(p =0.458) respectively (Table 3)

Table 3.Inter- and intra-group comparison of pain intensity at 24 and 32 WGs

		Group A (n = 25) mean ± SD	Group B (n = 26) mean ± SD	P value*
Pain intensity	24 WGs	7.23± 10.97	9.8 ± 11.03	0.408
	32 WGs	13.58 ± 16.51	17.2 ± 18.08	0.458
	P value**	0.001	0.000	
***Inter-group comparison; **intra-group comparison of the results. P > 0.05 = non-significant; P < 0.05 = significant; P < 0.01= highly significant.**				

Correlation between lumber curvature and low back pain :

In group B, There was statistical significant positive correlation between LBP and lumbar curvature angle at 24 WGs (r= .959**, p=0.000) and at 32 WGs (r=.943**, p=0.000). also, in group A there was significant positive correlations between LBP and lumber curvature angel at 24 WGs (r = - 0.888; P = 0.000). and at 32 WGs (r = - 0.901; P = 0.000). (Table 4)

Table 4.Correlation between WLBP and lumber curvature angle in pregnant PTs at 24 and 32 WGs

	Group A (n=26)		Group B (n=25)	
	R	*p value*	*r*	*p value*
Low back pain VS. lumbar curvature 24WGs	0.888	0.000	0.957	0.000
Low back pain VS. lumbar curvature 32WGs	0.901	0.000	0.943	0.000
r = Spearman's rho correlation coefficient				

Discussion

LBP is a most common problem suffered with a high prevalence and work-related life among PTs [6].The nature of physical therapy activities demanding a strong and repetitive movements activities in inadequate rooms and with inappropriate postures. This may lead to musculoskeletal disturbances specifically of the lumbar spine[16]. PTs reported higher rate of LBP than male probably due to their smallest size and weight. Also pregnancy predisposing females for higher prevalence of WRLBP[6].

Back pain is well-recognized problem affecting many women during pregnancy. The onset and severity of these symptoms are often attributed to the postural adaptations of pregnancy[17]. The epidemiology of LBP during pregnancy demonstrates incidence rates of approximately 50% among retrospective reviews[18]. It is generally characterized by axial or parasagittal discomfort in the lower lumber region. This can be due to a combination of mechanical, hormonal, circulatory and psychological factors[19].

One popular theory for the causes of LBP during pregnancy is that the enlarging gravid uterus and accompanying compensatory lumbar lordosis contribute to substantial mechanical strain on the lower back. In addition, the tendency for pelvic rotation is increased as the lumbar lordosis increases. These altered biomechanics in combination with relaxation of the pelvic and SIJs under the influence of relaxin may further increase strain on the pelvis and lower back[18,20].

The results of this study showed that the intensity of WRLBP was increased significantly between 24 and 32 WGs in both groups with non statically significant difference between both groups. Yoo et al. (2015)[21] reported that the pain in the low back during pregnancy was significantly higher in the third trimester compared with the second trimester . As, during pregnancy, relaxin secretion increases more than 10 fold. Relaxin relaxes the spine and sacroiliac joint [22]. In addition, the spinal curvature due to the growth of the fetus and the increase in weight load applied to the joints because of the change in the center of gravity may increases the pain in the lumbo-pelvic region [23].

Also lumber curvature angle showed that there was a highly statistical significant increase in the lumber curvature angle at 20, 24 and 32 WGs in both groups. And there was no statistical significant difference between group (A and B). **Yousef et al. (2011)**[23] found that, there was a statistically highly significant increase ($P< 0.001$) in the thoracic kyphosis a, lumbar lordosis angle and pelvic inclination angle between 12&22 WGs, 22&32 WGs and 12&32 WGs.

Our results concluded that there is appositive correlation between lumber curvature angle and WRLBP during pregnancy. This results is supported by the results of Moore et al., 1990[24] who found a significant relationship between change in lumber lordosis during pregnancy and increase in LBP. Also Ostgaard et al., 1993[25] found that abdominal sagittal diameter, transverse diameter and depth of the lordosis were related to the development of back pain during pregnancy.

Postural changes have often been implicated as a major cause of back pain in pregnant women [26]. There is a wide range of postural and physiological adaptations experienced by the pregnant women[17]**.** Ligamentous laxity is a physiologic change of pregnancy. It is related to the production of the relaxin and estrogen hormones. Relaxin is known to remodel pelvic connective tissue and activate the collagenolytic system. There is an initial increase in relaxin level which reaches its peak at the 12th wk followed by a decline until the 17th wk. Thereafter, stable serum levels around 50% of the peak values are recorded[27]**.** Postural adaptations to these physiological changes usually entail an alteration in the loading and alignment of muscle forces along the vertebral column[17]**.**

There is a forward shift in the centre of gravity followed by an anterior pelvic tilt and a subsequent increase in lumbar lordosis and thoracic kyphosis [17]**.** Also, there is a natural tendency for anterior displacement of the trunk that may be counterbalanced by increased activities of gastrocnemius, soleus muscles and extension of hip joints. Additionally, due to instability and looseness of the joints, the pregnant woman attempts to keep joints locked during locomotion. However, even with the locking of the joints, there is still disturbing features of increased shearing stress applied on lumbosacral area [28]**.** As the pregnancy progresses, both forward rotation and hyperlordosis increase these factors contribute to increasing mechanical strain on the lower back[29]**.**

Additional research is needed to investigate the relation between posture and work-related low back pain further and to identify strategies for prevention and treatment

Conclusion:

These findings concluded that there is a positive correlation between WRLBP in PTs and lumber curvature angle.

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